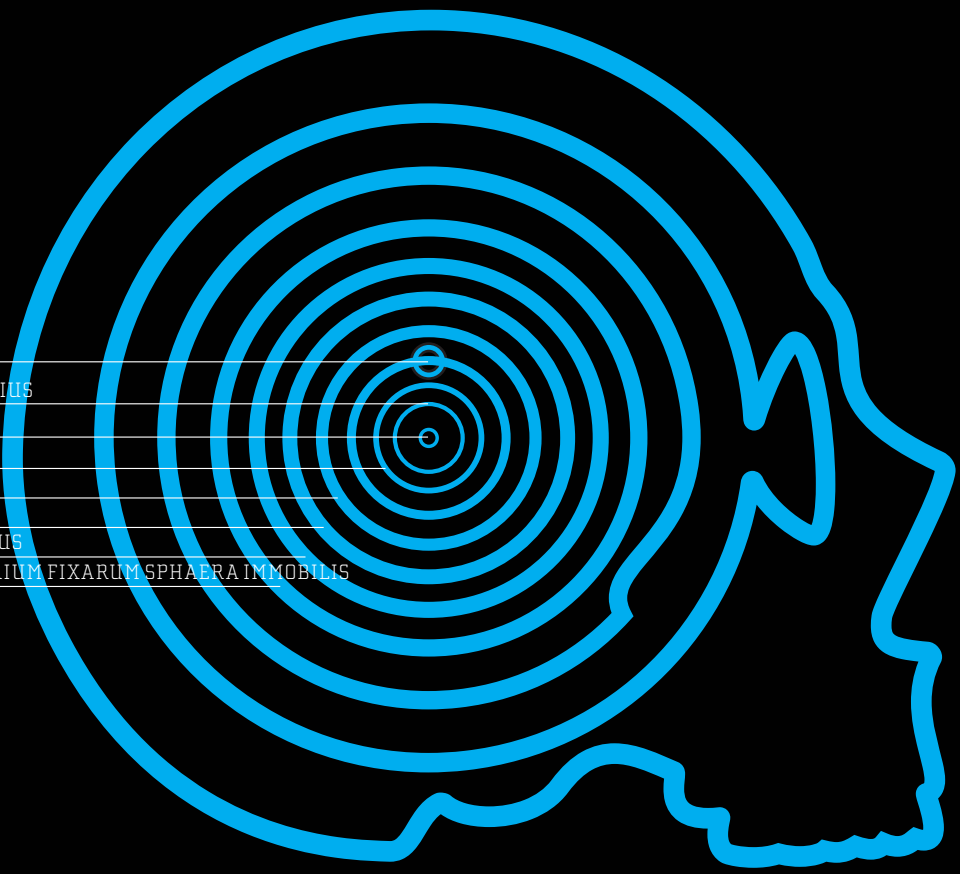


POLISH ACADEMY OF ARTS AND SCIENCES

The Nicolaus Copernicus grave mystery

A dialogue of experts

Edited by Michał Kokowski



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Kraków 2015

**The Nicolaus Copernicus
grave mystery
A dialogue of experts**

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A dialogue of experts

Kraków, 22–23 February 2010

Edited by Michał Kokowski

Kraków 2015



Revision and proofreading:
Filip Klepacki

Proofreading:
Cathal Gantley

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Tomasz Budzyń

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Audiatur et altera pars
(May the other side also be heard)

*The basic principle in the Roman procedural law
and in the whole of Latin civilization*

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Department of History of Science, Natural Sciences and Technology, Ludwik and Aleksander Birkenmajer Institute for the History of Science, Polish Academy of Sciences; Copernicus Center for Interdisciplinary Studies, Poland; www.cyfronet.pl/~n1kokows/home.html; michal.kokowski@gmail.com

Introduction

On 22–23 February 2010 a scientific conference “The Nicolaus Copernicus grave mystery. A dialogue of experts” was held in Kraków. The institutional organizers of the conference were: the European Society for the History of Science (hereafter the ESHS), the Copernicus Center for Interdisciplinary Studies (CCIS), the Polish Academy of Arts and Sciences (PAAS) with its two commissions: the Commission of History of Science of the PAAS (CHS PAAS), and the Commission of Philosophy of Natural Sciences of the PAAS (CPNS PAAS); the Institute for the History of Science of the Polish Academy of Sciences (IHS PAS); and the Tischner European University (TEU). Moreover, the author of these words was the initiator and scientific manager of the conference.

The conference took place in the building of the Polish Academy of Arts and Sciences, where all papers were presented, and in the Jagiellonian Library, where an exhibition of the autograph of *De revolutionibus* was organized specially for this occasion. On behalf of the organizers, Rev. Professor Michał Heller opened the conference and handed the chair of the meeting to the author of these words, who began by outlining the basic ideas of the conference.

The purpose of this conference was to discuss the controversy surrounding the discovery of the grave of Nicolaus Copernicus and the identification of his remains. For this reason, all the major participants of the search for the grave of Nicolaus Copernicus and critics of these studies were invited to participate in the conference. It was the first, and so far only, such meeting when it was possible to speak openly and *on equal terms* for both the supporters and the critics of the thesis that the grave of the great astronomer had been found and the identification of the found fragments of his skeleton had been completed. It was the intention of the organizers of the conference that the central idea of this meeting was a creative scientific *dialogue* and a courageous struggle with different interpretations of the

same facts and issues. All this was to serve a better understanding of the hitherto results of the search for the grave of Nicolaus Copernicus and the identification of his remains, and possibly show new opportunities to deepen this kind of research.

What is referred to in the word “dialogue”, mentioned here? What does it mean? To explain it, I will use the words of one of my teachers and an outstanding philosopher, Rev. Professor Józef Tischner, who in his *Ethics of Solidarity* wrote:

Dialogue means that people have come out from their undergrounds, have come closer to each other, have started exchanging words. The beginning of dialogue, emerging from a hiding place, is already a significant event. One needs to reach out, cross the threshold, offer one’s hand, find a common place for conversation. (...) How many obstacles does one need to overcome sometimes to begin a dialogue! How much patience in order to continue! One needs not only overcome fear and dispel prejudice, but also one must find a common language. It cannot be the language of any one group, much less a language of insinuation, slander, nor even a language of accusations. (...) the language of reliable dialogue is a “concrete language,” that is, a language that fits things. What is black is called black, what is white is called white. (...) The first condition of dialogue is the ability to sympathize with the other’s point of view. It is (...) about (...) a recognition that the other, from his point of view, is always to some extent right. No one voluntarily shuts oneself up in the underground, evidently one must have a reason for it. It is necessary to accept this reason. In the first word of a dialogue, there is hidden a confession, “you must be to some extent right.” This goes along with the second no less important confession, “surely I am not entirely right.” Both sides surpass themselves in these confessions, striving to the unity of one and the same point of view on things and matters. (...) Dialogue is the building of reciprocity (Tischner 2007, pp. 41–42).

To build this reciprocity, the first day of the conference was devoted to the fullest possible presentation of views of people involved in the search for the grave of Copernicus and the identification of his remains, while the second day to the presentation of views of commentators of these studies. The sessions of the first day were chaired by the author of these words, and of the second by the said author and also by Rev. Dr. Wojciech Grygiel (from the Pontifical University of John Paul II, and Copernicus Centre for Interdisciplinary Studies).

On the first day, as part of the introduction to the conference, three videos describing the search for Copernicus’s grave were shown:

1. *Tajemnica grobu Kopernika / Copernicus Tomb Mystery* (60 min), written and directed by Michał Juszcakiewicz (Michał Juszcakiewicz Art’s Agency, 2008).
2. *Światowe odkrycie archeologów z Pultuska. Poznana tajemnica grobu Kopernika / A world discovery of archaeologists from Pultusk. The uncovered secret of the grave of Copernicus* (6 min 13 s), written and directed by Józef

Śniegocki, Paweł Kiela (Wyższa Szkoła Humanistyczna im. A. Gieysztorą w Pułtusku, 2008).

3. *Misterium cranii Nicolai Copernici* (29 min 12 s), written and directed by Marcin Stefaniak (Fundacja Kronenberga przy Citi Handlowy, 2008).

These were documentary films, depicting various phases of the search for the grave of Nicolaus Copernicus and the identification of his remains by a team of Professor Jerzy Gąssowski. They are all therefore very valuable sources of information, especially for the first of these films, as the film crew accompanied the researchers for nearly one hundred days in Poland and Sweden, from the moment of finding the skull to the DNA analyses (Juszczakiewicz 2009).

After the film session the following papers were presented:

1. Dr Jerzy Sikorski (The Provincial Office of Historic Preservation in Olsztyn), “The location of Nicolaus Copernicus’s burial in the light of the contemporary practice” (in Polish; on behalf of the author, the text was read by Michał Kokowski, head of the conference).
2. Prof. Krzysztof Mikulski (Nicolaus Copernicus University, Toruń), doctoral students: Joanna Jendrzewska (Nicolaus Copernicus University, Toruń) and Anna Stachowska (Nicolaus Copernicus University, Toruń), “Ancestors and closest relatives of Nicolaus Copernicus and their female offspring” (in Polish);
3. Dr Wojciech Branicki (Institute of Forensic Research & Jagiellonian University, Kraków), Dr Tomasz Kupiec (Institute of Forensic Research Kraków), “The analysis of nuclear DNA markers in the remains from grave 13/05” (in Polish);
4. Dr Tomasz Kupiec (Institute of Forensic Research, Kraków, Poland), Dr Wojciech Branicki (Institute of Forensic Research & Jagiellonian University, Kraków), “The application of the mtDNA analysis to the identification of human remains from grave 13/05” (in Polish).

On the second day of the conference a trip was organized to see the exhibition of the autograph of *De revolutionibus* in the Jagiellonian Library. Later, in the Great Hall of the Polish Academy of Arts and Sciences, the following papers were delivered:

1. Dr Arkadiusz Sołtysiak (Warsaw University, Warsaw), “Magical thinking in archaeological interpretation. Examples, an attempt of classification, and perspectives” (in Polish);
2. Dr Jarosław Bednarek (Collegium Medicum, Nicolaus Copernicus University, Bydgoszcz), “A trap of anthropological typology” (in Polish);
3. Dr Tomasz Kozłowski (Nicolaus Copernicus University, Toruń), “Reflections of an anthropologist on the identification of bone remains found in

- the Frombork Cathedral as those of Nicolaus Copernicus. An attempt at a critical interpretation” (in Polish);
4. Habilitated Dr Bronisław Młodziejowski (University of Warmia and Mazury, Olsztyn), “The efficiency of facial reconstruction methods in the light of contemporary forensic anthropology” (in Polish; a summary of paper; on behalf of the author, the text was read by the head of the conference);
 5. Prof. Józef Flik (Nicolaus Copernicus University, Toruń), “The 16th century portraits of Nicolaus Copernicus” (in Polish; on behalf of the author the text was read by the head of the conference);
 6. Habilitated Dr Tomasz Grzybowski (Collegium Medicum, Nicolaus Copernicus University, Bydgoszcz), “A statistical and phylogenetic interpretation of research results of mtDNA of the alleged Nicolaus Copernicus remains from the Frombork Archcathedral” (in Polish);
 7. Dr Peter Gwozdz (independent scholar, Cupertino CA, USA), “Copernicus Y-DNA is Haplogroup R1b1b2a1” (in English);
 8. Habilitated Dr Adam Walanus (AGH University of Science and Technology, Kraków), “Radiocarbon dating and the case of Copernicus grave” (in Polish);
 9. Prof. Lidia Smentek (Nicolaus Copernicus University, Toruń; Vanderbilt University, Nashville, USA), “Lost OR found?” (in English);
 10. Habilitated Dr Michał Kokowski (Institute for History of Science, Polish Academy of Sciences; Copernicus Center for Interdisciplinary Studies; Commission History of Science and of Philosophy of Natural Sciences of the Polish Academy of Arts and Sciences, Kraków), “A procedure of identification of remains no. 13/05 as belonging to Copernicus in the light of rationality of justification and rhetorics of persuasion” (in Polish).

At the invitation of Rev. Prof. Michał Heller, Dr Owen Gingerich, Prof. Emeritus of Astronomy and History of Science at Harvard University also took part in the conference, at the end of which he spoke to summarize the meeting.

As the initiator and scientific manager of the conference, I would like to express my gratitude to all the speakers and participants and all the institutions and individuals who contributed to its organization. Special thanks (listed in chronological order) extend to:

- The Authorities of the European Society for the History of Science for recognizing this conference as one of the conferences of the Society;
- The Authorities of the Polish Academy of Arts and Sciences, including the Authorities of the Commission of the History of Science of the Polish Academy of Arts and Sciences and the Commission of the Philosophy of Natural Sciences of the Polish Academy of Arts and Sciences for their ac-

tive involvement in the financial support of this conference, its organization and financing the costs of publishing conference proceedings in both Polish and English;

- The Authorities of the Tischner European University for funding the majority of the costs of the conference and the accommodation of the speakers;
- The Authorities of the Copernicus Center for Interdisciplinary Studies for involvement in the financing of the conference and co-financing the costs of publishing conference proceedings in Polish;
- The Authorities of the Institute of History of Science of the Polish Academy of Sciences for involvement in the financing of the conference;
- Rev. Prof. Michał Heller, Director of the Copernicus Center of Interdisciplinary Studies for issuing invitations to potential speakers to attend the conference;
- Habilitated Dr Bartosz Brożek (JU), Vice Director of the CCIS, and Habilitated Dr Janusz Mączka (JPII PU), Director of the Foundation of the CCIS, for coordinating the conference;
- Prof. Zdzisław Pietrzyk, Director of the Jagiellonian Library for organizing the exhibition of the autograph *De revolutionibus* for the participants of the conference;
- Prof. Jerzy Gąssowski for enabling the presentation of the film *Światowe odkrycie archeologów z Pułtuska. Poznana tajemnica grobu Kopernika / A world discovery of archaeologists from Pułtusk. The uncovered secret of the grave of Copernicus*;
- Mr Michał Juszczakiewicz for enabling the presentation of the film *Tajemnica grobu Kopernika / Copernicus Tomb Mystery*;
- Mr Krzysztof Kaczmar, Director of the Fundacja Bankowa im. Leopolda Kronenberga, for enabling the presentation of the film *Misterium cranii Nicolai Copernici*;
- Rev. Dr Wojciech Grygiel (JPII PU, CCIS) for chairing the part of the session on the second day of the conference.

In this book, we present the aftermath of the conference – full texts or summaries of them, sent by the authors. In the latter case, where possible, additional information is included on other texts published by the author(s) on the same subject.

The texts of articles presented in this monograph were subjected to several stages of review process, both explicit and implicit.

The authors of the work presented here are recognized experts in many different disciplines and are responsible for the content of these texts.

I would like to draw the attention of the readers of this collective monograph to the fact that on its pages one can find contrary theses proclaimed by various

authors. By no means does it constitute a flaw in this study. It emphasizes a conscious decision: the idea was to show the diversity of opinions present in the scientific community, and thus to create the possibility of a future creative exchange of views – because the progress in science entails continuous improvement of the theses propounded and enriches the argumentation in favour of them.

The evaluation of the texts published here is left with the readers. I would like to emphasize the need to read these texts carefully, since they touch upon complex issues of various scientific disciplines. I would like to use this occasion to encourage readers to under-take more intensive Copernican studies, which are unfortunately becoming scarce in Poland (see the description of the problem: Kokowski 2009).

References

JUSZCZAKIEWICZ Michał

2009: *Website of the film “Copernicus tomb mystery”*; <http://www.copernicuscodemystery.com/page3/page3.html>.

KOKOWSKI Michał

2009: *Różne oblicza Mikołaja Kopernika. Spotkania z historią interpretacji (Different faces of Nicholas Copernicus. Meetings with a history of interpretations)*. Warszawa–Kraków: Instytut Historii Nauki PAN, Polska Akademia Umiejętności. ISBN 978-83-87992-67-5; pp. 676.

2010: Academic conference: *The Nicolaus Copernicus grave mystery. A dialogue of experts (Kraków, 22–23 February 2010)*; http://www.cyfronet.krakow.pl/~n1kows/konferencja_tajemnica_en.html.

TISCHNER Józef

2007: *The Ethics of Solidarity*, selected by Dobrosław Kot from *Etyka solidarności [The Ethics of Solidarity]*, Kraków 2005. Translated by Anna Fraś, “Thinking In Values: the Tischner Institute Journal of Philosophy”, vol. 1, pp. 41–42, http://www.tischner.org.pl/Content/Images/tischner_3_ethics.pdf.

Michał KOKOWSKI

Department of History of Science, Natural Sciences and Technology, Ludwik and Aleksander Birkenmajer Institute for the History of Science, Polish Academy of Sciences; Copernicus Center for Interdisciplinary Studies, Poland; www.cyfronet.pl/~n1kokows/home.html; michal.kokowski@gmail.com

Introduction to the English edition

The theme of this collective monograph is a description and critical analysis of the arguments for the thesis about the alleged discovery of the remains and the grave of Nicolaus Copernicus – for further details see *Introduction* (to the Polish edition). This is so far the only elaboration of this type in world literature. We have made it available in an English translation, in order to reach the widest possible range of researchers so that they can become familiar with this subject.¹

The presented monograph stems from the Polish tradition of practicing multidisciplinary and interdisciplinary research on the achievements and life of Nicolaus Copernicus. Being the longest research tradition in the world, it began with Jan Brożek (1627) and Jan Śniadecki (1782; 1802) and their studies, based on respect for the university model *Septem Artes Liberales*, *New Humanism of George Sarton* and the *Third Culture of Sarton – Snow* (author's term) (cf. Kokowski 1996; 2001; ed. 2002; 2004; 2012 and, in particular, 2009).

A reader, if somewhat familiar with Copernican studies and subject to the influence of a popularizing style of practicing the history of science (cf. *Wikipedia* 2014, chap. “Death”) and mass culture (cf. e.g. The Associated Press 2005; Reuters 2005; Bowcott 2008; Easton 2008; Gera 2010; Bradley 2010; Stonehill College 2010), may be surprised at the level of substantive discussion on many various disciplines presented in this monograph, but omitted in the studies of prominent American authors (cf. Gingerich, MacLachlan 2005; Gingerich 2009; 2011; Goddu 2007; 2010). I hope this will not be a reason to ignore the considerations presented in this monograph, as it has already happened in certain analogous cases in the past.

I wish you a fruitful and insightful experience while reading and invite you to join the debate.

¹ By decision of Prof. Lidia Smentek (Department of Chemistry, Vanderbilt University, Nashville, USA) her popular article (2012) has not been included in the translation.

References

THE ASSOCIATED PRESS

2005: *Copernicus' grave found in Polish church*, "USA Today" http://usatoday30.usatoday.com/tech/science/discoveries/2005-11-03-copernicus-grave_x.htm (posted 11/3/2005 5:16 PM).

BOWCOTT Owen

2008: *16th-century skeleton identified as astronomer Copernicus*, "The Guardian" [the-guardian.com](http://www.theguardian.com/science/2008/nov/21/astronomy-archaeology), Friday 21 November 2008 11.39 GMT; <http://www.theguardian.com/science/2008/nov/21/astronomy-archaeology>.

BRADLEY Carlotta

2010: *Astronomer Copernicus Reburied As Hero*. "The Associated Press", 22 May 2010; YouTube: http://www.youtube.com/watch?v=-bMB2Odz_UU.

BROŹEK Jan

1956: *Wybór pism*. Vol. I (edited by Henryk Barycz). Warszawa: Państwowe Wydawnictwo Naukowe.

EASTON Adam

2008: *Polish tests 'confirm Copernicus'*; "BBC News", Warsaw; <http://news.bbc.co.uk/2/hi/europe/7740908.stm> (last updated at 12:11 GMT, Friday, 21 November 2008).

GERA Vanessa

2010: *After 467 years, Copernicus gets a hero's burial*, "The Independent", Sunday 23 May 2010; <http://www.independent.co.uk/news/world/europe/after-467-years-copernicus-gets-a-heros-burial-1980493.html>.

GINGERICH Owen

2009: *The Copernicus grave mystery*, "PNAS" ("Proceedings of the National Academy of Sciences of the United States of America") July 28, vol. 106, no. 30, pp. 12215–12216, published online before print July 21, 2009, doi: 10.1073/pnas.0907491106; <http://www.pnas.org/content/106/30/12215.full>.

2011: *In the Orbit of Copernicus. A discovery of the great astronomer's bones, and their reburial in Poland*, "The American Scholar", Summer 2011, vol. 80, no. 3, pp. 43–49.

GINGERICH Owen, MacLACHLAN James

2005: *Mikołaj Kopernik: gdy Ziemia stała się planetą*. Transl. Jarosław Włodarczyk, Foreword: Jacek Jezierski, Afterword: Jerzy Gąssowski. Pułtusk: Wyższa Szkoła Humanistyczna imienia Aleksandra Gieysztora.

GODDU André

2007: *Book Review: Copernicus in Person: Poszukiwanie grobu Mikołaja Kopernika*. "Journal for the History of Astronomy" 2007 vol. 38, pp. 255–256; the online version at: <http://jha.sagepub.com/content/38/2/255.citation>.

2010: *Copernicus and the Aristotelian tradition: education, reading, and philosophy in Copernicus's path to heliocentrism* (Brill, 2010); (Brill series: "History of Science and Medicine Library", vol. 15, "Medieval and Early Modern Science", vol. 12); <http://books.google.com/books?id=iEjk13-1xSYC>.

KOKOWSKI Michał

1996: *Copernicus and the hypothetico-deductive method of correspondence thinking. An introduction*, "Theoria et Historia Scientiarum", vol. 5 (1996), pp. 7–101.

2001: *Thomas S. Kuhn (1922–1996) a zagadnienie rewolucji kopernikowskiej (Thomas S. Kuhn (1922–1996) and the Issue of the Copernican Revolution)*, "Studia Copernicana" vol. XXXIX. Warszawa. ISBN 83-86062-02-9; pp. 397.

(ed.) 2002: *Ludwik Antoni Birkenmajer. W stulecie wydania przez Akademię Umiejętności dzieła "Mikołaj Kopernik" (On the centenary of the publication of "Nicolaus Copernicus" by the Academy of Arts and Sciences)*. Komisja Historii Nauki. Monografie, no. 5. Kraków: Polska Akademia Umiejętności. ISBN 83-88857-41-X; pp. 75.

2004: *Copernicus's Originality: Towards Integration of Contemporary Copernican Studies*. Warsaw–Cracow: Wydawnictwa IHN PAN. ISBN 83-86062-27-4; pp. XVI+340.

2009: *Różne oblicza Mikołaja Kopernika. Spotkania z historią interpretacji (Different faces of Nicholas Copernicus. Meetings with a history of interpretations)*. Warszawa–Kraków: Instytut Historii Nauki PAN, Polska Akademia Umiejętności. ISBN 978-83-87992-67-5; pp. 676.

(ed.) 2012: *Tajemnica grobu Mikołaja Kopernika. Dialog ekspertów (Kraków, 22–23 lutego 2010)*. Kraków: Polska Akademia Umiejętności, Centrum Kopernika Badań Interdyscyplinarnych. ISBN 978-83-7676-124-4; pp. 320.

2012: *Copernicus, Arabic Science, and the Scientific (R)evolution*, in: Arun Bala (ed.) 2012: *Asia, Europe, and the Emergence of Modern Science: Knowledge Crossing Boundaries*. New York: Palgrave Macmillan, 2012, p. 55–72. DOI: 10.1057/9781137031730.0008 (Print Pub Date: July 2012; Online Date: August 2012). Available from: <http://www.palgraveconnect.com/pc/doi/10.1057/9781137031730.0008>.

REUTERS

2005: *Copernicus's Grave Is Reported Found*. "New York Times" (published: November 6, 2005): http://www.nytimes.com/2005/11/06/international/europe/06coper.html?ex=1168664400&en=51cfba8541461466&ei=5070&_r=0.

SMENTEK Lidia

2012: *Zagubione CZY znalezione? (Lost OR Found?)*. In: Kokowski (ed.) 2012, pp. 167–175.

STAROWOLSKI Szymon

1625 / 1956: *Nicolaus Copernicus*, in: *Scriptorum Polonicorum Hekatomtas seu centum illustrium Poloniae scriptorum elogia et vitae*. Frankfurt 1625, Venetiis 1627, Frankfurt 1644, Wrocław 1733 (CV attached in 2nd ed., on pp. 158–161, is broader than in the 1st, 3rd and 4th editions); 1956 (Polish translation): *Mikołaj Kopernik*, in Brożek 1956, vol. I, pp. 538–541.

STONEHILL COLLEGE

2010: *Stonehill Professor Attends Reburial of Copernicus*; 14 July 2010; <http://www.stonehill.edu/x22014.xml>.

ŚNIADECKI Jan

1782/1958a: *Pochwała Mikołaja Kopernika, akademika krakowskiego, astronomii odnowiciela, z okazji otwarcia Katedry Astronomicznej dnia 30 września 1782*, reprinted in: Śniadecki 1958c, vol. I, pp. 141–164.

1802/1873, 1958b: *O Koperniku*, “Roczniki Towarzystwa Przyjaciół Nauk w Warszawie” vol. 2 (1802), pp. 83–192; reprinted in: Śniadecki 1958c, vol. I, pp. 190–299.

1958c: *Pisma filozoficzne*. Vols I–II. Warszawa: Państwowe Wydawnictwo Naukowe.

WIKIPEDIA

2014: *Nicolaus Copernicus*; http://en.wikipedia.org/wiki/Nicolaus_Copernicus (last modified on 14 July 2014 at 11:59).

Jerzy SIKORSKI

The Provincial Office of Historic Preservation in Olsztyn, Poland

The mystery of Nicolaus Copernicus's grave – myths and reality¹

Abstract

It has been known from the research conducted up to now that Nicolaus Copernicus (1473–1543) was a Warmia canon and was buried in Frombork Cathedral. Nevertheless, it has not been certain at which particular location. In order to establish the place, a systematic analysis has been conducted comprising preserved source materials (stored in the Warmia Archdiocese Archives in Olsztyn) and scientific literature of the subject (among others the works of Leopold Prowy, Hans Schmauch and Eugen Brachvogel).

A prevailing rule of ‘canonicate – altar – grave’ has been discussed (as well as the exceptions to the rule): In the Cathedral Chapter of Warmia there were sixteen canons corresponding with sixteen canon altars in Frombork Cathedral, with each canon being responsible for the corresponding altar and it was at that altar that he was usually buried.

A chronological register of all burials at all sixteen canon altars from 15th to 18th century has been restored. Owing to that, it could be proven that until the end of his life Copernicus had owned the fourth altar in the right row and at that altar he should have been buried.

The issue of the location of Copernicus's epitaph founded in 1581 by Bishop Marcin Kromer has been discussed. In the light of the aforementioned registers, it came forth that the commemorative plaque had been wrongly installed (on the southern wall of the cathedral next to the seventh, i.e. penultimate, altar in the right row).

Keywords: Frombork Cathedral, canon burials, location of Copernicus's grave and commemorative plaque, analysis of archival documents and scientific literature.

1. The question of Nicolaus Copernicus's place of burial and the commemorative plaque founded by Bishop Marcin Kromer

The question of Nicolaus Copernicus's place of burial in Frombork Cathedral surfaced for the first time in 1581 when Marcin Kromer, Bishop of Warmia, entrusted

¹ The following article was peer-reviewed by Professor Karolina Targosz, Habilitated Doctor in Humanities (Ludwik and Aleksander Birkenmajer Institute for the History of Science, Polish Academy of Sciences), and translated by Mr Filip Klepacki.

ed the Cathedral Chapter with the task of commemorating the burial place with an appropriate commemorative plaque, contents of which he composed himself. Consequently, it has placed the chapter in a predicament. It appeared that merely 38 years after Copernicus's demise, no one from the chapter could pinpoint his place of burial to fulfil the bishop's desire. Everything faded into oblivion. The bishop could remember neither the first name of the famous Frombork sage (he called him erroneously 'Joannes') nor the basic facts about his life – when he died and how long he had lived – and left gaps in the epitaph for the chapter to complete (Wermter 1968, p. 170–171). That task also proved to be beyond the chapter's powers. Eventually, the epitaph was thoroughly simplified.

The predicament the chapter found itself in can hardly be surprising. All searches for Copernicus's date of death in the documents that have been preserved until modern times without being damaged have proven futile. At the date of 21 May 1543 the register listed information that was supposed to be clear enough to close the case of Copernicus's presence in the chapter. It was the date when Jan Loitsch was accepted to the chapter, the man who, after Holy See's approval, was designated by Copernicus himself as his successor with the right to take the canonicate directly after Copernicus's death. Consequently, it is obvious that Copernicus was not among the living on 21 May. Astonishingly, this fact had not occurred to the researchers of Copernicus's life and until our times the erroneous date of 24 May was in use. When exactly Copernicus died is not yet known and we will probably never find out (Sikorski 1973).

Thus the wish of Bishop Marcin Kromer could only be fulfilled to the extent possible, which proved to be so limited that a desperate decision was made to seek help in an alien milieu of the court of Prince Albrecht in Königsberg (Polish: Królewiec, now Kaliningrad). It should be emphasized that the environment was also alien in terms of religious beliefs, which was vitally important at the time. The addressee of the chapter's expectations was Maciej Stojus, personal physician of the prince, who was also known for his interest in mathematics and astronomy, as well as being a poet. However, it turned out that even this educated man could not complete the missing personal information of the Frombork astronomer, already famous in the world at the time. Moreover – and against the intentions of Bishop Kromer, who in his text of the epitaph wanted to see Copernicus as the 'restorer of astronomy' – the Lutheran consultant made him purposefully 'Praestanti Astrologo, et ejus discipline instauratori' ('excellent astrologer and the restorer of this discipline').² This is hardly surprising. Stojus

² The contents of the epitaph according to Jan Brożek's (Johannes Broscius) record from 1618 are quoted by Szymon Starowolski (1627, p. 158–162). On Maciej Stojus – see Forstreuer, Gause (ed.) 1967, vol. 2, p. 705.

could not have treated Copernicus's theories in a different manner to the way they were treated by the leaders of the Reformation including Martin Luther and Philipp Melanchthon, nor differently to the way they were regarded at universities in Wittenberg, Zurich, Rostock and Heidelberg, which were influenced by Protestantism.³

The commemorative plaque – against the wish of the bishop – was installed randomly, presumably in a place that was vacant (it is known that the walls were densely covered with such plaques). It was the place almost at the end of the southern aisle, more or less opposite the penultimate pillar, and hence not even clearly communicated with any particular altar, which would have been very significant.⁴

All these problems could have been avoided if Copernicus himself had taken care of commemorating his burial and consequently his presence in the Chapter of Warmia, whose member he had been for 46 years, with 33 years spent in the residence at the cathedral. A mere gravestone laid at the place of burial by the altar entrusted to him could have been such a permanent mark. Yet, the executors of his will did not find any relevant instructions. Thus, he was buried at a place which neither he nor his contemporaries left information about to future generations.

In consequence of this we are dealing with an issue of Copernicus's place of burial, which has remained unresolved due to erroneous research assumptions and, additionally, somewhat carefree researchers as well as incomplete knowledge about the internal operations of the chapter. It transpires that a sheer strong enough conviction was sufficient to be treated as proof. Thus, a few basic issues need to be – however briefly – explained.

2. Chapter Canons of Warmia, their altars and graves

The Chapter of Warmia consisted of sixteen canons. Not always was the group complete. Out of fifteen canons contemporary to Copernicus only six, similarly to him, died in Frombork. Only four of them were given commemorative plaques as they had expressed such a wish and had left relevant funds. The remaining two, similarly to Copernicus, were buried namelessly under the cathedral floor. These

³ The original very negative opinion of the leader of Protestants on the cosmological and religious aspect of Copernicus's theory was significantly softened in the so called Wittenberg astronomical school formed in the last four decades of the 16th century under the auspices of the aforementioned Philipp Melanchthon (1497–1560) – see Kokowski 2009, p. 89, 94 and further references there.

⁴ The history of this epitaph – see Hipler (ed.) 1873, p. 292.

were also the executors of Copernicus's will, Georg Donner and Leonard Niderhoff. Despite his position in the chapter the latter did not care to remain remembered, although as the dean he was second only to the provost. Hence, it is still known as a fact that he was buried at the altar that had been permanently bound to that prelature, namely the first one in the right row.

Each of the sixteen canons was entitled to a different altar. With the exception of the main altar, which was in place at the time of Copernicus and which has been preserved to this day, the canon altars stood in two rows, leaning against pillars, as they stand today: eight at the pillars in the left row and eight in the right row. They would have been assigned to canons together with canonicates virtually once for the whole of their lives. According to the regulations of the chapter statutes, the altars were not subject to free choice as canon houses or manors were, which meant that they could not be changed. Canons succeeded altars and canonicates from their deceased predecessors.⁵ In order not to get confused, it was in Copernicus's times that separate lists were created for each of the sixteen canonicates. These were first established by Canon Doctor Alexander Sculteti, one of the closest friends of Copernicus. With the use of his own and other people's memory he managed to restore them as much as it was possible. Later, until the 18th century, appropriate names would be added to the lists.⁶

Documented on each of the sixteen lists, the succession was thus connected with two factors regulated by the statutes: the canonicate and the corresponding altar. Nevertheless, outside the rulings of the statutes, yet accepted as a principle and remaining logically linked to the other two and crucially important to our deliberations, there was a third factor, namely the burial. Thus, we find a principle in the practices of the chapter of Warmia, which is possible to express in three words: canonicate – altar – grave.

In the face of this obediently followed practice it is the aforementioned lists of canons – or to put it differently, registers – that become particularly significant. One only needs to prove a link between one of the lists and the corresponding altar to be able to answer which canon was entitled to be buried at which particular altar. Being entitled to it, however, did not have to mean an actual burial. In specific cases we will not connect the burial with the altar assigned to the canon, and these are the obvious situations: when the canon died outside of the diocese, when he resigned from the canonicate or when he expressed a wish in his will to be buried elsewhere (e.g. in the church where the canon was a parish priest).

⁵ *Die Statuten des ermländischen Domkapitels von B. Nikolaus v. Tüngen* – see Hipler (ed.) 1873, p. 249.

⁶ See Warmia Archdiocese Archives in Olsztyn, Files of Chapter C.

There were also other reasons, possible to establish, for which a burial of a canon did not take place at the altar received in succession. It occurred at times when, at a point in his life, the canon received the title of a prelate from the chapter. Since there were four prelatures, it happened rather frequently and they disturbed the established order. Consequently, in the so far regular chain of successions one particular link would become anomalous. The promoted canon, although still present on the list corresponding with the altar received with the canonicate upon succession, would not leave the altar to the canon that took the canonicate after him. In fact, he did not vacate the canonicate and he would leave the altar to the canon who received the canonicate after the deceased prelate, who was on a list corresponding with a completely different altar. In other words, in this case, that new canon received a “strange” altar that was not assigned to the list he was added to after the death of the prelate, but on the one that still listed the promoted canon. Nevertheless, since that moment onwards that “strange” altar would become the appropriate one for the new list that the new canon, as it were, had put it on and had “taken” with him. Consequently, the altar connected to the new list was succeeded later in the usual way along with the canonicate by all successors of the new canon, unless a similar situation occurred and the entire operation was repeated as indicated above.

Also, with regard to the prelatures, one should add that different variants could arise and they did so not infrequently. An ordinary canon that was promoted to a prelate and thus received a corresponding altar could be promoted further, receiving another, higher prelate and consequently another altar assigned to this prelate. Theoretically, a canon could have been promoted in that manner four times, which corresponded with the number of prelatures, changing the altar accordingly. Only at the final altar did he find the appropriate burial. The altars assigned to prelates always remained the same. The provost held the altar in the most distinguished location: the first one in the left row since it was on that side of the main altar where the Gospel was rested (*ad cornu Evangeliae*). The dean had the first altar in the right row, the chancellor – the second one in the left row, and the precentor – the second one in the right row (however, for some time the precentor’s altar was third in the left row, perhaps with the intention to distinguish the dean even more, who would be thus the only one to have an altar in the right row).

To conclude, one should once more emphasize that the lists of canonicates determining the succession had permanent character – nothing was changed on them. If a canon present on one of the lists received a prelate, he remained on the list but he changed the altar. However, following the canon that was added to the list after the deceased prelate, the one whom the canon succeeded the canonicate from, the entire list was transferred to the altar that was vacated due to the promotion of its previous owner.

3. Three German historians and familiarity with the principle determining places of burial for canons

Our deliberations have brought us to a point where one should admit that only familiarity with the aforementioned principles, with their transparent – since repeated – intricacies, can serve as a starting point for considerations where one or any other member of the chapter was buried, Copernicus included.

Some familiarity with these principles – yet not perfect – was exhibited by Doctor Leopold Prowe (1821–1887). Born in Toruń, headmaster of the local gymnasium and a fond admirer of his fellow man from Toruń, Nicolaus Copernicus, he was greatly honored in Germany for his research into Copernicus's life and work. After he had pointed – however erroneously – Copernicus's place of burial, Alexander von Humboldt, a greatly admired person himself, awarded Prowe with an honorary name of the first Copernicologist in the world. Later, in the years 1883–1884, when Prowe published his monumental work on Copernicus in two volumes with an additional volume of archival sources, he was twice honored with a personal audience with the German Emperor Wilhelm I and received the Order of the Red Eagle (Forstreuer, Gause (ed.) 1967, vol. 2; Prowe 1886, 1870, 1883–1884).

Despite undeniable contributions, Prowe can be blamed for many misgivings. First and foremost, while being preoccupied with the issue of Copernicus's burial and hence visiting the cathedral many a time (the Archdiocese Archives with numerous Copernicus-related documents was located next to the cathedral) he did not reveal the slightest interest in the commemorative plaques of the canons. Over a hundred of those plaques had lain around the canon altars until in 1861 they were all transferred to random places or even removed from the cathedral with the intention to destroy them and make room for a new floor. This enterprise of the then hosts of the cathedral that Prowe showed no interest in, was completed with unmatched light-heartedness. Although Ferdinand von Quast, a conservator and a great admirer of the Frombork treasures, had his office in Berlin, it occurred to no-one to conduct a regular inventory of all the objects *in situ* – in their original place – before moving them. Thus they were stripped of their subjectivity, their unity with the burials was destroyed and they were doomed to irreversible anonymity (Dittrich 1913).

Prowe completely ignored the natural documentation of the burials created by previous ages. He did not understand that commemorative plaques could be helpful in verifying his earlier assumptions about Copernicus's place of burial. He lost the one and only chance without being aware of it, since he assumed – which is quite unfathomable – that he did not need any verification. If only had he bothered to look at those plaques and had been able to draw the right conclusions, he would undoubtedly have found himself in a predicament. Even today next to the fourth altar in the right aisle one can find a plaque of Canon Andrzej Zagórny,

who died in 1634 – so only 91 years after Copernicus – and whose name does not appear on that same fourteenth list containing the name of Copernicus. Prowe knew these lists as he himself had found them, but he did not understand their meaning – he was solely interested in Copernicus. Indeed, he used that fourteenth list as a proof, but in a way that best suited him and against common sense.

The claim disseminated by Prowe that Copernicus was buried at the seventh canon altar in the right row has been maintained until modern times, so for one hundred and fifty years. At that place, as it is already known, had the original Copernicus's commemorative plaque (founded by Bishop Marcin Kromer) existed until 1746. For Prowe it was unthinkable that it could have been installed in a place different from where the bishop had wished, and he wanted it to be installed “on the wall next to his grave” (*parieti ad sepulchrum eius affigi*), meaning obviously Copernicus's grave. Apparently, that sufficed for Prowe to shed all doubts. Finally, he found support for his decision in an experiment – albeit treated less importantly – with the fourteenth list. He continued attempting to match the list with the pre-assumed seventh altar in the right row until he finally accomplished that beyond any doubt. He did so in a manner that can be puzzling, but puzzling in its naivety. By counting the altars, yet not in a straight line but across – starting with the first one in the left row and then the first one in the second row, and then back to the second one in the left row and so on, Prowe found – presumably to his utter content – that the fourteenth altar (penultimate in the right row), supposedly corresponding with the fourteenth list, was the very altar next to which Copernicus's commemorative plaque had previously been installed. Prowe was unaware of the fact that the first four altars belonged to prelates and thus his method of counting was completely without merit.

The indispensable knowledge of it all, supported by a greater than Prowe's (yet, still not perfect) familiarity with the chapter's statutes was exhibited by Prof. (in German: Dozent) Hans Schmauch, a professional historian living closer to our times, and known for his numerous works on the dominion of the Warmia bishops in the 15th and the 16th century. Faced with a fruitless archaeological search conducted by an expedition from the university in Königsberg in January 1939 on the supposed place of burial indicated by Prowe, Schmauch became interested in the issue and returned again to the archival sources that had once been used by Prowe. Schmauch was right to reason that according to the succession principle it should be sufficient to find evidence which altar belonged to any one of Copernicus's predecessors or any of his successors (as long as he was not a prelate) to relate the evidence also to Copernicus. And such Schmauch indeed found. During one of the chapter's sessions on 11 January 1480, it was noted that the fourth altar in the right row was owned by a canon who appeared on the fourteenth list under the name of “Joannes Zanow” directly before Copernicus. It was thus evident for

Schmauch that this very fourth altar must have been succeeded by Copernicus, together with the canonicate and, most importantly, it was there that one could expect to find evidence of Copernicus's grave.

Schmauch published all his findings without delay (1941) thus correcting Prowe's claims about the altar that he had erroneously attributed to Copernicus, but he did not draw final conclusions with regard to Copernicus's place of burial. This was due to the fact that, Prowe alike, he succumbed to the suggestion that the commemorative plaque founded by Kromer in 1581, in accordance with the founder's wish, was to have been placed directly at the astronomer's grave. Not being able to explain the supposed discrepancy, Schmauch concluded helplessly that in the case of Copernicus, for reasons unknown, an exception from the principle had been made: his altar had been in one place, but he had been buried elsewhere (Schmauch 1941).

Rev. Eugen Brachvogel was the last German scientist to have a say in this matter. He was a parish priest of one of Frombork's neighboring parishes and thus a frequent visitor to the local Archdiocese Archives. As his earlier publications exhibited his deeper knowledge of the realities of the Chapter of Warmia in Copernicus's times, he was appointed as an expert by the aforementioned scientific expedition from Königsberg during their search for Copernicus's remains. In his posthumously published article (Brachvogel 1942) he attempted to explain Schmauch's dilemmas by stating that Copernicus could have – in Brachvogel's view – exchanged his fourth altar for a different one, namely the one that since 1581 had been next to his commemorative plaque. Thus, in spite of significant progress in scientific research, the argument about Copernicus's place of burial, once established by Prowe, remained irrefutable.

4. Solution to the question of Nicolaus Copernicus's place of burial

Today, a scientist willing to resolve the issue of Copernicus's place of burial is faced with two questions requiring convincing answers:

1. Was it permissible for Copernicus to exchange the altar and canonicate that he succeeded for the one indicated by Prowe and Brachvogel?
2. Can it be deemed probable that the commemorative plaque founded by Bishop Marcin Kromer was – against his wish – not installed at Copernicus's place of burial?

The answer to the first question has been established as a result of long-term source queries that has ultimately allowed for establishing complete registers of all owners of the canon altars in the cathedral since the 15th century when the sources came into existence until 1720 when the burials at the altars were re-

placed with burials in a crypt built below the chancel at the time. From those registers corresponding with the aforementioned sixteen lists of canons it could be concluded that by no means could Copernicus have exchanged his fourth altar for either the seventh one or any other as each one of those sixteen altars held its own list of owners in an uninterrupted chronological order. It was also quite naturally impossible for two canons to own one altar at the same time, as in accordance with the statutes these were assigned individually alongside with the canonicate.

Having established the above, the answer to the latter question presented itself naturally. It could quite easily be substantiated that the chapter simply was unable to fulfil the wish of the bishop. As mentioned earlier, the commemorative plaque was installed in a place where there was enough vacant space on the wall. In actuality everything supports the claim that the plaque could not have corresponded with Copernicus's place of burial and – against the opinions of the scientists mentioned before – cannot be used as proof.

Copernicus's burial had to have taken place in accordance with the aforementioned principles and was by no means special and thus the mystery of his grave finds solution at the fourth altar in the right aisle, which belonged to him since the moment he received the canonicate until the day of his demise. These conclusions were the basis for the bold decisions of Doctor Bishop Jacek Jezierski, Provost of the Chapter of Warmia, to undertake a direct search for Copernicus's grave in the cathedral. From the historian's point of view, the principles practiced in the chapter, including Copernicus's grave, have been confirmed as expected (Sikorski 2005/2006; 2008).

References

BRACHVOGEL Eugen

1942: *Das Copernicus – Dienst im Dom zu Frauenburg*, "Zeitschrift für die Geschichte und Altertumskunde Ermlands", vol. 27 (3), pp. 585–587.

DITTRICH Frantz

1913: *Der Dom zu Frauenburg*, "Zeitschrift für die Geschichte und Altertumskunde Ermlands", vol. 18, pp. 157–158, 640.

FORSTREUTER Kurt, GAUSE Fritz (eds.)

1967: *Altpreussische Biographie*. Marburg – Lahn: Elwert; Historische Kommission für ost- und westpreußische Landesforschung, vol. 2.

HIPLER Franz (ed.)

1873: *Spicilegium Copernicanum. Festschrift des historischen Vereins für Ermland zum vierhundertsten Geburtstag des ermländischen Domherrn Nikolaus Kopernikus*. Braunsberg: Eduard Peter.

GĄSSOWSKI Jerzy

- (ed.) 2005 / (ed.) 2006: *Poszukiwanie grobu Mikołaja Kopernika*. Pod redakcją Jerzego Gąssowskiego. "Castrī Domināe Nostrae Letterae Annales" vol. II. Pułtusk: Wyższa Szkoła Humanistyczna im. Aleksandra Gieysztor, Bałtycki Ośrodek Badawczy, 2005; (ed.) 2006a (English translation): *The Search for Nicolaus Copernicus's Tomb*. Editor: Jerzy Gąssowski. Pułtusk: The Pułtusk Academy of Humanities, Institute of Anthropology and Archaeology; Fundacja Kronenberga, Citibank Handlowy.
- (ed.) 2008: *Badania nad identyfikacją grobu Kopernika / The Search for identity of Copernicus Tomb*. Pułtusk: The Pułtusk Academy of Humanities, Institute of Anthropology and Archaeology; Fundacja Kronenberga przy Citi Handlowy.

KOKOWSKI Michał

- 2009: *Różne oblicza Mikołaja Kopernika. Spotkania z historią interpretacji*. Warszawa–Kraków: Instytut Historii Nauki PAN, Polska Akademia Umiejętności.

PROWE Leopold

- 1866: *Über die Sterbeort und die Grabstätte von Copernicus*, "Der neuen Preussischen Provinzial – Blätter" 3 Folge, vol. 11, pp. 213–245.
- 1870: *Das Andenken des Copernicus bei der dankbaren Nachwelt* (Thorn). Reprinted from: „Neue Preussische Provinzial Blätter”; 3 Folge, vol. 11, 3/1870.
- 1883–1884: *Nicolaus Copernicus*, vol. 1, part 1–2, vol. 2. Berlin: Weidmannsche Buchhandlung.

SCHMAUCH Hans

- 1941: *Der Altar des Nicolaus Copernicus in der Frauenburger Domkirche*, "Zeitschrift für die Geschichte und Altertumskunde Ermlands", vol. 27 (2), pp. 424–430.

SIKORSKI Jerzy

- 1973: *W sprawie datowania śmierci Mikołaja Kopernika*, „Komunikaty Mazursko-Warmińskie”, 3/1973, pp. 261–274.
- 2005/2006: *Grób Mikołaja Kopernika w katedrze biskupów warmińskich we Fromborku na tle praktyki grzebalnej kapituły w XV–XVIII wieku / Nicolaus Copernicus's tomb in the Warmia bishops' cathedral in Frombork in the light of the chapter's burial practises in the 15th to the 18th centuries*. In: Gąssowski (ed.) 2005, pp. 81–170 / Gąssowski (ed.) 2006, pp. 73–165.
- 2008: *Praktyka pochówków biskupich w katedrze we Fromborku oraz kwestia grobu Łukasza Watzenrodego, wuja Mikołaja Kopernika / The practice of bishops burials in Frombork cathedral and the question of the grave of Nicolaus Copernicus's uncle Łukasz Watzenrode*. In: J. Gąssowski (ed.) 2008, pp. 134–155.

STAROWOLSKI Szymon

- 1627: *Scriptorum Polonicorum Hekatontas seu centum illustrium Poloniae Scriptorum elogia et vitae*. Venetiis.

WERMTER Ernst Manfred

- 1968: *Das polnisch – litauische Staatswesen aus der Sicht des ermländischen Bischofs Martin Kromer*. In: *Acta Prussica. Abhandlungen zur Geschichte Ost- und Westpreussens. Fritz Gause zum 75. Geburtstag*. Würzburg: Holzner.

Krzysztof Mikulski, Joanna Jendrzejewska, Anna Stachowska

Institute of History and Archives, Nicolaus Copernicus University, Toruń, Poland

Ancestors and close relatives of Nicolaus Copernicus and their female offspring

(Summary)

Presented here are the latest results of the research into genealogies of Toruń middle-class families connected to Nicolaus Copernicus as well as the origins of Copernicus's predecessors. The generations of Copernicus's great great grandfathers on his mother's side (Łukasz Russe and Herman Kordelitz, both of whom lived in the second half of the fourteenth century) have been traced. These studies fundamentally revise the genealogy of the Watzenrode family, revealing its connections with the Russe family in a different generation than it was previously claimed. A relatively plausible hypothesis has been formulated that refers to the parentage of the astronomer's grandmother from Kordelitz family.

Also presented are the hitherto results of the studies of female offspring of the aforementioned Copernicus's grandmother, Catherine née Kordelitz, which have been traced to mid-eighteenth century with some prospects for continuation in further generations.

These relate to three lines of offspring derived from Copernicus's first cousin Kordula von Allen, and his first cousin once removed Anna Krueger and Krystyna Beutel, who were married to representatives of the patrician class in Gdańsk in the early sixteenth century.

The interested reader is referred to the authors' previous publications.

MIKULSKI Krzysztof

1996: *Watzenrodowie i dom rodzinny Mikołaja Kopernika w Toruniu*. In: *Studia z dziejów miast i mieszczaństwa*, vol. 2, ed. by J. Tandecki, R. Czaja, Toruń 1996, pp. 243–256; http://kpbc.umk.pl/dlibra/applet?content_url=/Content/46264/Copernicana_012_13.djvu&handler=djvu.

- 1997: *Watzenrodowie i kapituła warmińska (rola związków rodzinnych w duchownych karierach mieszczan toruńskich w XIV-XV wieku)*. In: *Homines et societas. Czasy Piastów i Jagiellonów*, ed. by T. Jasiński, P. Jurek, J. M. Piskorski, Poznań 1997, pp. 358–371; http://kpbc.umk.pl/dlibra/applet?content_url=/Content/47936/Licencje_048_02.djvu&handler=djvu.
- 2008: *W kręgu toruńskich przodków Mikołaja Kopernika – Watzenrodowie i ich koligacje rodzinne / In the circle of Nicolaus Copernicus's Toruń ancestors – the Watzenrodes and their family relationships*. In: J. Gąsowski (ed.), *Badania nad identyfikacją grobu Kopernika / The search for identity of Copernicus tomb*. Pułtusk: The Pułtusk Academy of Humanities, Institute of Anthropology and Archaeology; Fundacja Kronenberga przy City Handlowy, pp. 40–65.

JENDRZEJEWSKA Joanna, STACHOWSKA Anna

- 2008: *Genealogia żeńskiej linii krewnych Mikołaja Kopernika – charakterystyka i stan badań / Nicolaus Copernicus's matrilineal genealogy – characteristics and progress examination*. In: J. Gąsowski (ed.), *Badania nad identyfikacją grobu Kopernika / The search for identity of Copernicus tomb*. Pułtusk: The Pułtusk Academy of Humanities, Institute of Anthropology and Archaeology; Fundacja Kronenberga przy City Handlowy, pp. 66–133.

Wojciech BRANICKI^{a,b}, Tomasz KUPIEC^a

^a Institute of Forensic Research, Section of Forensic Genetics, Kraków, Poland

^b Department of Genetics and Evolution, Institute of Zoology, Faculty of Biology and Earth Sciences, Jagiellonian University, Kraków, Poland

Examination of nuclear DNA markers in human remains from the grave 13/05 (Summary)

Keywords: Nicolaus Copernicus, human remains, identification, microsatellites, Y chromosome, genetic prediction of iris color.

There are two main reasons for which the use of mitochondrial DNA (mtDNA) markers constitutes a primary method employed in cases concerning identification of ancient bone material. Firstly, the high sensitivity of mtDNA analysis enables examination of heavily degraded specimens. Secondly, it provides greater feasibility for collection of suitable reference material. Analysis of nuclear DNA markers in bone samples is substantially more difficult as they are less stable in human remains. However, nuclear DNA data can be very valuable in the process of human identification. The positive results obtained for mtDNA markers analysis of the tooth collected from the grave 13/05 encouraged examinations of nuclear DNA markers.

Genotyping of a set of 15 autosomal microsatellite loci enabled determination of a partial DNA profile. It was thus confirmed that despite significant degradation of the sample, analysis of nuclear loci remains possible. Examination of amelogenin locus showed that the remains under examination belonged to a human male. The complete profile of the micro-satellite loci of the Y chromosome (Y-STR) could be useful if relatives in Copernicus's paternal line were found. A comparison of the minimal Y-STR haplotype (seven loci) determined in the studied remains with the haplotypes from the YHRD.ORG database revealed that contemporary matching profiles have been determined mainly in various European populations, e.g. Austrian, Czech and Polish.

Analysis of nuclear DNA may potentially provide access to another type of very useful information. Among nuclear markers there are ca. 25,000 genes determining human pheno-typic features. Their role is now a subject of intensive research.

The results of the analysis of the locus *HERC2*, which is the best known predictor of iris color, indicates that the person under investigation might have had blue eyes. This result is particularly interesting in the light of known portraits of Copernicus. This case is the first example of DNA-based eye-color prediction in human remains subject to identification.

The interested reader is referred to the authors' previous publications:

BRANICKI Wojciech, KUPIEC Tomasz

2008: *Badania genetyczne domniemanych szczątków Mikołaja Kopernika / Genetic analysis of alleged remains of Nicolaus Copernicus*. In: J. Gąsowski (ed.), *Badania nad identyfikacją grobu Kopernika / The search for identity of Copernicus tomb*. Pułtusk: The Pułtusk Academy of Humanities, Institute of Anthropology and Archaeology; Fundacja Kronenberga przy City Handlowy, pp. 212–225.

BOGDANOWICZ Wiesław, ALLEN Marie, BRANICKI Wojciech, LEMBRING Maria, GAJEWSKA Maria, KUPIEC Tomasz

2009: *Genetic identification of putative remains of the famous astronomer Nicolaus Copernicus*, "Proceedings of the National Academy of Sciences of the United States of America", July 28, vol. 106 (30), pp. 12279–12282;
<http://www.pnas.org/content/106/30/12279.full>.

Tomasz KUPIEC^a, Wojciech BRANICKI^{a,b}

^a Institute of Forensic Research, Section of Forensic Genetics, Kraków, Poland

^b Department of Genetics and Evolution, Institute of Zoology, Faculty of Biology and Earth Sciences, Jagiellonian University, Kraków, Poland

Identification of human remains from the grave 13/05 based on mitochondrial DNA data (Summary)

Keywords: Nicolaus Copernicus, human remains, hair, identification study, mitochondrial DNA, EMPOP database.

Analysis of polymorphism in mitochondrial DNA (mtDNA) has an obvious drawback caused by the low discrimination power of mtDNA markers. Nevertheless, it is often the only method possible to apply in cases of identification of human remains. This is due to two reasons. Firstly, the mtDNA analysis facilitates the highest possible sensitivity, which permits analysis of even seriously degraded specimens. Secondly, due to maternal inheritance of the mtDNA genome, its analysis may be the only source of identification markers when the available reference material comes from distant relatives representing maternal lineage.

Good preservation of the DNA extracted from the tooth collected from the alleged skull of Nicolaus Copernicus permitted positive analysis of highly discriminative nuclear markers. However, their identification capacity proved to be small due to the lack of appropriate reference material. The only reference samples preserved were retrieved from a few hair shafts found in a book used by the great astronomer and these could only be examined by mtDNA analysis. The examination of the skeleton showed that in the hypervariable region I (HVI) the same genetic profile existed both in the femur and the tooth. A complete mtDNA profile covering two hypervariable regions HVI and HVII (16129A, 16316G, 263G, 315.1C) was obtained from the tooth and the result was confirmed in two other independent laboratories. The analysis of reference material carried out at Uppsala University showed that the same mtDNA profile existed in two out of four reference hair shafts the analysis of which yielded positive results. The matching

mtDNA profile was noted four times in the database of mitochondrial haplotypes EMPOP.ORG. Based on this result, the estimated frequency of this mtDNA profile in general population could not be higher than 1:483 unrelated individuals. The outcome, when considered together with all other results in the studied case, strongly supports the hypothesis that the human remains from the grave 13/05 belong to our great astronomer Nicolaus Copernicus.

The interested reader is referred to the authors' previous publications:

BRANICKI Wojciech, KUPIEC Tomasz

2008: *Badania genetyczne domniemanych szczątków Mikołaja Kopernika / Genetic analysis of alleged remains of Nicolaus Copernicus* In: J. Gąsowski (ed.), *Badania nad identyfikacją grobu Kopernika / The search for identity of Copernicus tomb*. Pułtusk: The Pułtusk Academy of Humanities, Institute of Anthropology and Archaeology; Fundacja Kronenberga przy City Handlowy, pp. 212–225.

BOGDANOWICZ Wiesław, ALLEN Marie, BRANICKI Wojciech, LEMBRING Maria, GAJEWSKA Maria, KUPIEC Tomasz

2009: *Genetic identification of putative remains of the famous astronomer Nicolaus Copernicus*, "Proceedings of the National Academy of Sciences of the United States of America", July 28, vol. 106 (30), pp. 12279–12282; <http://www.pnas.org/content/106/30/12279.full>.

Arkadiusz SOŁTYSIAK

Department of Bioarchaeology, Institute of Archaeology, University of Warsaw, Poland

The use of an interpretative index in archaeology: a case study of the cranium 13/05 from Frombork¹

Abstract

Archaeological interpretations are frequently affected by wishful thinking. This problem may be reduced by consciously arranging the interpretation process, e.g. with use of a simple interpretative index. The first step is the definition of all possible and imaginable interpretations of a given phenomenon, then all possible pieces of evidence pro or contra the given interpretation should be identified and listed. When the list of interpretations and the list of criteria are ready, our evaluation of significance of gathered evidence can be arranged in a table using the following scale: -2 (the piece of evidence falsifies a given interpretation), -1 (it weakens the interpretation), 0 (the criterion is not adequate for a given interpretation), +1 (the piece of evidence supports the interpretation), +2 (it confirms the interpretation). The interpretative index is the arithmetic mean of all positive and negative values for a given interpretation. At the same time it is possible to calculate the diagnostic value of the whole gathered evidence as a proportion of the criteria for which the obtained values were different from zero. The ultimate result of such somewhat formalised procedure is the accepted interpretation with the highest interpretative index. The effectiveness of such method is tested here on a case study of the *cranium* 13/05 found in the Frombork cathedral and identified as the remains of Nicolaus Copernicus.

Key words: interpretative index, Nicolaus Copernicus, forensic identification, osteology.

Wishful thinking stands behind some archaeological interpretations (e.g. Nowak 1997 for an extreme example). This problem may be however reduced by arranging the process of interpretation in an explicit way allowing for easy verification, with the use of a simple interpretative index (II). To calculate such an index it is necessary to define the set of all imaginable interpretations of a given archaeo-

¹ The following article was peer-reviewed by Professor Sławomir Kadrow, Habilitated Doctor in Humanities (Cracow Branch of Institute of Archaeology and Ethnology, Polish Academy of Sciences; Department of Protohistoric Archaeology, Institute of Archaeology, University of Rzeszów).

logical phenomenon and to define the list of all potential pieces of evidence pro or contra any given interpretation. When the list of interpretations and the list of criteria is ready, they can be arranged in a simple table (interpretations in rows, criteria in columns). Next, we can fill in the table with our evaluation of significance of gathered evidence, which may be arranged in a table using the following scale: -2 (the piece of evidence falsifies a given interpretation), -1 (it weakens the interpretation), 0 (the criterion is not adequate for a given interpretation), $+1$ (the piece of evidence supports the interpretation), $+2$ (it confirms the interpretation). The II is the arithmetic mean of all positive and negative values for a given interpretation. Along with the II, it is possible to calculate the diagnostic value (DV) for a given set of criteria, as a proportion of the criteria for which the obtained values were different from zero.

The II defined in such a way may be very useful even not as a method for obtaining most likely interpretations, but to estimate the inter-observer error in interpretation by comparing IIs calculated by different interpreters. On the other hand, low DV may suggest that the used criteria are not adequate for a given problem. The ultimate result of such a somewhat formalised procedure is the accepted interpretation with the highest II, possibly accompanied by an estimation of the inter-observer error.

The use of the II may be exemplified on a relatively simple case study: the interpretation of the *cranium* 13/05 from Frombork (see the supplement). The authors of the original interpretation took into their consideration only one possibility, i.e. that the *cranium* belonged to Nicolaus Copernicus, and six criteria: (1) burial location, (2) accordance of sex and age-at-death, (3) presence of a wound above the orbit, (4) evidence of nose fracture, (5) concurrence of the reconstructed face of the individual 13/05 with the portrait of Copernicus, (6) concurrence of mtDNA extracted from the *cranium* 13/05 and from the hair found in the book that had belonged to Copernicus. According to Jerzy Gąssowski, all these pieces of evidence unequivocally support the only interpretation which had been taken into account (Gąssowski 2008).

Since a calculation of the II for one interpretation only makes no sense, also three other possibilities are considered here, namely that the *cranium* 13/05 belonged to (a) Lukas Watzenrode, Copernicus's maternal uncle, (b) other member of the Frombork chapter in the years ~ 1520 – 1626 , (c) another person, not a chapter member. Apart from six criteria listed above, two others may potentially differentiate the II of the four interpretations. First of them is the possible difference in proportions of stable oxygen, strontium or sulphur isotopes between the bone and the enamel of the individual 13/05. Such kind of research enables answering the question whether an individual migrated, and sometimes the direction of migration can be also assessed (Budd *et al.* 2004). During his child-

hood, Copernicus lived in Toruń, but he spent most of his adult life in Frombork, some 160 km north-east of Toruń. Thus, there is a possibility to obtain another (although weak) piece of evidence pro or contra the identification of the cranium 13/05 as Copernicus's bone. Also, radiocarbon dating of the bone has not been performed. In spite of its relatively broad range of uncertainty for the period of Copernicus's life, it may have been quite a strong piece of evidence in favour of the hypothesis that the cranium belonged to a non-member of the chapter if the obtained date is clearly earlier or later than the first half of 16th century AD. Radiocarbon dating together with ancient DNA analysis was successfully used for the falsification of the identification of the purported skull of St. Bridget (Birgitta) (Nilsson *et al.* 2010).

From among six criteria, four appeared to be not adequate for the addressed problem (see comments in the supplement). The concurrence of mtDNA suggests that the *cranium* 13/05 may have belonged to the member of the Warmia chapter between ~1520 and 1626 when the volume of *Calendarium Romanum magnum* was in Frombork. It is however not likely that this canon was Nicolaus Copernicus, because relatively low level of tooth attrition is a strong evidence against the identification of the *cranium* 13/05 as belonging to a person who died at the age of 70 years. Also Lucas Watzenrode may be excluded, as he died at the age of 65 while the age-at-death of the individual 13/05, based on tooth attrition, falls within the range of 20–40 years, and rather in its lower than upper part.

Supplement: The identification of the cranium 13/05 from Frombork

Diagnostic criteria and their assessment

1. Location of the alleged grave of Copernicus

- 1a. The hypothesis linking the burial place with the altar is speculative.
- 1b. The hypothesis linking the burial place with the altar has been falsified.
- 1c. The *cranium* 13/05 was most likely found in a secondary context.

2. Correspondence of sex and age-at-death

- 2a. Sex is not a good diagnostic criterion in this case.
- 2b. Age-at-death may be assessed as 20–40 years using the degree of dental wear.
- 2c. Probability that the individual 13/05 died in the age of 70 years is minimal.

3. Scar over the orbit

- 3a. There is a vascular groove over the orbit of the *cranium* 13/05.
- 3b. No scar can be observed on the Copernicus's portrait used for comparison.

4. Nasal bone fracture

- 4a. The *cranium* and atlas 13/05 exhibit great asymmetry.
- 4b. No fracture of nasal bones is visible on the photograph.
- 4c. The method of the fracture diagnosis was not specified.

5. Identity of the reconstructed face of the individual 13/05 with the Copernicus' portrait

- 5a. The approximation of the face from the skull is not a reliable method of identification.
- 5b. The shape of the mandible was imagined by the reconstructor.
- 5c. The eyebrows were reconstructed in an unusual way.

6. Correspondence of mtDNA isolated from the *cranium* 13/05 and a hair found in a book which once had belonged to Copernicus

- 6a. The probability of accidental correspondence was not estimated in a proper way.
- 6b. If the *cranium* 13/05 and the hair belonged to the same individual, he did not necessarily have to be Copernicus.

Tab. 1. Diagnostic criteria, interpretative index and diagnostic value for the *cranium* 13/05.

Diagnostic criterion	Lucas Watzenrode	Nicolaus Copernicus	Another chapter member	An individual who was not the chapter member
burial place	0	0	0	0
sex	0	0	0	0
age-at-death	-2	-2	0	0
scar over the orbita	0	0	0	0
broken nose	0	0	0	0
face identity	0	0	0	0
mtDNA correspondence	0	+1	+1	0
interpretative index	-2,0	-0,5	+1,0	-
diagnostic value	c. 15%	c. 30%	c. 15%	0%

Comments

1a. Leopold Prowe hypothesized that – as Copernicus’s commemorative plaque was located close to the St. Bartholomeus’s altar – Copernicus had curated that altar and was buried close to it (Sikorski 2006, p. 86). It is possible to deduce from historical sources that, actually, Copernicus curated the St. Vaclav’s altar (Gąssowski 2008 mentioned the St. Andrew’s altar). Jerzy Sikorski wrote in this context that Copernicus must have been buried close to the latter altar (Sikorski 2006, p. 94) and archaeological excavations were undertaken in that place. However, the tradition of burying canons close to the altars under their curation is not explicitly mentioned by any historical source and the whole Sikorski’s (2006) discussion of this tradition is speculative. The mentioned testaments in which canons asked for burial close to the altars which they had curated (Sikorski 2006, p. 89) is an argument against the existence of such a rule.

1b. The only skeleton found during the archaeological excavations in the Frombork cathedral close to the former St. Vaclav’s altar and identified on the basis of the coffin plaque was Andrzej Gąsiorowski, who curated the St. Ann’s altar (Gąssowski, Jurkiewicz 2006, p. 11). Close to the St. Bartholomeus’s altar, the tombstones of Jacob Tymmermann and Jan Hannow were located (Sikorski 2006, p. 88), and they curated, accordingly, the altars of St. Augustine (Sikorski 2006, p. 127) and St. Stephan (Sikorski 2006, p. 120).

1c. The burial labelled as 13/05 was discovered in the same place where the grave 2/05 had been found (Gąssowski, Jurkiewicz 2006, p. 12). The level of the grave 2/05 is 19.59 m above sea level (Gąssowski, Jurkiewicz 2006, p. 14), and the level of the grave 13/05 is 19.51 m above sea level (Gąssowski, Jurkiewicz 2006, p. 16). The difference is only 8 cm – much less than the dimension of a *cranium in situ* in any position. As the *cranium* 13/05 is not deformed in a considerable way, there is only one possible interpretation: the *cranium* 13/05 was thrown into the burial pit 2/05, and the “coffin outline” mentioned in the archaeological report is actually a part of the outline of the coffin from the grave 2/05. No drawings nor photographs of the alleged burial 13/05 have been published, but the lack of the mandible is another strong evidence that this burial was secondary. Also, according to the archaeological report, some bones found in other graves belonged to the individual 13/05. No list of these bones is available, nor any information how they were attributed to one individual (Gąssowski, Jurkiewicz 2006, p. 16). According to the witness of the excavations, these bones were scattered along the coffin 2/05 (Michał Juszczakiewicz, personal communication). The third piece of evidence in favour of the attribution of the *cranium* 13/05 to a secondary burial is *post mortem* loss of three incisors, which belong to the category of teeth which

most likely are lost during transportation of cranium after complete decomposition of soft tissues (cf. Duric *et al.* 2004).

2a. No diagnostic method of sex assessment using skeletal morphology was presented in the available books or papers about the *cranium* 13/05 from Frombork; the male sex has been determined using a genetic method (Branicki, Kupiec 2008, p. 219). As it may be assumed, the cathedral in Frombork was chiefly the burial place of priests, and thus the correspondence of sex has no diagnostic value in this case.

2b. No diagnostic method of the age-at-death assessment was presented either (Piasecki, Zajdel 2006; Piasecki 2008). It was possible to verify the age range mentioned in the archaeological report (60–70 years) using the available photograph of the maxillary dental arch (Tyszczyk 2009, p. 386). Three different methods (Brothwell, Miles, Millard and Gowland) produced similar results (Sołtysiak, Kozłowski 2009) and the age-at-death of the individual 13/05 may be estimated as 20–40 years.

2c. The probability that an individual who died at the age of 70 years had only so slightly worn teeth as the individual 13/05 may be roughly estimated using data published by Andrew Millard and Rebecca Gowland (2002). Dental wear of the first molar of the individual 13/05 is 8 (right side) or 11 (left side) in a 15-grade scale. For a higher degree of dental wear the 95% confidence range is 30–58 years, hence assuming that the dental wear distribution is close to the normal distribution, the mean is 44 years with a standard deviation of 7.14. Copernicus's age-at-death was 70 years, and such an age is distant from the mean by 3.64 standard deviations. Therefore, the probability that a 70-year-old or older individual had had the dental wear degree of the first molar equal to 11 is 0.000136. The dental wear of the second molar is 3 (right side) or 4 (left side). For dental wear degree of the left second molar the average age is 23 with the standard deviation of 3.6, so the age of 70 years is distant by 13.06 standard deviations from the mean. The probability that an individual with so slightly worn teeth was 70 years old or older is so small that the statistical programs produce 0 (Sołtysiak 2010a).

It is possible to hypothesize that the teeth of the individual 13/05 were exceptionally weakly worn due to a diet completely lacking abrasive particles. This hypothesis may be checked using the observation that three molars erupt one after other in the space of about 6 years. It means that the wear of the second molar starts about 6 years after the first molar has been used. Therefore, the greater difference in dental wear between the first and the second molar, the faster the dental attrition (Smith 1972; Scott 1979). As comparative samples, two sets of human remains were selected, both from the Khabur drainage in Syria. The first of them

was dated to ca. 3800–700 BCE (n=112), the second to ca. 500 BCE–1900 CE (n=8). In the earliest sample (A) females in each house milled flour using simple saddle querns and thus the bread contained great quantities of external mineral grit. In the later period (B) large rotary querns were introduced and flour was milled in community-based professional mills (Sołtysiak 2010b, p. 56–57). In effect, the quality of food increased. This change in the food preparation technique induced considerable decrease in the difference of dental wear between first and second molar (mean standardized difference is 0.07 in sample A and –1.12 in sample B; $t=2.99$, $p=0.0034$). The teeth at the right side of the maxilla of the individual 13/05 show difference –0.06 (after standardization), and the teeth at the left side show difference 1.40, which fits the central or upper range of sample A ($Z=-0.12$, $p=0.904$ for the right side; $Z=1.34$, $p=0.180$ for the left side), and differs from the mean for sample B ($Z=1.63$, $p=0.103$ for the right side; $Z=3.88$, $p=0.0001$ for the left side). It means that the rate of molar wear in the individual 13/05 was fast, so the methods of age-at-death assessment used for pre-industrial populations (among them the method of Millard and Gowland) produce reliable results or even overestimate actual age-at-death. The quality of food (and presence of grit particles which may have accelerated the rate of dental wear) may be verified using the analysis of enamel microwear pattern (cf. Mahoney 2006).

3. The vascular groove is clearly visible on the only relatively good-quality photograph of the *cranium* 13/05 (Gąssowski 2009, p. 16). On the other hand, no trauma is visible in the area of the right orbit (Kozłowski 2009). Also the portrait of Copernicus used for comparison (Gąssowski 2008, p. 27) shows no scar.

4. Also in the case of the alleged nose fracture – on the photograph of the *cranium*, nasal bones exhibit considerable asymmetry, but without fracture. Also Copernicus's nose on the portrait is not broken. No differential diagnosis was presented by the Pułtusk team.

5a. Facial approximations cannot be treated as a reliable tool of individual identification (Stephan, Henneberg 2001), chiefly because many characteristics which are taken into account during identification cannot be safely reconstructed using the skull (Stephan 2009; Stephan, Henneberg 2006; George 1993; cf. Sołtysiak, Kozłowski 2009). The authors of the reconstruction claim that they are able to reconstruct these elements using racial typology (Piasecki, Zajdel 2006, p. 33), i.e. the model of heredity of morphological characteristics which had been falsified more than 50 years ago and is no longer used in osteology (Bednarek 2015).

5b. The authors of the reconstruction claimed that the shape of the lower part of the face could be reconstructed using the shape of the mandibular pits of the temporal bones, but they did not refer to any anatomical paper showing that there

is any correlation between the shape of the mandible and the shape of the mandibular pit in the *cranium* (Piasecki, Zajdel 2006, pp. 32–33). Actually, there is an obvious isometric correlation between the general sizes of the *cranium* and the mandible, but the correlations between proportions of the two parts of the skull are weak (Ehrhardt 1952; Hilloowala *et al.* 1998; Andria *et al.* 2004; Spoor *et al.* 2005; Guyot *et al.* 2006). The shape of the mandibular pit in the temporal bone strongly correlates only with the shape of the condylar process in the mandible, but this is obvious as they are related anatomically (Kantomaa 1989).

5c. On the published picture showing the facial reconstruction, the upper edge of the reconstructed eyebrow is located below the upper edge of the orbit (Piasecki, Zajdel 2006, p. 32), although in the papers on the methods of facial approximation some authors observe that the lower edge of the eyebrows is usually located a few millimeters above (Krogman, Iscan 1986; Taylor, Brown 1998) or on the upper edge of the orbit (Yoshino, Seta 2000; cf. Jayaprakash, Alarmelmangai 2005; Sołtysiak, Kozłowski 2009).

6a. The correspondence of the sequence of a part of the HVI region in the mitochondrial DNA sampled from the *cranium* 13/05 and from the two hairs found in the *Calendarium Romanum magnum* that had belonged originally to Nicolaus Copernicus was interpreted as the ultimate proof of the identification of the *cranium* 13/05 as a part of Copernicus's skeleton (Gaśowski 2008, p. 36; Bogdanowicz *et al.* 2009, p. 12281), in spite of former caveats expressed by Marie Allen who did the mtDNA analysis (Allen 2008, p. 232). The maximum match probability (Lange 1993) was estimated at 0.2067% using a part of the EMPOP database which contains modern mtDNA sequences from the whole of Europe (Bogdanowicz *et al.* 2009, p. 12280). However, the authors of this research did not take into account the high inter-regional mtDNA variance which is the result of genetic drift (Helgason *et al.* 2009; Behar *et al.* 2006) and probably genetic draft too (Mishmar *et al.* 2003; cf. Lalueza *et al.* 1997). The inter-regional variance and the population substructure is routinely considered in forensics even in the case of DNA markers which exhibit much lower inter-population variance than HVI mtDNA (Awise 2008, pp. 153–155, translated by W. Branicki). In this peculiar case also the difference in time and the past migration processes must be taken into consideration, especially the massive migration of a large part of Pomerania and Warmia population to Germany after the Second World War. The haplotype of the individual 13/05 from Frombork was found in contemporary Ulm, Rostock and Copenhagen (Bogdanowicz *et al.* 2009, p. 12281) and such a distribution may be the effect of 20th century migrations rather than – as suggested by the authors of the genetic research – the evidence of the German origins of the individual 13/05.

The genealogical research has shown that Nicolaus Copernicus was born in an endogamic urban population in which females entered the reproductive age late (Jendrzewska, Stachowska 2008). In effect, the reproduction rate was low, which increases the genetic drift (cf. Yasuda *et al.* 1974). Additionally we know that the population of individuals buried in the Frombork cathedral was not a random sample from a regional population, but it included chiefly bishops and canons (Sikorski 2006), who could be related to each other in maternal line (as for example Nicolaus Copernicus, his brother Andrew and their maternal uncle Lucas Watzenrode in the years 1499–1512). Taking all this into account, it may be assumed that the polymorphism of mtDNA in the population of people buried in the Frombork cathedral could be substantially different from the mtDNA polymorphism in the contemporary European population covered by the EMPOP database. No attempt of more reliable estimation of accidental correspondence was undertaken for the population of individuals buried in Frombork, although the skeletons of more than hundred individuals were found in 2004–2006 during archaeological works and exploration of the crypts (Gąssowski 2008, p. 20, 32), and the mtDNA sequences of these individuals may have been checked.

6b. Among nine hairs found in *Calendarium Romanum magnum*, four yielded three different mtDNA sequences (Bogdanowicz *et al.* 2009).

The HVI region of mtDNA may mutate not only in germline cells (which leads to haplotype differentiation) but also in somatic cells. In effect, samples taken from different tissues or even from one tissue of one individual may include several variants of mtDNA, especially in elder individuals (Coskun *et al.* 2003; Yao *et al.* 2007; Kujoth *et al.* 2007; He *et al.* 2010). This may be the cause of mtDNA variability, e.g. in various samples of Isaac Newton's hairs (Gilbert *et al.* 2004). As the differences between samples taken from hairs found in the *Calendarium Romanum magnum* were noted in several loci (details have not been published; Allen 2008, p. 232) it is possible that these hairs belonged to three different individuals and not to one individual with three different haplotypes in somatic cells. If these hairs had belonged to three different individuals, the identification of the *cranium* 13/05 as a part of Nicolaus Copernicus's skeleton (with implicit assumption that he was the only reader of the *Calendarium*...) cannot be accepted. On the other hand, if these hairs had belonged to one individual, it means that individual identification based on mtDNA is not possible at all.

The volume *Calendarium Romanum magnum* belonged for roughly 20 years to Nicolaus Copernicus and then for almost 80 years (until 1626) to the Warmia chapter. During this time, the Gregorian calendar reform was introduced (1582). It seems likely that contemporary bishops and canons, if they wanted to know more about the Roman calendar and the need of its reform, read Stöffler's book

about the calendar, which was available in the chapter library. Therefore, the correspondence of the mtDNA sequence in the bone of the individual 13/05 and in the hairs found in *Calendarium...* may be the evidence in favour of the identification of the individual 13/05 as one of the possible readers of the book (i.e. most likely the chapter member from the years ~1520–1626), but not the ultimate proof that this individual was Nicolaus Copernicus.

According to Jerzy Gąssowski, the decisive evidence would be the correspondence of the mtDNA sequence between the *cranium* 13/05 from Frombork and a living Copernicus's relative in the maternal line (Gąssowski 2008, p. 28). In fact, the positive result would only show that the individual 13/05 was akin in maternal line with the modern relative of Copernicus. On the other hand, a lack of correspondence would not make such a relation impossible, taking into account the relatively high mutation rate in the HVI region of mtDNA (at least 0.0043 per generation, Sigurðardóttir *et al.* 2000, cf. Henn *et al.* 2009).

References

ALLEN M.

2008: *DNA analysis of shed hairs from Nicolaus Copernicus calendar*. In: J. Gąssowski (ed.), *Badania nad identyfikacją grobu Kopernika / The Search for identity of Copernicus Tomb*. Pułtusk: The Pułtusk Academy of Humanities, Institute of Anthropology and Archaeology; Fundacja Kronenberga przy Citi Handlowy, pp. 227–235.

ANDRIA L.M., LEITE L.P., PREVATTE T.M., KING L.B.

2004: *Correlation of the cranial base angle and its components with other dental/skeletal variables and treatment time*, “Angle Orthodontics”, vol. 74 (3), pp. 61–366.

AVISE J.C.

2008: *Markery molekularne, historia naturalna i ewolucja*. Translated by W. Branicki. Warszawa: Wydawnictwa UW.

BEDNAREK J.

2015: *The pitfalls of anthropological typology and the alleged skull of Nicolaus Copernicus* (in this monograph).

BEHAR D.M., METSPALU E., KIVISILD T., ACHILLI A., HADID Y. *et al.*

2006: *The matrilineal ancestry of Ashkenazi Jewry: Portrait of a recent founder event*, “American Journal of Human Genetics”, vol. 78 (3), pp. 487–497.

BOGDANOWICZ W., ALLEN M., BRANICKI W., LEMBRING M., GAJEWSKA M., KUPIEC T.

2009: *Genetic identification of putative remains of the famous astronomer Nicolaus Copernicus*, “Proceedings of the National Academy of Sciences”, vol. 106, pp. 12279–12282.

BRANICKI W., KUPIEC T.

2008: *Genetic analysis of alleged remains of Nicolaus Copernicus*. In: J. Gąssowski (ed.), *Badania nad identyfikacją grobu Kopernika / The Search for identity of Copernicus Tomb*. Pułtusk: The Pułtusk Academy of Humanities, Institute of Anthropology and Archaeology; Fundacja Kronenberga przy Citi Handlowy, pp. 213–225.

BUDD P., MILLARD A., CHENERY C., LUCY S., ROBERTS C.

2004: *Investigating population movement by stable isotope analysis: a report from Britain*, “Antiquity”, vol. 78 (299), pp. 127–141.

COSKUN P.E., RUIZ-PESINI E., WALLACE D.C.

2003: *Control region mtDNA variants: Longevity, climatic adaptation, and a forensic conundrum*, “Proceedings of the National Academy of Sciences”, vol. 100 (5), pp. 2174–2176.

DURIC M., RAKOCEVIC Z., TULLER H.

2004: *Factors affecting postmortem tooth loss*, “Journal of Forensic Sciences”, vol. 49 (6), pp. 1313–1318.

EHRHARDT S.

1952: *Die Morphologie eines Unterkiefers von Bogazköy*. In: K. Bittel, R. Naumann (ed.), *Bogazköy – Hattuşa: Ergebnisse der Ausgrabungen des Deutschen Archäologischen Instituts und der Deutschen Orient-Gesellschaft in den Jahren 1931–1939*. Stuttgart, vol. I, pp. 155–160.

GĄSSOWSKI J.

2008: *Examinations conducted to find Nicolaus Copernicus's grave and identify his skeleton*. In: J. Gąssowski (ed.), *Badania nad identyfikacją grobu Kopernika / The Search for identity of Copernicus Tomb*. Pułtusk: The Pułtusk Academy of Humanities, Institute of Anthropology and Archaeology; Fundacja Kronenberga przy Citi Handlowy, pp. 9–39.

2009: *Odkrycie grobu Kopernika*, “Archeologia Żywa”, vol. 5 (45), pp. 12–19.

GĄSSOWSKI J., JURKIEWICZ B.

2006: *The search for Nicolaus Copernicus's tomb*. In: J. Gąssowski (ed.), *The search for identity of Copernicus tomb*. Pułtusk: The Pułtusk Academy of Humanities, Institute of Anthropology and Archaeology; Fundacja Kronenberga, Citibank Handlowy, pp. 9–19.

GEORGE R.M.

1993: *Anatomical and artistic guidelines for forensic facial reconstruction*. In: M.Y. Iscan, R.P. Helmer (ed.), *Forensic analysis of the skull. Craniofacial analysis, reconstruction, and identification*. New York: Wiley-Liss, pp. 215–227.

GILBERT M.T.P., WILSON A.S., BUNCE M., HANSEN A.J., WILLERSLEV E. *et al.*

2004: *Ancient mitochondrial DNA from hair*, “Current Biology”, vol. 14 (12), pp. R463–464.

- GUYOT L., RICHARD O., ADALIAN P., BARTOLI C., DUTOUR O., LEONETTI G.
2006: *An anthropometric study of relationships between the clival angle and craniofacial measurements in adult human skulls*, "Surgical and Radiologic Anatomy", vol. 28 (6), pp. 559–563.
- HE Y., WU J., DRESSMAN D.C., IACOBUZIO-DONAHUE C., MARKOWITZ S.D. *et al.*
2010: *Heteroplasmic mitochondrial DNA mutations in normal and tumour cells*, "Nature", vol. 464, pp. 610–614.
- HELGASON A., LALUEZA-FOX C., GHOSH S., SIGURÐARDÓTTIR S., SAMPIETRO M.L. *et al.*
2009: *Sequences from first settlers reveal rapid evolution in Icelandic mtDNA pool*, "PLoS Genetics", vol. 5 (1), p. e1000343.
- HENN B.M., GIGNOUX C.R., FELDMAN M.W., MOUNTAIN J.L.
2009: *Characterizing the time dependency of human mitochondrial DNA mutation rate estimates*, "Molecular Biology and Evolution", vol. 26 (1), pp. 217–230.
- HILLOOWALA R.A., TRENT R.B., PIFER R.G.
1998: *Interrelationships of brain, cranial base and mandible*, "Cranio. The Journal of Craniomandibular Practice", vol. 16 (4), pp. 267–274.
- JAYAPRAKASH P.T., ALARMELMANGAI S.
2005: *Cranio-facial correlations of the orbital zone ascertained using skull-photograph superimposition*. In: T.M. Buzug *et al.* (ed.), *Reconstruction of soft facial parts. 2nd International conference, March 17–18, 2005. Book of abstracts*. Remagen: Kreative Konzepte, pp. 27–28.
- JENDRZEJEWSKA J., STACHOWSKA A.
2008: *Nicolaus Copernicus's matrilineal genealogy – characteristics and progress examination*. In: J. Gąssowski (ed.), *Badania nad identyfikacją grobu Kopernika / The Search for identity of Copernicus Tomb*. Pułusk: The Pułusk Academy of Humanities, Institute of Anthropology and Archaeology; Fundacja Kronenberga przy Citi Handlowy, pp. 66–133.
- KANTOMAA T.
1989: *The relation between mandibular configuration and the shape of the glenoid fossa in the human*, "European Journal of Orthodontics", vol. 11 (1), pp. 77–81.
- KOZŁOWSKI T.
2009: *Wstrzymać Kopernika! Ad vocem*, "Archeologia Żywa", vol. 6 (46), pp. 38–42.
- KROGMAN W.N., ISCAN M.Y.
1986: *The human skeleton in forensic medicine*, Springfield: Charles C. Thomas.
- KUJOTH G.C., BRADSHAW P.C., HAROON S., PROLLA T.A.
2007: *The role of mitochondrial DNA mutations in mammalian aging*, "PLoS Genetics", vol. 3 (2), p. e24.

LALUEZA C., PEREZ-PEREZ A., PRATS E., CORNUDELLA L., TURBON D.

1997: *Lack of founding Amerindian mitochondrial DNA lineages in extinct Aborigines from Tierra del Fuego-Patagonia*, "Human Molecular Genetics", vol. 6 (1), pp. 41–46.

LANGE K.

1993: *Match probabilities in racially admixed populations*, "American Journal of Human Genetics", vol. 52, pp. 305–311.

MAHONEY P.

2006: *Dental microwear from Natufian hunter-gatherers and Early Neolithic farmers: comparisons within and between samples*, "American Journal of Physical Anthropology", vol. 30, pp. 308–319.

MILLARD A.R., GOWLAND R.L.

2002: *A Bayesian approach to the estimation of the age of humans from tooth development and wear*, "Archeologia e Calcolatori", vol. 13, pp. 197–210.

MISHMAR D., RUIZ-PESINI E., GOLIK P., MACAULAY V., CLARK A.G. *et al.*

2003: *Natural selection shaped regional mtDNA variation in humans*, "Proceedings of the National Academy of Sciences", vol. 100 (1), pp. 171–176.

NILSSON M., POSSNERT G., EDLUND H., BUDOWLE B., KJELLSTRÖM A., ALLEN M.

2010: *Analysis of the putative remains of a European patron saint – St. Birgitta*, "PLoS ONE", vol. 5 (2), p. e8986.

NOWAK Z.

1997: *Ocean Czasu. Śladami Ossowieckiego: eksperymenty z psychometrii archeologicznej*. Warszawa: Fundacja Biomed.

PASSEMARD L.

1938: *Les statuettes féminines paléolithiques dites Vénus stéatopyges*. Nîmes: Tessier.

PIASECKI K.

2008: *Etyczne problemy odkrycia naukowego. Przypadek Mikołaja Kopernika / The ethical problems of scientific discovery. The case of Nicolaus Copernicus*. In: J. Gąssowski (ed.), *Badania nad identyfikacją grobu Kopernika / The Search for identity of Copernicus Tomb*. Pułtusk: The Pułtusk Academy of Humanities, Institute of Anthropology and Archaeology; Fundacja Kronenberga przy Citi Handlowy, pp. 196–203.

PIASECKI K., ZAJDEL D.

2006: *Anthropological research in Frombork. Tomb No. 13. Reconstruction of the appearance of the head on the basis of the skull*. In: J. Gąssowski (ed.), *The Search for identity of Copernicus Tomb*. Pułtusk: The Pułtusk Academy of Humanities, Institute of Anthropology and Archaeology; Fundacja Kronenberga, Citi Handlowy, pp. 21–36.

SCOTT E.C.

1979: *Principal axis analysis of dental attrition data*, "American Journal of Physical Anthropology", vol. 51 (2), pp. 203–211.

SIGURÐARDÓTTIR S., HELGASON A., GULCHER J., STEFANSSON K., DONNELLY P.

2000: *The mutation rate in the human mtDNA control region*, "American Journal of Human Genetics", vol. 66 (5), pp. 1599–1609.

SIKORSKI J.

2006: *Nicolaus Copernicus's tomb in the Warmia bishop's cathedral in Frombork in the light of the chapter's burial practises in the 15th to the 18th centuries*. In: J. Gąssowski (ed.), *The Search for identity of Copernicus Tomb*. Pułtusk: The Pułtusk Academy of Humanities, Institute of Anthropology and Archaeology; Fundacja Kronenberga, Citi Handlowy, pp. 73–165.

SMITH P.

1972: *Diet and attrition in the Natufians*, "American Journal of Physical Anthropology", vol. 37, pp. 33–238.

SOŁTYSIAK A.

2010a: *Kilka uwag do tekstu Karola Piaseckiego pt. „Wstrzymać Kopernika!”*, "Archeologia Żywa", vol. 1 (47), pp. 62–63.

2010b: *Death and decay at the dawn of the city. Interpretation of human bone deposits at Tell Majnuna. Areas MTW, EM and EMS*. Warszawa: Instytut Archeologii UW.

SOŁTYSIAK A., KOZŁOWSKI T.

2009: *Komentarz do identyfikacji cranium 13/05 z Fromborka jako kości Mikołaja Kopernika*, "Archeologia Polski", vol. 54 (2), pp. 377–386.

SPOOR F., LEAKEY M.G., LEAKEY L.N.

2005: *Correlation of cranial and mandibular prognathism in extant and fossil hominids*, "Transactions of the Royal Society of South Africa", vol. 60, pp. 85–89.

STEPHAN C.N.

2009: *Craniofacial identification: techniques of facial approximation and craniofacial superimposition*. In: S. Blau, D. Ubelaker (ed.) *Handbook of forensic anthropology and archaeology*. Walnut Creek: Left Coast Press, pp. 304–321.

STEPHAN C.N., HENNEBERG M.

2001: *Building faces from dry skulls: are they recognized above chance rates?*, "Journal of Forensic Sciences", vol. 46, pp. 432–440.

2006: *Recognition by forensic facial approximation: Case specific examples and empirical tests*, "Forensic Science International", vol. 156, pp. 182–191.

TAYLOR K.T., BROWN K.A.

1998: *Superimposition techniques*. In: G.J. Clement, D.L. Ranson (ed.) *Craniofacial identification in forensic medicine*. London: Arnold, pp. 151–164.

TYSZCZUK S.

2009: *Trójwymiarowa, cyfrowa dokumentacja kraniometryczna – drzemiące możliwości*. In: W. Dzieduszycki, J. Wrzesiński (ed.), *Metody. Źródła. Dokumentacja. Funeralia Lednickie, spotkanie*, vol. 11. Poznań: Stowarzyszenie Naukowe Archeologów Polskich, pp. 381–388.

YAO Y.-G., OGASAWARA Y., KAJIGAYA S., MOLLDREM J.J., FALCAO R.P. *et al.*

2007: *Mitochondrial DNA sequence variation in single cells from leukaemia patients*, “Blood”, vol. 109 (2), pp. 756–762.

YASUDA N., CAVALLI-SFORZA N.N., SKOLNICK M., MORONI A.

1974: *The evolution of surnames: An analysis of their distribution and extinction*, “Theoretical Population Biology”, vol. 5 (1), pp. 123–142.

YOSHINO M., SETA S.

2000: *Skull-photo superimposition*. In: J.A. Siegel (ed.), *Encyclopedia of forensic sciences*. San Diego: Academic Press, pp. 807–815.

Jarosław BEDNAREK

Chair of Molecular and Forensic Genetics, Department of Forensic Medicine, Collegium Medicum in Bydgoszcz, Nicolaus Copernicus University in Toruń, Poland

The pitfalls of anthropological typology and the alleged skull of Nicolaus Copernicus¹

Abstract

The aim of anthropological typology is a classification of human biological variability on the basis of morphological features. The authors of this concept argue that each individual can be assigned to a particular anthropological type, based on a defined set of characteristics. These characteristics are monogenically inherited in accordance with Mendel laws. Under these assumptions it is possible to use the typology for the purpose of personal identification. However, in light of contemporary knowledge in the field of population genetics and evolutionary biology, this concept is completely unscientific and devoid of biological meaning. This paper is a critical overview of the fundamentals of anthropological typology including attempts at using them in practice of personal identification, as it was in the search of the tomb of Nicholas Copernicus.

Keywords: anthropology, anthropological typology, personal identification the alleged skeleton of Nicolaus Copernicus.

1. Introduction

The human skeleton has many characteristics which may be useful for the purpose of identifying corpses. If the skeleton is complete, well-preserved and not changed by pathological, developmental, or genetic malformations, it is possible to uncover the gender, age at death and body height of the dead individual with sufficient precision to allow identification (Ubelaker 1989, Bass 1995, Piontek 1996). Experts base their assessment on thoroughly tested relationships between certain features of the skeleton and the age, gender and morphological character-

¹ The following article was peer-reviewed by Professor Guido Kriesel, Habilitated Doctor in Humanities (Department of Anthropology, Institute of Ecology and Environment Protection, Faculty of Biology and Earth Sciences, Nicolaus Copernicus University in Toruń; a member of the Committee of Anthropology, Polish Academy of Sciences).

istics of living persons. These methods are based on strong scientific evidence and their proper application, along with the experience of the scientists, guarantee the high probability of both reliable results and correct conclusions.

Unfortunately, alongside these trustworthy anthropological methods, some expert, when identifying specimens, employ methods lacking sufficient scientific grounding, i.e. methods originating from times when knowledge of the genetic background of human morphology was far from complete (Piasecki and Zajdel 2005, Zajdel 2006, Czubak 2009). One such method is anthropological typology.

2. Anthropological typology: its origin, scope and flaws

The doctrine of typology was created to deal with morphological variability of humans and understand its underlying mechanisms. The Polish school of anthropology provided the most significant contribution to this doctrine (Czekanowski 1937, Michalski 1947, Henzel and Michalski 1955). The aforementioned scientists distinguished three main varieties among human beings: White, Black and Yellow, which they further divided into 6 pure types and 15 mixed types resulting from cross-breeding of the pure types. According to Michalski, these types were further divided into lower taxonomic subunits: facies and morphs (Michalski 1947).

The aforementioned classification system was based on morphological criteria. According to its creators, individuals could be categorized by certain taxonomic units (types) depending on a combination of morphological characteristics. For instance, persons who were tall, with slender body built, short trunks, long limbs, narrow palms and feet, white skin with a pink tinge, fair hair, blue eyes, a narrow and straight nose, a narrow and oblong face and an oblong head were categorized as belonging to a Nordic type.

As a result, it was individuals rather than populations that were the basic unit of races. Correspondingly, every population irrespective of its location in the world, was to be a pool of individuals representing various anthropological types. Differences between various populations would be manifested in the proportion of individuals representing certain anthropological types.

Beside its morphological aspects, the doctrine of typology regarded the questions of taxonomy, genetics and statistics. In terms of taxonomy, a type (race) was understood as a unit consisting of subspecies or varieties. However, from a statistical point of view, the type was a set of certain traits, which in a population of randomly cross-bred individuals occur more frequently than it would be expected when assuming that traits are inherited independently.

The genetic aspect appears to play the most important role in trying to explain the inheritance of anthropological types. According to the founders of typology,

the characteristics specific for a certain anthropological type are inherited dependently, following Mendelian inheritance pattern. This suggests that they are determined monogenically and result in the pleiotropic effect. Consequently, every anthropological type is coded by a single gene which determines body height, proportion of head, face, limbs and trunk, and the pigmentation of eyes, hair and skin simultaneously. On the premise of monogenic inheritance of anthropological types, it was assumed that individuals possessing a specific set of morphological traits that made them homozygous represent the so-called “pure” types. Crossbreeding between representatives of various “pure” types gives rise to heterozygous individuals, representing the so-called “mixed” types. However, “pure” types do not disappear completely since they are reconstructed in future generations due to the so-called Mendelian cleavage pattern of half-breeds.

The typological attitude towards the question of morphological variability in human populations appears to be attractive from the point of view of examination technique methodology. The typological specificity of each individual may be easily determined by means of basic anthropometric tools and scale patterns of eye and hair pigmentation, as well as uncomplicated measurements and comparisons. Some typologists go even further and rely on their “gut feeling” alone. Hence, they use neither measurements nor statistical methods, classifying human types based on their own subjective impression.

Typological methods are sometimes used for the purposes of skeletal examination. Anthropological types are determined based on skull measurements. Since sets of morphological traits characteristic of certain types have been described in detail, typologists believe that determination of the anthropological type based solely on skull measurements allows for reliable conclusions about the eye and hair pigmentation.

Such an attitude is absolutely unjustifiable from a scientific point of view. The fundamentals of the typological doctrine of races were formulated in the second decade of the previous century, i.e. in a period of time when the foundations of population and molecular genetics as well as modern evolutionary synthesis had still not been developed. Typological theories were based solely on the analysis of morphological features and for obvious reasons could not be validated through genetic studies. The inaccuracy of the inheritance models proposed by typological schools – and in consequence of the whole theory – were already proven in the early 1960s by Bielicki (1961). The author did not have to use any genetic data, which was in fact unavailable in those days, and instead based his proof on the Hardy-Weinberg principle, a fundamental principle of population genetics. According to the typological doctrine, this principle is known as the law of type frequencies. It assumes that in a population with genetic equilibrium, the sum of square roots of empirically established frequencies of “pure” types should be

equal or close to one. However, in scientific literature reviews, Bielicki revealed that such relation – even if it existed – usually resulted from a so-called “cosmetization”, i.e. a purposeful selection of experimental material in order to achieve results that would prove the preconceived assumption. In other studies reviewed, the sums of square roots of “pure” type frequencies were significantly lower than one, and usually did not exceed 0.5. Consequently, the law of type frequencies is not satisfied, and typology itself is unjustifiable from the viewpoint of genetics. This conclusion is hardly surprising since it is not possible to create advanced theories on the dependent inheritance of sets of traits without any knowledge of the models of inheritance for individual traits.

Critics of typology accuse it also of being an abiological conceptualization, since it denies the existence of evolution (Bielicki, 1961). Typologists assumed that all human types were constant and remained unchanged throughout time and space. This means that they always existed and remained unaffected irrespective of changes in environmental conditions, the effects of natural selection, genetic drift, mutational pressure or migrations. This hypothesis lacks logic, particularly if – as claimed by its founders – anthropological types represent various combinations of traits and as some types predominate in particular regions of the world, it could be anticipated that they emerged as an adaptive response to specific environmental conditions in the given region. Consequently, each environmental change will result in either a decline of certain morphological features or a formation of new ones. Thus, any hypothesis claiming that morphological traits are neither formed nor modified as a result of evolutionary mechanisms lacks biological sense.

Another weak point of typology lies in its subjectivity. The existence of numerous alternative typological classifications and the disagreements among typologists on the definitions of certain anthropological types is proof enough. As Bielicki (1961) emphasized, typological classifications may be based on numerous criteria depending solely on the classifier’s feelings. Consequently, the taxonomy of the same individual may differ depending on the classification of choice. This also results from the fact that the reference ranges for the anthropometric indicators used to describe proportions have to be established arbitrarily by their very nature.

The typological doctrine of races is a theory which can currently only be considered as a historical curiosity. In fact, it is a collection of hypotheses formulated by scientists who lacked sufficient knowledge of the biological character of traits which were the subject of their studies. Anthropological typology is subjective, abiological and unjustifiable from the point of view of genetics. Consequently, the units which typologists described as races, types or race elements should be considered only as fictitious. Due to the aforementioned reasons, any attempt towards practical application of typology would be unjustified and discreditable. The determination of eye or hair pigmentation or skin tinge of unknown individu-

als based solely on the measurements of their skull is absolutely unfounded and may lead to false conclusions. These in turn will have fatal consequences if utilized for the purpose of investigation by the police or prosecutors. The process of identifying unknown individuals may be lead in the wrong direction and it may consequently become delayed or even impossible.

3. Critical remarks on the typological study of the alleged skull of Copernicus

The anthropological typology criticized above provides a theoretical basis for the anthropological examination of the alleged skull of Copernicus conducted by Karol Piasecki and the facial reconstruction made by Dariusz Zajdel (2005).

These authors stress the need to apply the typological knowledge for the purpose of identification of individuals, which is probably still being applied by only few anthropologists and police laboratories (Piasecki and Zajdel 2005; Zajdel 2006; Czubak 2009). In the context of the considerations presented in chapter 2, it is an obvious error.

Equally culpable, but perhaps without so many significant consequences, is the application of typology to the facial reconstruction of individuals or historical figures whose remnants were excavated by archeologists. Such a situation took place, among others, in the case of the remnants of Nicolaus Copernicus (Piasecki and Zajdel 2005). The authors claim in their report that the result of their efforts is “merely a model of the real appearance, not its reconstruction”. However, on the other hand, they fully acknowledge the use of typology for the purpose of determination of physical appearance and even quote the accomplishments of the Central Forensic Laboratory of the Polish Police Headquarters. Unfortunately, the authors do not refer to any scientific publications which would either document these achievements or defend convincingly the hypothesis of the applicability of typology to human identification. Moreover, they seem not to see or understand the scientific arguments against typology. In their opinion, the doctrine was discarded solely for ideological reasons in the rise of political correctness. Additionally, they mislead their readers formulating a peculiar and mistaken hypotheses about “the negation of the scientific foundations for any biological, internal division of our species”. This suggests their deficiency in the knowledge of the population doctrine of races (Montagu 1962), the concept of cline variability (Huxley 1938) and the imposing number of publications documenting recent studies on the genetic basis of variability in human populations (Cavalli-Sforza 1997; Collins, Brookes and Chakravarti 1998; Jorde and Wooding 2004; Malyarchuk *et al.* 2008; Tishkoff *et al.* 2009).

References

- BASS William M.
1995: *Human osteology. A Laboratory and Field Manual*. Missouri Archeological Society.
- BIELICKI Tadeusz
1961: *Typologiczna i populacyjna koncepcja rasy w antropologii*, "Materiały i Prace Antropologiczne", vol. 53.
- CAVALLI-SFORZA Luca L.
1997: *Genes, peoples, and languages*, "Proceedings of the National Academy of Sciences", vol. 94, pp. 7719–7724.
- COLLINS Francis S., BROOKS Lisa D., CHAKRAVARTI Aravinda
1998: *A DNA Polymorphism Discovery Resource for Research on Human Genetic Variation*, "Genome Research", vol. 8, pp. 1229–1231.
- CZEKANOWSKI Jan
1937: *Człowiek w czasie i przestrzeni*. Warszawa: Trzaska, Evert i Michalski.
- CZUBAK Andrzej
2009: *Rekonstrukcja wyglądu twarzy oraz antropologiczna ocena szkieletu generała Władysława Sikorskiego*, "Archiwum Medycyny Sądowej i Kryminologii", vol. 59, p. 27–32.
- GĄSSOWSKI Jerzy
(ed.) 2005 / (ed.) 2006: *Poszukiwanie grobu Mikołaja Kopernika*. Pod redakcją Jerzego Gąssowskiego. „Castrı Dominae Nostrae Letterae Annales” vol. II. Pułtusk: Wyższa Szkoła Humanistyczna im. Aleksandra Gieysztora, Bałtycki Ośrodek Badawczy, 2005; (ed.) 2006 (English translation): *The Search for Nicolaus Copernicus's Tomb*. Editor: Jerzy Gąssowski. Pułtusk: The Pułtusk Academy of Humanities, Institute of Anthropology and Archaeology; Fundacja Kronenberga, Citibank Handlowy, 2006.
- HENZEL Tadeusz, MICHALSKI Ireneusz
1955: *Podstawy klasyfikacji człowieka w ujęciu Tadeusza Henzla i Ireneusza Michalskiego*, "Przegląd Antropologiczny", vol. 21, no. 2.
- HUXLEY Julian
1938: *Clines: an auxiliary taxonomic principle*, "Nature", vol. 142, pp. 219–220.
- JORDE Lynn B., WOODING Stephen P.
2004: *Genetic variation, classification and "race"*, "Nature Genetics", vol. 36 (11 Suppl.), pp. 28–33.
- MALYARCHUK Boris *et al.*
2008: *Mitochondrial DNA phylogeny in Eastern and Western Slavs*, "Molecular Biology and Evolution", no. 25(8), pp. 1651–1658.

MICHALSKI Ireneusz

1949: *Struktura antropologiczna Polski*. Łódź: Łódzkie Towarzystwo Naukowe.

MONTAGU Ashley

1962: *The Concept of Race*, "American Anthropologist", New Series, vol. 64, no. 5, pp. 919–928.

PIASECKI Karol, ZAJDEL Dariusz

2005/2006: *Badania antropologiczne we Fromborku. Grób nr 13. Rekonstrukcja wyglądu głowy na podstawie czaszki*. In: Gąssowski (ed.) 2005c, pp. 27–37; 2006 (English translation): *Anthropological Research in Frombork. Tomb no. 13. Reconstruction of the appearance of the head on the basis of the skull*. In: Gąssowski (ed.) 2006, pp. 21–36.

PIONTEK Janusz

1996: *Biologia populacji pradziejowych*. Poznań: Wydawnictwo Naukowe UAM.

TISHKOFF Sarah A. *et al.*

2009: *The genetic structure and history of Africans and African Americans*, "Science", vol. 22, no. 324 (5930), pp. 1035–1044.

UBELAKER Daouglas

1989: *Human Skeletal Remains. Excavation, Analysis, Interpretation*. Washington: Taraxacum.

ZAJDEL Dariusz

2006: *Czy tak wyglądał Kopernik?*, "Problemy Kryminalistyki", no. 251, pp. 39–44.

Tomasz KOZŁOWSKI

Department of Anthropology, Faculty of Biology and Environment Protection, Nicolaus Copernicus University, Toruń, Poland; www.biol.uni.torun.pl/~kozlow/antrop/antrop.htm; kozlow@umk.pl

An anthropologist's reflections over the identification of the bone remains discovered in Frombork Cathedral and regarded as belonging to Nicolaus Copernicus. An attempt at critical evaluation¹

Abstract

It is claimed that the skull and fragments of skeleton discovered in Frombork Cathedral in 2004 undoubtedly belonged to Nicolaus Copernicus. On the basis of the available documentation and a description of the investigation conducted into these remains, an attempt is made at a critical argument with the premises that supposedly justify accepting the hypothesis of a positive identification. The paper refers to the research methods applied and to the interpretation of the results of anthropological (biological) and palaeopathological analyses.

Key words: physical anthropology, palaeopathology, age at the moment of death, cranial trauma, cranial asymmetry, facial approximation, mtDNA.

1. Introduction

Historical anthropology and bioarchaeology are natural (biological) sciences, focusing mainly on gaining knowledge and creating a description of the style and conditions of life, as well as the biological features of early-historic and prehistoric human populations. These disciplines study biological processes occurring in ancient populations and try to analyze the factors that influenced them. It is the analyses of individual remains, however, that are a particular type of anthropo-

¹ The following article was peer-reviewed by: Professor Krzysztof Kaczanowski, Habilitated Doctor in Biological Sciences (Department of Anthropology, Institute of Zoology, Faculty of Biology and Earth Sciences, Jagiellonian University, Chairman of the Committee on Anthropology of the Polish Academy of Sciences).



logical study. They usually focus either on skeletons of famous historical figures or on forensic analyses of bones of accident or crime victims. These studies aim at confirming the person's identity and gaining as much knowledge about this person's life and death as possible.

The 20th century, and especially its second half, is a period of dynamic development of new technologies and techniques of skeletal material analyses (see, for instance Charzewski, Piontek (ed.) 2000). They allowed an insight into past human lives. The use of modern scientific methods allowed also verification and reinterpretation of many previous results, and resolving problems that had been out of the scientists' reach until recently. Correspondingly, modern scholars, including anthropologists, have to continue modifying and modernizing their tools, and interpreting their results based on modern theories, rejecting methods and hypotheses that have been negatively verified. An updated selection of scientific methods is a subject of numerous anthropological publications, appearing along with the increase of knowledge on the subject (see, for instance Acsadi, Nemeskeri 1971, Buikstra, Ubelaker 1994, Piontek 1996, White 2000, White, Folkens 2005).

Science has worked out procedures that aim at objective verification of the study results announced. These procedures include, among others: an obligation to present the source materials constituting the base of the analysis in detail, and a precise description of the methods employed. They have to be both adequate to the task and to the latest contemporary knowledge related to the phenomenon under study. The whole scientific process is submitted to the reviews of the community representing the given discipline. The results gained during the studies that do not meet the above criteria cannot be fully accepted.

The alleged certain identification of the partly preserved human skeleton found in Frombork Cathedral is a clear violation of scientific conduct. These bones, registered in the inventory as 13/05, were presented to the public as the remains of Nicolaus Copernicus (Gąssowski, Jurkiewicz 2006, Gąssowski 2008, Archeologia 2009).

After a thorough analysis of the available information it appears that in the context of the errors committed, the method employed and the abandonment of many standard scientific procedures, these bones cannot be identified with enough certainty as belonging to the great astronomer. This paper is limited to a critique of anthropological and palaeopathological issues exclusively, and omits those that are a subject of interest of other scientific disciplines, such as archaeology, history or history of art.

Premise 1.

The age of the individual at the moment of death was estimated as 70, which is consistent with the age of Copernicus at the moment of his death.

The human skeleton has no single feature that would allow estimation of an individual's chronological age at the moment of death with a 1-year tolerance. The age evaluated on the basis of the bones is a biological age, not a calendar one. It can only be a more or less precise approximation of the number of years a given person lived. Not all of the bones have the same age diagnostic value either. This is why comprehensive methods are recommended in the case of age estimation (Pickering, Bachman 2009). It is especially important in the case of single skeleton studies.

We do not know what criteria were used for the age evaluation of the remains from Frombork registered as 13/05. There is no detailed information concerning this issue. It can only be assumed that it was based on the level of obliteration of cranial sutures. This method is seriously inaccurate, due to the extremely large variation in the rate of fusion of the cranial sutures in humans. Completely open sutures can be found even in 20-year-old individuals and open ones in persons of old age (Novotny *et al.* 1993). In the case of the presence of other skeletal diagnostic features some forensic anthropologists even recommend ignoring the degree of fusion of cranial sutures as an age criterion (Klepinger 2006).

On the other hand, the most reliable method based on the observation of a single feature is the observation of the rate of tooth wear (Lovejoy *et al.* 1985, White, Folkens 2005). The abrasion of the occlusal surface of a tooth crown is one of the features of the hard tissue of teeth that changes along with the process of aging (Fig. 1). This phenomenon is well recognized in archaeological skeletal materials (Aufderheide, Rodriguez-Martin 1998).

In light of this, the negation of this method by J. Gąssowski (2009) is completely unfathomable. It is contrary to the knowledge of the usefulness of particular morphological features to define the moment of death on the basis of a skeleton. A. Sołtysiak and T. Kozłowski (2009) state, that in the case of the skull 13/05 the age did not exceed 50 years. It was estimated by means of three methods of examination of the abrasion of maxillary molars (right and left M1 and M2) following the analysis of the published photographs of the upper teeth arch (Tyszczyk 2009). As a result, the remains cannot belong to Copernicus, who died at the age of 70. A. Sołtysiak (2010) goes as far as saying that the possibility of a 70-year-old or older individual having such a level of wear of the first molar is equal to 0,000136. It can indicate that a method that did not give an expected result was disregarded on purpose.



Fig. 1. Average level of molar abrasion in old age (>55 years of age). Inowrocław, 16th–18th century, male (photo T. Kozłowski).

Is it possible to evaluate the level of tooth abrasion from a photograph? The answer to this question is positive. As a part of the Global History of Health Project all its participants, including the author of this paper, had to perform the so-called “inter-observer error quiz”. The test included, among others, evaluation of molar teeth abrasion according to the scale used in the project (Codebook 2005). Obviously, it was done from photographs by comparing them to models. The statistical analysis of the test results showed high consistency both between the evaluators, and between the evaluation performed on both the bone material and the photograph (Kozłowski 2008). Each interested party can take an online test (<http://global.sbs.ohio-state.edu/onlinequiz>).

It must also be stated, that in the case of a skull, after disregarding teeth, what remains for analysis are the cranial sutures. The methods of estimation of age on older individuals from other skeletal elements limit the diagnosis to stating that the individual was more than 50 years of age. Thus the expression of suture obliteration should be confronted with all other age marking features (such as the evaluation of the internal structure of the proximal ends of the humerus and the

femur, the morphology of the pubic symphysis and the auricular surface of the ilium and the acetabulum).

In conclusion, it cannot be unequivocally stated that the discovered skull and other bones belonged to a person who died around the age of 70. Other features, such as the abrasion of tooth crowns, suggest that the age could be radically different. This problem would require further comprehensive studies, which have not been conducted.

Premise 2.

Facial approximation from the skull and its general and detailed consistency with the so-called "Toruń portrait" of Copernicus.

The human face is an extremely complicated morphological system. Its individual features are defined by a large number of more or less discrete features that often do not show any stronger relation to the shaping of the skull bones (George 1993). Because of this the so-called "reconstructions" of human appearance are to a large extent a subjective image of a human face. They are almost an artistic vision. It is proved by various approximations performed on the basis of the same skull that differ so much from one another that one can have an impression of looking at completely different persons. During adult life our face changes radically from early adulthood to old age. Facial bones do not show such dynamic changes.

Obviously, it is only possible to capture some general morphological features based on a macerated skull. It is, however, absolutely impossible to recreate true individuality comprising the following features: the shape of the eye gap and the eyelids, the shape and morphology of lips, direction of facial grooves, facial and head hair and all pigmentation features; wrinkles, subcutaneous fat, moles, etc. (George 1993). Therefore, such reconstruction is not a visualization of the actual human appearance at all and can differ from it substantially.

As numerous research results show, facial "reconstruction" rarely leads to creation of a properly identified image. The frequency of correct recognition is comparable to the frequency derived from the calculus of probability in the case of completely random face selection from a set of different individuals that includes the image of the person that the skull belonged to. Among the tested methods only the so-called "3D sculpting American method" has given statistically significant results (Stephan, Henneberg 2000, Stephan, Henneberg 2005). It turns out that in the case of the most popular methods, especially those of Gierasimov and Krogman, deployed to reconstruct, for instance, nasal protrusion, the "reconstructions" give wrong results for this part of the face (Stephan, Henneberg,

Sampson 2003). It should also be mentioned that the facial approximation based on the skull 13/05 from Frombork was indeed done by means of the Gierasimov method (Piasecki, Zajdel 2006). The results of the analyses mentioned above as well as their statistical data unequivocally show that the method of facial “reconstruction” is an incorrect, imprecise and unreliable technique.

It is also possible to refer to the alleged similarity of the created approximation to the portrait images of the astronomer. It can be done by means of a detailed analysis of various morphological features. Such actions have been undertaken, for instance, during anthropological studies related to disputed paternity cases. Today, the identification of individuals takes place on the basis of photographs. Such analysis relies upon description of similarities and differences between more than 200 facial and head features in specific morphological structures, e.g.: head hair, eye and its surrounding area, nose, lips and their surrounding area, facial grooves, auricle, etc. (see, for instance Szczotkova 1985). In the light of the evaluation of similarities and differences between the approximation and the so-called Toruń portrait, it turns out that they are close (similar) only within the range of the features that were impossible to recreate basing on the skull. The features showing the largest similarity are mainly: the shape, form and arrangement of the head hair, the shape and details of the lower face – below the lips and the stylization of clothing elements. Other morphological features, created in the approximation, usually significantly differ from the portrait. Obviously, the variability of the morphological features in the ontogenesis as a result of the aging of the organism, has been taken into account here (Szczotkova 1985). One can be under the impression that it was the intention of the approximation authors to offer our subconsciousness distinctive physical features similar to those in the known images, which, however, are not certain to be authentic.

The brain is built to attempt to find familiar regularities and structures even in meaningless noise, especially when a pre-made interpretation is suggested (Shermer 2009). This effect is well-known to neurophysiologists and psychologists. A similar mechanism was used for the validation of a trace of a non-existing “scar” after an injury in an entanglement of lines, colorful spots and chiaroscuro, symbolizing mimic wrinkles and facial grooves visible on the portraits of Copernicus. Additionally, as mentioned above, such features as the shape and form of hair, the lower part of the face, and most of all – the clothing, unambiguously refer to the known portrait of the astronomer. Such stylization is unacceptable. It results in the approximation being recognized as the person from the portrait, which is similar to the way caricatures, albeit significantly different from the original in terms of anatomy and morphology, are easily associated with the real, physical persons. It seems that the similarity might be just an illusion suggested to the brain by the authors of the approximation.

Assuming that one of the portraits of Copernicus might be true, the superprojection technique would be more appropriate here. It has been already postulated by M. Kokowski (2006/2007, 2007). The true image of the head and the face of the analyzed person is superimposed on the image of the skull, to compare their consistency in terms of morphological features and the localization of anthropometric points. This technique was used, among others, in the case of the identification of some members of the family of the last Russian Tsar, Nikolai Romanov (Kolesnikov, Pashinyan, Abramov 2001).

Premise 3.

The consistency of the anthropological type of the skull with the racial type of the person in the portrait.

One of the most difficult things here is a comprehensive reaction to the indiscriminate use of racial typology as a method of identification. A comprehensive criticism of the typological assumptions exceeds the scope of this work. We can, however, attempt to summarize the main objections to the typological concept of race. In Poland it was formulated by T. Bielicki as early as at the beginning of the 1960s (Bielicki 1961). Racial typology was considered as: missing any genetic foundations, abiological and inconsistent with the theory of evolution. Additionally, it is laden with research bias. It completely discredits the race typology in the area of contemporary human biology, and thus it should not be used in anthropological forensic research either.

Anthropologists are fully aware of the fact that humans differ from one another. Individual variability has been studied for many decades. A set of phenotypic features is not, however, just a derivative of the function of genes inherited in an uncomplicated Mendelian manner (such as blood types). It is a resultant of development determinants, the genes, and then of the influence of paragenetic and non-genetic factors (developmental stimulators) and the influence of the natural and cultural environment (Malinowski 2004). Features of quantitative character are especially ecosensitive. A major part of these features was considered as highly diagnostic in the concept of racial typology. A single individual would never represent the variability characterizing the group they originate from. It relates both to the variants of their genes – the alleles, and to the value of the morphological features, characterizing the individual. Based on the skull, it is possible to perform identification of the so-called “variants” (white, yellow, black), and then to assume the expression of some of phenotypic features (such as pigmentation). On the other hand, based on a skull structure, it is impossible to draw conclusions about the pigmentation features of an individual coming from a Eu-

ropean population, in which virtually all variants occur, including disharmonic ones (for instance dark hair and bright eyes). If Nicolaus Copernicus had been a native African or Asian, and the task had involved the identification of his skull in a set of native European skulls, it would have been possible. Such procedures were elaborated for the forensic anthropology in countries with a population being a biologically and ethnically diversified conglomerate, for instance: the USA (Novotny *et al.* 1993, Gill 2009).

The use of racial typology discredits the results gained, from the perspective of the contemporary human biology, the ontogenetic development theory and genetics, including population genetics and ecology. Where does this attachment to the typological way of thinking come from? As J. Strzałko (2005) points out, quoting D. Hull, the phenomenon results from the natural human habit of stereotypical thinking and the tendency towards typological classification of the surrounding reality. This also includes other people despite the fact that it is contrary to contemporary knowledge of the evolution of living organisms, which man is not born with (Strzałko 2005).

The fact that racial typology is still used in Polish forensic science and forensic anthropology is indeed very disturbing. A good example of that are the typological descriptions of the skull 13/05 from Frombork (Piasecki, Zajdel 2006), or an even greater curiosity, the description and “racial” analysis of the remains of general Władysław Sikorski (Czubak 2009).

Premise 4.

Confirmed pathological changes in the 13/05 Frombork skull.

Palaeopathology focuses on studying and diagnosing pathological changes in fossil materials. This is a well-established discipline with its own research procedures and algorithms of recognizing and differentiating pathological changes in bone material. It employs a whole spectrum of analytical methods, including imaging and visualization, as well as advanced diagnostics. Bone material traumas have been studied by palaeopathology for a long time (Armelagos, Mielke, Winter 1971, Goodman, Martin 2002), and also described and analyzed in Polish anthropology (e.g. Ćwirko-Godycki, Swedborg 1978; Malinowski, Huber 1981; Gładkowska-Rzeczycka 1980, 1989; Promińska 1993; Kozłowski 1993; Kozłowski 1994; Jakubowska, Kozłowski 2010). The criteria of trauma recognition and classification are well known (Ortner, Putschar 1981; Kozłowski 1993; Aufderheide, Rodriguez-Martin 1998; Ortner 2003; Roberts, Manchester 2005). It is also true for forensic anthropology (Klepinger 2006), in which traumas are the cause of death and therefore have to be revealed and properly interpreted.

In the case of the analysis of the skull 13/05 from Frombork, no diagnostic criteria or ways of evaluation of their assumed pathological changes were presented. No proper documentation is present either. It puts the statements in an area of speculation. One of the postulates suggests the existence of a “scar” after an injury, above the right eye socket (Gąsowski Jurkiewicz 2006; Piasecki, Zajdel 2006), and a post-injury state after a nose fracture (Piasecki 2009), which was supposed to cause the visible asymmetry of the whole skull. The trace is located quite high above the eye socket on the plate of the frontal bone is without any doubt an arterial groove (an epigenetic feature) (Hauser, De Stefano 1989), and has nothing to do with trauma or pathology. Very similar traits appear also on other skulls (Fig. 2). The diagnosis was completely wrong here. The evaluation of



Fig. 2. Arterial grooves on a skull above the right eye socket, “identical” in terms of form and localization to the case of the skull 13/05 from Frombork. Mogilno, contemporary, male (photo T. Kozłowski).

the injury of the nose and its surrounding area, and the secondary skull asymmetry is also problematic. Skull asymmetry can be a result of numerous causes, including post-mortem and taphonomic changes (Jurda 2008). Ante-mortem causes comprise various developmental defects (Barnes 1994), metabolic illnesses such as rickets (Brickley, Ives 2008), head and neck tumors, nerve paralysis, muscle contracture and damage (Dacre, Kopelman 2003), and disturbed skull suture fusion (Barnes 1994, Rice 2008). The differences between the left and right side of the head can also be an expression of fluctuating asymmetry (Szczerowski, Kwiatkowska 2008). Without additional research, considering the wrong interpretation of the arterial groove, the hypothesis related to the nasal / facial injury cannot be considered as an obvious fact. Furthermore, skull injuries, even serious ones, do not always lead to general asymmetry of the skull. The features visible on the published photographs of the skull 13/05 (Tyszczyk 2009, Archeologia



Fig. 3. Asymmetry of a skull without traumatic traces. The asymmetry is present in, among others, nasal bones, nasal base, as well as in the mastoid process and the skull base. Middle Ages, male (photo T. Kozłowski).

2009), which actually reveal the asymmetry, do not determine the veracity of its post-traumatic etiology. Similarly to the case of the skull from Linowo (Fig. 3), they present similar asymmetry, including nasal bone structures. In this case it is surely not a result of a trauma, i.e. bone fracture.



Fig. 4. A tomographic image of a skull revealing an asymmetry of the posterior cranial fossa and positions of the pyramids of the temporal bones. The arrows show hypoplasia of the squama occipitalis. Brzeg (Oder), 13th–16th century, male.

It seems that the problem of existence of possible pathologies and their etiology could be explained by performing detailed radiological examinations, including CT (Fig. 4). Histological analyses can also be helpful here. Results of such studies have not been presented. One can be particularly concerned about the possibility that the false information about the health of Nicolaus Copernicus will become a part of the scientific and popular literature if the remains were actually considered as authentic.

Premise 5.
**Conformity of mtDNA sequences gained from the bones
with the hair found in the book.**

Examination of ancient DNA is complicated and difficult. Interpretation of the results is often ambiguous. Sometimes earlier conclusions are thoroughly revised later on. One such proof is, for instance, the molecular confirmation of cross-breeding of humans of modern anatomy with Neanderthals (Gibbons 2010), which had been excluded by former research basing on the analysis of mtDNA. The opinions and final conclusions of genetic experts in disputed paternity cases sometimes, for various reasons, completely exclude one another (Grzybowski *et al.* 2009). Recently, a paper was published on mtDNA variability at an individual level (He *et al.* 2010). Its authors suggest that the new data can influence the interpretation of forensic expert opinions basing on various types of genetic material.

Unfortunately, contemporary archaeology started to regard ancient DNA studies as a method “that explains everything” and “finally settles all questions”. This usually results from the lack of knowledge among the representatives of humanities about the properties of the DNA: its structure, its inter- and intra-population variability, research methods and all the limitations.

It can be assumed that the examination of the mtDNA obtained from one hair found in a book in Uppsala has been performed in accordance with current standards (Allen 2008). Nevertheless, the methods themselves and their reliability are not a problem here. There is no doubt that the subject hair cannot be indiscriminately considered as belonging to Nicolaus Copernicus. In other words, the genetic material coming from it cannot be considered as a certain source. Based on such evidence, it is difficult to acknowledge the identity of the remains as confirmed. The Russian Orthodox Church, requesting unequivocal evidence supporting the authenticity of the remains of the last Tsar and his wife ensured complete certainty of the research based on mtDNA (Lech, Piechota 2010). The genetic material was taken from reliable sources, i.e. the skeleton of the younger brother of Nikolai II and his living female line relative. Additionally, it was also obtained from a person related in a female line with Nikolai’s wife, Alexandra Feodorova. Obviously, in the case of the remains from Frombork no such possibilities exist, so unequivocal and certain conclusions are impossible too.

The assumption that the mtDNA from a tooth of a person of unknown identity and that coming from a hair of another person of unknown identity should allow identification of Nicolaus Copernicus is not justified. It is a grave error. It is based on the premise that fragments of the mtDNA obtained from the skull confirmed that the hair belonged to Copernicus, while the fragments of the mtDNA obtained from the hair confirmed that the subject skull belonged to the astronomer. Such

conclusions are of tautological character. It can also be mentioned that a similar error characterized the methods of distinguishing the so-called racial types (see, for instance Bielicki 1961).

Mitochondrial DNA can only be used to determine the affiliation of an individual to the same maternal line of mtDNA. It is believed that mtDNA is inherited exclusively from the mother. Nicolaus Copernicus thus did not differ from his uncle, Lukas Watzenrode, nor his mother, grandmother or their other offspring. It seems that Marie Allen was perfectly aware of that fact when she wrote that the obtained results are not a conclusive proof and can only support finding the answer to the mystery (Allen 2008).

The examination of the DNA isolated from bones, performed by W. Bogdanowicz and his team (Bogdanowicz *et al.* 2009) cannot unequivocally validate the identification of the studied bones as the remains of Nicolaus Copernicus. In the paper, besides abundant extremely interesting and detailed information about the individual the bones belonged to, e.g. the bright (blue) pigmentation of the iris, the authors consistently use the term “supposed remains”. It is not controversial. These studies also show the disadvantages of the use of the concept of racial typology. K. Piasecki, while conducting a typological analysis of the skull 13/05 from Frombork, had to state that this person must have had dark eyes, which was included in the face approximation made by D. Zajdel (Piasecki, Zajdel 2006).

In the case of the genetic examinations performed we can thus only state that they did not exclude the possibility that the bones from Frombork belonged to Nicolaus Copernicus. It is not, however, identical to certain and unequivocal confirmation that the bones belong to the astronomer. This is sometimes omitted, but it is essential information for the recipient of the results of genetic research.

Conclusions

Virtually immediately after finding of the skull and skeleton 13/05 remains they were aggressively promoted as belonging to Nicolaus Copernicus. One can have an impression that the search and the studies that followed were only a part of a wide-scale promotional activity. Substantive issues and search for the truth were moved aside (compare Kokowski 2006/2007, 2007).

In 1912, in the town of Piltdown in England skull bones were discovered which were later interpreted as remains of a “missing link” between apes and humans. This opinion was favoured by the major part of the community of the most prominent British anthropologists including the famous Sir Arthur Keith. The atmosphere around the discovery was very similar to the one around the discovery of the so-called “Copernicus skull”. A similar discussion is taking place in the case of the remains of “the hobbit” from the Indonesian island of Flores. There

is a large group of anthropologists who do not acknowledge this find as a representative of a different human species (Henneberg, Schofield 2008). It should be added that the author of this article participated, among others, in interdisciplinary, detailed studies of medieval burials in the crypt of Kwidzyn cathedral. They are assumed to belong to the Three Great Teutonic Masters (Grupa, Kozłowski, ed. 2009). Despite a rich archaeological context (well-preserved crypt, preserved coffins containing complete skeletons, remaining robe fragments and other inventories) and additional use of a wide spectrum of analyses (dendrochronological dating, chemical and molecular bone analyses, morphological and radiological studies of the skeletons), I am fully aware that the evidence is circumstantial. In consequence, the final conclusion must remain in the sphere of more or less probable assumptions. On the other hand, as a reliable scholar, I felt obliged to present all source data (see Grupa, Kozłowski ed. 2009) to be verified by other scholars and discussed without any limitations.

In Polish anthropology and archaeology, it is possible to find, albeit rare, cases of errors, myth-making or even archaeological parapsychological “studies” described in books by proud authors.

It seems that neglecting numerous additional studies of the remains 13/05 from Frombork and the non-publication of detailed documentation of this find have deterred an explanation of many doubts. Circumstances that have not been fully explained in the process cannot be interpreted in favour of the identification claim, as is the process in court cases. Science is ruled by different laws. We can mention such analyses, which would significantly contribute to the issue, as bone chemical analysis (trace elements, stable isotopes of C, N and O), radiological examinations, and computer tomography, as well as detailed morphological analyses of all discovered bones. The comprehensive and interdisciplinary studies of medieval burial sites found in the chancel of the Kwidzyń cathedral could be an example of such proceedings (Grupa, Kozłowski (ed.) 2009).

If the remains truly belonged to Nicolaus Copernicus, the result is a lack of information about the history of the astronomer’s life, which would significantly enrich his biography. Therefore, it raises a question about the purpose of the effort aiming at finding his remains.

References

- ACSADI G., NEMESKERI J.
1970: *History of human life span and mortality*. Budapest: Akademiai Kiado.
- ALLEN M.
2008: *DNA analysis of shed hairs from Nicolaus Copernicus calendar*. In: J. Gąsowski (ed.), *Badania nad identyfikacją grobu Kopernika / The search for identity of Co-*

pernicus tomb. Pułtusk: The Pułtusk Academy of Humanities, Institute of Anthropology and Archaeology; Fundacja Kronenberga przy Citi Handlowy, pp. 227–235.

“ARCHEOLOGIA”

2009: *Odkrycie grobu Kopernika*. “Archeologia Żywa”, vol. 5 (45), pp. 12–19.

ARMELAGOS J.G., MIELEKE H.J., WINTER J.

1971: *Bibliography of Human Paleopathology*. “Research Reports” Number 8. Amherst, Massachusetts.

AUFDERHEIDE A., RODRIGUEZ-MARTIN C.

1998: *The Cambridge Encyclopedia of Human Paleopathology*. Cambridge: Cambridge University Press.

BARNES E.

1994: *Developmental Defects of the Axial Skeleton in Paleopathology*. Colorado: University Press of Colorado.

BIELICKI T.

1961: *Typologiczna i populacyjna koncepcja rasy w antropologii*. “Materiały i Prace Antropologiczne”, Nr 53. Wrocław: Zakład Antropologii PAN.

BOGDANOWICZ W., ALLEN M., BRANICKI W., LAMBRING M., GAJEWSKA M., KUPIEC T.

2009: *Genetic identification of putative remains of the famous astronomer Nicolaus Copernicus*. “Proceedings of the National Academy of Sciences of the United States of America”, vol. 106 (30), pp. 12279–12282.

BRICKLEY M., IVES R.

2008: *The Bioarchaeology of Metabolic Bone Disease*. Elsevier.

BUIKSTRA J., UBELAKER D.

(ed.) 1994: *Standards for data collection from human skeletal remains*, “Arkansas Archaeological Survey Research Series”, No. 44, Fayetteville.

CHARZEWSKI J., PIONTEK J.

(ed.) 2000: *Nowe Techniki i Technologie Badań Materiałów Kostnych*. Warszawa: Akademia Wychowania Fizycznego im. J. Piłsudskiego.

CODEBOOK

2005: *Data Collection Codebook*, ed. R. Steckel and C. Larsen, P. Sciulli, P. Walker. “The Global History of Health Project”; <http://global.sbs.ohio-state.edu/>.

CZUBAK A.

2009: *Rekonstrukcja wyglądu twarzy oraz antropologiczna ocena szkieletu generała Władysława Sikorskiego*. “Archiwum Medycyny Sądowej i Kryminologii”, vol. LIX, pp. 27–32.

ĆWIRKO-GODYCKI M., SWEDBORG I.

1978: *Ludność pochowana na cmentarzysku Ostrowa Lednickiego pod względem metrycznym z uwzględnieniem zmienności cech oraz objawów patologicznych na kościach*. Część III. "Przegląd Antropologiczny", vol. 44 (2), pp. 221–239.

DACRE J., KOPELMAN P.

2003: *Badania kliniczne*. Warszawa: Wydawnictwo Lekarskie PZWL.

GĄSSOWSKI J.

2008: *Examinations conducted to find Nicolaus Copernicus's grave and identify his skeleton*. In: J. Gąssowski (ed.), *Badania nad identyfikacją grobu Kopernika. The search for identity of Copernicus tomb*. Pułtusk: Instytut Antropologii i Archeologii, pp. 9–39.

2009: *To jest czaszka Kopernika*. "Focus Historia", vol. 6, p. 48.

GĄSSOWSKI J., JURKIEWICZ B.

2006: *The search for Nicolaus Copernicus's tomb*. In: J. Gąssowski (ed.), *The Search for identity of Copernicus Tomb*. Pułtusk: The Pułtusk Academy of Humanities, Institute of Anthropology and Archaeology; Fundacja Kronenberga, Citi Handlowy, pp. 9–19.

GEORGE R.M.

1993: *Anatomical and artistic guidelines for forensic facial reconstruction*. In: M.Y. Iscan & R.P. Helmer (eds), *Forensic analysis of the skull. Craniofacial analysis, reconstruction, and identification*. Wiley-Liss: New York, pp. 215–227.

GIBBONS A.

2010: *Close Encounters of the Prehistoric Kinds*. "Science", vol. 328 (5979), pp. 680–684.

GILL G.W.

2009: *Assessing Ancestry (Race) from the Skeleton*. In: R. Pickering & D. Bachman (eds), *The Use of Forensic Anthropology*. Second Edition. Boca Raton, London, New York: CRC Press, pp. 103–111.

GLADYKOWSKA-RZECZYCKA J.

1980: *Complicated traumas from ancient cemeteries in Poland*. In: *Paleopathology Association, 3th European Meeting*, Caen, pp. 121–125.

1989: *Schorzenia ludności prahistorycznej na ziemiach polskich*. Gdańsk: Muzeum Archeologiczne w Gdańsku.

GOODMAN A.H., MARTIN D.L., ARMELAGOS G.J.

1984: *Indications of Stress from Bone and Teeth*. In: M. Cohen & G. Armelagos (eds), *Paleopathology at the Orgins of Agriculture*. Orlando: Academic Press, pp. 13–49.

GRUPA M., KOZŁOWSKI T.

(ed.) 2009: *Kwidzyn cathedral – the mystery of the crypts*. Kwidzyn: Kwidzyńskie Centrum Kultury, pp. 1–192.

- GRZYBOWSKI T., ROGALLA U., PŁOSKI R., KONARZEWSKA M., KRAJEWSKI P.
2009: *Dziwne wpadki biegłych*. "Genetyka i Prawo", vol. 4 (7), pp. 13–15.
- HAUSER G., DE STEFANO G.F.
1989: *Epigenetic variants of the human skull*. Stuttgart: Schweizerbart.
- HE Y., WU J., DRESSMAN D.C., IACOBUZIO-DONAHUE C., MARKOWITZ S.D.,
VELCULESCU V.E., DIAZ JR L.A., KINZLER K.W., VOGELSTEIN B.,
PAPADOPOULOS N.
2010: *Heteroplasmic Mitochondrial DNA mutations in normal and tumour cells*. "Nature", vol. 464, pp. 610–614.
- HENNEBERG M., SCHOFIELD J.
2008: *The Hobbit Trap. Money, fame, science and the discovery of a "new species"*. Wakefield Press, Kent Town, South Australia.
- JAKUBOWSKA G., KOZŁOWSKI T.
2010: *Interpretation of the causes of cranial injuries in a post-medieval population from Płonkowo, Poland*. "Abstracts, 37rd Annual Meeting (North America), Paleopathology Association", Albuquerque, New Mexico, USA.
- JURDA M.
2008: *Tafonomicke zmeny lidske lebky z pohledu geometricke morfometrie*. Brno: Masarykova Univerzita, Prirodovedcka fakulta, "Diplomova Prace".
- KLEPINGER L.L.
2006: *Fundamentals of Forensic Anthropology*. New Jersey: Wiley-Liss.
- KOKOWSKI M.
2006/2007: *Poszukiwania grobu Kopernika – refleksje advocati diaboli*. Cz. II: *Rozważania w kontekście aktualnych badań*. http://www.cyfronet.pl/~n1kokows/kokowski_grob_kopernika_2.pdf.
2007: *Poszukiwania grobu Kopernika – refleksje advocati diaboli*. Cz. II: *Rozważania w kontekście aktualnych badań*. "Kwartalnik Historii Nauki i Techniki", vol. 2007/1, pp. 131–151.
- KOLESNIKOV L.L., PASHINYAN G.A., ABRAMOV S.S.
2001: *Anatomical Appraisal of the Skulls and Teeth Associated With the Family of Tsar Nicolay Romanow*. "The Anatomical Record", vol. 265, pp. 15–32.
- KOZŁOWSKI T.
1993: *Charakterystyka urazów układu kostnego ludności pochowanej na cmentarzysku w Grucznie (XI–XIV w.)*. "Przegląd Antropologiczny", vol. 54 (1–2), pp. 177–189.
1994: *Przypadki zmian chorobowych w materiale kostnym z cmentarzyska w Skrwilnie (XIII–XVI wiek)*. "Zmienność Biologiczna Człowieka", vol. 2, pp. 59–65.
2008: *"The Global History of Health"*. *Zdrowie i choroby człowieka w Europie od schyłku paleolitu do czasów współczesnych*. In: B. Jerszyńska (ed.), *Współczesna Antropologia Fizyczna. Zakres i Metody Badań, współpraca interdyscyplinarna*.

na, *XI Warsztaty Antropologiczne im. Prof. Janusza Charzewskiego*. Poznań: Wydawnictwo Sorus, pp. 79–88.

LECH K., PIECHOTA J.

2010: *Genetyczne śledztwo*. “Wiedza i Życie”, March 2010, pp. 22–26.

LOVEJOY C.O., MEINDL R.S., MENSFORTH R.P., BARTON T.J.

1985: *Multifactorial determination of skeletal age at death: A method and blind tests of its accuracy*. “American Journal of Physical Anthropology”, vol. 68, pp. 1–14.

MALINOWSKI A.

2004: *Auksologia. Rozwój osobniczy człowieka w ujęciu biomedycznym*. Zielona Góra: Uniwersytet Zielonogórski.

MALINOWSKI A., HUBER Z.

1981: *Ocena antropologiczna urazów czaszki i trepanacji leczniczych ze znalezisk archeologicznych*. In: A. Malinowski (ed.), “Źródła do badań biologii i historii populacji słowiańskich”, Seria “Antropologia” vol. 10. Poznań: Wydawnictwo Naukowe Uniwersytetu im. Adama Mickiewicza, pp. 185–201.

NOVOTNY V., ISCAN Y.M., LOTH S.R.

1993: *Morphologic and Osteometric Assessment of Age, Sex, and Race From the Skull*. In: M.Y. Iscan & R.P. Helmer (eds), *Forensic analysis of the skull. Craniofacial analysis, reconstruction, and identification*. New York: Wiley-Liss, pp. 71–88.

ORTNER D.J.

2003: *Identification of pathological conditions in human skeletal remains*. Second Edition. San Diego CA, USA – London GB: Academic Press.

ORTNER D.J., PUTSCHER W.G.J.

1997: *Identification of Pathological Conditions In Human Skeletal Remains*. Washington, London: Smithsonian Institution Press.

PIASECKI K.

2009: *Kontra czyli z “armaty do muchy”*. “Archeologia Żywa”, vol. 6 (46), pp. 41–42.

PIASECKI K., ZAJDEL D.

2006: *Anthropological research in Frombork. Tomb No. 13. Reconstruction of the appearance of the head on the basis of the skull*. In: J. Gąssowski (ed.), *The Search for identity of Copernicus Tomb*. Pułtusk: The Pułtusk Academy of Humanities, Institute of Anthropology and Archaeology; Fundacja Kronenberga, Citi Handlowy, pp. 21–36.

PICKERING R., BACHMAN D.

2009: *Ten key questions. Question 8: What is the Age?* In: R. Pickering, D. Bachman (eds), *The Use of Forensic Anthropology*. Second Edition Boca Raton, London, New York: CRC Press, pp. 90–96.

PIONTEK J.

1996: *Biologia populacji pradziejowych. Zarys metodyczny*. Poznań: Wydawnictwo Naukowe UAM.

PROMIŃSKA E.

1993: *Odciać rękę ... czyli o celowych okaleczeniach ciała*. Warszawa: Akademia Wychowania Fizycznego, "Studia i Monografie".

RICE D.P.

(ed.) 2008: *Craniofacial Sutures. Development, Disease, Treatment*. "Frontiers of Oral Biology", vol. 12, pp. 1–236.

ROBERTS C.A., MANCHESTER K.

2005: *The Archaeology of Disease*. Third Edition. Ithaca, NY: Cornell University Press.

SHERMER M.

2009: *Telefon do nieboszczyka*. "Świat Nauki", vol. 2 (210), pp. 17–18.

SOLTYSIAK A.

2010: *Kilka uwag do tekstu Karola Piaseckiego pt. "Wstrzymać Kopernika"*. "Archeologia Żywa", 1 (47), p. 62.

SOLTYSIAK A., KOZŁOWSKI T.

2009: *Komentarz do identyfikacji cranium 13/05 z Fromborka jako kości Mikołaja Kopernika*. "Archeologia Polski", vol. LIV, 2, pp. 281–290.

STEPHAN C.N., HENNEBERG M.

2001: *Building faces from dry skulls: are they recognized above chance rates?* "Journal of Forensic Sciences", vol. 46, pp. 432–440.

STEPHAN C.N., HENNEBERG M.

2006: *Recognition by forensic facial approximation: Case specific examples and empirical tests*, "Forensic Science International", vol. 156, pp. 182–191.

STEPHAN C.N., HENNEBERG M., SAMPSON W.

2003: *Predicting Nose Projection and Pronasale Position in Facial Approximation: A Test of Published Methods and Proposal of New Guidelines*. "American Journal of Physical Anthropology", vol. 122, pp. 240–250.

STRZAŁKO J.

2005: *Czy pojęcie rasy potrzebne jest w antropologii*. In: P. Bergman, J. Charzewska, K. Kaczanowski & H. Piechaczek (eds), *Problemy taksonomii kopalnych form ludzkich i typologii współczesnego człowieka*. Akademia Wychowania Fizycznego im. Józefa Piłsudskiego, pp. 55–60.

SZCZOTKOWA Z.

1985: *Antropologia w dochodzeniu ojcostwa*. Warszawa-Wrocław: PWN.

SZCZUROWSKI J., KWIATKOWSKA B.

2008: *Asymetria fluktuacyjna – jeden z przejawów asymetrii morfologicznej ciała ludzkiego oraz miernik homeostazy rozwojowej i stresogenego wpływu środowiska*. In: B. Jerszyńska (ed.), *Współczesna antropologia fizyczna. Zakres i metody badań, współpraca interdyscyplinarna*. Poznań: Wydawnictwo Sorus, pp. 29–43.

TYSZCZUK S.

2009: *Trójwymiarowa, cyfrowa dokumentacja kraniometryczna – drzemiące możliwości*. In: W. Dzieduszycki & J. Wrzeński (eds), “Metody. Źródła. Dokumentacja. Funeraria Lednickie, spotkanie 11”. Poznań: Stowarzyszenie Naukowe Archeologów Polskich, pp. 381–388.

WHITE T.D.

2000: *Human osteology*. San Diego & London: Academic Press.

WHITE T.D., FOLKENS P.

2005: *Human bone*. Manual. Elsevier.

Bronisław MŁODZIEJOWSKI

President of the Central Board of the Polish Forensic Association; Department of Criminalistics and Forensic Medicine, University of Warmia and Mazury in Olsztyn, Poland

Efficiency of facial reconstruction methods in light of contemporary forensic anthropology (Summary)

The question of reconstruction of faces of unknown individuals is tackled by law enforcement and justice system agencies in criminal cases, and also in situations when it is necessary to establish the identity of disaster victims whose DNA was degraded. Also, when heroic deaths of war prisoners or victims of totalitarian repressions (e.g. the mass murder in Katyń) are to be commemorated, not infrequently the method of choice is the reconstruction of the living appearance of the dead person. This is due to the lack of reliable comparative materials from deceased members of the closest family.

The bone element necessary to perform facial reconstruction of a person to be identified is their skull, possibly complete. Nevertheless, this condition is not always possible to meet and it is then that the person performing the reconstruction should act ensuring that maximum objectivity of their actions is maintained. Excess interference and use of imagination and fancy produce reverse effects to those intended.

It is thus my claim that a meticulous reconstruction of every wrinkle, every little detail and element of the face structure, such as the shape of the person's hair, type of hairstyle, the shaping of the areas around the eye slit, mouth slit, nose and most of the mimic muscles is the result of the researcher's subjectivism.

Reconstructions for historical or phylogenetic purposes have a somewhat different character, and some influence of the researcher's emotions can be allowed here, but also in such situations modern comparative methods should be employed, including computer simulations. Individual facial reconstructions of great persons, as other works have shown, are thus exposed to criticism and undermine the otherwise considerable efforts of the researchers. It is usual for the

analysis of the anatomical and morphological structure of the skull to be done by an anthropologist with the reconstruction being conducted by an artist. It can result in unintended discrepancies which will have an effect on the final result. It should thus be acknowledged that different research groups can produce different final results, contrary to hitherto findings.¹

¹ Editor's comment (M.K.): The issues discussed in this summary were first brought to public attention in 2005 in an article of mine: *The search for Copernicus's grave. Reflections of a devil's advocate*; online version: http://www.cyfronet.pl/~n1kokows/poszukiwania_cz_2_pl.html; the printed version was published in 2007 in "Kwartalnik Historii Nauki i Techniki" (Quarterly Journal of the History of Science and Technology), vol. 52, 1/2007, pp. 131–151. It is however worth emphasizing that Professor Młodziejowski, as an expert on forensic anthropology and medicine and President of the Central Board of the Polish Forensic Association, speaks here as an authoritative figure of that kind of issues. The summary was translated by Mr. Filip Klepacki.

Józef FLIK

Institute for the Study, Conservation and Restoration of Cultural Heritage, Faculty of Fine Arts,
Nicolaus Copernicus University, Toruń, Poland

16th century portraits of Nicolaus Copernicus¹

Abstract

The paper comprises an analysis of historic, stylistic and ideological as well as mainly technological and conservation issues of the 16th century likenesses of Nicolaus Copernicus. The discussion refers to, among others, 15 painted portraits, engravings and copperplates. The painters' workshop was established and attempts were made to define the provenance of the likenesses.

Key words: Nicolaus Copernicus, portrait, history, artistic technique and technology.

1. Outline of the subject matter

Portraits of Nicolaus Copernicus, especially the oldest ones, for a long time have enjoyed outstanding attention. The most interesting are the three existing painted likenesses, representing different workshops, based on the Northern European models. They are of the highest artistic quality and render the astronomer's features best.

Those are as follows:

1. the Strasbourg portrait – from an astronomic clock in the Strasbourg cathedral, painted by Tobias Stimmer in the years 1571–1574;
2. the epitaph portrait – from the Cathedral of St. John the Baptist and St. John the Evangelist in Toruń (known as the Church of SS. Johns), of the year 1580;

¹ The paper was reviewed by Professor Karolina Targosz, Habilitated Doctor in Humanities (Ludwik and Aleksander Birkenmajer Institute for the History of Science, Polish Academy of Sciences).

It was presented at the conference in Kraków in February 2010. Due to my poor health I could not attend the conference and the paper was presented on my behalf by Michał Kokowski. I had presented a similar topic, however in another aspect, at the conference in Olsztyn in May 2010 (see Flik 2010a, 2010b).



3. the college (Academic Gymnasium) portrait – from the former academic college in Toruń, of the year 1580, presently exhibited in the Old Town Hall, the seat of the District Museum in Toruń.

For the purpose of stylistic and historic study also other 16th-century paintings are discussed along with some prints closest to the above mentioned painted portraits, each of them to some extent altered over the centuries.

At first sight all the portraits are similar, but they differ in details that I was able to study during the analysis of their technical structure and the painters' workshop, mostly in the course of completion of numerous copies and painting reconstructions.

Today, after many years that have passed since the first studies of those representations, bourgeois portraits and epitaph portraits in Toruń I find it easier to evaluate Copernicus's portraits. I am able to notice more details characteristic of the astronomer's features, his haircut, shape of the eyes, brows, nose, mouth and chin as well as the garments he wore, with a characteristic grey collar turned out over the red fur-lined coat.

The first existing portraits were painted 37 years after the astronomer's death – he died in 1543. In such a short time it was impossible to forget what a person, who was well-known at the time, who studied in Poland and Italy, and who held important functions in the Warmia chapter, looked like. It is mainly owing to bishop Watzenrode, his uncle, to whom he gave medical attention (in spite of the fact that he had not completed medical studies, but practised medicine helping many people), Copernicus held the seat of the chancellor of the Warmia chapter, administering its estate at the same time. This did not stop him from dealing with economic issues, more important to him (*On the Minting of Coin*, Latin: *Monetae cudendae ratio*), and astronomical studies, crowned in the twilight of his life with his timeless work *De revolutionibus orbium coelestium*. All these activities required many efforts and involved meeting many people and friends, who undoubtedly wished to commemorate the Deceased with a proper epitaph or by painting his portrait. Portraits from the second half of the 16th century tend to depict the physiognomy of a great scholar, a truly European humanist. The attributes accompanying Copernicus in his portraits crystallized gradually, and so did the idea now venerated in his persona. That great genius of the Renaissance era was glorified first as a clergyman, then as a physician, an economist, a mathematician and an astronomer (Flik-Fizek 1992, p. 154).

What still remains a mystery is the so called "autographon" that was to be a source of all the likenesses of the astronomer. Does the term "autographon" mean a self-portrait or a representation confirmed by a personal signature? Janina Kruszelnicka thought that Pierre Gassendi's report on Copernicus's self portrait seems to be based on quite a liberal interpretation of the term "autographon" mean-

ing “self-portrait”. This may refer to the inscription on the Strasbourg portrait: EX · IPSIVS AVTOGRAPHO · DEPICTA. According to J. Kruszelnicka, Gassendi used those words to concoct a legend of the alleged history of the portrait. However, even if the “autographon” had been an image produced by somebody else and



Fig. 1. a) Woodcut by Tobias Stimmer from the book by Nicolaus Reusner, 1587 (a copy from the Czartoryski Museum in Krakow, photo Cz. Kuchta); b) Copperplate by Theodor de Bry from *Icones virorum illustrium* by Jean Jacques Boissard, 1597–1599 (a copy in the District Museum in Toruń, photo W. Górski); c) Copperplate from *Tychonis Braheii (...) vita* by Peter Gassendi, 1654 (photo W. Górski); d) the so-called Kaufmann’s copperplate, late 16th century, individual print (a copy in the Czartoryski Museum in Krakow, photo Cz. Kuchta).

just signed by the depicted person it would have meant that the portrayed would have accepted his/her image in the manner it had been rendered in the portrait (Flik, Kruszelnicka 1996, pp. 99–100).

One is entitled to assume that some archetype drawing but not painting had existed and came from Frombork. Małgorzata Flik-Fizek thought that after Nicolaus Copernicus death the “autographon” was in possession of Dr. Tiedemann Giese from Gdańsk, who between 1571 and 1574 sent it to Conrad Dasypodius to Strasbourg. The latter might have used it during the construction and decoration of the astronomic clock. This leads to a conclusion that there were three owners of the “autographon”: Nicolaus Copernicus, Tiedeman Giese and Tycho Brahe (Flik-Fizek 1992, p. 161). So far, there has been no information on Nicolaus Copernicus ever practising drawing or figurative painting. Surely, he had drawn maps and mathematic figures in the manuscript of *De revolutionibus orbium coelestium* (Flik, Kruszelnicka 1996, p. 100).

Zygmunt Batowski (1933, p. 23) did not catalogue the images, but was the first to demonstrate some more detailed relations between them, saying that the oldest one, painted ca. 1574, is the portrait attributed to Tobias Stimmer located in the turret of the astronomical clock in Strasbourg Cathedral. According to Batowski, that portrait became the archetype for all later Copernicus’s portraits. Unfortunately, the author – as many others – was not aware, that the face and garments on that portrait had been painted over.

Only Florian Łobeski in 1857, in his article printed in “Rozmaitości” (a supplement to the “Gazeta Lwowska” magazine), discussed the epitaph portrait against the background of other portraits and counted the image of Copernicus from the astronomic clock in the Strasbourg Cathedral among the source portraits. But even he doubted whether Stimmer had faithfully copied that self-portrait, and was more inclined to trust the graphic images, which – in his opinion – rendered the authentic physiognomy and were based on the epitaph portrait. These included:

1. the woodcut by Tobias Stimmer published in the book by Nicolaus Reusner;
2. the copperplate by Theodore de Bry in a book by Jean-Jacques Boissard;
3. the copperplate in a book by Pierre Gassendi;
4. the so-called Kaufmann’s woodcut (Flik, Kruszelnicka 1996, pp. 18–20).

2. The Strasbourg portrait

The portrait was painted in the years 1571–1574 in an oil technique on a pine board measuring $184 \times 62.5 \times 2.5$ cm by Tobias Stimmer (born in 1539 Schaffhausen, Switzerland, died in 1584 in Strasbourg) (fig. 2). This likeness from the beginning has been related with the architecture of the clock tower of the Stras-



Fig. 2. The Strasbourg portrait, Strasbourg Cathedral, oil on wooden panel, 1571–1574, overpainted in 1838 modelled on the college portrait from Toruń (photo J. Gardzielewska).



Fig. 3. Copy of the Strasbourg portrait, oil on wooden panel, 1989, by Józef Flik (photo W. Górski).

bourg Cathedral, where it was placed alongside portraits of other famous persons. The learned originator of the clock, Conrad Dasypodius, already in 1580 mentioned the portrait of the astronomer as a part of painted decoration of the grand clock. The view of the clock can be seen on the woodcuts from the years 1574 and 1602 (fig. 4).

In 1973 the Strasbourg painting was presented at the exhibition in the District Museum in Toruń on the occasion of the 500-anniversary of the birth of Nicolaus Copernicus. The X-ray examination that I have then conducted revealed that the astronomer's head and red overcoat had been painted over. This turned out to have been done in 1838 during a thorough repair of the clock (Flik 1974, pp. 66–72).

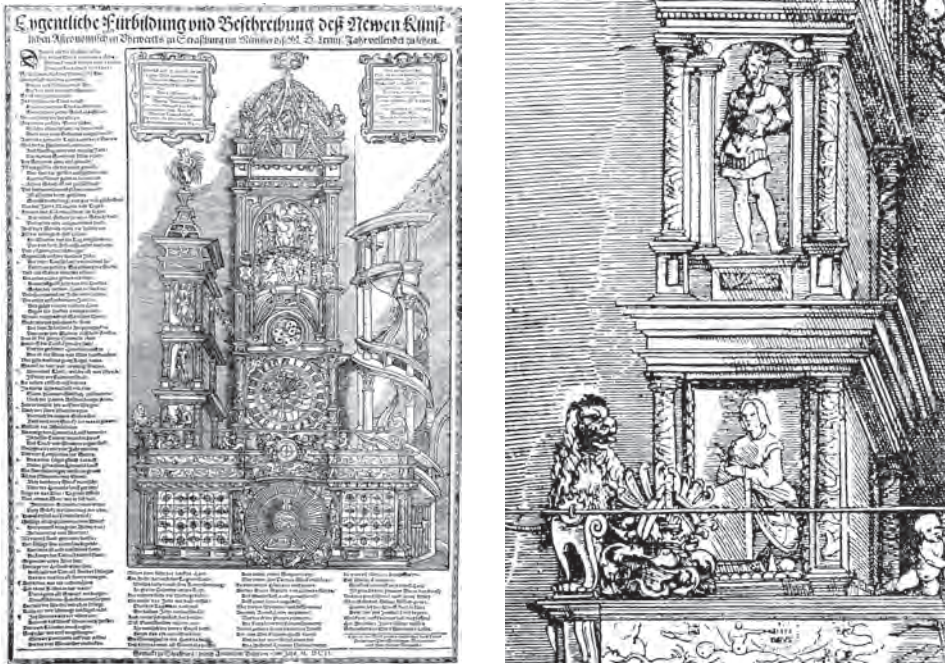


Fig. 4. a) Astronomical clock in the Strasbourg Cathedral, woodcut, 1574 (after Batowski 1933, photo W. Górski); b) – detail depicting the clock's turret.

The X-rays reveal also numerous repairs, as the putty filling the holes left by woodworms (fig. 5). Copernicus's face is different here, more oval and the hair is shoulder-long, unlike in the other portraits (from the Academic Gymnasium and the one in the epitaph), in which the hair is arranged in characteristic curls.

One should consider that Tobias Stimmer painted that portrait following a drawn sketch, received from Frombork by Tiedemann Giese. The oval face clearly resembles the non-existent 17th-century portrait from Gołuchów, which went missing before World War II and is known only from a black-and-white photograph and a copy painted by Nora Zinck (oil on wooden panel) from the National Museum in Warsaw, where one can observe individual features and those revealing the influence of the Northern European school, originating from the workshop of Albrecht Dürer (fig. 6). An oval face, smoothly-combed hair, a long nose, eyes and mouth clearly defined with thin lines are quite individual features that do not correspond with other likenesses of Nicolaus Copernicus. Only the non-existent portrait of bishop Lucas Watzenrode (fig. 7), the astronomer's uncle, which I happened to reconstruct, reveals technical resemblance to the Gołuchów portrait.

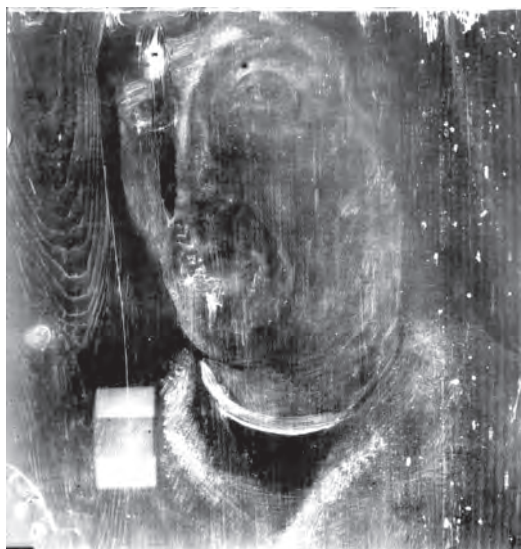


Fig. 5. The Strasbour portrait – the head, an x-ray (photo J. Flik).



Fig. 6. Copy of the lost 16th century image of Nicolaus Copernicus (the so called Gołuchów portrait), 1944, oil on wooden panel, by Nora Zinck.



Fig. 7. The portrait of Lucas Watzenrode, the Bishop of Warmia, Copernicus's uncle, a copy by Józef Flik based on iconographic sources, oil on wooden panel, 1973 (District Museum in Toruń, photo W. Górski).

On the X-ray film one can clearly see, that the red garment with a small fur collar conceals a large, shoulder-wide fur collar (fig. 9). A similar form of collar can be seen in the copperplate images printed on the front page of Pierre Gassendi's book *Tychonis Brahei (...) vita* in two editions from 1654 and 1655 (fig. 8 and 10). Grassend informs that Copernicus's attire was copied there from the clothes painted in the Strasbourg portrait, which had also been red since its lower part had not been altered.



Fig. 8. Copperplate from *Tychonis Brahei (...) vita* by Pierre Gassendi, 1654 (photo W. Górski).

To answer the question what the repainting of the Strasbourg portrait was based on in 1838, one should state that two portraits from Toruń served here as models: first of all, the college portrait and – to a lesser extent – the epitaph portrait. In 1735 a copy of the college portrait was painted in Toruń – according to the inscription at the bottom of the painting – for the Astronomic Observatory in Paris (fig. 11). This one in turn served as a model for the repainting of the portrait of Copernicus from the astronomic clock in Strasbourg. This is how the Copernicus on the Strasbourg portrait assumed the physiognomic features of the Toruń likeness. He has a similar hair-style – with the fringe combed aside – as in the college portrait, from which also the shape of the small, narrow fur collar was copied.



Fig. 9. The Strasbourg portrait – the bust, X-ray (photo J. Flik).



Fig. 10. Copperplate from Gassendi's book – the bust (photo W. Górski).

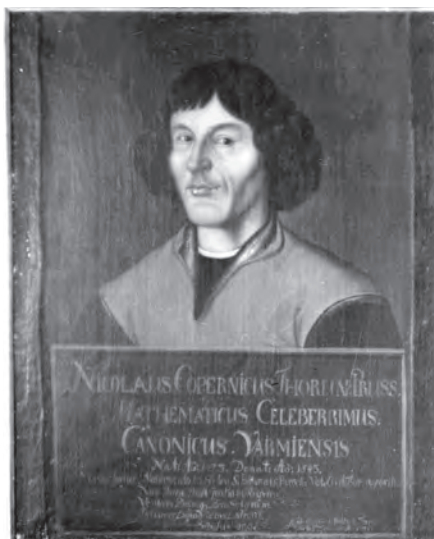


Fig. 11. The portrait of Nicolaus Copernicus from the Paris Astronomical Observatory, a copy painted in 1735 based on the college portrait from Toruń, oil on canvas (photo J. Gardzielewska).

3. The epitaph portrait

The 1580 portrait of Nicolaus Copernicus in an ornate setting of the epitaph is the oldest memorial of the Canon and great scholar (fig. 12). Approximately thirty seven years after Copernicus's death it was founded by Melchior Pirnesius, a re-



b)

Fig. 12. The epitaph of Nicolaus Copernicus in the Cathedral of SS. Johns in Toruń, 1580 (photo W. Górski): a) overall view; b) the epitaph portrait, oil on panel.

nowned Toruń physician (Flik 1973, pp. 96–102). Janina Kruszelnicka rightly assumes that the figure of the astronomer in the Toruń epitaph is particularly exposed in the whole composition, mainly when compared with the size of the crucifix, which could be assessed as being in contradiction with the rules of composition of epitaph paintings. If not for the hands joined in prayer, the character of the portrait would be almost too worldly (Flik, Kruszelnicka 1996). The epitaph in its upper part contains also the portrait of King Olbracht from early 17th century. The structure of the epitaph, measuring 192 × 117 cm was made of pine wood. In 1733, on the initiative of Jakub Rubinkowski, an additional plaque, measuring 38 × 106 cm, with a poem inscribed on it, was made of the same material and hung below the consoles supporting the epitaph

The portrait of Nicolaus Copernicus that is the most interesting for us is painted on an oak support base made of three boards measuring 95 × 80 × 1 cm. On

a thin chalk-and-glue priming an exceptionally precise black drawing was made with a thin brush. Then an overall, yellow-brown oil imprimatura was applied, followed by a uniform grey oil layer on which preliminary modelling was executed by bringing up the lights with lead white. The achieved form was realistic enough for the next layers applied in oil to add only colour value to the painting (Flik, Kruszelnicka 1996, pp. 131–181). Special attention should be paid to the detailed and precise finishing of Copernicus's face and crucified Christ placed against a varied landscape seen through a window.

Similarly executed was the portrait of St. Gerome placed in the epitaph of Anna Pirnesius, dated back to almost the same time (ca. 1576) and located in the same Church of SS. Johns in Toruń (fig. 13). It also bears resemblance in modelling and form to two other portraits: of Johan Stroband and Benedict Koie (both in the District Museum in Toruń). This resemblance is limited to the realistic rendering of the faces in both portraits as well as in the epitaph portrait of Nicolaus Copernicus.



Fig. 13. The epitaph of Anna Pirnesius in the Cathedral of SS. Johns in Toruń with the image of St Jerome, 1576 (photo W. Górski).

Oak support and the technical structure of the aforementioned portraits are typical for paintings from the Northern Europe of the 16th century. In principle, they can be attributed to the circle of Albrecht Dürer, whose technique of painting was commonly followed not only in Germany but all over the Northern Europe, particularly in the Netherlands, for a long time.

Friedrich Schwarz (Flik, Kruszelnicka 1996, p. 103) advanced a hypothesis that Copernicus's epitaph portrait in the Church of SS. Johns in Toruń could have been executed by Fabian Neisser, a painter who came to Toruń from Gdańsk and in 1594, together with his brother Mathias Neisser, a woodcarver, executed an epitaph commemorating their parents and the whole Neisser family. It is located in St. Mary's Church (Church of the Assumption of the Blessed Virgin Mary) in Toruń. This is rather improbable, since the painting depicting the Baptism of Christ in that epitaph is artistically on a much higher level than Copernicus's portrait from the Church of SS. Johns, and the technique is slightly different.

At the same time there was a painter from Amsterdam, Hans Michel (died in 1593 in Toruń) working in Toruń. Could he have been the maker of St. Jerome's portrait in the epitaph of Anna Pirmesius or even of the epitaph portrait of Copernicus? The image of St Jerome is modelled directly on St. Jerome's likeness by Jan Metsys, who in turn had followed Albrecht Dürer, the author of the magnificent image of the saint which is in a private collection in Spain (Flik 1994). In Toruń, there are also eight burgher's portraits and twelve epitaph paintings in St. Mary's Church and SS. Johns' Church (Flik 1995, pp. 371–373; 1982). All of them are of a unique value and can be qualified among the works of the Dutch

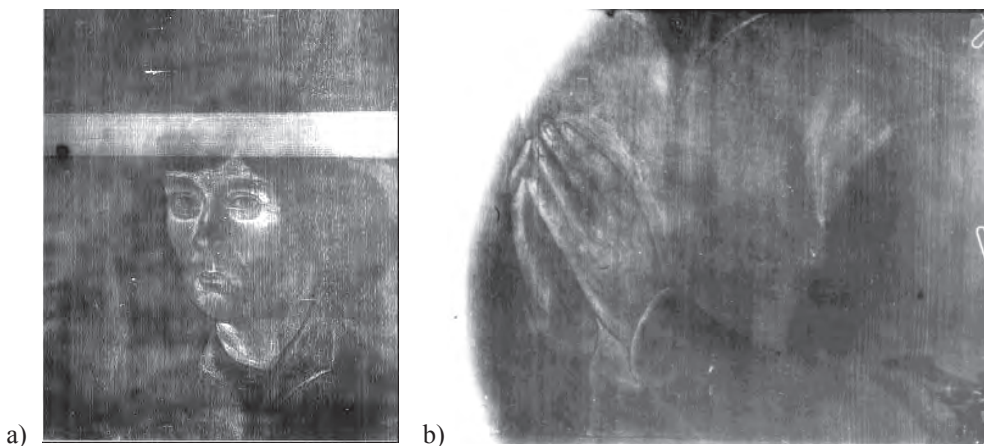


Fig. 14. The epitaph portrait, X-ray (photo J. Flik): a) head; b) hands and attire, visible buttons of the garment and the outlines of flowers.

School, but each of them indicates that they could not have been painted by either the same author or in the same atelier (except the abovementioned portraits of Jan Stroband and Benedict Koie, compared with Copernicus portrait).

In 1972 I X-rayed the Copernicus epitaph and the results shed new light on the details of the image and the polychrome of the frame (fig. 14).

Today, after 38 years, I have a somewhat different interpretation of the mutual dependencies of the three most important images, i.e. the two from Toruń and the one from Strasbourg.



Fig. 15. The Strasbourg portrait. **Fig. 16.** The college portrait. **Fig. 17.** The epitaph portrait.

In the epitaph portrait, the black, buttoned-up robe was painted over in the early 17th century, and the red, sleeveless fur-lined coat with a reversed white-gray collar had been “pulled over” it. This coat also concealed the medical herbs that the Frombork Canon held in his hands to symbolize his interest in medicine. The fact that the red coat was painted later is indicated by the thick red paint contours along the black sleeves, the white board and the left hand visible on the X-ray. The source of this interference was the known portrait of astronomer in red sheepskin, the so-called the college portrait, that was brought to Toruń at that time. In the upper right corner of the painting a shelf was added with astronomical instruments on it.

The first renovation of the portrait and the whole epitaph was performed in the early 17th century on the initiative of the Jesuits, the then owners of SS. Johns’ Church in Toruń, familiar with the European trends in science, who made certain that Nicolaus Copernicus was presented as an astronomer. In that sense, the most crucial alterations were made to the framing. They can all be seen on the X-ray images. The Copernicus’s epigram was moved from the upper cornice to the so-

cle, to make room for the epigram referring to the King who had died in Toruń in 1501, and whose portrait had been placed in a semi-circular head on the very top, thusly adding to the astronomer's splendour. Moving Copernicus's epigram to the socle resulted in covering the portrait of the founder with black paint, originally placed there, in order to paint the white lettering of the epigram commemorating Copernicus's achievements in the field of mathematics and astronomy, which in those times were inseparable.² On two lower panels, placed right and left of the epigram, bunches of flowers in vases were painted (fig. 18).



Fig. 18. The epitaph of Nicolaus Copernicus in the Cathedral of SS. Johns in Toruń, X-ray (photo J. Flik): a) epigram below the painting, figure of the founder visible in the *tondo*; b) lower right panel, fragments of a vase with flowers visible under the globe.

In 1733 an additional board was made, hung right below the epitaph. On a black background there is an inscription in the same colour and lettering as the inscriptions on the cornice and on the socle. The contents praises the beauty of Copernicus's persona, the scholar and the teacher who placed the Sun in the centre of the Universe and set the Earth in motion.³ Then, there is an in-

² "To Nicolaus Copernicus, the citizen of Toruń, a mathematician of great discernment, who died in Warmia in his canony on (...), 1543, aged 73 (a mistake, since Copernicus died at the age of 70), well-known among foreigners; so that the memory of a man of such greatness did not die in his homeland – this memorial was founded. And in the year of 1733 it was renewed and restored by the eminent Jakub Kazimierz Rubinkowski, a councillor and chief postmaster in Toruń" (the English translation of this and the following inscriptions is based on Polish translations of the Latin originals by Krystyna Wyszomirska).

³ "The Copernicus who you can see draws attention by (as it were) a living visage. His likeness in terms of beauty achieved outstanding perfection: red lips, beautiful eyes and beautiful hair as well as noble limbs, mirroring Apelles's paintings. You could see him as the researcher and the

scription on the upper socle referring to King Olbracht, who died of apoplexy in Toruń on 17th June 1501, aged 41, and whose heart was buried in SS. Johns' Church in Toruń.⁴

4. Recreating the original look of the Copernicus's epitaph based on the results of visual, stratigraphic and X-ray analyses

There were three versions recreated (fig. 19):

Version I. Nicolaus Copernicus without the red coat, dressed in black (a cassock) holding blooming medical herbs in his hands joined in prayer.

Version II. No white board with the text of epitaph sentence, written in capitalized Latin.⁵

Version III. It was discovered that the lack of the board causes excessive elongation of the Canon Nicolaus's body, and besides that, the inscription naturally coexists with the praying gesture addressed to the crucified Christ, unless the sen-

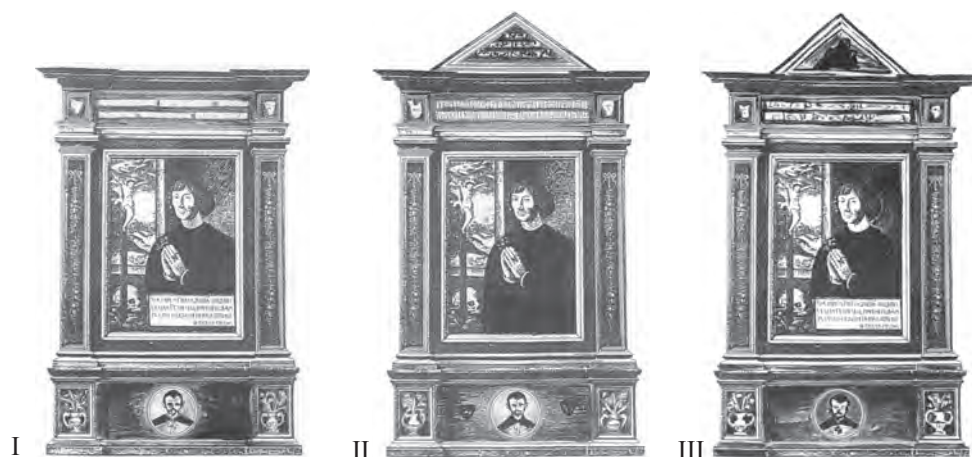


Fig. 19. The original look of the epitaph, versions I–III (by J. Flik).

teacher that he was when he ordered to stop the stars and the sky in their places and conceived to set the Earth in motion and placed the Sun in the centre of the world. To the greatest and highest God and to the greater glory of the eminent man, this is offered and dedicated by the very one who had it renovated.”

⁴ His Highness Prince and Lord Olbracht, King of Poland, died in Toruń of apoplexy on 17th June 1501, aged 41. His intestines are buried here, the body brought to Krakow on the eighth year of his rule.”

⁵ “Neither do I demand the grace equal (the one given) to Paul, nor do I claim forgiveness (given to) Peter, but I humbly ask for the one you offered on the Cross to the thief”.

tences had been originally placed above the painting (where now King Olbracht's epigram is located), but there is no satisfying evidence to support this. Hence, this version corresponds with the original look.

In the largest rectangular field, today filled with Copernicus's epigram, the reconstructed version has a male portrait in an oval – this is most probably the likeness of the epitaph's founder, Dr. Melchior Pirnesius. The man portrayed has a beard, a moustache and characteristic hair with a fringe and a side bald spot, he is dressed in a buttoned-up garment with a large fur coat. Two smaller rectangular panels on both sides of the central one feature bunches of flowers in stylised vases. On two upper small panels, there are outlines of antique masks – these were usually painted on 16th-century epitaphs. Similar masks can be seen on the 16th-century epitaph of Anna Pirnesius, hung on the wall nearby. It was decided that the possible revealing the authentic polychrome of the epitaph would be pointless, since the early 17th-century overpainting, depicting Nicolaus Copernicus as an eminent astronomer and mathematician, is in historical terms unique and unmistakable, and the original 16th-century look can be seen on the X-ray films and on the drawings. One should consider here not only the exceptionally interesting epigrams but also the astronomical instruments painted in livid and yellow on the panels: a set square and a mirror-sextant at the upper cornice and a circular sundial and a sky globe at the socle. The only authentic adornments in form of floral garlands in red, golden-yellow and orange on a bluish background are located on both sides of Nicolaus Copernicus's portrait.

5. The college portrait

This portrait is stored in the collection of the District Museum in Toruń (fig. 20). It was painted ca. 1580 on an oak board measuring 51 × 40.5 cm, in oil and distemper technique. Undoubtedly, it is of the best artistic quality and it faithfully renders the astronomer's likeness. Against the background of other 16th-century burghers' portraits, it makes a unique phenomenon, since a painting of identical workshop features has so far never been found.

The college portrait, like both paintings already mentioned, that is the Strasbourg portrait and the epitaph portrait, enjoyed much interest in the 19th and 20th centuries. It was received as remaining under the influence of the Northern European school, mostly German, e.g. of Albrecht Dürer (Brochwicz 1973) and it was compared with numerous images. Of course, it was derived from the non-existent Frombork "autographon". Zygmunt Batowski (1933) dated the portrait back to the late 16th or early 17th century, attributing it to the Northern European school. Anna Ottówna (1955, pp. 4–8, 31, 35, 39–44), an author of a monograph

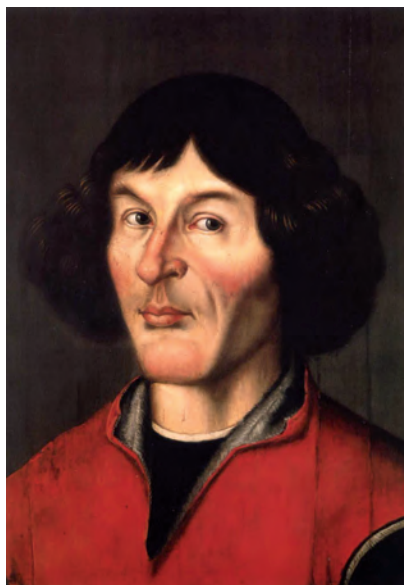


Fig. 20. The college portrait, distemper and oil on wooden panel, ca. 1580 (the District Museum in Toruń, photo W. Górski).

on the 16th-century Toruń painting, confirmed certain influence of Dürer's art in the college portrait and dated it back to mid-16th century. In 1953 for the first time it was studied by renowned art-conservators: Leonard Torwirt (1953) and Bohdan Marconi (1953), who analysed the painting mostly in its structural aspect in light of technological research.

Unfortunately, the conclusions they drew were different. L. Torwirt claimed that the likeness was to be dated to the first half of the 16th century and represented top-quality technical skills, being a clear similarity to Dürer's circle. According to this author, the portrait was characterised by perfect craftsmanship and exceptionally suggestive artistic expression. The dating was based on the fact that the artist had painted a scar on the base of the left brow and a reflection of a double Gothic window in the astronomer's eyeballs, which was to be the proof that the portrait had been painted from nature. Bohdan Marconi, in turn, claimed that this detail did not help in dating the portrait back to the first half of 16th century, since similar windows undoubtedly had been in use for much longer. Also the scar, in his opinion, did not constitute a decisive proof for painting from nature. Marconi initially dated the painting back to mid-16th century and later altered the date to the years 1570–1580 (Marconi 1954).

Prof. Zbigniew Brochwicz (1973), during his thorough investigation into the portrait's structure, claimed that the process of creating the painting was based on

the guidelines from *Het Schilder-boeck*, the treatise by Karel van Mander, written in the second half of the 16th century and printed in 1604. The author of the college portrait strictly followed the rules of a multi-layered painting comprised in that treatise, which had clearly defined that on a chalk-and-glue priming a black drawing is to be made with a brush, followed by a flesh-coloured imprimatur and a grey underpainting onto which the final layers of glaze were to be applied. Consequently, Brochwicz counted the painting as belonging to the Northern European circle.

The college portrait of the astronomer from Toruń was also subject to thorough studies by the author of the present paper in 1972 (Flik 1973) and then in 1986–1990 (Flik 1990). The studies comprised above all the infra-red, ultra-violet and X-ray analyses followed by painting experiments resulting in a copy and a painted reconstruction of the college painting from the collection of the District Museum in Toruń.

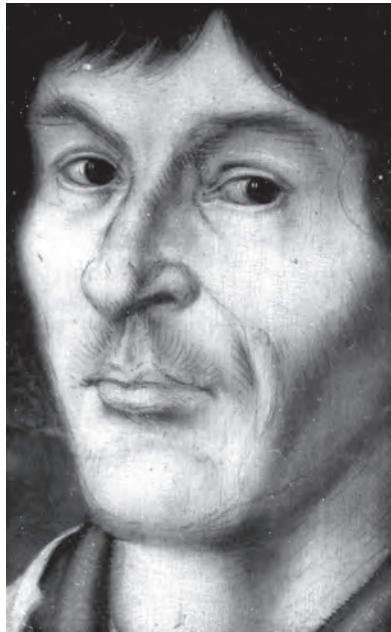


Fig. 21. The college portrait – the face, reflectography in near IRENI (photo W. Górski).

The aforementioned experiments contributed to the final explanation of the way the portrait had been painted and – by comparison with previous likenesses and graphic representations – to establishing the provenance and the dating of the portraits. The drawing on the college portrait, visible in infra-red (fig. 21) and

in ultra-violet (fig. 22), indicates that the author had been searching for the final form of the facial features. This is a creative drawing that did not follow strict canons comprised in treatises. The *grisaille* modelling of the college portrait, visible on X-ray images (fig. 23), achieved by bringing the mid-tones and lights up with white paint, reveals a particularly suggestive rendering, which seems to be slightly different from the final one – somewhat more detailed. This was the principle of underpainting which in the 16th century was controlled by the representatives of the guild of painters.

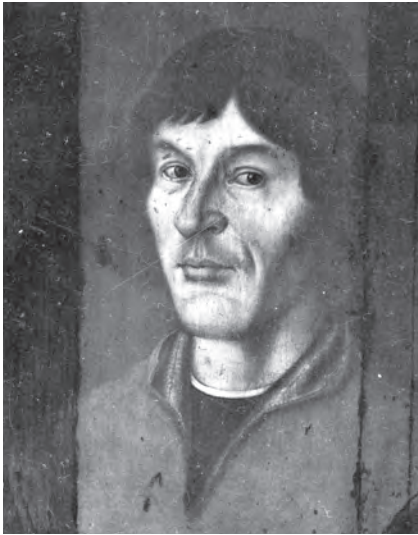


Fig. 22. The college portrait – UV-fluorescence (photo J. Flik).



Fig. 23. The college portrait – X-ray (photo J. Flik).

The scar, visible in normal light on the base of the left brow, is repeated on the X-ray image on the base of the right brow. The astronomer's eyes, both on the drawing and on the underpainting are slightly bigger and the upper and lower eyelids are drawn slightly higher and lower of the pupil which is positioned closer to the centre of the eyeball, which means that the person portrayed was looking more straight. Those alterations should be regarded as made by the author and they indicate that the painter was not very keen on strictly following the model, that is the "autographon". The eyes of Nicolaus Copernicus in his college portrait are painted quite strangely, with the left being ca. 3 mm lower than the right one. No other portrait in Poland has been found with a similar solution. Similarly located eyes can be seen on the copperplate by Theodore de Bry from the late 16th century (fig. 24–26).



Fig. 24. Copperplate by Theodore de Bry from *Icones virorum illustrium* by Jean Jacques Boissard, 1597–1599 (a copy in the District Museum in Toruń, photo W. Górski). Marked format of the college portrait.



Fig. 25. Copperplate by Theodore de Bry, fragment.

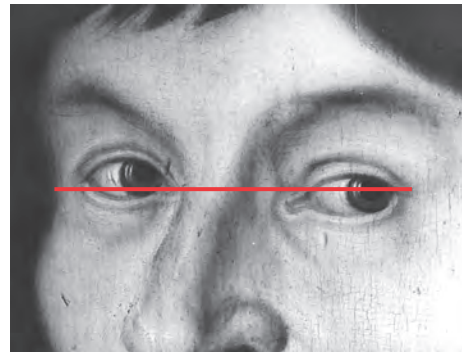


Fig. 26. The college portrait, fragment Józef Flik.

Theodore de Bry – a drawer and engraver – collaborated with another painter, Marcus Gheeraerts the Elder (born ca. 1516 in Bruges, died before 1604 in England) (Thieme, Becker 1920, pp. 326–327), who in the years 1558–1568 belonged to the guild of painters in Bruges. Both artists had to flee the Netherlands in 1568 due to their religious denomination. Theodore de Bry settled in Germa-

ny, where he made his name mostly as the author of illustrations for Boissard's *Icones virorum illustrium* (*The portraits of eminent men*), Frankfurt 1597–1599 (Thieme, Becker 1911, pp. 162–163). Marcus Gheeraerts together with his son Marcus (born 1561, died 1635 in London) went to England, where he painted numerous portraits and altar paintings. He also used to make matrices for engravers, including Theodore de Bry, whom he met in 1587 in London to hand him over certain matrices.

A comparison between the engraving of Copernicus by Theodore de Bry and the college portrait reveals exceptional parallels in the modelling of the face and the attire. On the other hand, as far as the setting of the eyes in the college portrait is concerned, in the National Portrait Gallery in London I came across the portrait of Sir Henry Lee from 1600 by Marcus Gheeraerts the Elder and the portrait of Robert Devereux, Duke of Essex, by Gheeraerts the Son, in which the eyes were set in the same way – the left one 3 mm lower than the right one (fig. 27, 28).

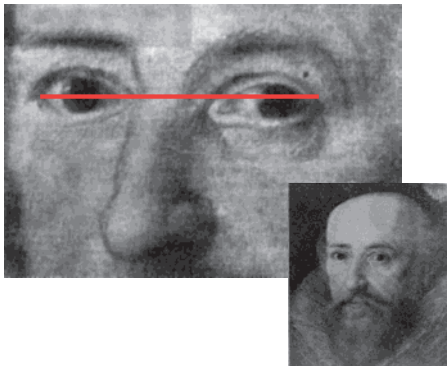


Fig. 27. The portrait of Henry Lee, ca. 1600, by Marcus Gheeraerts the Elder (National Portrait Gallery, London).



Fig. 28. The portrait of Robert Devereux Duke of Essex, ca. 1596, by Marcus Gheeraerts the Elder (National Portrait Gallery, London).

In this situation, it becomes probable that the college portrait is of Dutch provenance. In the book by Prof. Krzysztof Mikulski (2009, p. 27) one reads that the school in Chełmno, frequented by Nicolaus Copernicus, also admitted students even from the distant Netherlands, for example Jan Kampen from Amsterdam, who attended it in the years 1486–1491. The school enjoyed a good reputation at the time and was supported by bishop Lucas Watzenrode himself, the astronomer's uncle. Could those facts have somehow influenced Copernicus's interest in Dutch painters and vice-versa?

The format and the composition of the college portrait were of particular interest to me. No other known 16th-century portrait of the astronomer, both painted

and engraved, except for the ones from Berlin and Gołuchów, depicts men with no arms visible. The college portrait was trimmed and this is the reason why the torso is too short, the head too big and the shoulders too narrow for the format.

Microscopic examination revealed traces of sawing on both sides and at the bottom. This was done in the early 17th century, since the 17th-century copy painted for the Astronomic Observatory in Warsaw (lost during World War II and known only from its black-and-white photograph) (Batowski 1933), presented Copernicus with both hands visible, holding a blooming sprig of lily of the valley (fig. 29).



Fig. 29. The portrait of Nicolaus Copernicus from the Astronomical Observatory of Warsaw University, lost copy of the college portrait, 17th century (after Batowski 1933).

Moreover, a copy of the college portrait painted in 1735 for the Astronomic Observatory in Paris (canvas measuring 77 × 57 cm) presents the scholar with no arms visible, with a board with an epigram and the date of execution painted below, which replaced the hand holding the flower,⁶ visible prior to the trimming

⁶ Before the trimming, the college portrait already in 1594 was hanging among other burghers' portraits in the library of the Academic College in Toruń. Later it was destroyed for some unknown reason.

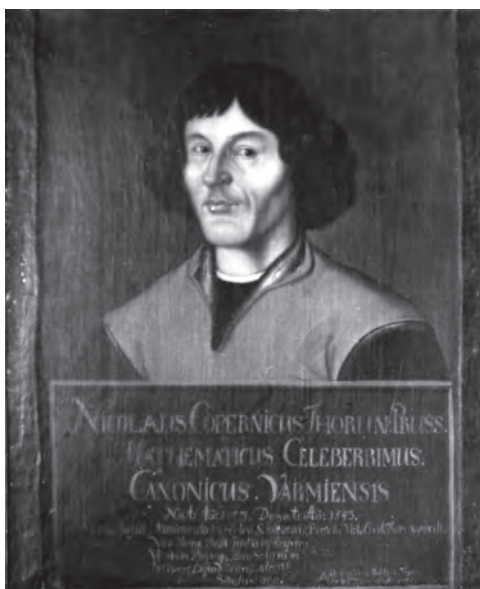


Fig. 30. The portrait of Nicolaus Copernicus from the Astronomical Observatory in Paris, copy of the Toruń college portrait, oil on canvas, 1735 (photo J. Gardzielewska).



Fig. 31. Copy and reconstruction of the college portrait, oil on wooden panel, 1987, by J. Flik (photo A. Skowroński).

(fig. 30). Thus a copy and the painted reconstruction of the college portrait that I executed in the years 1986-1987 were a result of complex technological, conservation and stylistic research, and above all of numerous painting tests which altogether led to creating a portrait on a board measuring 77×57 cm in distemper and oil⁷ (fig. 31). In the 1990s I painted a number of such copies and reconstructions, among others for the universities in Kraków and Toruń. I do hope that the reconstructed portrait of Nicolaus Copernicus faithfully renders the look of the original college image from 1580, painted by the rules of the Dutch school, most probably by Marcus Gheeraerts from Bruges, active in the court of Queen Elisabeth I in London. This portrait was modelled on the painting from Frombork and as far as the face is concerned, it is very similar to the epitaph portrait, although the way of painting, especially the texture, was different. In artistic terms the college portrait is an isolated phenomenon, since similar attitude to the painting's matter and texture has so far never been accounted for. Besides, the astronomer on this portrait is a man more advanced in years, looking about 50 years of age

⁷ This portrait me and my spouse Regina have presented to His Holiness Pope John Paul during his stay in Wrocław in 1991, presently it is exhibited in the Polish Pilgrims' House in Rome.

(distinct wrinkles around the eyes, sharp lines on the cheeks, the forehead and the chin), while on the epitaph portrait he seems to be 10 years younger.

There are two more details different in both paintings: the shape of the fringe, which is smoothly combed aside from the forehead on the epitaph portrait, and a small collar on the red overcoat, which is bigger on the college portrait (fig. 32, 33).



Fig.. 32. The epitaph portrait – fragment
(photo W. Górski).



Fig. 33. The college portrait – fragment
(photo W. Górski).

6. Conclusion

Jan Ludwik Strzesz, the Canon of the Chełmno chapter, after he, on behalf of the bishop,⁸ had visited SS. Johns' Church in Toruń in 1671, recognised the epitaph portrait as the true one (*vera effigies*), that is the one that renders the true physiognomy of Copernicus, who, he claimed, was younger, had laughing eyes, firmer lips, a less protruding nose and a rounded chin (Flik, Kruszelnicka 1996, pp. 13–14). This opinion was probably the result of a comparison between the Toruń likenesses, that is the epitaph portrait and the college portrait.

We still do not know the author of the epitaph portrait, an example of the Northern European school, which is indicated in the presence of a typical grey

⁸ Jan Ludwik Strzesz was the so-called general inspector of Bp. Andrzej Olszowski. See: Mańkowski 1928, pp. 203–204.

underpainting, an expression of the initial modelling. This portrait, as far as the workshop is concerned, has very much in common with the image of St. Jerome in the neighbouring epitaph of Anna Pirnesius (Flik 1994, pp. 3–14), which may suggest that Hans Michel could have painted the epitaph portrait modelling it on the one from Frombork. Małgorzata Flik-Fizek (1992, pp. 166–173) mentioned a non-existent portrait of Nicolaus Copernicus from Frombork, which – as she claims – was also painted after the Frombork “autographon” of the 16th/17th century. There is a black-and-white photograph of that painting (fig. 40) that allows for a conclusion that the painting – depicting the astronomer’s figure against a dark background, with an inscription identifying the portrayed person in the top right corner and a cloth-covered table with a pair of compasses and a circular clock in the bottom left corner – could have been painted in late 16th century. Copernicus’s face, his attire: a black robe and a red coat, and his hands joined in prayer closely resemble the epitaph portrait from Toruń.⁹

Among the three oldest painted portraits the authentic image from Strasbourg Cathedral, painted by Tobias Stimmer – that is the one in which the X-ray revealed shoulder-long hair framing the astronomer’s oval face and in which he is dressed in a coat with a large collar – is a so far little known link. It probably originated from Frombork and was the model for the Gołuchów portrait, painted on a wooden panel in the 16th century, in which Copernicus is depicted at an older age, with a more oval and thoughtful face. What is quite characteristic in the manner the face was painted, are the thin lines defining particular features. A similar manner was deployed by Lucas Cranach the Elder, a South-German painter, who seemed to draw his paintings twice – that is prior to painting and afterwards, in order to bring up the most characteristic facial features of his model. The portrait of Bishop Lucas Watzenrode painted on a wooden panel in the second half of the 16th century, which also went missing (I happened to recreate it from a black-and-white photograph), displayed a similar painting style.

Based on the Strasbourg portrait, the missing portrait of the year 1593 was also executed,¹⁰ painted on canvas in oil, the photograph of which is in the collection of the Museum in Berlin (fig. 34), and of which only a poor copy has been preserved. On this portrait Copernicus was depicted with long hair and an oval, expressive face.

⁹ At the turn of the year 2009 I painted a portrait of Nicolaus Copernicus with a view of Frombork Cathedral in the background. I modelled this painting on the portrait from Frombork and the epitaph portrait from Toruń.

¹⁰ J. Kruszelnicka quotes after E. Zinner, that the painting had been bought in 1937 by the Berlin Museum and earlier it was kept in the Johannes Michael Schwartz’s vine wholesale establishment in Toruń (Flik, Kruszelnicka, p. 34).

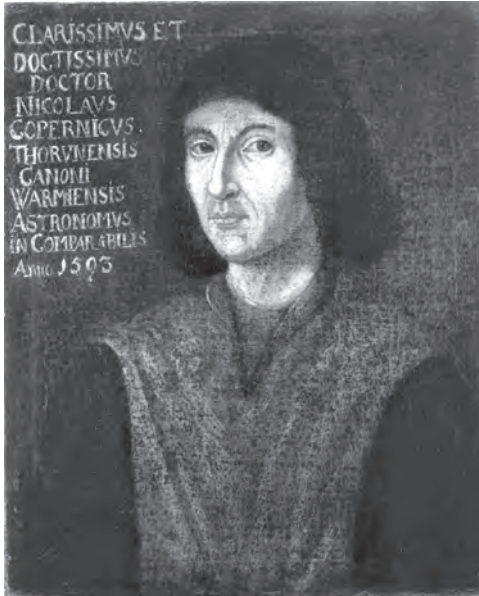


Fig. 34. The portrait of Nicolaus Copernicus in the National Gallery, Berlin, oil on canvas, 1593, photograph of the non-existent original.



Fig. 35. The portrait of Nicolaus Copernicus with lily-of-the-valley, German school, oil on wooden panel, second half of 16th century.

A mysterious portrait of a man identified as Nicolaus Copernicus, holding a sprig of lily of the valley and wearing a beret-shaped head covering and a coat with a large, light-coloured fur collar (fig. 35), does not diverge from the earlier mentioned portraits. That portrait was painted on a wooden panel in the second half of the 16th century and is attributed to a German painter. Even a mere photograph allows for a conclusion that it displayed a high-quality Northern European painting workshop. Oddly enough, none of the known 16th-century engravings has much in common either with the two discussed portraits or with the Strasbourg (prior to it being painted over) or the Gołuchów portrait.

Among the portraits originating from Frombork there are both Toruń portraits: the one in the epitaph (fig. 39) and the one from the college with a lily of the valley (fig. 36, 37, 38) as well as the one from Frombork (fig. 40). As we already know, they are very similar as far as physiognomic resemblance is concerned, which cannot be said about their technique. To that group one can count also engravings of the astronomer from the second half of the 16th century: the reversed woodcut by Tobias Stimmer, the so-called Reusner portrait (fig. 1a), the copperplate by Theodore de Bry (fig. 1B, 24), which has particular ties with the college portrait (fig. 36), and the Kaufmann's woodcut (fig. 1d).

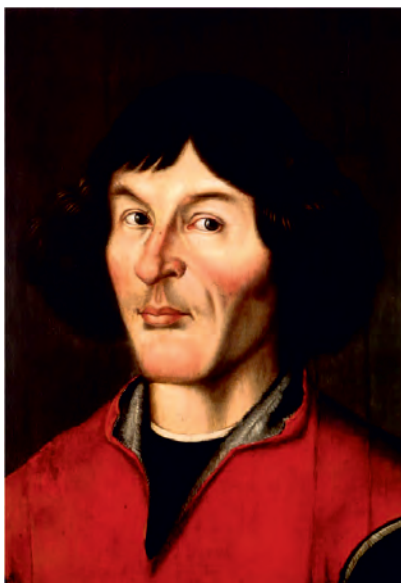


Fig. 36. The college portrait, 1580.



Fig. 37. The portrait from the Astronomical Observatory of Warsaw University, 17th century copy (missing).

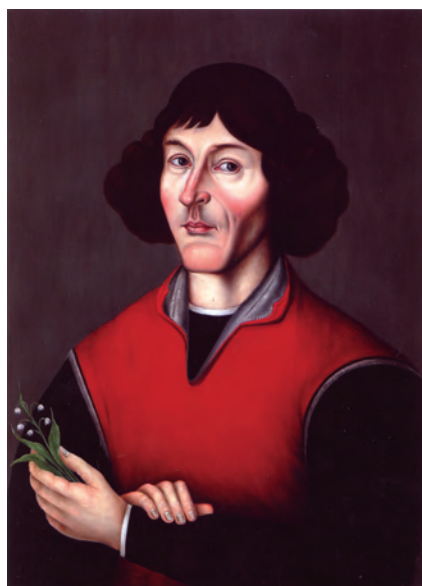


Fig. 38. The college portrait, copy and reconstruction, 1987, by J. Flik.



Fig. 39. The epitaph portrait, 1580.



Fig. 40. The Frombork portrait of Nicolaus Copernicus 16th/17th century (missing).

Finally, I wish to express my hopes that this study shall contribute to clarifying some of the tangled threads regarding the origin and the technique of making the oldest likenesses of our astronomer, which, albeit painted ca. 37 years after his death, faithfully resemble the great scholar and humanist, so easily recognizable in Poland and abroad.

References

BATOWSKI Zygmunt

1933: *Wizerunki Kopernika*. Toruń: Towarzystwo Bibliofilów im. Lelewela z zasiłkami Funduszu Kultury Narodowej i Pomorskiego Starosty Krajowego.

BROCHWICZ Zbigniew

1973: *Toruński portret Mikołaja Kopernika w świetle nowych badań technologicznych*, “Rocznik Muzeum w Toruniu”, vol. 5, pp. 113–126.

FLIK Józef

1973: *Najnowsze badania portretu Mikołaja Kopernika ze zbiorów Muzeum Okręgowego w Toruniu*, “Rocznik Muzeum w Toruniu”, vol. 5, pp. 83–112.

- 1974: *Portrety Mikołaja Kopernika z katedry w Strasburgu i Muzeum Okręgowego w Toruniu*, "Ochrona Zabytków", vol. 27, no. 1, pp. 66–71.
- 1982: *Portrety mieszczańskie drugiej połowy XVI wieku z Muzeum w Toruniu – technologie i techniki malarskie*. Toruń.
- 1990: *Portret Mikołaja Kopernika z Muzeum Okręgowego w Toruniu. Studium warsztatu malarskiego*. Toruń: Uniwersytet Mikołaja Kopernika.
- 1994: *Obraz św. Hieronima z XVI wieku z kościoła świętojańskiego w Toruniu, zagadnienia artystyczne i technologiczne*, "A.U.N.C. Zabytkoznawstwo i Konserwatorstwo", vol. XXII, pp. 3–14.
- 1995: *Wpływy niderlandzkie na technikę toruńskiego malarstwa portretowego i epitafijnego z k. XVI w.*. In: *Niderlandyzm w sztuce polskiej. Materiały Sesji Stowarzyszenia Historyków Sztuki*, Toruń, Dec.1992. Warszawa: WN PWN.
- 2010a: *Szesnastowieczne portrety Mikołaja Kopernika*. Ppaper delivered at the conference "Tajemnica grobu Kopernika. Dialog ekspertów" / "The Nicolaus Copernicus grave mystery. A dialogue of experts" (Kraków, 22–23 February 2010); on behalf of the author the paper was given by Michał Kokowski.
- 2010b: *Najstarsze portrety Mikołaja Kopernika jako kanonika fromborskiego i astronoma*. In: A. Kopiczko, J. Jezierski, Z. Żywica (ed.), *Warmińska kapituła katedralna. Dzieje i wybitni przedstawiciele*. Olsztyn: Instytut Historii i Stosunków Międzynarodowych UWM, pp. 37–62. Paper delivered at the conference: "Warmińska Kapituła Katedralna. Dzieje i wybitni przedstawiciele", Olsztyn-Kortowo, Wydział Humanistyczny UWM, May 20–21, 2010.
- FLIK Józef, KRUSZELNICKA Janina
- 1996: *Epitafum Mikołaja Kopernika w bazylice katedralnej św. Janów w Toruniu*. Toruń: Wydawnictwo UMK.
- FLIK-FIZEK Małgorzata
- 1992: *Najstarsze wizerunki Mikołaja Kopernika w malarstwie i grafice z XVI i XVII wieku*, "Rocznik Muzeum w Toruniu", vol. IX, pp. 153–181.
- Alfons MAŃKOWSKI
- 1928: *Prałaci i kanonicy katedralni Chełmińscy od założenia kapituły do naszych czasów*. Toruń: Towarzystwo Naukowe w Toruniu. (Rocznik Towarzystwa Naukowego w Toruniu vol. 33/34)
- MARCONI Bohdan
- 1953: *Toruński portret Mikołaja Kopernika*, „Biuletyn Historii Sztuki”, vol. 15, no. 2, pp. 3–5.
- 1954: *W sprawie współczesności toruńskiego portretu Kopernika*, „Biuletyn Historii Sztuki”, vol. 16, no. 2, pp. 277–279.
- MIKULSKI Krzysztof
- 2009: *Mikołaj Kopernik życie i działalność*. Toruń: Uniwersytet Mikołaja Kopernika.
- OTTÓWNA Anna
- 1955: *Szesnastowieczne malarstwo w Toruniu*, manuscript, Poznań.

THIEME Ulrich, BECKER Felix

1911: *Allgemeines Lexikon der Bildenden Künstler von der Antike bis zur Gegenwart*, vol. V, Leipzig.

1920: *Allgemeines Lexikon der Bildenden Künstler von der Antike bis zur Gegenwart*, vol. XIII, Leipzig.

TORWIRT Leonard

1953: *Zagadnienie autentyczności portretu Mikołaja Kopernika, znajdującego się w Muzeum Pomorskim w Toruniu*, "Ochrona Zabytków", vol. 6, no. 1, pp. 40–46.

**Tomasz GRZYBOWSKI^a, Katarzyna SKONIECZNA^{a, b},
Urszula ROGALLA^a, Boris A. MALYARCHUK^c**

^a Nicolaus Copernicus University, Ludwik Rydygier Collegium Medicum, Institute of Forensic Medicine, Department of Molecular and Forensic Genetics, Bydgoszcz, Poland

^b Postgraduate School of Molecular Medicine, Warsaw, Poland

^c Institute of Biological Problems of the North, Russian Academy of Sciences, Magadan, Russia

Statistical and phylogenetic interpretation of the results of mitochondrial DNA analysis of the alleged Nicolaus Copernicus's remains from the Frombork Cathedral¹

Abstract

In the course of this study the frequency of the haplotype determined for the remains from the burial site 13/05 in Frombork Cathedral has been updated and a phylogenetic interpretation of the remains has been performed. Based on the results of a mitochondrial DNA analysis from 31,367 maternally unrelated persons from European populations, it has been stated that the haplotype is found once in 791–458 persons. In addition, owing to entire mitochondrial DNA sequencing, the haplotype has been assigned to the H27 haplogroup.

Keywords: mitochondrial DNA, haplotype databases, haplogroups, phylogeny.

1. Introduction

Although mitochondrial DNA (mtDNA) sequence analysis has already become one of the most frequently used methods for human remains identification purposes, some issues concerning the results of the interpretation of mtDNA sequencing are a matter of ongoing debate. These questions concern size, geographical range and quality of population mtDNA databases used for assessing haplotype

¹ The following article was peer-reviewed by: Professor Zofia Szczerkowska, Habilitated Doctor in Medical Sciences (Department of Forensic Medicine, Medical University of Gdansk, Chairwoman of the Commission on the Forensic Genetics of the Polish Society of Forensic Medicine and Criminology).

frequencies. Recently, owing to a phylogeographical approach, an *a posteriori* quality control of mtDNA haplotypes deposited in some databases has been performed (Salas *et al.* 2007). It became possible as a result of the existence of extensive knowledge of mtDNA phylogeny on a global scale (van Oven and Kayser 2009).

The aim of this study is to attempt a statistical assessment of the results of mtDNA analyses of the alleged Nicolaus Copernicus's remains using up-to-date, extended mtDNA databases, and to evaluate the credibility of the outcome by the means of available phylogenetic tools.

2. Materials and methods

In order to estimate the frequencies of both the haplotype received from the remains at the burial site 13/05 in Frombork cathedral (Bogdanowicz *et al.* 2009) and the H27 haplogroup, mtDNA sequencing results from 31367 maternally unrelated individuals representing European populations were used (Tab. 1). Some of the data was taken from scientific publications dedicated to various ethnic groups, some came from the EMPOP2 database (both the forensic and literature source) as well as from the publicly accessible part of the database created for the Genographic Project (haplotypes of the West-Eurasian origin). This is not all the data available for comparison, but only those that were previously validated, among others, by the means of phylogenetic tools. It was only the HVS-I region between nucleotide positions 16024 and 16365 that was taken into account in the search of population data. Normal approximation of binomial distribution with a 95% confidence interval was used to assess the frequency of the haplotype and the haplogroup in the population on the basis of the number of observations in the databases (Holland & Parsons 1999).

In order to confirm the assignment of the haplotype determined for the burial site 13/05 to a specific haplogroup, we conducted an entire mtDNA genome sequencing of two specimens from the Polish population belonging to the H haplogroup and bearing the HVS-I 16129A-16316G motif. The entire procedure was performed as in Malyarchuk *et al.* (2008a). The maximum parsimony (MP) tree was constructed manually. The phylogenetic nomenclature was presented according to the updated evolutionary tree created on the basis of the entire mitochondrial genome sequences (van Oven & Kayser 2009). HVS-I haplotype networks belonging to this specific clade were reconstructed to illustrate the diversity within the H27 haplogroup. They were identified on the basis of a literature and database search (Tab. 1). The reconstruction of the haplotype networks utilizing the MJ algorithm (Bandelt *et al.* 1999) was made using Network v. 4.5.1.6

Tab. 1. Overview of population data concerning the HVS-I sequence of mtDNA prepared in order to determine the number of observations (n) of the haplotype extracted from the bones from the 13/05 burial site and the haplotypes belonging to haplogroup H27.

Population	Number	Haplotype from 13/2005 burial site (n)	Haplogroup H27 (n)	Literature
Poles	403			Grzybowski, unpublished data
Czechs	268		2	Vanecek <i>et al.</i> 2004; Malyarchuk <i>et al.</i> 2006
Slovaks	207		1	Malyarchuk <i>et al.</i> 2008b
Russians from Eur. regions	507		1	Orekhov <i>et al.</i> 1999; Richards <i>et al.</i> 2000; Malyarchuk <i>et al.</i> 2002; 2004
Siberians	201		1	Rubinstein <i>et al.</i> 2008a; 2008b
Russians (Old Believers)	188		1	Rubinstein <i>et al.</i> 2008a; 2008b
Byelorussians	292		2	Kushnerevich <i>et al.</i> 2008
Ukrainians	95			Malyarchuk&Derenko 2001; Malyarchuk 2003; Grzybowski, unpublished data
Bulgarians	139	1	1	Richards <i>et al.</i> 2000
Lithuanians	180		1	Kasparaviciute <i>et al.</i> 2004
Latvians	299		1	Pliss <i>et al.</i> 2005
Baltic populations	376		1	Richards <i>et al.</i> 2000
Estonians	48			Sajantila <i>et al.</i> 1995
Finnish	403			Meinila <i>et al.</i> 2001

Tab. 1. (continued)

Population	Number	Haplotype from 13/2005 burial site (n)	Haplogroup H27 (n)	Literature
Karelians	83			Sajantila <i>et al.</i> 1995
Nenets	58			Saillard <i>et al.</i> 2000
Udmurts	101		1	Bermisheva <i>et al.</i> 2002
Komi-Zyrians	62		2	Bermisheva <i>et al.</i> 2002
Komi-Permians	74			Bermisheva <i>et al.</i> 2002
Mordvins	102			Bermisheva <i>et al.</i> 2002
Mari	136			Bermisheva <i>et al.</i> 2002
Chuvash	55		2	Bermisheva <i>et al.</i> 2002
Tatars	228			Bermisheva <i>et al.</i> 2002
Bashkirs	221			Bermisheva <i>et al.</i> 2002
British	98	1	2	Piercy <i>et al.</i> 1993, taking into account remarks from Bandelt <i>et al.</i> 2001
Austrians	101			Parson <i>et al.</i> 1998
Norwegians	74			Passarino <i>et al.</i> 2002

Tab. 1. (continued)

Population	Number	Haplotype from 13/2005 burial site (n)	Haplogroup H27 (n)	Literature
Swiss	154		1	Dimo-Simonin <i>et al.</i> 2000, taking into account remarks from Bandelt <i>et al.</i> 2001
Germans	806	2	7	
Total population	67		1	Hofmann <i>et al.</i> 1997
Western Germany	150	1	1	Baasner <i>et al.</i> 1998; Baasner i Madea 2000
North West Germany	89		1	Pfeiffer <i>et al.</i> 1999
Southern Germany	200		1	Lutz <i>et al.</i> 1998; 1999
North East Germany	300	1	3	Poetsch <i>et al.</i> 2003; 2004
Italians	83			Tagliabracci <i>et al.</i> 2001
French	210			Dubut <i>et al.</i> 2004
Spaniards	118		1	Crespillo <i>et al.</i> 2000
Portuguese	549		2	Pereira <i>et al.</i> 2004
EMPOP2 Data	5475	9	30	www.empop.org
Geographic Project Data	18973	41	79	Behar <i>et al.</i> 2007

software (www.fluxus-engineering.com). Length polymorphisms (insertions and deletions) as well as transversions occurring between nucleotide positions 16180-16193 were omitted in order to maximize the credibility of the phylogenetic relationships between haplotypes.

3. Results and discussion

The analysis of the entire mitochondrial DNA molecules bearing the transition A16316G in HVS-I has shown that these genomes belong to the H27 subhaplogroup, defined, *inter alia*, by back-mutation at position 11719 (Fig. 1). The A16316G mutation in the control region is a relatively stable marker for the H27 haplogroup. For example, in the publicly accessible database created for The Genographic Project (Behar *et al.* 2007), only a limited number of homoplasies, i.e. parallel existence of the same mutation in different haplogroups, were noted in this position: out of 85 A16316G transitions observed in the database encompassing various haplotypes that descend from the R macro-haplogroup, as much as 79 belonged to an H haplogroup and the other 6 – to U*, K and T haplogroups. On the other hand, a literature review permitted us to reveal that the A16316G transition quite seldomly occurs in the known H subhaplogroups – an example of such incidental observation concerns a haplotype belonging to the H1a subclade in the French population (Rousselet & Mangin 1998). Taking into account the stability of A16316G against H27 subhaplogroup, on the basis of presence of this transition in the HVS-I region and the knowledge of D-loop mutations diagnostic for other West-Eurasian mtDNA haplogroups, a database search was made against the frequency and inner diversity of the H27 haplogroup in Europe (Tab. 1, Fig. 2 and 3). The haplotype diversity within this haplogroup was depicted in a form of networks – separately for literature data referring to ethnicity of the donors (Fig. 2) and for the Genographic Project data, for which such information is not publicly accessible (Fig. 3). The frequency of H27 in the European populations (total number of haplotypes: 31367) lies within the range between 0.003696 and 0.005166 (139 observations in the database, Tab. 1). In both data sets, the most frequent haplotype bears the 16093C-16129A-16316G motif, whereas the haplotype determined for the remains from the 13/05 burial site (16129A-16316G) is the second most common profile. The most frequent haplotype has a broad geographical range and is found in populations of Western, Central and Eastern Europe within a large variety of linguistic groups (Slavonic-, German-, Finno-Ugric-, Baltic-, Romanian- and Turkic-speaking populations). The HVS-I haplotype determined for the remains from the 13/05 burial site has already been noted in the German, Danish, British, Polish, Bulgarian and Romanian popula-

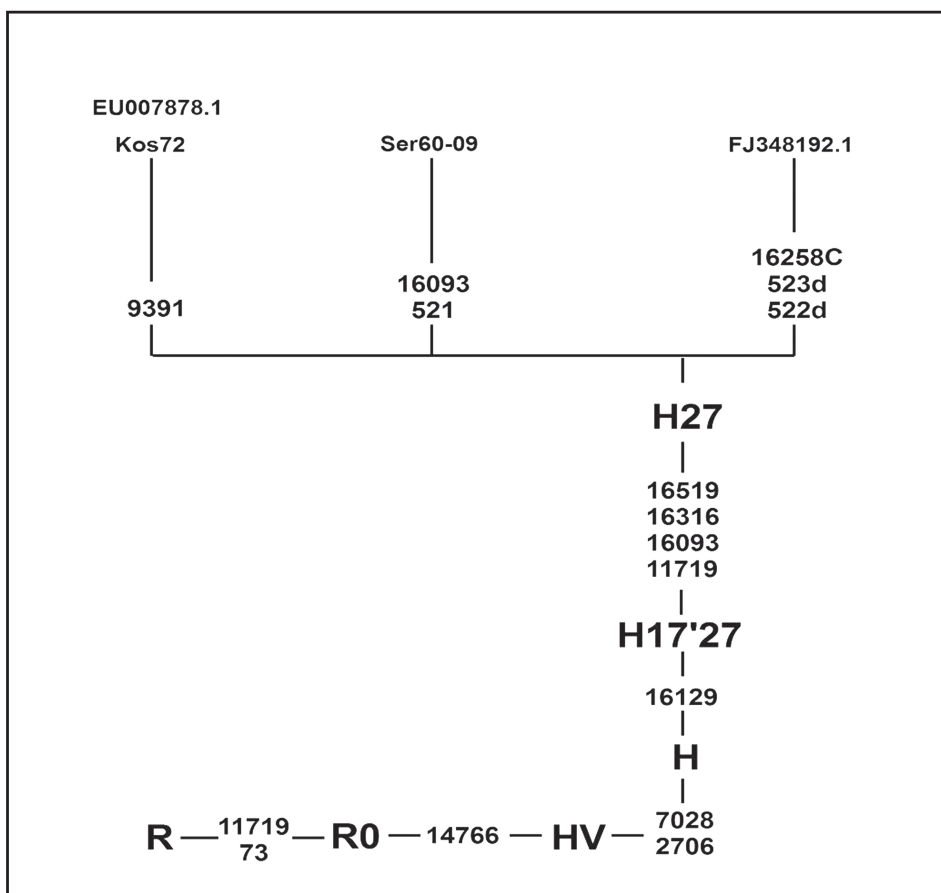


Fig. 1. Phylogenetic tree of haplogroup H27 reconstructed on the basis of the maximum parsimony algorithm using entire mtDNA genome sequences Kos72 and Ser60-09, the specimens from the Polish population analyzed in this study; EU007878.1, FJ348192.1, accession numbers for the other specimens deposited in GenBank database (<http://www.ncbi.nlm.nih.gov/nucleotide/>). The branches of the tree are marked with mtDNA nucleotide positions according to the numbering used for the revised reference sequence (rCRS, Andrews *et al.* 1999). No indication of a base next to the sequence position stands for transition; transversion is denoted with a corresponding base. Deletions are marked with a (d) suffix. The tree was rooted in haplogroup R.

tions (Fig. 2). The inner diversity of H27 expressed by a number of different haplotypes is slightly higher in German- than Slavonic-speaking populations (8 and 5 haplotypes, respectively). However, it probably does not support the hypothesis on the German descent of the maternal line to which the haplotype of the remains from the 13/05 burial site belongs (Bogdanowicz *et al.* 2009). In fact, the geo-

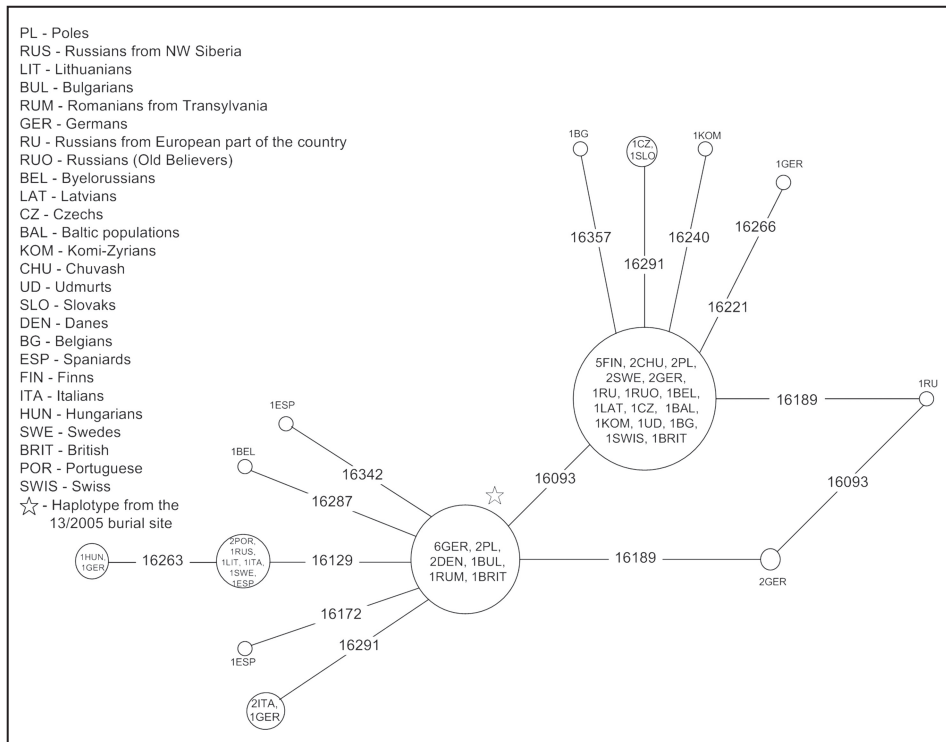


Fig. 2. Phylogenetic network of HVS-I haplotypes belonging to haplogroup H27, identified on the basis of literature data overview (from Tab 1.) accompanied by information on the ethnicity of the examined groups. The size of the nodes is proportional to the number of haplotypes included, which is given next to the abbreviations of the population names. The connections between the nodes are marked with nucleotide positions according to the numbering used for the revised reference sequence (rCRS, Andrews *et al.* 1999). No indication of a base next to the sequence position stands for transition. The haplotype determined for the bones from the 13/05 burial site is marked with an asterisk.

graphical range of H27 is rather wide, and the lack of additional data in the form of entire mtDNA sequences and molecular dating hinders unambiguous determination of the origin of this clade. The frequency of the HVS-I haplotype determined for the remains from the 13/05 burial site amounts to 0.001263–0.00218 (54 observations, Tab. 1). In other words, this haplotype is found in the European populations once in every 791–458 persons. It is worth noting that Bogdanowicz *et al.* (2009) received very similar results by screening an over 8 times smaller HVS-I and HVS-II database (3830 haplotypes from Western Eurasia in forensic and literature directory of EMPOP1). The statistical qualification of the results of the mtDNA analysis of the remains from the 13/05 burial site and of the hair from

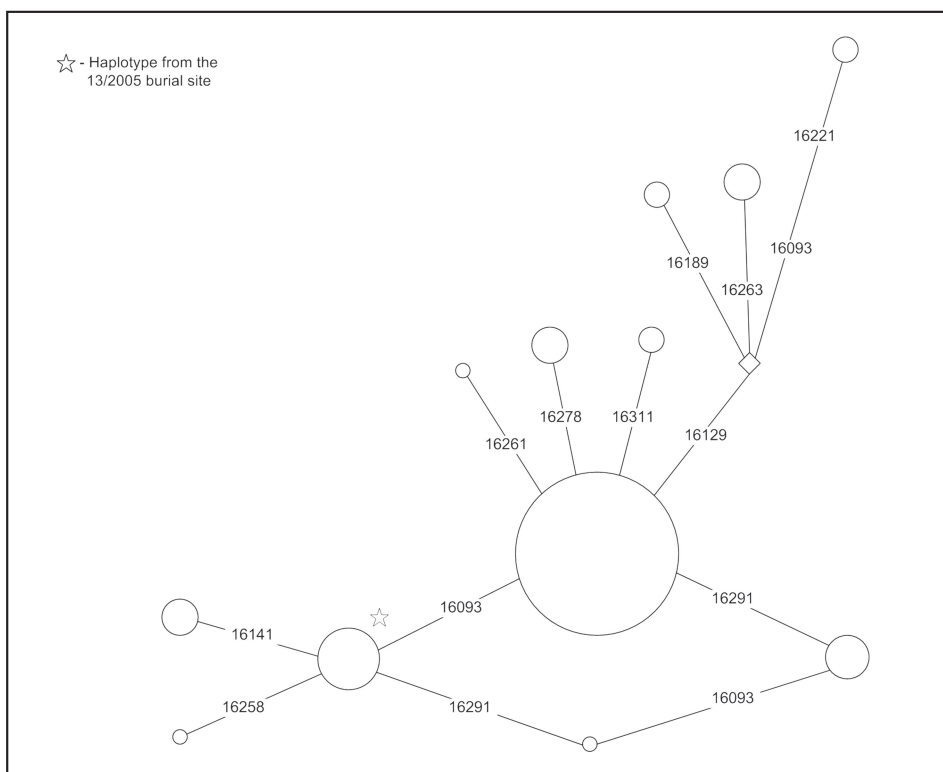


Fig. 3. Phylogenetic network of HVS-I haplotypes belonging to haplogroup H27, identified on the basis of the publicly accessible part of the database from the Genographic Project (Behar *et al.* 2007). The size of the nodes is proportional to the number of the haplotypes included. The connections between the nodes are marked with nucleotide positions according to the numbering used for the revised reference sequence (rCRS, Andrews *et al.* 1999). No indication of a base next to the sequence position stands for transition. The haplotype determined for the bones from the 13/05 burial site is marked with an asterisk.

Calendarium Romanum Magnum did not significantly change despite a substantial increase of the database size used for frequency calculations. By employing the concept of likelihood ratio (LR), commonly accepted by the international society of forensic geneticists, one may state that the conformity between the mtDNA profiles of the bones from Frombork cathedral and the hair from *Calendarium* is 458 to 791 times more probable, assuming that both samples belong to the same maternal line and not to different ones.

In the discussion concerning the results presented by Bogdanowicz *et al.* (2009) the problem of the size and geographical range of the mtDNA population databases was occasionally raised. For instance, Kokowski (2010) stated that there

was no reliable means of determining the frequency of a mtDNA haplotype in a population due to a small number of databases in comparison to the total human population. In our opinion, this statement seems too vague to be a substantial contribution to the discussion on the results of certain analyses, i.e. to the assessment of the frequency of the haplotype determined for the bones from Frombork. As a matter of fact, in his deliberations Kokowski (2010) disregarded some crucial issues such as continental specificity of mtDNA haplogroups, a different level of mtDNA diversity in various populations inhabiting the same continent, the representative character of the databases understood as the level of their saturation regarding the most important parameters of the population pool of mtDNA, and finally, the actual influence of the database size on the results of the estimation of haplotype frequencies.

Firstly, it is beyond all doubt that it was the database encompassing mtDNA profiles from West Eurasia, where H27 is most frequently observed, that should have been used – as Bogdanowicz *et al.* (2009) did – for the assessment of the frequency of the haplotype from the aforementioned remains and not the mtDNA data of the world population. In fact, the distribution of mtDNA haplogroups is different for populations from different continents – this heterogeneity began to arise soon after modern humans left Africa and subsequently was emphasized by a genetic drift in populations inhabiting distant geographical regions. Because of this, it is widely accepted by forensic geneticists to screen databases representing such geographical regions where a certain haplotype is said to be most frequent (Forster *et al.* 2002). Secondly, the distribution of both mtDNA haplogroup frequencies and control region haplotypes in various European populations is relatively uniform: there is no visible stratification (structure) of the mtDNA pool in the European population, and the diversity of haplotypes is much lower than in the African population (Simoni *et al.* 2000; McEvoy *et al.* 2004; Grzybowski *et al.* 2007; Tishkoff *et al.* 2009). Moreover, a huge difference between the values of effective population sizes (N_e) has been noted in African and non-African populations, which reflects the substantial reduction of the size of the human population during the movement out of Africa. Eventually, it resulted in a decrease in genetic diversity in non-African populations. Due to a relatively low level of mtDNA diversity, there is definitely no need to create a database encompassing mtDNA haplotypes of all Europeans in order to reflect their frequencies reliably. The actual representative character of the databases can be assessed by examining the level of saturation of the database with reference to such parameters as the number of different haplotypes and polymorphic positions as well as haplotype and nucleotide diversity. The level of saturation – understood as the size of the database, above which the values of the aforementioned parameters stop rising – can be different depending upon the parameter and the population (Helgason *et al.* 2000;

Pereira *et al.* 2004). These kinds of analyses carried out for the Genographic Project database (Behar *et al.* 2007) led to the conclusion that the database is closer to saturation with respect to the number of polymorphic sites, yet it is still far from saturation with respect to the number of different HVS-I haplotypes. It means that with the increase of the database size one can expect a continuing growth of the number of rare haplotypes (Behar *et al.* 2007). Nevertheless, the lack of saturation of the database has a significant influence on the estimation of the frequencies of very rare and unique haplotypes. In the vast majority of cases it leads to the over-estimation of the frequency of unique haplotypes against their true frequency in the population (Holland and Parsons 1999). As proven in this study, the haplotype determined for the remains from the 13/05 burial site is not unique. In our opinion, this is the reason for which the assessment of this haplotype's frequency did not change significantly after increasing the size of the population database.

References

- ANDREWS R.M., KUBACKA I., CHINNERY P.F., LIGHTOWLERS R.N., TURNBULL D.M., HOWELL N.
1999: *Reanalysis and revision of the Cambridge reference sequence for human mitochondrial DNA*, "Nature Genetics", vol. 23, p. 147.
- BAASNER A., MADEA B.
2000: *Sequence polymorphisms of the mitochondrial DNA control region in 100 German Caucasians*, "Journal of Forensic Sciences", vol. 45, pp. 1343–1348.
- BAASNER A., SCHAFFER C., JUNGE A., MADEA B.
1998: *Polymorphic sites in human mitochondrial DNA control region sequences: population data and maternal inheritance*, "Forensic Science International", vol. 98, pp. 169–178.
- BANDELT H.J., FORSTER P., ROHL A.
1999: *Median-joining networks for inferring intraspecific phylogenies*, "Molecular Biology and Evolution", vol. 16, pp. 37–48.
- BANDELT H.J., LAHERMO P., RICHARDS M., MACAULAY V.
2001: *Detecting errors in mtDNA data by phylogenetic analysis*, "International Journal of Legal Medicine", vol. 115, pp. 64–69.
- BEHAR D.M., ROSSET S., BLUE-SMITH J., BALANOVSKY O., TZUR S., COMAS D., MITCHELL R.J., QUINTANA-MURCI L., TYLER-SMITH C., WELLS R.S., THE GENOGRAPHIC CONSORTIUM
2007: *The Genographic Project public participation mitochondrial DNA database*, "PLoS Genetics: A Peer-Reviewed Open-Access Journal", June 2007, vol. 3, iss. 6, e104, pp. 1083–1095.

- BERMISHEVA M., TAMBETS K., VILLEMS R., KHUSNUTDINOVA E.
2002: *Diversity of mitochondrial DNA haplotypes in ethnic populations of the Volga-Ural region of Russia*, "Molecular Biology" (Moscow), vol. 36, pp. 990–1001.
- BOGDANOWICZ W., ALLEN M., BRANICKI W., LEMBRING M., GAJEWSKA M., KUPIEC T.
2009: *Genetic identification of putative remains of the famous astronomer Nicolaus Copernicus*, "Proceedings of the National Academy of Sciences", vol. 106 (30), pp. 12279—12282; <http://www.pnas.org/content/106/30/12279.full>.
- CRESPILLO M., LUQUE J.A., PAREDES M., FERNANDEZ R., RAMIREZ E., VALVERDE J.L.
2000: *Mitochondrial DNA sequences for 118 individuals from northeastern Spain*, "International Journal of Legal Medicine", vol. 114, pp. 130–132.
- DIMO-SIMONIN N., GRANGE F., TARONI F., BRANDT-CASADEVALL C., MANGIN P.
2000: *Forensic evaluation of mtDNA in a population from south west Switzerland*, "International Journal of Legal Medicine", vol. 113, pp. 89–97.
- DUBUT V., CHOLLET L., MURAIL P., CARTAULT F., BERAUD-COLOMB E., SERRE M., MOGENTALE-PROFIZI N.
2004: *mtDNA polymorphisms in five French groups: importance of regional sampling*, "European Journal of Human Genetics", vol. 12, pp. 293–300.
- FORSTER P., CALI F., ROHL A., METSPALU E., D'ANNA R., MIRISOLA M., DE LEO G., FLUGY A., SALERNO A., AYALA G. *et al.*
2002: *Continental and subcontinental distributions of mtDNA control region types*, "International Journal of Legal Medicine", vol. 116, pp. 99–108.
- GRZYBOWSKI T., MALYARCHUK B.A., DERENKO M.V., PERKOVA M.A., BEDNAREK J., WOŹNIAK M.
2007: *Complex interactions of the Eastern and Western Slavic populations with other European groups as revealed by mitochondrial DNA analysis*, "Forensic Science International: Genetics", vol. 1, pp. 141–147.
- HELGASON A., SIGURÐARDÓTTIR S., GULCHER J.R., STEFANSSON K., WARD R.
2000: *Sampling saturation and the European mtDNA pool: implications for detecting genetic relationships among populations*. In: C. Renfrew & K. Boyle (eds), *Archeogenetics: DNA and the population prehistory of Europe*. Cambridge: McDonald Institute for Archeological Research, University of Cambridge, pp. 285–294.
- HOFMANN S., JAKSCH M., BEZOLD R., MERTENS S., AHOLT S., PAPROTTA A., GERBITZ K.D.
1997: *Population genetics and disease susceptibility: characterization of central European haplogroups by mtDNA gene mutations, correlation with D loop variants and association with disease*, "Human Molecular Genetics", vol. 6, pp. 1835–1846.
- HOLLAND M.M., PARSONS T.J.
1999: *Mitochondrial DNA sequence analysis – validation and use for forensic case-work*, "Forensic Science Review", vol. 11, pp. 21–50.

KASPERAVICIUTE D., KUCINSKAS V., STONEKING M.

2004: *Y chromosome and mitochondrial DNA variation in Lithuanians*, "Annals of Human Genetics", vol. 68, pp. 438–452.

KOKOWSKI M.

2010: *Procedura identyfikacji szczątków nr 13/05 jako szczątków Kopernika w świetle racjonalności uzasadnienia i retoryki perswazji*. Presentation delivered at the conference "Tajemnica grobu Mikołaja Kopernika. Dialog ekspertów" / "The Nicolaus Copernicus grave mystery. A dialogue of experts" (Kraków, 22–23 February 2010).

KUSHNEREVICH E I.

2008: *Polymorphism of nucleotide sequences of mitochondrial DNA and Y-chromosome of modern native population of Belarus*. PhD Thesis. Minsk: Institute of Genetics and Cytology of National Academy of Belarus Republic.

LUTZ S., WEISSER H.J., HEIZMANN J., POLLAK S.

1998: *Location and frequency of polymorphic positions in the mtDNA control region of individuals from Germany*, "International Journal of Legal Medicine", vol. 111, pp. 67–77.

LUTZ S., WEISSER H.J., HEIZMANN J., POLLAK S.

1999: *Erratum. Location and frequency of polymorphic positions in the mtDNA control region of individuals from Germany*, "International Journal of Legal Medicine", vol. 112, pp. 145–150.

MALYARCHUK B.A.

2003: *Variation of the Human Mitochondrial Genome and the Genetic History of Slavs*. Doctoral (Biol.) Dissertation. Moscow: Vavilov Institute of General Genetics.

MALYARCHUK B.A., DERENKO M.V.

2001: *Mitochondrial DNA variability in Russians and Ukrainians: implication to the origin of the Eastern Slavs*, "Annals of Human Genetics", vol. 65, pp. 63–78.

MALYARCHUK B.A., GRZYBOWSKI T., DERENKO M.V., CZARNY J., WOŹNIAK M., MIŚCICKA-ŚLIWKA D.

2002: *Mitochondrial DNA variability in Poles and Russians*, "Annals of Human Genetics", vol. 66, pp. 261–283.

MALYARCHUK B., DERENKO M., GRZYBOWSKI T., LUNKINA A., CZARNY J., RYCHKOV S., MOROZOVA I., DENISOVA G., MIŚCICKA-ŚLIWKA D.

2004: *Differentiation of mitochondrial DNA and Y chromosomes in Russian populations*, "Human Biology", vol. 76, pp. 877–900.

MALYARCHUK B.A., VANECEK T., PERKOVA M.A., DERENKO M.V., SIP M.

2006: *Mitochondrial DNA variability in the Czech population, with application to the ethnic history of Slavs*, "Human Biology", vol. 78, pp. 681–696.

- MALYARCHUK B., GRZYBOWSKI T., DERENKO M., PERKOVA M., VANECEK T., LAZUR J., GOMOLCAK P., TSYBOVSKY I.
2008a: *Mitochondrial DNA phylogeny in Eastern and Western Slavs*, “Molecular Biology and Evolution”, vol. 25, pp. 1651–1658.
- MALYARCHUK B.A., PERKOVA M.A., DERENKO M.V., VANECEK T., LAZUR J., GOMOLCAK P.
2008b: *Mitochondrial DNA variability in Slovaks, with application to the Roma origin*, “Annals of Human Genetics”, vol. 72, pp. 228–240.
- McEVOY B., RICHARDS M., FORSTER P., BRADLEY D.G.
2004: *The Longue Duree of genetic ancestry: multiple genetic marker systems and Celtic origins on the Atlantic facade of Europe*, “The American Journal of Human Genetics”, vol. 75, pp. 693–702.
- MEINILÄ M., FINNILÄ S., MAJAMAA K.
2001: *Evidence for mtDNA admixture between the Finns and the Saami*, “Human Heredity”, vol. 52, pp. 160–170.
- OREKHOV V., POLTORAUS A., ZHIVOTOVSKY L.A., SPITSYN V., IVANOV P., YANKOVSKY N.
1999: *Mitochondrial DNA sequence diversity in Russians*, “FEBS Letters”, vol. 445, pp. 197–201.
- PARSON W., PARSONS T.J., SCHEITHAUER R., HOLLAND M.M.
(199: *Population data for 101 Austrian Caucasian mitochondrial DNA d-loop sequences: application of mtDNA sequence analysis to a forensic case*, “International Journal of Legal Medicine”, vol. 111, pp. 124–132.
- PASSARINO G., CAVALLERI G.L., LIN A.A., CAVALLI-SFORZA L.L., BORRESEN-DALE A.L., UNDERHILL P.A.
2002: *Different genetic components in the Norwegian population revealed by the analysis of mtDNA and Y chromosome polymorphisms*, “European Journal of Human Genetics”, vol. 10, pp. 521–529.
- PEREIRA L., CUNHA C., AMORIM A.
2004: *Predicting sampling saturation of mtDNA haplotypes: an application to an enlarged Portuguese database*, “International Journal of Legal Medicine”, vol. 118, pp. 132–136.
- PFEIFFER H., BRINKMANN B., HUHNE J., ROLF B., MORRIS A.A., STEIGHNER R., HOLLAND M.M., FORSTER P.
1999: *Expanding the forensic German mitochondrial DNA control region database: genetic diversity as a function of sample size and microgeography*, “International Journal of Legal Medicine”, vol. 112, pp. 291–298.
- PIERCY R., SULLIVAN K.M., BENSON N., GILL P.
1993: *The application of mitochondrial DNA typing to the study of white Caucasian genetic identification*, “International Journal of Legal Medicine”, vol. 106, pp. 85–90.

- PLISS L., TAMBETS K., LOOGVÄLI E.L., PRONINA N., LAZDINS M., KRUMINA A., BAUMANIS V., VILLEMS R.
2005: *Mitochondrial DNA portrait of Latvians: towards the understanding of the genetic structure of Baltic-speaking populations*, "Annals of Human Genetics", vol. 69, pp. 1–20.
- POETSCH M., WITTIG H., KRAUSE D., LIGNITZ E.
2003: *Mitochondrial diversity of a northeast German population sample*, "Forensic Science International", vol. 137, pp. 125–132.
2004: *Erratum. Mitochondrial diversity of a northeast German population sample*, "Forensic Science International", vol. 145, pp. 73–77.
- RICHARDS M., MACAULAY V., HICKEY E., VEGA E., SYKES B., GUIDA V., RENGO C., SELLITO D., CRUCIANI F., KIVISILD T. *et al.*
2000: *Tracing European founder lineages in the Near Eastern mtDNA pool*, "The American Journal of Human Genetics", vol. 67, pp. 1251–1276.
- ROUSSELET F., MANGIN P.
1998: *Mitochondrial DNA polymorphisms: a study of 50 French Caucasian individuals and application to forensic casework*, "International Journal of Legal Medicine", vol. 111, pp. 292–298.
- RUBINSTEIN S., DUUK M.C., GOKCUMEN O., ZHADANOV S., OSIPOVA L., COCCA M., MEHTA N., GUBINA M., POSUKH O., SCHURR T.G.
2008a: *Russian Old Believers: genetic consequences of their persecution and exile, as shown by mitochondrial DNA evidence*, "Human Biology", vol. 80, pp. 203–237.
2008b: *Erratum. Russian Old Believers: genetic consequences of their persecution and exile, as shown by mitochondrial DNA evidence*, "Human Biology", vol. 80, pp. 675–677.
- SAILLARD J., ESEVA I., TRANEBJAERG L., NORBY S.
2000: *Mitochondrial DNA diversity among Nenets*. In: C. Renfrew & K. Boyle (eds), *Archaeogenetics: DNA and the population prehistory of Europe*. Cambridge: McDonald Institute for Archeological Research, University of Cambridge, pp. 255–258.
- SAJANTILA A., LAHERMO P., ANTTINEN T., LUKKA M., SISTONEN P., SAVONTAUS M.L., AULA P., BECKMAN L., TRANEBJAERG L., GEDDE-DAHL T. *et al.*
1995: *Genes and languages in Europe: an analysis of mitochondrial lineages*, "Genome Research", vol. 5, pp. 42–52.
- SALAS A., BANDELT H.J., MACAULAY V., RICHARDS M.B.
2007: *Phylogeographic investigations: the role of trees in forensic genetics*, "Forensic Science International", vol. 168, pp. 1–13.
- SIMONI L., CALAFELL F., PETTENER D., BERTRANPETIT J., BARBUJANI G.
2000: *Geographic patterns of mtDNA diversity in Europe*, "The American Journal of Human Genetics", vol. 66, p. 262–278.

TAGLIABRACCI A., TURCHI C., BUSCEMI L., SASSAROLI C.

2001: *Polymorphism of the mitochondrial DNA control region in Italians*, "International Journal of Legal Medicine", vol. 114, pp. 224–228.

TISHKOFF S.A., REED F.A., FRIEDLAENDER F.R., EHRET C., RANCIARO A., FROMENT A., HIRBO J.B., AWOMOYI A.A., BODO J.M., DOUMBO O., IBRAHIM M., JUMA A.T., KOTZE M.J., LEMA G., MOORE J.H., MORTENSEN H., NYAMBO T.B., OMAR S.A., POWELL K., PRETORIUS G.S., SMITH M.W., THERA M.A., WAMBEBE C., WEBER J.L., WILLIAMS S.M.

2009: *The genetic structure and history of Africans and African Americans*, "Science", vol. 324, pp. 1035–1044.

VANECEK T., VOREL F., SIP M.

2004: *Mitochondrial DNA D-loop hypervariable regions: Czech population data*, "International Journal of Legal Medicine", vol. 118, pp. 14–18.

VAN OVEN M., KAYSER M.

2009: *Updated comprehensive phylogenetic tree of global human mitochondrial DNA variation*, "Human Mutation", vol. 30, pp. E386–394.

Peter S. GWOZDZ

Cupertino CA, USA; www.gwozdz.org; pete2g@comcast.net

The Y-DNA of the alleged Copernicus remains is haplogroup R1b1b2a1¹

Abstract

The DNA data from the putative Copernicus remains is analyzed. Statistical evidence is provided by multiple methods to establish with high confidence that this Y-DNA belongs to haplogroup R1b1b2a1 (P310). The haplogroup nomenclature changes as data accumulates over the months. Although haplotypes can be used to speculate on national origin, a number of caveats apply, and the confidence varies depending on the haplotype. The issue of German vs. Polish nationality for Copernicus cannot be estimated from the haplotype at this time, but that may change with more data in the future.²

Keywords: Copernicus remains, Copernicus grave, Copernicus DNA, DNA, STR, Short Tandem Repeat, Y-DNA, haplotype, haplogroup, haplogroup R1b, SNP, Single Nucleotide Polymorphism.

¹ The following article was peer-reviewed by Doctor Marcin Woźniak (Institute of Molecular and Forensic Genetics, Chair of Forensic Medicine, Collegium Medicum, Nicolaus Copernicus University, Bydgoszcz, Poland).

A postscript of the reviewer: The following publication is founded on the methodology of the haplogroup prediction for the Y-chromosome on the basis of the chromosome's haplotype obtained from the analysis of selected microsatellite systems. Such a prediction is certainly possible with the use of an appropriate database. However, the prediction method used in this article has not received full acceptance, supported by publications in peer-reviewed journals. One of the reasons is the scientific community's lack of full access to genetic data based on which the method of prediction was worked out. Another problem in this type of analysis is the uncertainty as to the extent to which the database in use represents the population from which the analyzed Y chromosome comes from. We should also keep in mind that the effectiveness of prediction is highly dependent on the number of microsatellite systems that were used to construct the haplotype of the given Y chromosome. From this point of view, the findings of the author of this article regarding the haplogroup membership of the Y chromosome of the alleged remains of Nicolaus Copernicus should be considered as quite probable, but requiring confirmation in the course of direct studies of point mutations that define the haplogroup.

² This article, written 15 May 2010, was updated 31 Dec 2011, with additional corrections introduced in the review process in 2012. Updates are in brackets "[]". Nomenclature update is now R1b1a2a1a1 (P310).

1. Introduction

Michał Kokowski (2009) provided invitation, references and discussion for this paper. Wiesław Bogdanowicz, Marié Allen, Wojciech Branicki, Maria Lembring, Maria Gajewska and Tomasz Kupiec (2009) published DNA data from the putative remains of Nicolaus Copernicus, summarizing previous publications in the book edited by Jerzy Gassowski (2008) including chapters by W. Bogdanowicz (2008), W. Branicki, T. Kupeic (2008) and M. Allen (2008). I present here a technical DNA analysis, with a high confidence Y-DNA haplogroup prediction.

This technical analysis neither adds nor subtracts evidence concerning the identification of Copernicus as the source of the DNA. I refer to the data as the “Copernicus DNA” for convenience.

The word “haplotype” has multiple meanings. For this article about Y-DNA “haplotype” is restricted to one common meaning: a set of numbers, each corresponding to the number of repeats in a particular short tandem repeat (STR), using any number of STR markers (specific locations) from the Y chromosome. For clarity I avoid using “haplotype” for the data from a man, instead using “sample” (plural “samples” or “data” or “database”). A man’s sample matches a particular haplotype, using a specified number of STR markers being considered.

The Y chromosome does not recombine (except for a very short segment) so the Y is inherited by males in the same way as a male line family name. Each STR chain mutates by slippage (change in number of repeats) over the millennia, so a son’s sample occasionally has one or more STR values different than his father’s.

Single Nucleotide Polymorphisms (SNPs) are very rare mutations, so the sequence of rare SNPs are used to define the branches in the Y chromosome family tree. These branches are called haplogroups. Samples from a haplogroup tend to have similar but not necessarily identical haplotypes.

Example: R1b is defined by a sequence of SNPs terminating with the SNP called M343. R1b1b2 is defined by the same sequence plus three more SNPs, terminating with M269. R1b1b2a1 is defined by the same sequence plus two more, terminating with P310.

2. Outline of the considerations

The Copernicus STR data match very well to haplogroup R1b1b2a1 (P310). Some samples assigned to the prior main branches such as R1b, R1b1 and R1b1b2 also match the Copernicus STR data. Those who work with R1b (M343) data understand that most R1b belong to R1b1b2a1, and that most samples assigned to the prior branches are likely R1b1b2a1. On that basis, the Copernicus sample is likely R1b1b2a1. However, this simple observation that R1b samples are likely

R1b1b2a1 is not fully documented in the literature. Documentation is provided here. Furthermore, most of the R1b that are known to belong to side branches off the main tree trunk leading to R1b1b2a1 do not match well to the Copernicus STR data, thereby improving the confidence of the R1b1b2a1 haplogroup prediction for Copernicus, as documented here. The tedious haplogroup documentation takes up much of this article. Readers uninterested in the detailed proof of the Copernicus haplogroup assignment may skip to section 18 “Discussion”.

Section 19 “Y-DNA and National Origin” discusses caveats for speculation about national origin.

1. Although R1b is known to be more common in Western Europe, this is not significant evidence of a Western European ancestry for Copernicus.
2. At this time no R1b haplogroup with geographic concentration in Central Europe has significant German vs. Polish concentration difference. That may change in the future, as more data accumulates.

The Copernicus sample best matches samples on the web from men in haplogroup R1b1b2a1a4, see section 16 “Wallace sample and branch R1b1b2a1a4” for data. It is statistically unfounded to assign this haplogroup to Copernicus, as explained at the end of section 19 “Y-DNA and National Origin”. Data is presented below showing that R1b1b2a1a4 is not particularly concentrated in Central Europe, so it is reasonable but premature to speculate that the Copernicus sample belongs to one of the other rarer R1b1b2a1 branches that are relatively concentrated in Central Europe.

Y-DNA is not particularly meaningful for establishing origin. As discussed in section 20 “National Origin”, conventional family tree research is more meaningful. Today DNA data from all chromosomes is informative at the continental level and in the future may offer evidence at the national level, although such future evidence might show a mixture of nationalities for Copernicus.

Similar analysis applies to mitochondrial DNA. Data is provided in section 21 “mtDNA” strengthening the conclusion that the Copernicus sample belongs to haplogroup H27.

Additional DNA measurements from the putative Copernicus remains will surely be justified in the near future, although not quite yet, as explained in section 22 “Conclusion”.

3. Materials and methods

Analysis is based on data available on the internet. Ysearch (2010) is the primary source. Ysearch is a very large on line database for Y-DNA STR data, with samples from men who choose to join. Ysearch is provided by FTDNA (2010), but

also includes samples transferred from other companies and services, and also includes samples typed in by users.

My presentation on 23 February 2010 at the conference was based on data downloaded in January 2010. This article is based primarily on Ysearch data downloaded in April and May 2010, with slightly more data than in January; the analysis and conclusions are the same as presented at the conference. Use is also made of other internet data sources with references below.

[I checked Ysearch on 30 Dec 2011. There is a bit more data. The analysis of this article is still valid.]

4. Statistical biases

The Ysearch database includes “modal haplotypes”, which are haplotypes that represent the best fit for a haplogroup, or for a cluster of haplotypes, or for a family. Ysearch includes family sets, results for samples from several men from an extended family, sometimes solicited by a single enthusiastic individual. Modal haplotypes and family sets can bias statistics. For example, data for a small haplogroup may be dominated by the family data submitted by one person. In the following, data downloads were manually flagged for modal haplotypes by search for the word “modal”. Data was sorted by family, place of origin, and haplogroup – family sets were flagged using a semi-automatic method; this method does not detect all family sets; this method no doubt flags sets that are really men who joined independently, particularly for a pair of men with a common family name. The flags provided a simple way to check all results for obvious bias. I present data counts without adjustment. I would have added an adjustment or comment if a bias had been found, but no such bias was detected for this article.

Y-DNA databases also have geographical biases [this is due to the non-random selection of all possible samples of the population – M.K.], and thereby haplogroup biases. For example, Ysearch is biased toward male lines from western Europe, and thereby R1b. Gwozdz (2009), for example, provides one adjustment method to adjust Ysearch data for geographical analysis. (However, the few geographical comments in this article have not been adjusted.) Another bias is historical: the relative frequency of haplogroups may have been somewhat different in the time of Copernicus than today.

5. Nomenclature

Y-DNA haplogroups are defined by SNPs along with an alphanumeric code. New SNPs are continually discovered, causing rearrangements of the SNP tree and changes in the alphanumeric code. Different websites have different versions of

the Y-DNA SNP tree. Ysearch follows FTDNA. ISOGG (2010) has a more up to date tree, with more recent SNPs. YCC (2010) had a tree based on Karafet (2008) with update modifications; that updated YCC tree was removed from the site during the review of this Copernicus paper.

The SNP named M269 defines the Y-DNA haplogroup R1b1b2. All these sites agree on this during late 2009 and early 2010. The name “R1b1b2” may change in the future, but M269 will not change as the SNP that I assign here to the Copernicus sample with very high confidence. There are five other SNPs that are found in the same samples with M269; these five provide alternate definitions of R1b1b2 at this time; all six are listed by ISOGG; in the future men might be found whose samples do not have all six SNPs and that would change the tree. [28 Dec 2011 ISOGG nomenclature update R1b1a2 (M269)]

However, those sites differ in the number of SNPs branches reported beyond R1b1b2 (M269). I follow Ysearch, which has 21 branches beyond the R1b1b2 (M269) node (on 15 May 2010). YCC has 13 branches reported in 2008, along with an update that has 15 branches. ISOGG has 31 branches beyond the R1b1b2 (M269) node (one was just added on 12 May). These sites do not disagree on any SNPs – they are just at different stages of being updated (on 15 May 2010). [28 Dec 2011 ISOGG update has 78 branches beyond M269.]

R1b1b2a1 (P310) is one of the branches beyond M269. This is my likely prediction for the Copernicus sample, explained below. On 25 April 2010, this is the Ysearch nomenclature. ISOGG assigns P310 to R1b1b2a1a, because ISOGG includes another newly discovered SNP between M269 and P310. ISOGG also lists S129 as an alternate name that can be found in the literature for the P310 SNP. ISOGG lists 4 other SNPs that are found in all P310 samples to date. YCC assigns P310 to R1b1b2a in the recent update (before 15 May 2010), but the 2008 publication at YCC does not have P310 because it was not available back then. [28 Dec 2011 ISOGG update R1b1a2a1a1 (P310) with 73 branches beyond P310.]

6. Copernicus Y-DNA

Bogdanowicz *et al.* (2009) reports that the commercial Yfiler kit (Applied Biosystems) was used for the Copernicus Y-DNA, providing values for 16 STR markers. One marker is a compound pair, so these are often treated as 17 markers, as I do here, following Ysearch. One marker, YGATA H4, has the value 12 following the Yfiler convention, equivalent to the value 11 used with the convention followed by Ysearch.

The Copernicus sample is available in Ysearch, ID code E32B5, entered by Hughes in mid 2009.

7. Copernicus Y-DNA is R1b (M343)

Athey (2010) provides an online haplogroup predictor. Athey (2005) is the publication of the method, which is based on frequency of STR values by haplogroup. The result when the 17 Copernicus values are typed is R1b with 100% probability. Indeed, using only the first 4 markers the result is R1b with 99.9% probability. This means that almost all samples in the Athey database that match even just most of the Copernicus STR values are R1b. I present further evidence below for R1b as the parent haplogroup for Copernicus.

8. Copernicus matches at Ysearch

Table 1 is the result of a comparison of the Copernicus 17 markers at Ysearch. “Step” means genetic distance-net STR mutation number. That one perfect match to Copernicus, ID K3ESJ, Wallace, was reported earlier by Mayka (2009). William Wallace (2010) explained to me that this entry is a modal haplotype for his family, discussed further below. This 17 marker table does not have very good statistics at close match because most samples in Ysearch do not use all these markers.

Table 2 is the result with 16 markers. DYS 635 was removed from the comparison, because this one is not used by other testing kits. I noticed that all samples in the 17 marker comparison within 3 steps of Copernicus have the Copernicus DYS 635 = 23 value, so dropping this marker does not give up significant information, while gaining a lot more data for statistical significance at close match.

Tab. 1. Matches to the Copernicus sample using all 17 markers. “Step” is genetic distance, the net difference in repeat number for all markers (i.e. the number of different mutations).

Download from Ysearch on 14 May 2010 for tables 1 to 4.

Step	Number	Comments
0	2	Copernicus & Wallace
1	0	
2	6	6 samples at 2 mutation steps
3	33	
4	111	
5	186	
6	323	

Tab. 2. Matches to the Copernicus sample using 16 markers. One marker not commonly used was removed from the search.

Step	Number	Comments
0	4	Copernicus & 3 Wallace
1	13	
2	131	
3	500	
4	>816	Time-out error

Table 2 step 4 gives a time-out error with 816 samples, so the number of samples is probably about 1,000.

Tab. 3. Matches to the Copernicus sample using the 13 markers that are available in the 25 marker standard panel at FTDNA. Four markers were removed from the search, as explained in the text, for more data.

Step	Number	Comments
0	10	
1	70	
2	464	
3	>850	Time-out error

Table 3 is the result with 13 markers. Three more markers were removed from this comparison: DYS 438, GATA H4, and DYS 456. The reason: these are not used by the FTDNA standard 25 marker panel, which is available for about half of the samples in Ysearch. I noticed in the 16 marker result that DYS 438 does not vary close to the Copernicus sample, so dropping it does not give up significant information. The other two markers do have some variation for step value close to Copernicus, so Table 3 does give up some information while gaining more data. In other words, a few of the samples from Table 1 and Table 2 come up in Table 3 at 1 or 2 lower step, but there are a lot more samples in Table 3 at close match.

Table 4 provides haplogroup detail for the 80 samples at steps 0 and 1 from Table 3. Table 4 of course includes all the samples at steps 0 and 1 from Tables 1 and 2.

Tab. 4. Haplogroup detail for the 80 samples at steps 0 and 1 from Table 3.

Step	Haplogroup
6	R1b*
2	R1b1*
1	R1b1 (tested)
1	R1b1b2*
6	R1b1b2 (tested)
4	R1b1b2a1a (tested)
2	R1b1b2a1a4*
2	R1b1b2a1a4 (tested)
2	R1b1b2a1b3 (tested)
1	R1b1b2a1b4 (tested)
2	R1b1b2a1b5 (tested)
51	Unknown

The remark “(tested)” is present in the database as an indication that the haplogroup was automatically assigned by FTDNA, based on SNP data. The haplogroups with “*” do not have associated SNP data. This is discussed further below.

All the samples that have haplogroup assignment in Table 4 are in the R1b family, confirming the high confidence prediction above for the Copernicus Y-DNA.

9. Copernicus Y-DNA is R1b1b2 (M269)

All the R1b samples with further branch haplogroup assignment in Table 4 are R1b1 (P25).

Worldwide, almost all R1b that are tested for further SNP markers are R1b1, as discussed below, in the section “Paragroups”.

Similarly all R1b1 samples with further assignment in Table 4 are R1b1b2 (M269). Similarly almost all R1b1 worldwide are R1b1b2, as discussed below.

Table 4 at face value provides 100% probability that the Copernicus sample is R1b1b2 because there are no R1b1b1 (M73). However, that 100% probability has low confidence because there are only 20 R1b1b2 samples. I provide a more confident prediction below.

The 17 marker data, Table 1, at steps 0 to 4, follow the same pattern with no samples off the R1b1b2 sequence. The first deviations are at step 5, with two

samples outside this pattern. One is J2, probably a statistical outlier due to the luck of random mutations. The other is R1b1b2g*, which no doubt is a user entry from a few years ago when the codes were different. (There is more discussion on this point in section 11 “Paragroups”.)

The 16 marker data, Table 2, at steps 0 to 1, follows the same pattern with no samples off the R1b1b2 sequence. The first deviation, at step 2, also shows up at step 2 in the 13 marker data, discussed next.

The 13 marker data, Tables 3 and 4, at steps 0 and 1, follows the R1b1b2 sequence, 80 samples, discussed further in the next section.

The 13 marker data, Table 3, at step 2, 464 samples, has 148 samples with haplogroup assignment (the other 316 are “Unknown”). Only two do not fall into the branches leading to R1b1b2. One is R1a1b (tested). One is R1b1a (tested). These are both very rare haplogroups. R1a1b has only 12 samples in all of Ysearch; R1b1a has 18. The other samples in these two haplogroups are much more distant from the Copernicus sample. These two are clearly just statistical outliers, close to Copernicus due to the luck of random mutations. Two out of 148 is only 1.35%, which is a very rough estimate that the Copernicus sample is really an outlier from one of these rare haplogroups. However, that does not mean 98.65% probability for R1b1b2, because of paragroups, discussed below.

10. Copernicus Y-DNA is likely R1b1b2a1 (P310)

All the R1b1b2 samples with further haplogroup assignment in Table 4 are R1b1b2a1.

Almost all R1b1b2 worldwide are R1b1b2a1, as discussed below.

Table 4 has a mix of R1b1b2a1a (U106) and R1b1b2a1b (P312). The 17 STR markers used by the Copernicus sample are not sufficient to distinguish the two haplogroup branches of R1b1b2a1.

Ysearch has 4 haplogroups beyond R1b1b2a1a. Ysearch has 13 haplogroups beyond R1b1b2a1b. ISOGG has 9 and 16 respectively in these two branches.

Conclusion: the Copernicus Y-DNA sample cannot be assigned at this time to any of these haplogroup branches beyond R1b1b2a1.

11. Paragroups

The word “paragroup” is used to signify a haplogroup without the known haplogroup branches. Paragroups may be indicated by an asterisk.

For example, R1b1 (P25) has known branches R1b1a (M18), R1b1b (P297), and R1b1c (PM335). The paragroup R1b1* is intended for those samples that are

positive for P25 but negative for the other three. Most if not all of those will end up someday in haplogroups defined by SNPs yet to be discovered.

The asterisk can cause confusion. For example, an R1b1* sample should automatically lose its paragroup assignment when a fourth R1b1 SNP is discovered, defining a new R1b1d. Technically, that sample will need to be tested for that new SNP in order to regain its asterisk (or be assigned to the new haplogroup).

A sample with an asterisk can be confusing in a database if it is not clear which branch SNPs had been tested. For example, R1b1* might mean a sample tested negative for only one or two of those three known SNPs.

In Ysearch paragroup status is not available. The asterisk is used for another purpose by Ysearch. In Ysearch results (see Table 4), the asterisk is used to mean a haplogroup assignment transferred from another testing service or selected from the haplogroup menu by a user who entered the data. The comment “(tested)”, means that sample is tied to an Ysearch account with a positive result for that haplogroup SNP. All samples on Ysearch with haplogroup assignment are either “*” or “(tested)”; the majority have no haplogroup assignment, so are assigned to “Unknown”.

These and other explanations of Ysearch in this article are my observations. I found no Ysearch documentation along these lines. My observations were verified by Mayka (2010), who is the volunteer administrator of the Polish FTDNA Project, not a representative of Ysearch. Project administrators have access to the SNP results for members of that project (discussed further below).

It is possible (but not likely) that Copernicus belongs to an unidentified branch of R1b1, not one of the three branches known today. The Copernicus Y-DNA sample might be negative for all three of the corresponding SNPs as far as we know, because they were not tested.

The Copernicus Y-DNA STR values match R1b1b (P297). There are no close matches at Ysearch to the other two SNP branches. The uncertainty that Copernicus is R1b1b is related to the percent of matching samples assigned to R1b1 that are negative for P297, but this data is not included in the Ysearch web database.

There is an ambiguity in the Ysearch results with asterisk, because these are not automatically updated. A user may have chosen the haplogroup based on an older alphanumeric code. Fortunately, the codes leading to R1b1b2 have been stable for a few years, but the codes beyond have changed.

The discussion above for paragroup R1b1 applies also to R, R1, R1b, R1b1b, etc.

In other words, the confidence in the Copernicus haplogroup assignment is dominated by the uncertainty in the paragroups.

The following sections provide evidence that there are very few samples that really belong to the prior paragroups, which implies high probability that Copernicus belongs to R1b1b2a1.

12. Published paragroup data

True paragroups (samples negative for all known SNP branches) R*, R1*, R1b*, and R1b1* are rare, as shown by the following references.

1. Cruciani *et al.* (2010) shows that R1b1* is rare, found mostly in central-western Africa. Cruciani (2010) is the publication of the R1b1a (V88) mutation, showing that most of the previous R1b1* are R1b1a. (This new mutation does not change the R1b1b code, because the older R1b1a (current at Ysearch) (M18) becomes a branch of the new R1b1a (V88)).
2. *Wikipedia* “Haplogroup R (Y-DNA)” (2010a) has a list of references establishing that R* and R1* are very rare.
3. *Wikipedia* “Haplogroup R1b (Y-DNA)” (2010b) has a list of references establishing that R1b* is very rare, found *at low* frequency in countries near the Dead Sea. This Wikipedia article also has references for the rarity of R1b1*. This Wikipedia article discusses R1b1b2 at length, as the most common haplogroup in Europe, with the implied assumption that paragroups R1b1b* and R1b1b2* are rare. However, there are only two short paragraphs in this regard. The one paragraph for R1b1b* is for the SNP discovery for R1b1b, Karafet *et al.* (2008), but Karafet does not explicitly document the rarity of the paragroup R1b1b*. The paragraph for *R1b1b2** points out that this paragroup “has been found at generally low frequencies throughout Eurasia”, with references, but without quantification of its rarity in Europe.

I was unable to find published documentation for the rarity of paragroup branches from R1b1b to R1b1b2a. My evidence data for this comes next.

Summary of published data: R*, R1*, R1b* and R1b1* are rare, particularly in Europe. The Copernicus data almost surely does not belong to any of those paragroups.

13. R1b Project

Data concerning R1b1b*, R1b1b2*, and R1b1b2a* can be gleaned from Kerchner’s R1b and Subclades Project, hosted at the FTDNA site; see Kerchner (2010).

Although SNP data is not publicly available at Ysearch or from the large FTDNA database, haplogroup assignments are available for samples from men who join public “projects” hosted at FTDNA. In project data, haplogroup assignments are color coded green when based on SNP results; paragroups are not distinguished. Haplogroup assignments are color coded red when predicted based on STR values. The prediction method is proprietary, based on the FTDNA SNP

database. The haplogroup predictions are very conservative; almost all are confirmed when SNP tests are subsequently performed.

Samples with SNP data are not predicted. For example, a sample with only P297 positive is assigned to R1b1b (green) even if the STR values match samples without any SNP test that are predicted R1b1b2 (red).

These FTDNA haplogroup predictions are not available at Ysearch. If a man with a predicted haplogroup in a project joins Ysearch, his haplogroup is assigned to “Unknown” at Ysearch unless he chooses to modify the assignment.

Table 5 has data for Kerchner’s “R1b” project, with 2399 samples (10 May 2010 download). This demonstrates the issue with R1b1b2: 1475 samples (61%) are assigned to R1b1b2. However, this does not imply paragroup assignment. These 1475 samples are a mix of paragroup samples plus samples that cannot be reliably predicted into known branches. As mentioned above, projects at FTDNA do not use * for paragroups. 1187 samples (49%) are predicted (red) R1b1b2 because the branch haplogroups cannot be predicted with high confidence based on STR values for those samples using the FTDNA prediction algorithm.

Tab. 5. Total R1b haplogroup assignments. Ysearch data 24 April 2010. Kerchner’s R1b project data 10 May 2010. The assignments in the R1b project are coded **green when based on SNP tests**, and **red for predictions based on STR values**. The columns on the right are Ysearch matches; for example “0–3” means the number of matches at steps 0 to 3, to the Copernicus data using the 13 markers. The bold numbers are haplogroups that are side branches from the branches leading to R1b1b2a1. Violet numbers are in branches representing the main trunk.

Haplogroup	SNP	R1b Project			Ysearch			
		Total	TestT	Pred.	Total	Copernicus		
			SNP	STR		0–1	0–2	0–3
–		1						
R	M207				52			3
R1	M173				48		1	2
R1a	SRY10831.2				848			
R1a1	M17				>1000			
R1a1a	M56				37			
R1a1b	M157				12		1	2
R1a1c	M87				5			
R1a1d	P98							
R1a1e	PK5							
R1b	M343	2	2		>1000	6	36	159

Tab. 5. (continued)

Haplogroup	SNP	R1b Project			Ysearch			
		Total	TestT	Pred.	Total	Copernicus		
			SNP	STR		0-1	0-2	0-3
R1b1	P25	83	56	27	>1000	3	18	69
R1b1a	M18				18		1	2
R1b1b	P297	17		17	136			15
R1b1b1	M73	3	3		46			
R1b1b2	M269	1475	288	1187	>1000	6	62	286
R1b1b2a	L23	34	34		167			6
R1b1b2a1	P310	14	13	1	71		1	2
R1b1b2a1a	U106	100	98	2	681	4	23	72
R1b1b2a1a1	U198	9	9		135		1	10
R1b1b2a1a2	P107				59			6
R1b1b2a1a3	L1	4	4		21			2
R1b1b2a1a4	L48	93	93		269	4	14	48
R1b1b2a1b	P132	204	201	3	923		4	32
R1b1b2a1b1	M65				2			
R1b1b2a1b2	M153	3	3		9			
R1b1b2a1b3	SRY2627	18	18		145	2	3	23
R1b1b2a1b4	U152	41	41		254	1	3	9
R1b1b2a1b4a	M126				1			
R1b1b2a1b4b	M160				1			
R1b1b2a1b4c	L2	36	36		199			10
R1b1b2a1b4c1	L20	5	5		34			
R1b1b2a1b4d	U152				1			
R1b1b2a1b5	L21	208	207	1	979	2	5	31
R1b1b2a1b5a	M37				6			
R1b1b2a1b5b	M222	49	48	1	526			1
R1b1b2a1b5c	P66				1			
R1b1c	M335				79			5
R2	H124				92			
Totals		2399	1159	1239	>5000	28	173	795
Bold Total						0	2	9
Bold %						0%	1.2%	1.1%

Note that only 288 samples are assigned to R1b1b2 based on SNP results (green). Even these are not all paragroup assignments, because there is no indication in the project data how many of these tested negative for the SNPs in branches beyond R1b1b2. For many years, M269 was a terminal SNP in the R1b tree, thus defining the R1b1b2 branch; branches beyond R1b1b2 (M269) first became available in 2008, as documented in the history links at the ISOGG site. No doubt many of these 288 samples assigned to R1b1b2 were evaluated for SNPs before that time, so many of those really belong to one of the branches beyond. I return to this issue with further discussion below.

The same discussion applies to the other apparent paragroups in Table 5, numbers colored violet. The number for each of them is small, except R1b1, which has 83 samples.

Table 5 also has the Ysearch haplogroup assignment totals. The far right columns in Table 5 indicate how many of the samples from Ysearch in that row match the Copernicus STR data, using the same 13 markers as for Tables 3 and 4. The column “0–1” has 28 samples, but Table 4 was updated a few weeks later so Table 4 has 29 samples in this category. Boldface is used in Table 5 to highlight the matches to the Copernicus sample from haplogroups that are not in the main trunk branches leading to R1b1b2a1. Only about 1% of the samples that match belong to these haplogroups. Those two samples at step 2 were discussed above. The three columns on the far right verify that the Copernicus sample belongs to the main R1b tree trunk leading to R1b1b2a1 with very high confidence, greater than 98%.

Back to the paragroups: Table 5, column 0–1, has only 15 close matches to Copernicus that are not within haplogroup R1b1b2a1. Those 15 are colored violet. They are all assigned to R1b, R1b1, and R1b1b2. The R1b project provides evidence that these are not really paragroup members.

The R1b project has only six samples that are close to the Copernicus sample in STR values. One is R1b1, at step 3. Five are R1b1b2, one at step 1, four at step 3. Kerchner (2010), founder and administrator of the R1b project, provided SNP results for these six samples. That one R1b1 has not been tested for branch SNPs. None of those five R1b1b2 have been tested negative for R1b1b2a1. In other words, the R1b project has no evidence of close matches to Copernicus that are true paragroup assignments in main branches prior to R1b1b2a1.

Two of those six are true paragroup R1b1b2a1*, negative for both R1b1b2a1a (U106) and R1b1b2a1b (P312), adding further evidence that the Copernicus sample cannot be confidently assigned to a branch of R1b1b2a1, as discussed above.

Wallace matches Copernicus (discussed above and again below). I provided the kit number for Wallace to Greenspan (2010), president of FTDNA. Greenspan checked close matches to Wallace (out to step 3 using the 25 standard markers) in the large FTDNA database and all are consistent with R1b1b2a1 – no side

branch samples. None are confirmed paragroup samples although many are R1b1 or R1b1b2 without the SNP test for R1b1b2a1.

These communications from Kerchner and Greenspan establish that most apparent paragroup assignment for samples that match Copernicus are not really paragroup assignments, but are samples untested for R1b1b2a1 (P310).

However, these were quick manual checks – not accurate computer database searches. This does not prove that all the 15 samples from Ysearch colored violet in column 1–2 of Table 5 belong to R1b1b2a1.

14. Statistical comments

The data in Table 5 are available as a list with detail including a family name. The list was checked for modal haplotypes and for family sets (explained above). No significant problems were detected. The statistics are slightly skewed by such issues, but the numbers in Table 5 do not need adjustment.

The previous section demonstrates that almost all R1b are R1b1b2a1. However, FTDNA predicts 1187 samples (in Table 5) to be R1b1b2, not R1b1b2a1. Here is a summary of my justification for extending the prediction to R1b1b2a1, going beyond the FTDNA method: My understanding is that the FTDNA prediction method relies on STR data match. For prediction, a sample must match a haplotype for which there is a statistically significant number of other matching samples that have tested positive for a haplogroup and for no other haplogroup (perhaps a very low percent exceptions are allowed). Note that Table 5 shows only 8 samples predicted by FTDNA (red STR column) in branches beyond R1b1b2. The FTDNA prediction method obviously does not consider the special case of R1b, where there are very low percent samples confirmed by SNP testing to be other R1b1b2a1. The R1b1b2a1 count is low in Table 5 because the SNP P310 became available about the same time as SNPs for further branches, so few samples were tested only for P310 and not for the branch SNPs. For the purposes of this paper, we have reasonably high confidence that almost all R1b samples without further SNP testing are R1b1b2a1, even without STR calibration to particular haplotypes.

In addition, the previous sections provide evidence that the Copernicus STR data do not match the known branches that do not lead to R1b1b2a1, with very low percent exceptions at step 2 and 3 of 13 due to statistical outliers.

Some of the Ysearch haplogroup assignments with asterisk are user assignments based on STR data, so these represent circular reasoning when used for prediction here. The 9 samples discussed in the previous section, matching Copernicus at step 0–1, have only one “(tested)” and 8 with asterisk. This is an

other reason these samples should not be all assumed to be R1b1b2. For example, a sample really from R1b1c, but without SNP data, and with very unusual STR values due to the luck of random mutations, might match closely to typical R1b1b2 STR values, so may be assigned to R1b1b2 by a user, or by a testing service trusted by the user. After all, there are 5 samples from R1b1c that match within step 3 of Copernicus (lower right corner of Table 5), so there might be an unidentified R1b1c sample that matches even closer to R1b1b2. Although there is very low probability that Copernicus belongs to a side branch such as R1b1c, the possibility cannot be ruled out.

Those 8 men could be contacted and asked if they have been tested for SNPs, but the result would be inconclusive because surely most have not been tested. (One was contacted; see William Wallace below.) For the purpose of this article it will be assumed for probability estimates that only a few percent of samples assigned on Ysearch to R1b main branches prior to R1b1b2a1 actually belong to the paragroup associated with that main branch. In the worst case, a high confidence prediction that “few percent” of samples is extended in this article to “fewer than one third” of samples.

R1b1b2: Table 5, column “0–1”, has 6 R1b and 3 R1b1 (violet). These are the only samples not R1b1b2 in that column, and as discussed in the previous section these are probably mostly samples not tested for R1b1b2. If all 9 were truly not R1b1b2 that would be $9 / 29$ (including branches) = 31%. If less than one third are truly not R1b1b2, it follows that the Copernicus sample has better than 90% confidence of being R1b1b2.

The next column, “0–2”, has $57 / 173 = 33\%$ not within R1b1b2. Since this includes the more distant step 2, it should represent a higher percent estimate with better statistics, adding evidence for the Copernicus assignment.

R1b1b2a1: The same calculation applies, but here the uncertainty is almost double because the number of uncertain samples in the R1b1b2 row is about equal to the totals in other prior rows in Table 5. The uncertainty is likely less than 20%.

15. Summary: Confidence of Copernicus haplogroup assignment

The Copernicus Y-DNA is R1b1b2a1 with about 95% probability. A conventional statistical sampling confidence interval does not apply because the confidence in that prediction is dominated by the unknown percent of samples listed on the web as R1b1b2 but really R1b1b2a1. Similarly, the confidence in a prediction for R1b1b2 is dominated by the unknown percent of R1b1 samples that are really R1b1b2.

R1b1b2 prediction is better than 90% confident, as explained above.

R1b1b2a1 prediction is better than 80% confident, as explained above.

16. Wallace sample and branch R1b1b2a1a4

Table 1 has two perfect Ysearch matches (step 0) at 17 markers. Copernicus, ID E32B5, was entered by Hughes in mid 2009. Wallace is ID K3ESJ. William Wallace explains that this entry with 76 markers is a family modal haplotype, combining a distant cousin's data from FTDNA with his own data from Sorensen (2010). Sorensen is a testing company that routinely tests for all 17 of the markers used for the Copernicus data; William is a perfect match to Copernicus.

Table 2 has 4 perfect matches including two more Wallace matches. Richard Wallace (2010) is the cousin with FTDNA data, but he submitted data independently before the data was combined so this really is three independent Ysearch entries, an indication that Wallace Group #03 is large. The third is the male family line of Lorna Wallace (2010).

Only one of these 4, Wallace K3ESJ, shows up in Table 4, as R1b1* in Ysearch, because Wallace entered that assignment prediction. The other 3 are "Unknown" haplogroup. None of these 4 show up in Table 7 because the "Origin" data are entered as Boston, Vermont, and two – Unknown.

The "Wallace" project at FTDNA has 95 members (14 May 2010). Five of these are "Group #03" with almost identical STR data, including William and Richard (above). This Wallace group has been generous, explaining their branches and DNA data to me. These five represent four of six Wallace families who found each other and who have unconnected family trees. Four have documentation as far back as 1650 to 1835 in the U.S. The Wallace name hints at origin in the British Isles, although none of these have such documentation.

Four of the five Wallace Group #03 are red (predicted) R1b1b2 (which, as we remember, is a prediction based on STR haplotype – M.K.). One has the SNP based (green) R1b1b2a1a4 assignment, so it is reasonable to assume that in fact all belong to this haplogroup, since they have the same family name and their STR values match with only 4 exceptions that are known to be rapid mutating STR markers (and one obvious data entry error).

William Wallace emailed to me a copy of his Sorensen home page. That page informs him he has 5 total STR matches (24 Jan 2010). These are perfect matches using the same 17 markers as the Copernicus data, so they also match Copernicus perfectly. (As explained above, Ysearch is a larger database but has fewer samples using one of these 17 markers, so the Sorensen result is best compared to Table 2.) Two matches are from two of the six Wallace families mentioned above. The other three have the family names Wilson, Dart, and Stevens. These names also hint at origin in the British Isles, but as discussed below for Copernicus, assignment to the same haplogroup terminal branch is not convincing without a family name match. The names Stevens and Wilson show up once each at step

1 in the data for Table 3 and multiple times at step 2, but these men at Ysearch are not the same men as the perfect matches at Sorensen. The combined data hints at large family Y-DNA groups with these names.

These perfect matches at 17 markers provide evidence that Copernicus belongs in R1b1b2a14, but the evidence is not convincing, as discussed below at the end of section 20 “National Origin”.

Richard Wallace, a perfect match to Copernicus at all 16 common markers, emailed me a copy of his FTDNA home pages. A person’s home pages have matching data not publicly available, extracted from the very large FTDNA database, without identification of individuals. All data at FTDNA have at least the standard 12 markers. At 12 markers, there are 25 perfect matches to Wallace (and Copernicus) with SNP haplogroup results: Five are R1b1b2a1a, one is R1b1b2a1a1, seven are R1b1b2a1a4, one is R1b1b2a1b4c, and one is R1b1b2a1b5. The other 10 apparently are not tested for these terminal branches, because they are listed as two R1b1 and eight R1b1b2. At step 1 (one mutation out of 12) there are 303 samples with SNP data and all are again in the branches leading to and beyond haplogroup R1b1b2a1, which adds evidence to the Copernicus assignment. At step 2 there are more than a thousand samples like this. At step 3 there is only one outlier, from haplogroup N1c1.

Donald Wallace (2010) points out that Group #03 is only one of 13 Wallace Y-DNA groups in the Wallace FTDNA project, and 33 of the 95 samples do not match any group. This is a reminder that common family names are not well correlated with Y-DNA data due to multiple name originations, adoption and other kinds of non-paternal events.

17. YHRD

YHRD (2010) is a European forensic Y-DNA STR database. Although YHRD has more samples than Ysearch, fewer samples have haplogroup indication. Distributions with fewer than 13 markers are similar to Table 3, with progressively more matches at higher steps, and with larger numbers.

During the review of this paper in 2012, the reviewer pointed out that YHRD has one ideal match to the Copernicus data using all 17 markers, and 96 total matches up to step 3. By comparison, Ysearch has 62 matches up to step 3 (20 Feb 2012). Table 1 has only 41 matches up to step 3 (Ysearch, May 2010), which shows how much Ysearch data has increased during the past 2 years. The larger distributions in 2012 are roughly proportional to Table 1 for both Ysearch and YHRD, so the same conclusions follow.

That one ideal YHRD match comes from Brazil, however no specification of male line ancestry has been provided.

18. Discussion

The Copernicus Y-DNA haplogroup assignment does not provide significant additional evidence to the issue of identification of Copernicus the astronomer as the true source of the DNA from the remains at Frombork cathedral.

Y-DNA could not be measured from the hair samples from the book at Uppsala, explained by Allen (2008). If in the future Y-DNA can be measured from the hair samples, SNP measurements (see Table 5) might be helpful as additional data in addition to STR values, for comparison to the remains. However, SNP results are not likely to be better than 17 marker STR data, except in the unlikely event that STR data matches and SNP results do not.

Although in general more STR markers are better for improved identification confidence, in the case of Copernicus more than 17 markers would not be very helpful because the Y-DNA branches beyond R1b1b2a1 are too similar in STR values to be confidently distinguished. The SNP markers (see ISSOGG for a list more complete than Table 5) could be used for higher confidence.

Similarly, if remains are identified in the future for a male line relative of Copernicus, SNP matches would provide marginally better evidence in addition to STR data.

19. National origin for Y-DNA

R1b is known to be the most common Y-DNA haplogroup in Western Europe. R1a is the most common haplogroup in Eastern Europe. These facts are supported by all references on the subject. See for example *Wikipedia* “Haplogroup R (Y-DNA)” (2010) for links. This does not provide evidence for male line national origin of the Copernicus sample because both R1a and R1b are common throughout Europe.

The R1a – R1b concentration border is near the present day border between Poland and Germany, as demonstrated by the data in Table 6.

This data is from the “Polish” and “German-Y-DNA” projects at FTDNA. The men who join are self selected, mostly from the diasporas of those countries. As per Table 6, R1a is relatively more concentrated in Poland and R1b is relatively more concentrated in Germany. But in either country the absolute concentrations are a low percent of the haplogroup total, because both haplogroups are widespread throughout the entire continent.

Most Y-DNA haplogroups do not have high absolute concentration in particular regions corresponding to modern nations, although a few do. See for example Gwozdz (2009) for a few Y-DNA haplogroups concentrated in Poland. These lo-

cally concentrated haplogroups provide evidence for national origin but only to the extent of up to one percent concentration in a specific nation. Further caveats are discussed below.

Tab. 6. Polish project and German-Y-DNA project, 10 May 2010.

Project	Total	R1a	R1b
Polish Y-DNA	1286	571	136
Germany Y-DNA	1214	135	446

Tab. 7. Ysearch data for selected haplogroups, for selected regions. Data as of 24 April 2010.

Haplogroup	Total	Poland		Germany		British Isles	
R1b1b2a1a	1166	10	0.9%	79	6.8%	405	35%
R1b1b2a1b	2925	11	0.4%	118	4.0%	1381	47%
R1b1b2a1a1	135			5	3.7%	43	32%
R1b1b2a1a2	60	1	1.7%			30	50%
R1b1b2a1a3	21	2	9.5%	3	14.3%	7	33%
R1b1b2a1a4	269			20	7.4%	99	37%
R1b1b2a1b3	145	1	0.7%	7	4.8%	48	33%
R1b1b2a1b4	254	2	0.8%	27	10.6%	67	26%
R1b1b2a1b5	823	1	0.1%	22	2.7%	533	65%
R1b1b2a1b5b	526			1	0.2%	350	67%

Table 7 has selected branches of R1b as examples of how R1b varies by region. The top two rows are the totals for all haplogroups, including all branches, within the two known branches of R1b1b2a1. The absolute concentration percentages are not meaningful, because for example people with ancestry from the British Isles are known to be more likely to join Ysearch, and people with ancestry from Poland are known to be less likely to join Ysearch. The relative numbers can be compared, however. R1b1b2a1a seems to have a relatively higher concentration of Central European (Poland + Germany) men, while R1b1b2a1b seems to have a relatively higher concentration of men from the British Isles.

Breakout by haplogroup assignment indicates that R1b1b2a1b5 has particular concentration in the British Isles. R1b1b2a1b4 by contrast has lower concentra-

tion in the British Isles and relatively higher concentration (compared to the other R1b1b2a1b haplogroups) in Central Europe. It is interesting that the two highest concentrations in Central Europe are one each from the two branches, R1b1b2a1a3 and R1b1b2a1b4. It is tempting but premature to speculate that Copernicus may belong to one of those two.

The numbers in the haplogroup breakouts of Table 7 are too small for statistical confidence. This will improve as data accumulates in the near future. More importantly, new branches will be identified in the near future, and a few of those might be particularly concentrated in Poland or Germany.

It will be interesting to see where the Copernicus data falls, if SNP data corresponding to Table 5 is taken for Copernicus in the future. It will be particularly interesting if Copernicus falls into a future haplogroup that is concentrated in Poland or Germany, although there is no *a priori* reason to expect that. Also, the male line national origin, interesting as it is, is not very indicative of national origin, as discussed in the next section.

Section 16 “Wallace sample and branch R1b1b2a1a4” above provides best matches to Copernicus Y-DNA with family names hinting at origin in the British Isles. One of them is confirmed as R1b1b2a1a4 (L48). However, samples from multiple haplogroups in Table 4 match Copernicus within 1 step (one mutation) out of 13. Best STR matches are not convincing without a family name match. Although this statistical point is accepted by experts, it is rarely discussed in the literature, and DNA web sites mention it briefly if at all. The next five rhetorical paragraphs are offered to readers unfamiliar with this point.

The best match out of a large Y-DNA STR database is not necessarily the closest male line relative in that database, for the same reason that a person in a large crowd with a face that most resembles Copernicus is not necessarily the closest Copernicus relative in that crowd.

Example: Suppose I were to examine the security tapes for a full week at a large airport. There would surely be a few faces that look almost exactly like me, plus more faces that look similar to me, plus very many faces that generally resemble me. By definition, there must be one or more individuals who are my closest genetic relative passing through that airport on that week. It might be a 3rd or 4th or 10th cousin. (Everyone has millions of 10th cousins.) Most of my distant cousins do not look like me, so the closest facial match individual is unlikely to be my closest relative individual in those tapes.

Similarly, Table 3 has a diffusion type distribution, with large numbers at high steps and fewer numbers at low steps. There are a large number of samples at Ysearch from the R1b1b2a1 haplogroup (including all branches – most do not have a haplogroup assignment). Most of these fall at a distant step from Copernicus (at 13 markers). All are descended in a male line from the most recent

common ancestor (MRCA) of R1b1b2a1, but due to the luck of random STR mutations, these are today in a diffusion type distribution for each STR marker value. At step zero, any particular sample is from a man with higher probability of being a male line close relative of Copernicus than other men from R1b1b2a1. However, due to the large number of samples, some at step zero are there just due to the diffusive nature of the luck of random mutations.

In other words: Wallace Group #03 by definition has a male line MRCA with Copernicus. Perhaps that man lived in what is now the British Isles, and one of his descendants, the male line ancestor of Copernicus, moved to what is now West Poland, where Copernicus was born. On the other hand, perhaps that MRCA lived in Poland and one of his descendants, the male line ancestor of Wallace Group #03, moved to the British Isles. Another very likely possibility is that the MRCA lived elsewhere, and both descendant male lines moved – the Copernicus and the Wallace ancestral lines each may have each moved more than once.

Figure 1a–c is a speculative illustration of the Copernicus male line family tree. The number of years for branches given are only approximate, based on my general understanding of estimates based on STR statistics. The present day is at the top of these trees. The lateral extent left and right is representative of STR values, with distance from the center illustrating step value (mutations), although

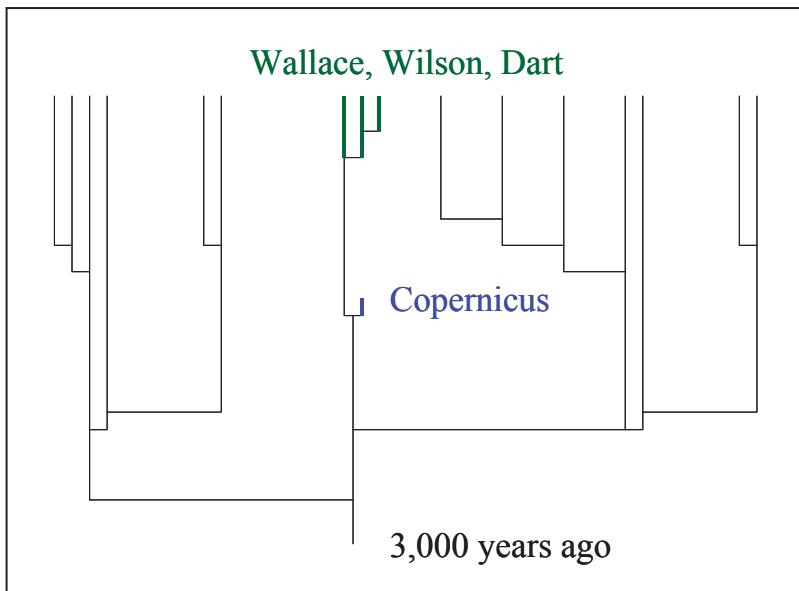


Fig. 1a. A speculative Copernicus Y-DNA tree, unlikely to be correct because the branch with his closest web matches is indicated as just a few generations before his birth.

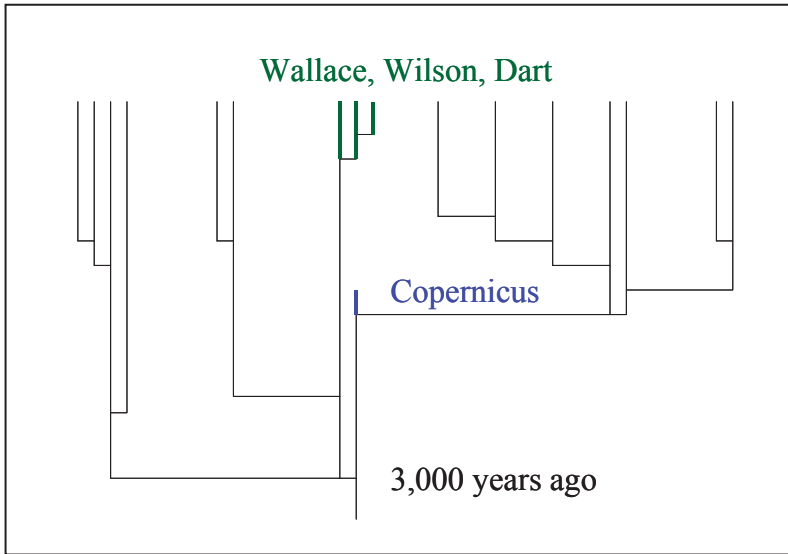


Fig. 1b. A speculative Copernicus Y-DNA tree, unlikely to be correct because the branch with his closest web matches is indicated as very long ago.

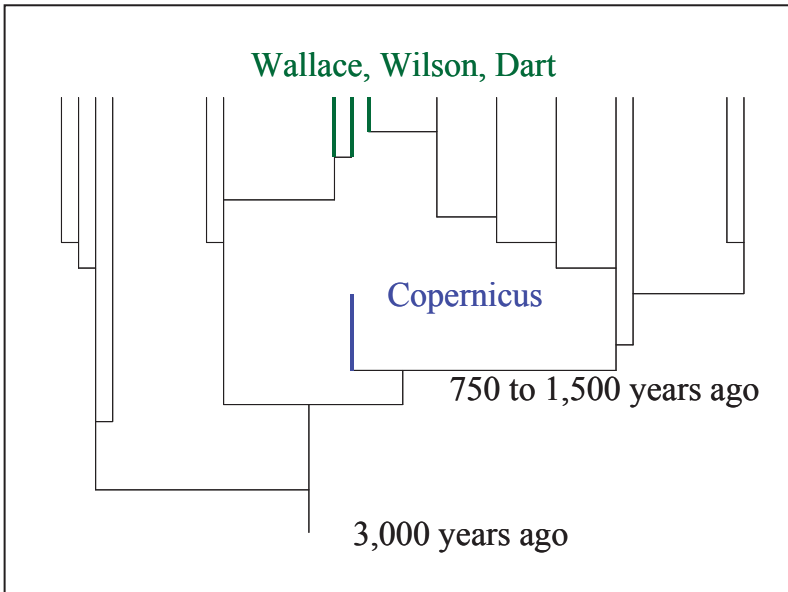


Fig. 1c. A Copernicus Y-DNA tree indicating his branch with his closest web matches within a likely broad range of time. The details of this tree are highly speculative, as explained in the text.

STR values are multidimensional and cannot be accurately depicted in one dimension. Figure 1a is possible but not likely to be correct, because it shows Copernicus as branching from his closest web matches only a few generations before his birth. Figure 1b is also possible but not likely to be correct because it shows Copernicus as branching from his closest web matches a very long time ago. Figure 1c is likely an accurate sketch of the time for the node of the Copernicus branch because it considers a broad range of possible time. Other details of Figure 1c are only representative, not intended to be accurate. For example, Figure 1c considers the possibility that the closest web matches to Copernicus come from different branches, although there is no particular evidence along these lines.

Richard Wallace, a perfect match to Copernicus at 17 markers, emailed to me a copy of his FTDNA home pages. One of these sets of pages has geographic data from the “Origin” field submitted with the samples, but not including the many samples with “Unknown” origin. At 37 markers, he has 3 perfect matches from Scotland. At 25 markers, he has 18 perfect matches: 1 Germany, 10 England, 1 United Kingdom, and 5 Scotland. This confirms that the Wallace ancestor is likely from the British Isles. All FTDNA samples have 12 markers, although not all indicate place of origin. At 12 markers there are 129 matches to Wallace (and to Copernicus). England has 26, Scotland has 21, Wales has 1, Ireland has 13 and “United Kingdom” has 19. However, Germany has 17 and Poland has 3. Other countries are listed. At one step out of 12, there are hundreds of samples; Germany has 244 and Poland has 13. This data supports the contention that the Copernicus sample cannot be confidently assigned to a particular European nation with the current data.

20. National origin

Y-DNA is misleading with regard to origin because the Y chromosome is only one of many. After all, a family tree at the 10th ancestral generation has exactly 1,024 spaces (2 to the power 10) requiring individual names to be identified. Ten generations is roughly 250 years before birth of the individual at the tree trunk. The male line represented by Y-DNA is only one of those 1,024 lines.

In that respect, a conventional genealogical family tree is a better indication of national origin than Y-DNA.

I am a perfect example. I am a man of Polish origin with German Y-DNA. My Y-DNA is E1b1b1a2 (V13) (previously E3b), a haplogroup with roots in the Balkans. The FTDNA “E3b” project has 213 samples positive for the V13 SNP, plus many more untested for that SNP with closely matching STR values. However, mine is the only obviously Polish name among the 147 men from that project that match my first 12 STR values within step 3. Many of those 147 names seem

German. At my FTDNA home page at 12 markers, Germany matches outnumber Poland matches 5 to 1. On the other hand, I have documented vital records for 104 of my ancestors, mostly from microfilms of Polish parish records, and all 104 have Polish names and all are recorded as Polish Catholics. I trace my Gwozdz male line back to the late 18th century in southern Poland. Most likely, I descend from a German Y-DNA male line that migrated to Poland more than 250 years ago.

The Y chromosome (Y-DNA) and the mitochondria (mtDNA) are special because they do not recombine, so they do not mix over the generations. They are interesting as a male line and a female line respectively.

The full chromosome set is a better indication of genetic origin. Genetic testing companies have developed tests for haplotypes (here meaning sections of all chromosomes, not restricted to Y STR haplotypes) that correlate with specific regions. 23AndMe (2010) is an example. At this time the correlation is continental, not national. No doubt many haplotypes with concentration at the national level will be identified in the future. A future test along these lines for the purported Copernicus remains at Frombork would be informative for discussion of his origins. It should be expected that such a future test would find both Polish and German haplotypes from the remains at Frombork, so the real open question is the ratio of the two origins (using all chromosomes).

21. mtDNA

The Copernicus mitochondrial DNA (mtDNA) has been reported as haplogroup H by Bogdanowicz *et al.* (2009), with 4 matches out of a database of 3,830 samples. At the Krakow conference in February 2010, comments were made that the data is consistent with haplogroup H27. The large FTDNA database, not publicly available, is helpful here, as it was above for the Y-DNA analysis. The Polish project at FTDNA has two mtDNA matches to the Copernicus sample, reported by Lawrence Mayka (2010), who as administrator has access to the same analysis as seen on the web by the person with the matching data. Mayka reports about 90 matches out of about 35,000 samples, which is statistically consistent with the smaller Bogdanowicz result. The mtDNA data is “about 90” because of inconsistencies in counting those people with measurements of both of the two variable regions in mtDNA. Also, there is uncertainty concerning the SNP 11719A, which is in the coding region of mtDNA, and therefore is particularly stable. 11719A is a good marker for H27, not measured for all samples at FTDNA, as explained to me by Mayka. The Copernicus DNA data has not had 11719A evaluated. This 11719A marker would improve the statistics for the comparison of the remains at Frombork to the hairs at Uppsala.

Many people are doing full decoding for their entire mtDNA because the cost is rapidly declining. This means more haplogroups with better statistics will be available in the near future for mtDNA analysis.

22. Conclusion

Although more data is always favorable, I see no pressing immediate indication for more data from the Copernicus remains. In the future, perhaps in only a few years time, DNA methods and analysis will likely be more comprehensive, at which time further measurement and analysis of the purported Copernicus remains will surely be very informative.

If more data can be taken sooner, more benefit would be obtained from the Y-DNA SNP markers for branches near R1b1b2a1. See Table 5 for a brief list; see the ISOGG site for more current detail. Benefit would be also obtained by measuring the 11719A marker for the mtDNA.

More than 17 Y-DNA STR markers are available with commercial kits. For R1b, the haplogroup for Copernicus, more STR markers are useful for matching but not as informative as the SNP haplogroup markers.

Data is rapidly increasing for better statistics and more haplogroup branches, for both Y-DNA and mtDNA. The near future will probably identify haplotype segments for all chromosomes that are concentrated at the national level, for a statistical measure of genetic nationality of individuals. The future will probably also see improvement in extraction and measurement techniques for DNA from archeological remains, particularly from teeth and hair. Such future improvements will no doubt suggest further DNA measurements and analysis for the purported Copernicus remains.

[31 Dec 2011 final edit no additional Conclusions at this time.]

Update (10 October 2013, during English translation)

Summary

There are now more data, confirming the analysis of this paper.

The alleged Copernicus remains are still confidently predicted to belong to the Y haplogroup defined by the SNP called P310. The title of this paper calls this haplogroup R1b1b2a1. Due to recent new SNP discoveries, this haplogroup is now called R1b1a2a1a at ISOGG. It is now called R1b1a2a1a1 at FTDNA and at Ysearch.

This P310 haplogroup is still divided into the two haplogroups defined by U106 and P312. It is still the case that the alleged Copernicus remains cannot be confidently predicted into either of these two branches, although more of the closest STR matches are U106 than P312. Therefore U106 is somewhat more probable than P312 as a prediction for the remains. Among the branches of U106, L48 is still a good candidate, with perhaps roughly 50% probability for the remains. (Confidence is not high in such probability due to the statistical issues discussed in this article.)

Because of the large number of new SNPs, U106 and P312 are now subdivided at ISOGG into a total of 195 haplogroups (including paragroups), all of which are candidates for the alleged Copernicus remains. Of these, 45 are branches for L48. It would probably require fewer than 10 SNP tests to assign the remains to one of those 195 haplogroup branches in the Y-DNA tree. (Perhaps we should call these small haplogroups twigs instead of branches?)

Details

At the Wallace DNA project, that one sample with SNP results has been updated as R1b1a2a1a1a4. This is not new data but just a nomenclature update for the SNP L48, which is a branch of U106.

Because there are now more data at Ysearch, the number of samples corresponding to Table 1 are now 3 (Copernicus and 2 Wallace) at step 0, 1 new one at step 1, 14 at step 2, and 58 at step 3. Table 2 update: 10 at step 0, 21 at step 1, 187 at step 2, and 754 at step 3. The breakdown for those 10 samples at step 0 in Table 2 is: Copernicus, 7 Wallace, Tinker, and Santee, so there are now three independent family name close matches to the alleged Copernicus remains. Santee is L48; Tinker has not been SNP tested.

Of those 972 samples at steps 0 through 3 for this update of Table 2, 280 have confirmed SNP results (“tested” at Ysearch). Most of those 280 have been tested only for the large main R1b1 branches leading to P310; exceptions are discussed below.

Only 3 samples are listed as “tested positive” only for P310, which means they are not confirmed positive for either branch U106 or P312, but such a listing does not indicate if they might have tested negative for either branch. We suppose that these have not been tested for either. Regardless, so few samples means that the paragroup defined by P310+ U106- P312- is very small.

Of those 754 samples at step 3 for this update of Table 2, 51 have been confirmed positive for one or more of the branches of U106; 51 have been confirmed positive for one or more of the branches of P312.

Of those 187 samples at step 2 for this update of Table 2, 15 have been confirmed positive for one or more of the branches of U106; 11 have been confirmed positive for one or more of the branches of P312.

Of those 21 samples at step 1 for this update of Table 2, three have been confirmed positive for one or more of the branches of U106; one has been confirmed positive for L193, which is a branch of P312.

Of those 10 samples at step 0 for this update of Table 2, only one (Santee) has been confirmed positive for L48, which is a branch of U106. (That Wallace L48 sample does not have data in Ysearch.)

In other words, the U106 vs. P312 results are running about equal in frequency among the STR matches at steps 0 to 3 at Ysearch to the alleged Copernicus remains. However, there is a trend toward proportionally more U106 than P312 results at closer step. This means that for new future samples that match the remains at step 0 (match at all 16 of those particular STR markers of Table 2), we can expect more than 50% of them to be U106. There should be some P312 at step 0, however, when enough data becomes available.

On this basis, using current frequencies for prediction regarding the remains, we predict with more than 50% probability that the alleged Copernicus DNA will come out U106, when tested for these SNP's. However, there is a significant probability the alleged Copernicus DNA will come out P312. (Confidence is not high due to the statistical issues discussed in this article.)

L48 is the largest sub-branch; 46 of those 70 confirmed U106 samples (51 + 15 + 3 + 1) have been tested for a branch of U106, and 39 of the 46 are L48. The probability of future L48 results is not much smaller than the probability of U106 results. L48 is a good candidate for a first SNP test on the alleged Copernicus DNA. ISOGG has 45 branches for L48.

Two of those 280 samples with confirmed SNP results are not within haplogroup R1b1. One is A1a (step 2); one is H (step 3). There are a few more A1a and H at steps 4 to 6. These are outliers; samples from haplogroups A1a and H that happen to be close to the alleged Copernicus STR values at those specific 16 markers due to the luck of random mutations. These are less than 1% of the confirmed results in this update of Table 2; the probability for future samples such as these at step 0 is surely much less than 1%. This new data provides an objective measure of <<1% probability that the alleged Copernicus remains are not haplogroup R1b1.

Of those 280 samples with confirmed SNP results 8 are haplogroup R1b1 but not a branch leading to P310; 7 are R1b1b (M335); one is R1b1c (V88). This new data provides an objective measure of about 3% (8/280) probability that the alleged Copernicus remains are haplogroup R1b1 but not that haplogroup defined by P310.

There are now 4 more SNPs listed at ISOGG that are equivalent to P310.

In Table 5, R1b1b2a1b (P312) has been mistyped as "P132".

References

23AndMe

2010: *A commercial DNA testing company*; <http://www.23andme.com>.

ALLEN Marié

2008: *Analiza DNA włosów znalezionych w kalendarzu należącym do Mikołaja Kopernika / DNA analysis of shed hairs from Nicolaus Copernicus calendar*. In: Gąssowski (ed.) 2008, pp. 226–235.

ATHEY Whit

2005: *Haplogroup prediction from Y-STR values using an allele frequency approach*, “Journal of Genetic Genealogy” vol. 1 (1), pp. 1–7; <http://www.jogg.info/11/athey.pdf>.

2010: *On-line Y-DNA haplogroup predictor*; <http://www.hprg.com/hapest5>.

BOGDANOWICZ Wiesław

2008: *Analiza DNA uzyskana z czaszki grobu nr 13/05 w katedrze we Fromborku / DNA analysis obtained from the skull of tomb no. 13/5 in the Frombork Cathedral*. In: Gąssowski (ed.) 2008, pp. 204–211.

BOGDANOWICZ Wiesław, ALLEN Marié, BRANICKI Wojciech, LEMBRING Maria, GAJEWSKA Maria, KUPIEC Tomasz

2009: *Genetic identification of putative remains of the famous astronomer Nicolaus Copernicus*, “PNAS” (“Proceedings of the National Academy of Sciences of the United States of America”) July 28, vol. 106(30), pp. 12279–12282; <http://www.pnas.org/content/106/30/12279.full>.

BRANICKI Wojciech, KUPIEC Tomasz

2008: *Badania genetyczne domniemanych szczątków Mikołaja Kopernika / Genetic analysis of alleged remains of Nicolaus Copernicus*. In: Gąssowski (ed.) 2008, p. 212–225.

CRUCIANI Fulvio, TROMBETTA Beniamino, SELLITTO Daniele, MASSAIA Andrea, DESTRO-BISOL Giovanni, WATSON Elizabeth, COLOMB Eliane Beraud, DUGOUJON Jean-Michel, MORAL Pedro, SCOZZARI Rosaria

2010: *Human Y Chromosome haplogroup R-V88: a paternal genetic record of early mid Holocene trans-Saharan connections and the spread of Chadic languages*, “European J. of Human Genetics”; published on-line 6 January 2010; <http://www.nature.com/ejhg/journal/vaop/ncurrent/abs/ejhg2009231a.html>.

FTDNA

2010: *A commercial DNA testing company that provides internet data, including Ysearch (2010)*; <http://www.familytreedna.com>.

GĄSSOWSKI Jerzy

(ed.) 2008: *Badania nad identyfikacją grobu Kopernika / The Search for identity of Copernicus Tomb*. Pułtusk: The Pułtusk Academy of Humanities, Institute of Anthropology and Archaeology; Fundacja Kronenberga przy Citi Handlowy.

GREENSPAN Bennett

2010: *Email communication to Peter S. Gwozdz.*

GWOZDZ Peter S.

2009: *Y-STR mountains in haploSPACE, Part II: Application to common Polish clades*, “Journal of Genetic Genealogy”, vol. 5(2), pp. 159–185; <http://www.jogg.info/52/files/Gwozdz2.pdf>.

2009, 2012: “Polish Y-DNA Clades”; <http://www.gwozdz.org/PolishClades.html>.

HUGHES Robert

2009: *Displaying User ID: E32B5*; http://www.ysearch.org/alphalist_view.asp?uid=&letter=C&lastname=Copernicus&viewuid=E32B5&p=0.

ISOGG – THE INTERNATIONAL SOCIETY OF GENETIC GENEALOGY

2010: *Y-DNA Haplogroup Tree 2010*; <http://www.isogg.org/tree/index10.html>.

KARAFET Tatiana M., MENDEZ Fernando L., MEILERMAN Monica B., UNDERHILL Peter A., ZEGURA Stephen L., HAMMER Michael F.

2008: *New binary polymorphisms reshape and increase resolution of the human Y chromosomal haplogroup tree*, “Genome Res.”, vol. 18, pp. 830–838. Available online at YCC (2010).

KERCHNER Charles

2010a: *The Kerchner R1b project*; <http://www.familytreedna.com/public/R1b>.

2010b: *Email communication to Peter S. Gwozdz.* “The Kerchner R1b project”.

KOKOWSKI Michał

2009: *Email communication to Peter S. Gwozdz.*

MAYKA Lawrence

2009: *Rootsweb Archive Genealogy – DNA – L*; 10 July 2009.

2010: *Email communication to Peter S. Gwozdz.*

SORENSEN

2010: *A commercial DNA testing company*; <http://www.smfg.com>.

WALLACE Donald

2010: *Email communication to Peter S. Gwozdz.*

WALLACE Lorna

2010: *Email communication to Peter S. Gwozdz.*

WALLACE Richard

2010: *Email communication to Peter S. Gwozdz.*

WALLACE William

2010: *Email communication to Peter S. Gwozdz.*

WIKIPEDIA

2010a: “Haplogroup R (Y-DNA)”; [http://en.wikipedia.org/wiki/Haplogroup_R_\(Y-DNA\)](http://en.wikipedia.org/wiki/Haplogroup_R_(Y-DNA)).

2010b: “Haplogroup R1b (Y-DNA)”; [http://en.wikipedia.org/wiki/Haplogroup_R1b_\(Y-DNA\)](http://en.wikipedia.org/wiki/Haplogroup_R1b_(Y-DNA)).

YCC

2010: *Y Chromosome Consortium*; <http://ycc.biosci.arizona.edu>.

YHRD

2010: *Y STR database*; <http://www.yhrd.org>.

YSEARCH

2010: *Primary data source*, April and May 2010; <http://www.ysearch.org>.

Adam Walanus^a, Michał KOKOWSKI^b

^a Faculty of Geology, Geophysics and Environmental Protection; AGH University of Science and Technology, Krakow, Poland; www.adamwalanus.pl, walanus@geol.agh.edu.pl

^b Department of History of Science, Natural Sciences and Technology, Ludwik and Aleksander Birkenmajer Institute for the History of Science, Polish Academy of Sciences; Copernicus Center for Interdisciplinary Studies, Poland; www.cyfronet.pl/~n1kokows/home.html; michal.kokowski@gmail.com

A potential usefulness of radiocarbon dating for the authentication of Nicolaus Copernicus's grave¹

Abstract

The authors analyse the potential usefulness of the method of radiocarbon dating to examine the grave of Nicolaus Copernicus, whose age is, in some sense, beyond the scope of the method which serves prehistoric archaeology rather than historic archaeology. The critical element in this case is the calibration curve, the shape of which makes it impossible to distinguish some “dates”. A diagram was given indicating the age of the samples that can be distinguished using the method of ¹⁴C.

Keywords: radiocarbon, ¹⁴C, absolute dating, calibration curve, dating of the alleged grave of Nicolaus Copernicus.

1. Introduction

As it is apparent from the publications of the team of Professor Jerzy Gąssowski (cf. e.g. Gąssowski 2005; Gąssowski (ed.) 2005; Gąssowski (ed.) 2008), the radiocarbon dating method was not used in the search for the grave and the remains of Nicolaus Copernicus at the altar of St. Cross of the Archcathedral Basilica in Frombork. Therefore, in this article we recall the basic information about the method and point to some possibilities of its application in the particular case of study of the grave of Nicolaus Copernicus.

¹ The paper was peer-reviewed by Professor Marek Krąpiec, Habilitated Doctor in Technical Sciences (Laboratory of Dendrochronology and Malacology, Department of Environmental Analysis, Cartography and Economic Geology, Faculty of Geology, Geophysics and Environmental Protection, AGH University of Science and Technology, Kraków).

2. Formulation of the problem: the relevance of the results of the dating using carbon isotope ^{14}C

The radiocarbon absolute dating method, based on the carbon isotope ^{14}C is widely used in archaeology, since its range of application is up to 50,000 yr b2k (before 2000). A result of the dating is such an age range that the actual (real) age of the object falls within the given range with a probability of 0.95 or, depending on the epistemological preferences of a researcher, 0.68 (these numbers result from the range $\pm 2\sigma$ and $\pm 1\sigma$ of the normal distribution, with σ being the standard deviation).

It should be emphasized in this context that for a historical period not very remote from modern times (last 500 years), this method is less useful than for ancient times, because of the relatively large measurement uncertainty, i.e. the width of the age range mentioned. While, for example, 7060BC–6750BC date is acceptable and can bring a lot of information in archaeological research, the historical date 1490AD–1650AD can be useful only in an extreme situation of a lack of any *a priori* knowledge about the object. Nevertheless, the ^{14}C method is used for the dating of historical objects. Therefore it is necessary to examine the accuracy of this measurement method in more detail.

3. The calibration curve

The radiocarbon method is strongly dependent on the so-called calibration. In other words, what results from the physical fact that the ^{14}C concentration in the atmosphere in the past was not exactly constant is the necessity to use the so-called calibration curve in the measuring procedure (fig. 1). This is obtained by taking measurements of thousands of samples of otherwise known age, for example from dendrochronology (Reimer *et al.* 2009). As a result, this method is substantially free of the so-called systematic shift error – some nuances of the problem were noticed by Adam Walanus (2009).

Figure 2 shows a fragment of the calibration curve for the last six hundred years. Using this enlarged graph, it is easy to explain how the calibration procedure works.

The result of the measurement of the ^{14}C concentration in the sample is given on the vertical axis. As any typical measurement result, it is subject to normal distribution (cf. fig. 3).

A typical value may be 500 ± 30 years BP (radiocarbon years *before present*). In this notation 500 years BP is called the radiocarbon date or, better, *radiocarbon determination*, whereas the value of 30 years is the error (uncertainty) of measurement. The value of the measurement error characterizes, in some sense, the

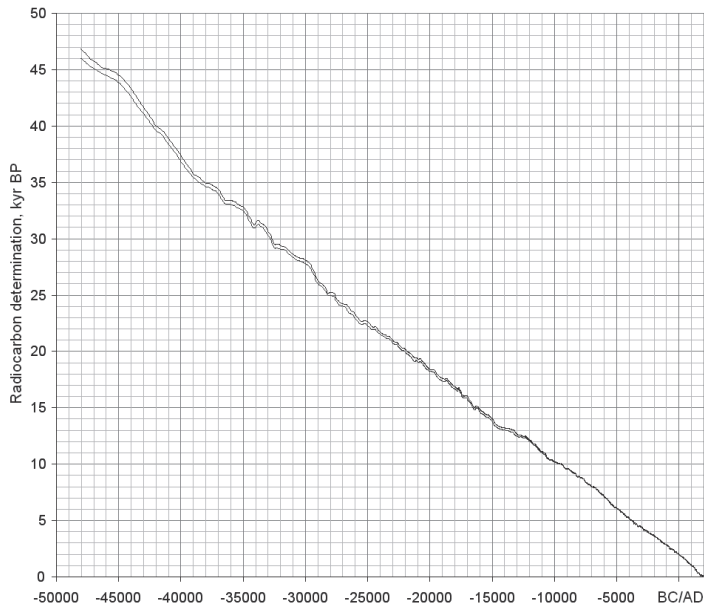


Fig. 1. The calibration curve of the radiocarbon dating method (IntCal09). The line is wiggled because of instabilities of the rate of production of ^{14}C as well as the atmosphere/ocean carbon exchange rate. The horizontal axis represents the age in years, while the vertical axis – the relative concentration of radiocarbon in the sample expressed in the so-called radiocarbon years (actually thousands of years; the abbreviation BP means before present, i.e. 1950AD).

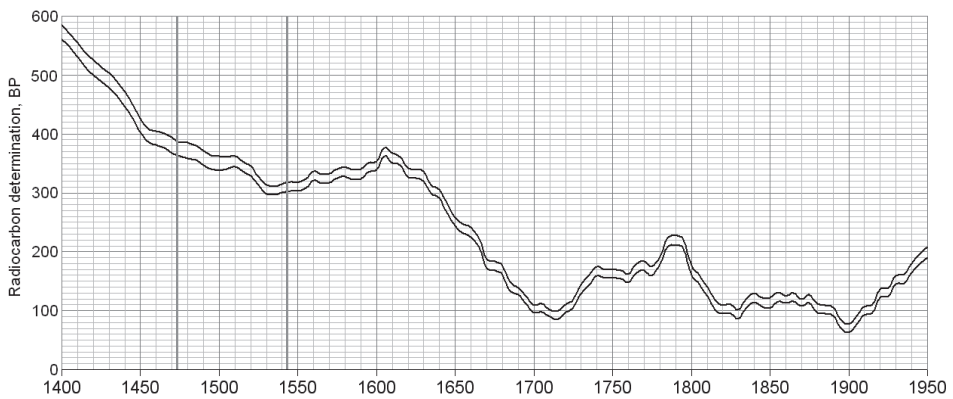


Fig. 2. The part of the radiocarbon calibration curve relevant to the subject. Two lines illustrate the precision of the curve itself. The precision, or rather the imprecision, or simply the measurement error of dates is in the range of 30–50 yr BP, as a rule. As a result, the samples of the age for which the expected “radiocarbon determinations” differ more than 60 or 100 years, would be distinguished. The dates of birth and death of Copernicus are marked. The graph axes – cf. the previous figure.

quality of measurement – to achieve a low measurement uncertainty we need to spend more money, because it requires a longer measurement. The error values of 20, 30 years may be obtained on special request. A typical value is ± 40 years.

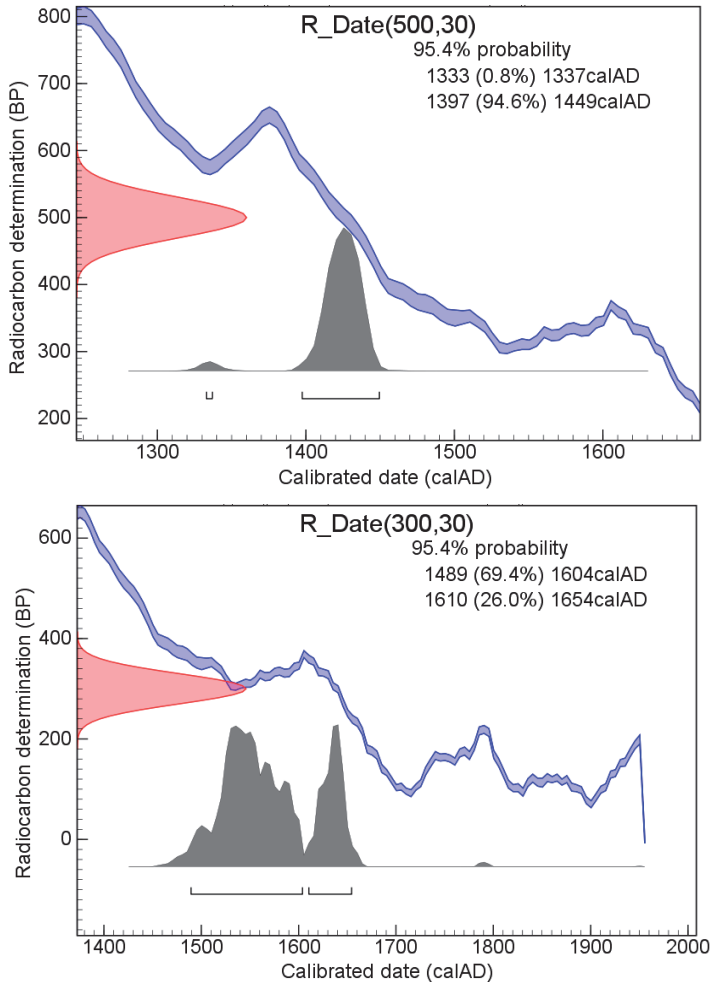


Fig. 3 a, b. Two examples of the dating results in its full, graphical form. The raw measurement result, the so-called “radiocarbon age”, is given in the upper part of the graph; it is 500 ± 30 yr BP, and 300 ± 30 yr BP respectively. This result, illustrated by the Gaussian curve on the vertical axis, is transformed by a calibration curve to form a complex curve placed on the axis of historical age, which is the final result of dating. The age ranges are also given with the respective probabilities (confidence levels) including the actual (unknown) age. For example, the entry “1610 (26.0%) 1654calAD” means that the 0.26 probability (confidence level) of the actual age of the sample lies within the range of 1610 to 1654 years. Graphs created with the OxCal4 program.

4. The usefulness of ^{14}C dating to verify archeological theses

Bearing in mind the size of the measurement uncertainty, whose value is placed on the above graphs on the vertical axis, and is usually ± 40 years, and taking account of the measurement uncertainty of the calibration curve (on the charts it is a stripe, not an “exact” line), we can now proceed to formulate the answer whether the radiocarbon method can be applied to solve a given specific issue. For example, can it give an answer to the question whether a piece of wood interesting to us arose (i.e. a tree grew) in 1500 AD or rather much later?

As it is easily seen from the graph in fig. 2, for the following dates: 1500AD–1520AD, 1595AD–1602AD, 1610AD–1615AD, the *radiocarbon age (radiocarbon determination)* should be 350 BP. Consequently, radiocarbon dating cannot distinguish between each timber (bones, etc.) sample from these periods, because they have approximately the same concentration of ^{14}C .

At this point we need to draw attention to the possibility of application of a certain, specific approach to the radiocarbon dating of a combination of a few samples. It is called *wiggle matching*, i.e. fitting a group of dates to the bends of the calibration curve (Walanus, Goslar 2009). This is a procedure which gives a very precise date even in the range of the so-called *radiocarbon plateau* (flat sections of the calibration curve). However, this method requires samples “combined” in time. In practice, this applies almost exclusively to wood samples in which we can count annual growth rings. If we have a beam composed of 50 growth rings, it may appear that it is insufficient to date the tree using the dendrochronological method, but may be sufficient to use wiggle matching. A couple of dates obtained from the extreme growth rings of the beam must match the bends of the calibration curve, which in a favourable situation can seriously reduce the uncertainty of measurement. To summarize, the graph in fig. 2 can be used as follows: if for two historical dates (AD, horizontal axis) the values read from the calibration curve on the vertical axis (BP) are similar, the radiocarbon method will not be able to determine which of the two dates is true for a given sample; if, instead, for two putative AD dates we obtain quite different values of BP, it is worth investing in the dating. An example of the latter case may be the question whether the given sample comes from the lifetime of Copernicus, or is later than 1650 AD.

The issue considered concerns the comparison of two historical dates (in terms of radiocarbon). Hence, a graph in which historical dates (AD) are on both axes should be of use. This graph is proposed on fig. 4, and it is read as follows: If the point specified by two hypothetical historical dates (the age of the “real” object and the age of the supposed forgery) is white, a measurement of ^{14}C will not distinguish between these two radiocarbon dates (since samples have the same amount of ^{14}C), whereas the dark colour indicates that such a measurement

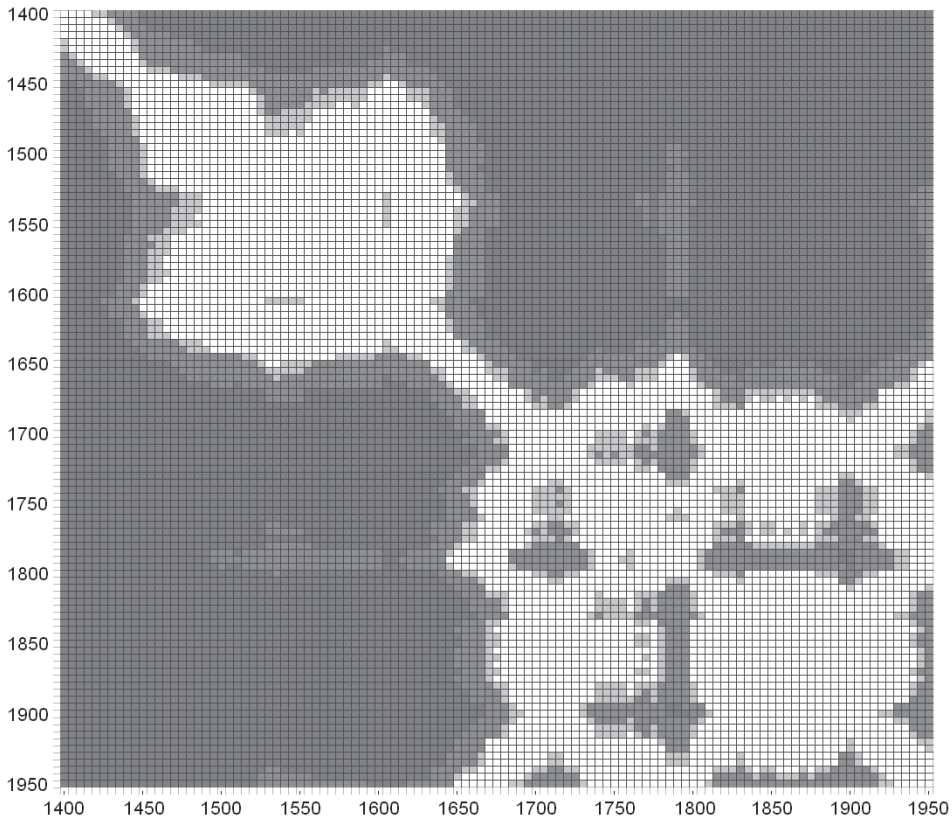


Fig. 4. The array of p-values (\approx significance levels) expected when two samples of a given, expected true age are compared. The white area around the diagonal indicates indistinguishable ages. The darkest area indicates the pair of dates that certainly would give different results in the measurement of ^{14}C . Intermediate gray is for $\alpha=0.01$; 0.05 and 0.001. The assumed radiocarbon determination error is $\sigma=30$ yr.

will be successful with a high probability. The intermediate shades of gray are defined by the respective degrees of the expected certainty. Three boundaries between different shades of gray correspond to the three levels of significance: $\alpha = 0.1, 0.05, 0.001$, of which the last (smallest) one corresponds to the darkest colour. (The degree of certainty or the confidence level is associated with the level of significance in such a manner that the sum of their values is equal to 1).

Another issue is the dating of samples that can be called contemporary, i.e. younger than 1950 AD. Due to the nuclear weapons tests conducted after this year, the level of ^{14}C in the atmosphere doubled. In consequence, the dating of samples from that time leaves no doubt as to their age. This is the so-called bomb effect (cf., e.g., Walanus, Goslar 2009).

As far as the possibility of using the radiocarbon method is concerned, we have to mention the type and the quantity of the material suitable for the dating. As ^{14}C is a carbon isotope, the sample must include this element in sufficient amount. For this and other reasons, the pieces of wood are the most useful. Before asking a question about the necessary weight of the sample, we should note that there are two completely different methods of measuring ^{14}C in parallel use: the older Scintillation Method and the new method of AMS, i.e. Accelerator Mass Spectrometry. They have different measuring sensitivities. The former requires grams of carbon, the latter – milligrams. This is the principal difference between them. Fortunately, the price of accelerator dating is not a thousand times higher. It is obvious that it is much easier to acquire a small sample for measurement. Therefore, only after AMS had been more widely used, was the Shroud of Turin dated (cf. Damon *et al.* 1989). In Poland, Poznań Radiocarbon Laboratory, which uses the method of accelerator mass spectrometry, recommends the following masses of samples: charcoal: 2–5 mg, peat: 5–10 mg, wood: 5–10 mg, shells: 20–50 mg, speleothems and other carbonate formations: 20–50 mg, bones: 1–5 g (see Poznańskie Laboratorium Radiowęglowe 2010). In contrast, Absolute Dating Laboratory in Skala (Poland), which uses the scintillation method, recommends larger samples: wood: 10–50 g, a minimum of 2–5 g; charcoal: 5–30 g, a minimum of 1–3 g; peat: 50–100 g, a minimum of 2 g; bone: 200–300 g, a minimum of 30 g (see Laboratorium Datowań Bezwzględnych w Skale 2010).

The final remark regarding the moment in time that is the result of the dating with the radiocarbon method. The date indicates the time when the plant tissue collected “fresh” carbon from the atmosphere (CO_2). A further circulation of the carbon (eaten by the animals in the form of grass, etc.) takes place almost instantaneously. However, for example collagen in the bones circulates quite slowly, which may have some significance for dating. The most unfavourable situation regards aquatic plants: radiocarbon dating of such samples should be avoided as they consume carbon from water, which at least partly is of mineral origin, and as far as ^{14}C is concerned, it is very old and no longer contains the isotope. Wood is a very good material for dating, but we must remember that 1) in the construction under study, a very old (already then) piece of wood could have been used, and 2) even in the case of a freshly cut tree trunk, one could deal with its middle part, which, when it was cut, could already be one hundred years or more.

With regard to the grave of Nicolaus Copernicus, it also seems appropriate to elaborate on the issue of dating bones. In this case, we measure the age of collagen extracted from the bones. Collagen is a relatively stable substance which does not exchange carbon with its surroundings when the bone is buried in the ground.

However a laboratory preparation of bone is difficult and time-consuming. Very well-preserved not very old bones contain at least 20% of the initial amount

of collagen, that is more than 40 mg of collagen per 1 g of bone. If the body was subjected to cremation or were burnt for other reasons, the bones contained no collagen and cannot be prepared with a standard technique. However, very often, a structural carbonate is retained in bones. This carbonate, deposited in the bone tissue throughout the life of the organism, contains the information about the true ^{14}C age (Walanus, Goslar 2009).

5. Conclusions

It seems that the radiocarbon dating of organic samples from the graves at the altar of St. Cross of the Archcathedral Basilica in Frombork may be an additional test of the relevance of the thesis about the discovery of the grave of Copernicus. The postulate for such additional tests was already reported (Kokowski 2008, 2009, 2010), as was also the suggestion that the team of Professor Jerzy Gąssowski determined precisely the methods of archaeological dating applied by them (Kokowski 2005b/2007).

The use of radiocarbon measurement method for the analysis of the remains attributed to Copernicus is relatively simple, since the remains are located in a secured coffin. In this context, however, we should emphasize that in the measurements of this type it is necessary to maintain great meticulousness in order to avoid being accused of failure to comply with elementary principles of performing this type of measurements.²

In addition, in order to increase the value of the accumulated empirical evidence, one should also test, using this measuring method, other archaeological objects discovered at the altar of St. Cross. It would, however, be much more organizationally difficult, since it would require a repetition of the archaeological work, because – as far as we know – these objects were placed in their original locations in the vicinity of the altar.

References

DAMON P.E., DONAHUE D.J., GORE B.H., HATHEWAY A.L., JULL A.J.T., LINICK T.W., SERCEL P.J., TOOLIN L.J., BRONK C.R., HALL E.T., HEDGES R.E.M., HOUSLEY R., LAW I.A., PERRY C., BONANI G., TRUMBORE S., WOELFLI W., AMBERS J.C., BOWMAN S.G.E., LEESE M.N., TITE M.S.

1989: *Radiocarbon dating of the Shroud of Turin*, "Nature", vol. 337, no. 6208, pp. 611–615, 16 February; <http://www.shroud.com/nature.htm>.

² Cf. the problem of methodical shortcomings in the dating of the Turin Shroud using the method of mass spectrometry (Marion, Lucotte 2008, pp. 79–85).

GAŚSOWSKI Jerzy

2005: *Poszukiwanie grobu Kopernika*. In: O. Gingerich, J. MacLachlan, *Mikołaj Kopernik: gdy Ziemia stała się planetą*. Translated by Jarosław Włodarczyk, Preface by Jacek Jezierski, Afterword by Jerzy Gaśowski. Pułtusk: Wyższa Szkoła Humanistyczna im. Aleksandra Gieysztora, pp. 127–136.

GAŚSOWSKI Jerzy

(ed.) 2005 / (ed.) 2006: *Poszukiwanie grobu Mikołaja Kopernika*. “Castrī Domināe Nostrae Letterae Annales” vol II. Pułtusk: Wyższa Szkoła Humanistyczna im. Aleksandra Gieysztora, Bałtycki Ośrodek Badawczy; (ed.) 2006a (English translation): *The Search for Nicolaus Copernicus's Tomb*. Pułtusk: The Pułtusk Academy of Humanities, Institute of Anthropology and Archaeology; Fundacja Kronenberga, Citibank Handlowy.

2008: *Badania nad identyfikacją grobu Kopernika / The Search for identity of Copernicus Tomb*. Pułtusk: The Pułtusk Academy of Humanities, Institute of Anthropology and Archaeology; Fundacja Kronenberga przy Citi Handlowy.

KOKOWSKI Michał

2005a: *Poszukiwania grobu Kopernika. Refleksje advocati diaboli*, an on-line version: Part I; http://www.cyfronet.pl/~n1kokows/poszukiwania_cz_1_pl.html.

2005b: *Poszukiwania grobu Kopernika. Refleksje advocati diaboli*; an on-line version: Part II; http://www.cyfronet.pl/~n1kokows/poszukiwania_cz_2_pl.html.

2007: *Poszukiwania grobu Kopernika. Refleksje advocati diaboli*. Part 1–2, “Kwartalnik Historii Nauki i Techniki”, vol. 52/1, pp. 121–131, 131–151.

2008: see Kostrzeva 2008.

2009: *Poszukiwania grobu Kopernika. Refleksje advocati diaboli*. Part 1–5. Presentation delivered at the “Symposium of the Copernicus Centre for Interdisciplinary Research” (Kraków, 20.03.2009).

2010: *Procedura identyfikacji szczątków nr 13/05 jako szczątków Kopernika w świetle racjonalności uzasadnienia i retoryki perswazji*. Presentation delivered at the conference “The Nicolaus Copernicus grave mystery. A dialogue of experts” (Kraków, 22–23 February 2010).

KOSTRZEWA Jarosław

2008: *Naukowcy szukają włosów Kopernika*, “Dziennik Polski”, 6–7 December, no. 285 (19599), vol. LXIV, p. A4; <http://www.dziennikpolski24.pl/pl/aktualnosci/kraj/888031-o-wlos-kopernika.html>.

LABORATORIUM DATOWAŃ BEZWZGLĘDNYCH W SKALE

2010: “*Wymagane masy próbek*”; <http://www.c14.pl/informacje-dla-zleceniodawcow> (last accessed: 12.02.2010).

MARION André, LUCOTTE Gérard

2008: *Tunika z Argenteuil i Całun Turyński*. Kraków: Wydawnictwo M; <http://books.google.pl/books?id=0s9LQkwCEWsC>.

POZNANSKIE LABORATORIUM RADIOWĘGLOWE

2010: "Rodzaje próbek"; http://radiocarbon.pl/index.php?option=com_content&task=view&id=7&Itemid=7 (last accessed: 12.02.2010).

REIMER P.J., BAILLIE M.G.L., BARD E., BAYLISS A., BECK J.W., BLACKWELL P.G., BRONK RAMSEY C., BUCK C.E., BURR G.S., EDWARDS R.L., FRIEDRICH M., GROOTES P.M., GUILDERSON T.P., HAJDAS I., HEATON T.J., HOGG A.G., HUGHEN K.A., KAISER K.F., KROMER B., McCORMAC F.G., MANNING S.W., REIMER R.W., RICHARDS D.A., SOUTHON J.R., TALAMO S., TURNEY C.S.M., VAN DER PLICHT J., WEYHENMEYER C.E.

2009: *IntCal09 and Marine09 radiocarbon age calibration curves, 0–50,000 years cal BP*, "Radiocarbon", vol. 51(4), pp. 1111–1150.

WALANUS Adam

2009: *Systematic bias of radiocarbon method*, "Radiocarbon", vol. 51, pp. 433–436.

2010: *Tajemnice ¹⁴C, czyli po co nam radiowęgiel*, "Archeologia Żywa", no. 1(47), pp. 44–48.

WALANUS Adam, GOSLAR Tadeusz

2009: *Datowanie radiowęglowe*. Kraków: Wydawnictwo AGH (pp. 147).

Michał KOKOWSKI

Department of History of Science, Natural Sciences and Technology, Ludwik and Aleksander Birkenmajer Institute for the History of Science, Polish Academy of Sciences; Copernicus Center for Interdisciplinary Studies, Poland; www.cyfronet.pl/~n1kokows/home.html; michal.kokowski@gmail.com

On the defectiveness of the argument for the finality of the discovery of the remains of Nicolaus Copernicus. Part 1: Results and interpretation of historical, archaeological, anthropological and anthroposcopic research¹

Abstract

The article presents a comprehensive critique of the argument in favour of the finding of the remains of Nicolaus Copernicus formulated before the genetic research. The arguments based on the knowledge of historical sources are analysed here, as well as the results of archaeological, anthropological and anthroposcopic research, the comparison of the skull 13/05 and the facial reconstruction with the portraits of Copernicus, and also the iconography of Copernicus and the methodology of interdisciplinary research.

The critique leads to the following assertion: Based on the results provided by the team of Jerzy Gąssowski before the genetic research, it was not possible to have grounds to assert that the grave of Nicolaus Copernicus had been discovered with a probability of 97% or higher. Therefore, this research should be continued, in order to increase the strength of the argumentation and obtain new evidence.

Keywords: Nicolaus Copernicus, Copernican studies, iconography of Copernicus, facial reconstruction, comparison of the skull 13/05 and facial reconstruction with Copernicus's portraits, argument of authority, methodology of interdisciplinary research.

¹ The following article was peer-reviewed by: Professor Karolina Targosz, Habilitated Doctor in Humanities (Ludwik and Aleksander Birkenmajer Institute for the History of Science, Polish Academy of Sciences) – the historical issues and the iconography of Copernicus; Rev. Zbigniew Liana, PhD (Chair in Natural Philosophy, Philosophical Faculty, The Pontifical University of John Paul II in Kraków) – methodological issues.

This text elaborates some of the theses mentioned in the paper “The procedure of identification of the remains no. 13/05 as the remains of Copernicus in the light of rationality of reasoning and the



Welcoming the resurgence of interest in the thought of Copernicus, we call for further deepening of this research and its competent popularization.

Frombork Declaration (3 November 2005)²

1. Introduction

The information about the 2004–2008 successful search for the remains of Nicolaus Copernicus is widely known in Poland and abroad. This is due to, on the one hand, the organization of many spectacular media events³, and on the other hand,

rhetoric of persuasion” (delivered at the conference “The secret grave of Nicolaus Copernicus. Dialogue of experts”, Kraków, 22–23 February 2010) and the paper “The search for the grave of Copernicus. Reflections of *Advocati diaboli*” (delivered during the “Copernicus Center Colloquium” #1, Kraków, 20 March 2009). The topics discussed here will be developed in more detail in a separate comprehensive interdisciplinary monograph, to which the interested reader is referred now.

² Translation – M.K. As an expert of the Polish Academy of Sciences which was invited to sign the Frombork Declaration, I actively participated in the last phase of drafting of this document. I removed from it several material errors and omissions unobtrusive to those who only occasionally deal with the analysis of Copernicus’s achievements. In particular, I had a direct impact on the shape of the quoted sentence, emphasizing the need to deepen the research into the ideas of Copernicus (in the original form the text raised only the need to popularize this idea). That kind of modification of the original text was brought about by a discovery of an amazing fact of the decline of Copernican research in Poland in the last thirty years. In order to remedy this situation, at least partially, I published a special monograph – an introduction to Copernican research: *Różne oblicza Mikołaja Kopernika. Spotkania z historią interpretacji* (*Different faces of Nicolaus Copernicus. Meetings with the history of interpretation*) (Kokowski 2009b, 2010d). I would like to add that this book had evolved over the years and its first version was ready as early as 2003.

³ Such as, among others, (a) “Scientific session dedicated to the memory of Nicolaus Copernicus” (Frombork, November 3, 2005), (b) the Kronenberg Foundation press conference “The secret grave of Copernicus explained” (Warsaw, 20 November 2008), (c) the film *Tajemnica grobu Kopernika / Copernicus Tomb Mystery* (60 min), written and directed by Michał Juszcakiewicz (Michał Juszcakiewicz Art’s Agency, 2008), the preview presentations of which were held in Toruń, Olsztyn and Kraków, the première was organized in Washington, DC (Carnegie Institution for Science, 3 December 2009), and other screenings – in New York (the seat of the Kosciuszko Foundation, 4 December 2009), Los Angeles (Loyola University, 7 December 2009), Uppsala (28 April 2010) (Juszcakiewicz 2009c). The film was later broadcast several times on Swedish public television. It was also shown during the Kraków conference *The Nicolaus Copernicus grave mystery. A dialogue of experts* (Kraków, 22–23 February 2010). In September 2010, the film won the Złoty Smok Award (Golden Dragon Award) in the category of scientific archaeological films at the festival of China International Conference of Science and Education Producers Meeting (14–20 September 2010, Suzhou, China) (Juszcakiewicz 2010); (d) the organization of the multi-phase ceremony of the re-burial of Nicolaus Copernicus from February to 22 May 2010. In February the alleged remains were transferred to Toruń, the birthplace of Nicolaus Copernicus, later to Olsztyn, from where they were carried in a pilgrimage throughout the Warmia into the Metropolitan Cathedral of Frombork, (e) the organization of the session *Kopernikana* (i.e. Copernican session) within the scientific symposium held on the occasion of the 750th anniversary of the Warmia Cathedral Chapter (Olsztyn, 20 May 2010).

the very lively interest of the popular media in these events. There is no doubt that in terms of advertising they were very successful ventures. The following facts can testify to the measure of their success:

1. In 2008 and 2009, these studies were considered by “Rzeczpospolita”⁴, “Przekrój”⁵ and “PAP – Nauka Polsce”⁶ as a few of the most famous scientific events in Polish science.
2. Fundacja Bankowa im. Leopolda Kronenberga przy Citi Handlowy (Kronenberg Foundation at Citi Handlowy), which funded the second stage of the research (in particular research carried out by Polish and Swedish geneticists) and promoted the results of that research, was awarded the *Mocni Wizerunkiem Award (Strong Image Award)* granted on 22 April 2009 during the 8th Congress of Public Relations (22–24 April 2009, School of Information Technology and Management in Rzeszów).
3. The results obtained quickly became part of the online world literature, for example, they are described extensively in various language versions of *Wikipedia*.

Reading various publications and interviews with the authors, who led the search for the grave, *leads to the unambiguous conclusions that they are deeply convinced that they have conclusively discovered the tomb of Nicolaus Copernicus, found his remains, determined his appearance around the age of seventy as well as his DNA profile. What speaks in favour of the discovery of the grave and the remains of this great thinker – in their opinion – are the irrefutable and consistent scientific arguments of varied nature:*

1. A detailed reading of historical sources.
2. The results of archaeological as well as anthropological and anthroposcopic research.
3. A comparison of the skull 13/05 with the portraits of Copernicus.

⁴ “Many researchers may view the past year as very successful. The journalists of the science column of »Rzeczpospolita« daily newspaper, as every year, reviewed the accomplishments of (Polish) researchers. *This, however, is not a ranking of discoveries. We only compiled a list of those that we think have become the flagships of Polish science and received most encouraging response in the media*” (Stanisławska *et al.* 2008; translation, italics – M.K.).

⁵ Cf. “Przekrój” 2009.

⁶ “The most important events in Polish science in 2008: the brightest, seen by people, optical flash coming from the distant universe, recorded by a Polish telescope; a breakthrough in the search for the grave of Nicolaus Copernicus and an innovative procedure thanks to which the patient can avoid diabetes – these are some of the most important events in the Polish science in 2008 [...] Research conducted at Uppsala University has shown that the DNA obtained from a hair discovered in one of the books belonging to the eminent astronomer is the same as that obtained from the skull found in the vicinity of the altar which he had looked after during his life. Thus, the grave of Copernicus has been identified in the cathedral in Frombork” (“PAP – Nauka Polsce” 2008b).

4. A comparison of the facial reconstruction from the skull 13/05 with the portraits of the astronomer.
5. The knowledge of the facts on the ethnicity of the population of Silesia and Toruń in 13th–14th century as well as Copernicus's parents and Copernicus himself.
6. The knowledge of the history of the manuscripts of Copernicus's writings and his library.
7. The results of the genetic research of the alleged remains of Copernicus and the hairs from the book by Johannes Stöffler (*Calendarium Romanum magnum, Caesareae maiestati dicatum*), which was used by the astronomer for a quarter of a century, including:
 - a) the comparison of the results of the analysis of HERC2 gene (which determines eye color) with portraits of Copernicus;
 - b) correct understanding of the methods of statistical analysis of genetic data;
 - c) the knowledge of the population databases of mtDNA and Y-DNA.

However, in the light of the detailed interdisciplinary analyses carried out by the author of this article, it transpires that despite the public-wide acceptance of the arguments in favour of the thesis of the conclusive finding of the remains of Nicolaus Copernicus, this argumentation *is flawed* for many relevant reasons.

2. Thematic scope

In this article, with reference to my earlier publications, I *explain synthetically the defectiveness of the arguments* regarding the first, the third, and the fourth of the issues above⁷. (Other issues, from the fifth to the tenth on the list, closely related to DNA research, are analysed in a separate article in this volume.)

To avoid any misunderstanding I would like to unambiguously point out that by undertaking the task of assessment of the results of the search for the remains of Nicolaus Copernicus (including the assessment of DNA research), I do not go beyond my professional expertise determined by both my education and scientific activity (for many years focused on, among others, the systematic work in the field of history and philosophy of science, including the history of Copernican research, the methodology of the empirical sciences and exact sciences, and lately on the so-called genetic genealogy). I refer here to the knowledge of the history

⁷ The second question, concerning the anthropological and archaeological findings, was discussed critically in the following articles: Kozłowski 2009a; 2009b; 2010a; Sołtysiak, Kozłowski 2009, and Sołtysiak 2010a; 2010b.

of the life and the descent of Nicolaus Copernicus, the coherence of the presented reasoning, the methodological issues and the statistical and mathematical issues (the latter are analysed in the said article in this volume).

3. Problems with the facial reconstruction from the skull and its comparison with portraits of Copernicus

As explained extensively in my earlier article (Kokowski 2005b / 2007a), the facial reconstruction from the alleged skull of Copernicus is fraught with a number of significant limitations:

1. In order to assess the reliability of the reconstruction better, it should have been entrusted to several independent professional teams (however in the analysed case only one team / researcher performed the reconstruction).
2. Only facial reconstruction of an individual at the age of about 70 was delivered, and no such reconstruction was made for another age, such as 25, 35–40, or 60 (which is needed to make a reliable comparison with the portraits)⁸.
3. The comparison is largely subjective, because:
 - a) what is compared – and only visually – is a graphical reconstruction of the face at the age of approximately 70 with the portraits depicting Copernicus aged 35–40;
 - b) in this comparison no objective, mathematical measures of the proposed similarity are used;
 - c) it is also maintained that the resulting reconstruction is very similar to the portraits (which does not convince me, because the reconstruction, beyond the general – i.e. in craniometric points – compatibility with the facial features shown on reliable portraits of Copernicus, significantly differs in many important details; I broadly explain this issue in the following sections of the article).

⁸ The validity of this criticism was accepted by Jerzy Gąssowski in 2006: “Still, none of the researchers claim that there is one hundred per cent certainty of the identification. This is due to the fact that the preserved realistic portraits of Nicolaus Copernicus – serving as reference material – come from the time when Copernicus was no more than 30–40 years of age. The reconstruction reveals a human face at least 30 years older, which might cause the obvious differences in appearance, and thus, it may be called into doubt” (Gąssowski 2006c, p. 1; translation – M.K.).

A confirmation of the validity of this type of criticism was also given in a J. Paszkowska’s interview with Dariusz Zajdel on 7 May 2007, and later a critical report of the subject by Bronisław Młodziejowski (2010), an expert in forensic anthropology, unrelated to J. Gąssowski’s group.

Although the researchers of J. Gąssowski’s group accept the legitimacy of this type of criticism, they do not refer to the article in which it was presented for the first time – cf. Kokowski 2005b / 2007. However, it is certain that they know this article – cf. Gąssowski 2005d; 2010; Piasecki 2005d.

4. With regard to the standard methodology of empirical measurements (especially the theory of measurement errors), not one, but three reconstructions for a given age should have been provided, which is equivalent to the minimum, average and maximum values of measurements. However – to my best knowledge – this type of requirement is not applied in the practice of reconstruction (which is a waste of important empirical information).
5. The authors of the comparison between the skull 13/05 from Frombork Cathedral and the facial reconstruction and the portraits of Copernicus did not have sufficient knowledge about him, and especially about the history of these portraits, which is explained at length in the following sections.

4. Familiarity with the knowledge about Nicolaus Copernicus among the authors who identified the remains from the grave 13/05 as the remains of Copernicus, and the question of the correctness of reasoning concerning the identification of the remains of the astronomer

In the first phase of the study (i.e. historical, archaeological, anthropological and anthroposcopic research and referring the results of this research to portraits of Copernicus) statements about the identification of remains of Copernicus were formulated by, among others, the following authors: Jerzy Gąssowski, Beata Jurkiewicz (archaeologists); Karol Piasecki (an anthropologist); Dariusz Zajdel (a specialist in anthroposcopy) and, fortuitously, Jerzy Sikorski, a historian. None of these people, with the exception of Jerzy Sikorski, had dealt with Copernican research before. Jerzy Gąssowski and Karol Piasecki openly admitted to it in their publications⁹. Despite this, the publications of the aforementioned authors, and especially of J. Gąssowski, abound with statements in which erroneous opinions concerning the most famous Canon of Warmia are notoriously spread (which will be shown and explained in detail below).

In the statements of these authors, an *implicit assumption* manifests itself clearly that a lack of expertise in the field of knowledge about Copernicus does not influence the correctness of the reasoning concerning the identification of the remains of the astronomer. It will be proven in this article that this seemingly reasonable assumption is incorrect. I also think that the adoption of this assumption has determined the overall rhetorical strategy of the publication of this team and resulted in a very serious weakening of the evidence presented by this team.

It should be noted here that I highly value the achievements of Jerzy Sikorski in the Copernican research. He belongs, in my opinion, to a small group of Pol-

⁹ Cf. for example Gąssowski / Hofman-Wiśniewska 2008, p. 1; Piasecki / Górka 2005.

ish experts, who in the last forty years, have made a significant contribution to the research into the life and work of Nicolaus Copernicus. An example of this – and it is one of many¹⁰ – can be found in his formulation of the hypothesis about the location of the grave of Nicolaus Copernicus on the basis of an analysis of historical sources and previous studies of the location of this grave. I have, however, two doubts with regard to this particular hypothesis, which I will reveal later in this article.

5. Identification of the remains from the grave 13/05 and the questions of the portraits of Copernicus (from the 16th–20th centuries) and his physical description

The fundamental weakness of the procedure of identification of the remains from the grave 13/05 as the remains of Copernicus is the omission of the specialized knowledge in the field of the history of the portraits of the astronomer from the 16th–20th centuries. This knowledge makes the anthropological comparison of the skull 13/05 with the portraits of Copernicus (made by K. Piasecki) and the comparison of the facial reconstruction from the skull 13/05 with the portraits of Copernicus (made by D. Zajdel) problematic (this will be elaborated on below). On the other hand, this difficulty determines a separate, but otherwise interesting research programme, consisting in searching for answers to the question which of the known portraits (in the visible or hidden layer) is the most consistent with or similar to the reconstruction.

In the context of these studies Karol Piasecki formulated a following strong thesis:

- There are plenty of images of the astronomer. – Obviously, each of us has seen Copernicus in portraits. The broken, big nose and the facial asymmetry are visible in all his images. It turns out, they are also present on the skull (Piasecki/Szczepkowska 2005, p. 11; translation – M.K.).

As an illustration of this thesis four images of Copernicus are given, “drawn and painted during his lifetime and after his death” (fig. 1) in the following articles: Kowalski 2005, p. 10 (reporting the results of Gąssowski’s research team) and Piasecki / Pohl, Zielinski 2005, p. 7. There is a number of significant concerns regarding these pictures, of which the authors of these articles are not aware.

¹⁰ Cf. numerous references to his various publications in: Kokowski 2009b. However, I must point out that I do not share J. Sikorski’s fascination with the issue of Anna Schilling (the alleged mistress of Copernicus). In my opinion there is not enough source data to put forward definite conclusions.



Fig. 1. Alleged and actual portraits of Copernicus.



Fig. 2. An alleged portrait of Copernicus (photograph: W. Skiba i A. Wyporek; source: Wasiutyński 1938, the illustration following p. 536).

The first portrait (fig. 2) – the person with a characteristic aquiline nose, despite the explicit inscription, does not represent Copernicus at all, but... Johannes Stöfler (1452–1531)¹¹. This portrait was made by J. Mittannour Chamahista and was published by Baltazar Moncornet (d. 1668).

¹¹ What is easy to see on the frontispiece of Stöfler's own work: *Ephemeridum opus Joannis Stoeffleri Justingensis Mathematici...*, Tubingae per Hulderricum Morhart Ann. XXXIII (1533), and the portrait of this author included in, for example, *Icones virorum illustrium doctrina et eruditione*



Fig. 3. The so-called Goluchów portrait of Copernicus – an oil painting of the German school (mid-16th century), a copy made by Nora Zinck (circa 1942; National Museum in Warsaw, the deposit of the District Museum in Toruń, inventory number MNW 190310; MT/MK/Dep/1).

The second portrait (fig. 3), the so-called Goluchów portrait of Copernicus, is considered as a controversial image of the astronomer at the age of 40–60. Zygmunt Batowski (1933, pp. 69 and 99), for example, stated that it was a portrait of an unknown man aged about 40.

The third portrait (fig. 4), the so-called Toruń or college (Academic Gymnasium) portrait of Copernicus, is not a self-portrait (this statement is not found in K. Piasecki's paper, however it is proclaimed by J. Gąssowski and B. Jurkiewicz – see Gąssowski, Jurkiewicz 2005b, p 19; Gąssowski 2008b, p 26; 2009a,

praestantium, cum eorum vitis by Jean-Jacques Boissard, 1652–1669, p. Tt4. The Johannes Stöffler mentioned here is the author of ...*Calendarium Romanum magnum, Caesareae maiestati dicatum* (1518). In the copy of this work owned by Copernicus two hairs attributed to Copernicus were found in Uppsala.



Fig. 4. The so-called Toruń or college portrait of Copernicus (The District Museum in Toruń, inventory no. MT/Ad/217/M/N).

p. 49) and is not the image created during the life of Copernicus (this statement is not found in K. Piasecki's paper, however it is proclaimed by Zajdel 2006, p. 39) – this is explained below in Section 5. Moreover, there is no source evidence that Copernicus painted any portraits, including self-portraits. The silence of the sources in this case speaks for the claim that he did not do it, otherwise – as the author of the Toruń portrait – he would have had to be an artist of great esteem and for this reason he would have had to paint numerous paintings.¹²

Finally, the fourth portrait (fig. 5) is a composition of Titus Maleszewski (1827–1898), published by W. Korn & Co. around 1860 in Berlin, in the lithography by G. Engelbach (1823–1885), and in 1873 in Warsaw in the lithography by W. Walkiewicz and included in the Polish translation of C. Flammarion's book *Vie de Copernic et histoire de la découverte du système du monde* (Polish: *Życie*

¹² I mentioned this already clearly in an earlier article: Kokowski 2008, p. 80.



Fig. 5. The portrait of Copernicus in a composition by Titus Maleszewski (1827–1898) (source: Flammarion 1873, p. 8).

Mikolaja Kopernika, translated by F. Sulimerski; published in Warsaw by Unger and Banarski's Bookstore, 1873, p. 8). So far it has also been claimed that the image of Copernicus in this portrait was supposed to be a copy of a painting by Ridolf Curandi (Ghirlandajo) of 1505 or 1508. However, as I prove it, it is an imaginary, free vision of Copernicus's figure, just like the alleged portrait by Ghirlandajo itself.¹³

6. Reliable portraits of Copernicus

The experts in the history of portraits of Nicolaus Copernicus know very well that there are no original images of the astronomer which *were created during*

¹³ I discuss this thread in another article published in this volume, see pp. 252–253.



Fig. 6. The so-called Reusner woodcut created by Tobias Stimmer (or his school) and published in N. Reusner's book (fragment) (source: N. Reusner, *Icones sive imagines virorum literis illustrium*, Argentorati 1587; Jagiellonian Library, Kraków, signature: Cim. 1422 Mag. St. Dr.).

his lifetime. In particular, the Toruń portrait (fig. 4) is no such image, since the dendrochronological analysis of oak plank on which the picture was painted, performed by Tomasz Ważny in 1987, proved that it came from a tree felled in 1571. Thus, due to the period of wood maturation, the picture could have been created in 1573 at the earliest and taking into account the issues of the technique of image formation – most likely only in the years 1580–1585.¹⁴

In the light of current knowledge a whole group of early portraits, derived from a lost original (called autographon) are considered as likely portraits of the

¹⁴ I discuss this at greater length in: Kokowski 2009b, p. 434, fn. 585.



Fig. 7. The so-called Boissard portrait, i.e. a copperplate by Theodore de Bry, published in Jean Jacques Boissard, *Icones Virorum Illustrium* (Frankfurt 1597, k. XVI; District Museum in Toruń, inventory number MT/MK/46; photo: Krzysztof Deczyński).

astronomer. The original was in the possession of a councillor of Gdansk, the nephew of Bishop Tiedemann Giese, a friend of Copernicus (the councillor happened to share the name with the bishop). This group of portraits includes:

1. The Strasbourg portrait painted by Tobias Stimmer in 1571–1574 (but before repainting in 1838, which likened this picture to the Toruń portrait).
2. The so-called Reusner woodcut published in 1587, which was made probably before 1584 (see fig. 6).
3. The so-called Boissard portrait, i.e. a copperplate by Theodore de Bry, published in 1597 (fig. 7).



Fig. 8. The epitaph portrait of Copernicus of the Church of SS. Johns in Toruń (1580) – oil painting by an unknown artist (ca. 1582–1589), founded by Melchior Pirnesius (a copy of Karl Hemmerlein, 1943; District Museum in Toruń, inventory number MT/MK/183).

4. The Toruń portrait from around 1580–1585 or rather its original form – similar to the Boissard portrait – revealed by the study of the X-ray spectrum (as well as infrared and ultraviolet spectrum).
5. The epitaph portrait from the Church of SS. Johns in Toruń from 1580 (fig. 8).¹⁵

The group of unquestionably reliable, but created somewhat later portraits of Copernicus includes among others the Kauffmann woodcut (fig. 9), representing the Reusner type and made in Wittenberg in the late 16th or early 17th century.¹⁶

¹⁵ Cf. Flik 1973; 1974; 1990.

¹⁶ Cf. Batowski 1933, p. 33–37 and illustration 5; Flik-Fizek 1992, p. 165.



Fig. 9. The so-called Kauffmann woodcut (fragment), Wittenberg, late 16th or early 17th century (source: Batowski 1933, illustration 3).

7. Elementary proof of falsity of the thesis by K. Piasecki (2005b), J. Gąsowski, B. Jurkiewicz (2005b) and J. Gąsowski (2008b) that a crooked nose appears on all portraits of Copernicus

The unquestionable early portraits of Copernicus above (fig. 4 and 6–9) are counter-testimonies to the thesis of K. Piasecki, J. Gąsowski and B. Jurkiewicz¹⁷ that a crooked nose appears on all portraits of Copernicus.

¹⁷ “Both in the preserved portraits (sic) and in the skull, a deformation of the nose can be ascertained; it is deflected to the left and this could be the result of an injury suffered at the age of 7–12 that subsequently could lead to visible deformation of the skull symmetry” (Gąsowski, Jurkiewicz 2006a, p. 18).

8. Doubt regarding K. Piasecki's thesis of the asymmetry of Copernicus's face

I think that K. Piasecki's thesis of the asymmetry of Copernicus face visible on the portraits of the astronomer is worth further interdisciplinary discussion, because the effect of this asymmetry (if it exists) is inconspicuous, and thus cannot be large (Kokowski 2005b/2007a).¹⁸

On this occasion, I would like to point out that human faces are not perfectly symmetrical, which we do not see in ordinary perception. Hence, doubts as to the existence of *the asymmetry of Copernicus face presented in his portraits*, can only be dispelled by accurate measurements. Until we have such measurements, I postulate that we treat the second thesis of Karol Piasecki as an untested empirical conjecture, a hypothesis. The burden of proof rests on the shoulders of Piasecki, because no one before him spoke regarding this effect. I stress the need for accurate measurements and *the publication of the results*, not mere verbal statements that this asymmetry is supposedly visible in the paintings.

9. The scar on the alleged skull of Copernicus and the scar on portraits of Copernicus

According to Gąssowski, Jurkiewicz 2005b, p. 18 and Gąssowski 2008b, p. 24:

A very important detail is the double vertical scar over the right eye-socket noticeable on the skull – probably the scar from a wound. The self-portrait (sic) reveals the same irregularity in the appearance of the left eyebrow, which in a small fragment seems to disappear. [In the classical technique of self-portrait, the method of a mirror image is applied. Hence, the comparison regards the right part of the skull and the left part of the head presented on the painting – annotation M. K.].

It is worth adding a few words of comment to the quotation above:

1. The aforementioned effect of the atrophy of the left eyebrow on the alleged self-portrait of Copernicus (on this picture, see also the remark below) was only revealed by L. Torwirt (1953), which, by analyzing the image in infrared and normal light, detected a “flaw, like a scar” at the base of the left eyebrow. This discovery was then strengthened by J. Flik (1973, 1974, 1990), who – in the study of this portrait in X-ray, as well as in infrared and ultraviolet radiation – detected on the X-ray photo of this portrait that the scar appears both on the left and the right side of the base of the nose.

¹⁸ It is worth noting that the fact of a small asymmetry was also noted by Zajdel / Paszkowska 2007.

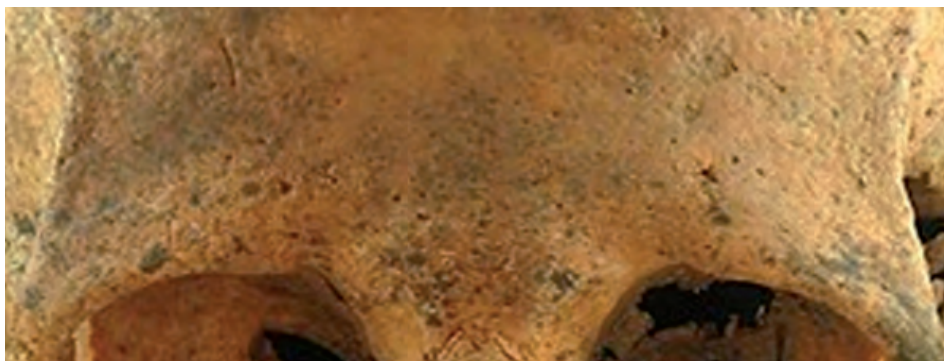


Fig. 10. Fragment of the skull 13/05 (magnified part of the photograph made by chief commissioner D. Zajdel, M.A.¹⁹; source: Gąssowski 2009c, p. 16; <http://i.wp.pl/a/f/jpeg/23516/kopernik4.jpeg>).²⁰

2. Let us note that on the portrait we cannot see at all the “double scar above the left eyebrow” analogous to the “double scar” above the right eyebrow on the alleged skull of Copernicus and the facial reconstruction by D. Zajdel (cf. fig. 10 and 11 and Kokowski 2005b/2007a).

Thus, the indicated discrepancy of the features of the alleged skull of N. Copernicus and of Copernicus’s “self-portrait” (i.e. his Toruń portrait), mentioned by J. Gąssowski and B. Jurkiewicz, significantly weakens the probative force of the argument in favour of identifying the skull. Since if we accept assumption₁ (on the credibility of the “self-portrait” and the historical records, which were mute regarding any double scar), and assumption₂ (on the fact that the double scar on the skull 13/05 had been formed before the “self-portrait” had been created), the fact of finding the skull leads us to a falsification of the thesis regarding the ultimate finding of the remains of Copernicus. If we accept assumption₂ and assumption₃ (that the found skull belongs to Copernicus), it leads us to a falsification of the thesis regarding the credibility of the “self-portrait” and the historical records.

¹⁹ Although the article of Jerzy Gąssowski (2009c, p. 16) does not give the name of the author of the photograph of Copernicus’s skull, through the exchange of correspondence between the Publishing House of the PAU and Professor Jerzy Gąssowski it transpired that it was podinspektor (underinspector) Dariusz Zajdel, MA (then nadkomisarz, chief commissioner).

²⁰ Since the publisher of the monograph did not receive from podinspektor (underinspector) Dariusz Zajdel, M.A. and professor Jerzy Gąssowski a consent to include all the photographs of the skull in the monograph, using the right to quote – in accordance with Article 29 §1 of *Ustawa o prawie autorskim i prawach pokrewnych* (*The Act on Copyright and Related Rights*), dated 4 February 1994, full text: *Dziennik Ustaw* 2006, No. 90, item 631) – I enclose some of them. Cf. Stanisławska-Block 2009, especially p. 166, Section 3.3 and Section 3.7, p. 169.

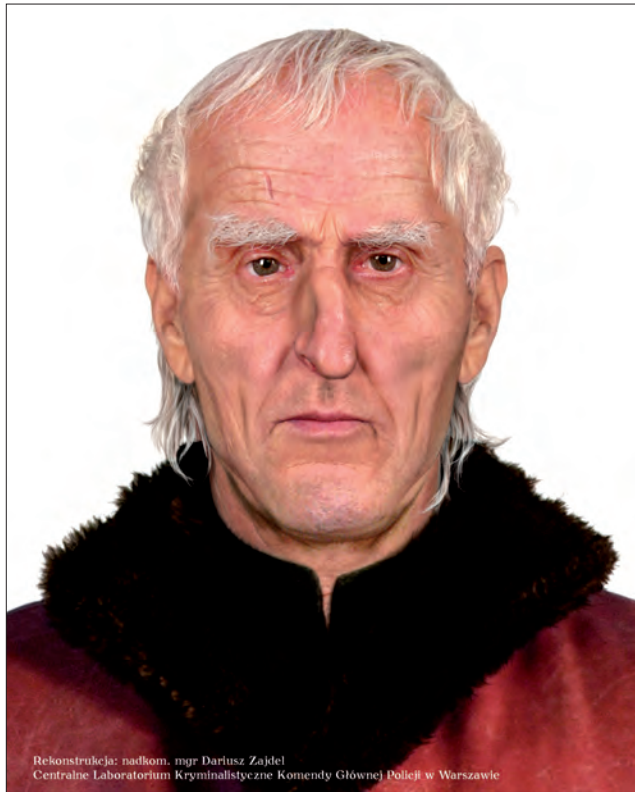


Fig. 11. The facial reconstruction from the skull 13/05, made by chief commissioner Dariusz Zajdel, M.A. (Central Forensic Laboratory of the Polish Police)²¹. “One of the skin damages (scars) over the right superciliary arch, mentioned in anthropological analysis, was clearly reflected in the damage to the skull’s bone structure” (Piasecki, Zajdel 2005, p. 34).

Hence, in order to save the credibility of the “self-portrait” and the historical evidence, and the credibility of finding the skull 13/05 we would have to reject assumption₂ and assume that the double scar on the skull 13/05 was formed – at the earliest – after the “self-portrait” had been painted or, according to K. Piasecki, even after the death of Copernicus, caused by gravediggers. However, also

²¹ This illustration is a part of the illustration no. 3 (file “plansza_03.jpg”) distributed on a CD-ROM at the ceremony in Frombork on 3 November, 2005 (see Zajdel 2005a). I do so in accordance with the directive set out in the reproduced on this disc file entitled “Copyright.txt”: “In the case of publication of the entire image or its part, the name of the Author along with the institution details should be stated each time, [...]” that is chief commissioner Dariusz Zajdel, Central Forensic Laboratory of the Polish Police. (Also notes on the right to quote given in the previous footnote apply here.)

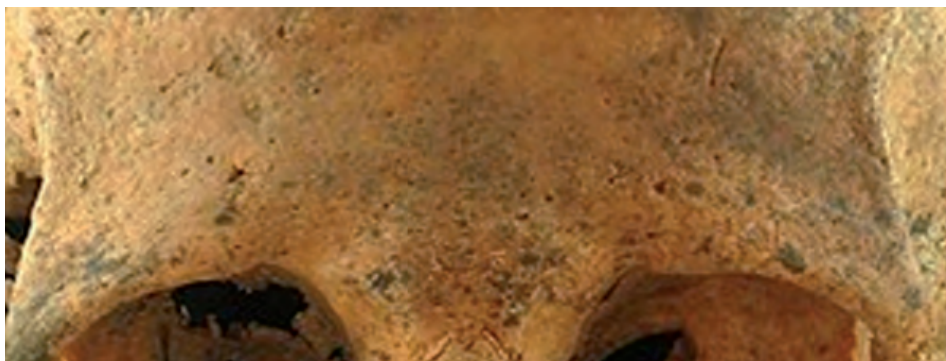


Fig. 12. Mirror image of the fragment of the skull 13/05 (a magnified part of a mirror image of the photograph taken by chief commissioner D. Zajdel, M.A.; source: Gaśowski 2009c, p. 16; <http://i.wp.pl/a/f/jpeg/23516/kopernik4.jpeg>).²²

this explanation is not satisfactory, because, according to T. Kozłowski (2009a, 2009b) and A. Soltysiak (2010a), the scar is not at all the result of a damage to the skull (either during the life of Copernicus, or after his death), but what remained of the arterial groove.

Let us notice, however, that the divergence of views on the origins of this scar has no effect on the fundamental fact that *no* artist included this type of scar on portraits of Copernicus.²³

The only dubious case is the so-called Reusner woodcut, on which an elongated, left-bulging flaw can be seen above the right eyebrow. This flaw, however, seems to be accidental damage. This is because if we assume that a flaw such as the one on the skull 13/05 was present on the skull of Copernicus, it should appear – according to the technique of creating woodcuts (i.e. a mirror image of the original) – above the left (not right) eyebrow in the so-called Reusner woodcut and have a right-sided (a not a left-sided) bulge – see fig. 6 and fig. 12.

Consequently, the so-called Reusner woodcut does not support the argument in favour of the discovery of the said scar on of the portraits of Copernicus (unless we assume, in accordance with the experts of iconography of Copernicus, that the so-called Reusner woodcut does not represent a mirror view of Copernicus's face, and it is e.g. the Toruń portrait that shows such a mirror view).

²² Cf. fn. 20 and 21.

²³ The earlier researchers, among them the famous Owen Gingerich of Harvard University, overlooked that (cf. Gingerich 2011b): “What seemed to be a forehead wound matching a faint scar in the Toruń portrait turned out to be a common arterial depression” (Gingerich 2010b, p. 229).

Prof. Gingerich did not mention the name of the author of the thesis recognizing the scar on the skull 13/05 as an arterial groove – it was Tomasz Kozłowski, already mentioned here.

10. To what extent Copernicus images reflect his true physiognomy

The authors of the identification of the remains of Copernicus take it for granted that the most famous portraits of Copernicus, and especially the Toruń portrait (called by them ‘the self-portrait’), represent the physiognomy of Copernicus with complete realism.

We may, however, have reasonable doubts as to the appropriateness of this assumption:

1. As we remember, the Toruń portrait is not a self-portrait at all, because it was painted early in 1580, perhaps from the so-called lost autographon (Kokowski 2009b, p. 434, fn. 585). It is obvious that the artists who painted these images might not have represented his physiognomy completely realistically – a painting, after all, is not a photograph (cf. Kokowski 2005b/2007a, p. 137).
2. It is also highly doubtful that in 1580 (37 years after the death of Canon of Warmia) anyone in Warmia and Toruń remembered well enough what Copernicus actually looked like: in old age, and even more in adolescence. This is not a groundless statement – since it is known that when in 1581 Marcin Kromer, the bishop of Warmia, decided to fund the memorial for Copernicus, there was no-one in the chapter of Warmia who could give the bishop elementary information on this canon (Kokowski 2009b, p. 40).

Hence, if we wanted to compare the portraits of Copernicus whether with the alleged skull of Copernicus, or with the facial reconstruction created from the skull, we would have to maintain a large degree of criticism. Unfortunately, the authors of this comparison, i.e. K. Piasecki, D. Zajdel and J. Gąssowski, neglected this type of considerations.

11. On the status of the claim of the 97% probability of the discovery

As I explained extensively in my earlier paper (Kokowski 2005b/2007a), no mathematical reasoning had been given that would have led Jerzy Gąssowski to the precise determination of the degree of probability of the discovery of the tomb and the skull of Copernicus at 97%. Hence, claiming the 97% probability of this discovery is merely a rhetorical figure.²⁴

²⁴ Full confirmation of the validity of my criticism of the thesis of the “97% probability” of the discovery of the grave of Copernicus was brought by the interview which K. Piasecki gave on 7 May, 2007 to J. Paszkowska (the author forgot only to quote... my name in this context): “K. Piasecki: What is the degree of the likelihood that the skull we found is the skull of Copernicus, it is difficult to estimate. But in accordance with all that we know about it, it is very high” (Piasecki / Paszkowska 2007).

I will also add that the claim made by J. Gąsowski regarding the “97% probability” of the discovery used as the conclusion of the phase of historical (J. Sikorski), archaeological (a team of archaeologists), anthropological (K. Piasecki) and anthroposcopic research (facial reconstruction by D. Zajdel) can be interpreted as a precise measure of his *subjective certainty* regarding the (allegedly) unequivocal discovery.²⁵

12. Sikorski’s hypothesis regarding the location of the grave of Copernicus and the 100% certainty of the discovery of this tomb

Already before the discovery of the tomb was recognized with the alleged “97% probability” (i.e. well before the DNA analyses were made), Jerzy Sikorski had announced the thesis that he was “100% sure that this must be the remains of Copernicus” (cf. Sikorski / Belz 2008; Sikorski / Czartoryski-Sziler 2010), since already an analysis of historical sources led him to this conclusion. However, such a conclusion is unjustified for two reasons:

1. It neglects to mention the hypothesis of Górski (1973a; 1973b), according to which Copernicus could have been buried in Frombork Cathedral near the altar of St. Catherine or St. Martin.²⁶
2. It ignores two facts disclosed by the early archaeological research of Gąsowski’s group, which showed who was buried in the area of the altar of St. Cross, namely:
 - a) Canon Andrew Gąsiorowski, who did not take care of this altar, but the altar of St. Anna (until 1639 the altar of St. Paul), and who should have been buried in the crypt under the chancel, which served this purpose at the time (cf. Sikorski 2005, p. 168 and 189; Gąsowski, Jurkiewicz 2005b, p. 13–14);
 - b) an anonymous young woman in a decorative *secular* dress – which means that the Cathedral statutes did not prohibit to bury lay people at the altar, and hence, an anonymous man at the age of around 70 could also have been buried there (we do not discuss here the difficulty of determining the age with such precision).

In order to defend himself against such criticism, Jerzy Sikorski would have to introduce an additional (*protective*) hypothesis that: (a) Canon Gąsiorowski was buried near the altar of St. Cross, because he could not be buried for some

²⁵ This thesis has strong epistemological grounds. It is known that so far the so-called inductive logic and inductive probability measure failed to be formulated. Cf., for example, Popper 1977, p. 29–31, 205–213.

²⁶ For more on this subject see Kokowski 2005a / 2007a and 2005b / 2007a.

important reasons at his altar; (b) there was no such reason in the case of Copernicus; and (c) no other secular man at the age of about 70 was not buried near the altar (since it is known that among the Canons of Warmia buried in the cathedral only Copernicus lived to that age). I must be said that it actually could have occurred, but it could also have occurred somewhat differently. Therefore, in order to confirm this additional three-part hypothesis, one would have to show historical sources which would disclose such facts or reasons. In the absence of such historical sources, this additional hypothesis would have the status of an *ad hoc hypothesis, formulated only to defend the fundamental hypothesis*, making it intractable to any undermining (falsification) or rejection (refutation), and thus transforming it into a thesis devoid of scientific content.

13. Defectiveness of the argument from authority in the reasoning in favour of recognizing the finding of the grave of Nicolaus Copernicus in the first phase of research

As we know from rhetorics, the art of persuasion, one of the means used in the procedure of argumentation (for or against any thesis) is *argumentum ad verecundiam*, that is an argument referring to respect, authority. It entails that in order to justify a thesis proclaimed by us we refer to some authority: a person or a whole environment who already accepted our thesis. This argument was used by Jerzy Gąssowski and his followers in two ways: to confirm the theses propounded by them and at the same time to defend the theses criticized by few opponents, including their first critic – the author of this article (cf. Kokowski 2005a; 2005b/2007a).

This argument has the following structure (*I provide it here in my own synthetic formulation*): “You criticize our research and its results, but: (1) we conducted model research and made a model interpretation of the results obtained, and (2) our achievements aroused great interest and scientific appreciation around the world”. Such an argument (*in a different, but semantically equivalent phrasing*) was reported, among others, by Jerzy Gąssowski, Adam Kosecki, Rector of the Pułtusk Academy of Humanities, and Karol Piasecki (cf. among others Gąssowski 2005d; Piasecki 2005d; J. Śniegocki, P. Kiela, R. Śniegocki 2008).

This argument, however, is flawed because it does not alter in any way the fact that the first phase of the research contained numerous shortcomings and errors which I pointed out above, and which were overlooked by:

1. The authors of this research (who, with the exception of Jerzy Sikorski, had never conducted their own Copernican studies).

2. Their many supporters, including the prominent promoters of research, journalists and authors of *Wikipedia* entry (who have never conducted their own Copernican research).
3. André Goddu, an American scholar of Copernican issues (2007).²⁷

14. The fundamental shortcomings of the first phase of research – insufficient knowledge of the Copernican iconography and the lack of sufficient sensitivity to interdisciplinary issues

As I indicated in earlier sections of this article, the authors involved in *the first phase* of the research into the identification of the putative remains of Nicolaus Copernicus (i.e. the phase of historical, archaeological, anthropological and anthroposcopic research and the evaluation of their results) committed a variety of errors (material and formal) in these studies. They arose from three main reasons:

1. From the lack of specific knowledge relating to Copernicology (that is the knowledge of the life of Nicolaus Copernicus and the origins, the contents and the reception of his achievements), especially one of its sections: the Copernican iconography.²⁸
2. From the subjective certainty (accompanying this lack of knowledge) of the conclusions resulting from the absence of sufficient knowledge of the various intricacies of Copernicology.
3. The above-mentioned errors were a consequence of another fundamental shortcoming, namely insufficient sensitivity of the authors of these studies to the problems of interdisciplinary research. It just resulted in these authors not feeling sufficiently strong need to conduct *integrated* interdis-

²⁷ It is worth mentioning that Professor Owen Gingerich had, however, some vague doubts about the certainty of the discovery of the grave of Copernicus and his remains: “When in 2005 Polish archaeologists led by Jerzy Gąssowski found fragments of a skeleton tentatively identified as the remains of the 16th-century astronomer Nicolaus Copernicus, some doubts remained” (Gingerich 2009, p. 12215).

The doubts about the credibility of the alleged self-portrait of Copernicus were reported also by said André Goddu: “If not a self-portrait or not copied from a self-portrait, then one of the comparisons between the forensic reconstruction and the portrait may be based on a false inference” (Goddu 2010, p. 436, fn. 125). I would like to point out that I discussed this issue extensively already before my colleague (who knows Polish): Kokowski 2005a; 2005b / 2007a; 2007b; 2009b, p. 40–45, 135–136, 434, fn. 585; 2010c.

²⁸ I would like to emphasize that ignoring the knowledge of Copernican iconography in the identification phase of the alleged remains of Nicolaus Copernicus constitutes the same kind of elementary error, as e.g. undertaking research into hieroglyphs ignoring the achievements of Jean François Champollion and his many successors in this field.

ciplinary research. And for that reason there was no methodologist of interdisciplinary research on their team and no expert in the portraits of Copernicus (the team did not even take advantage of the assistance of Jerzy Sikorski, who discussed the issue of portraits of Copernicus in his book: published in 1973 and having two later editions (1973/1985, 1999).

The above considerations refute *the implicit assumption* (see above, chap. 3) adopted by the team of Jerzy Gąssowski in the first phase of the research that a lack of specialized knowledge of Copernicus does not affect the correctness of the reasoning concerning the identification of the remains of astronomer.

15. Conclusion – the failure of argumentation in favour of the discovery of the remains of Nicolaus Copernicus in the first phase of the research

As indicated in this article, in the context of the numerous gaps in the argumentation formulated by the authors involved in the search for the tomb of the astronomer, I believe that in the first phase of the research (that is in the historical, archaeological, anthropological and anthroposcopic studies):

1. No scientific evidence to support the thesis regarding the discovery of this grave with “97% probability” or “high probability” was given.
2. It has only been proven that the remains found in grave 13/05 in Frombork Cathedral may but do not have to be the remains of the astronomer.

Therefore the research should have been continued to seek stronger arguments in favour of the discovery (I would like to recall here that I pointed to such a need already in December 2005, in a publication well-known to the team of Jerzy Gąssowski – cf. Kokowski 2005b/2007a).²⁹

References

ALLEN Marie

2008: *Analiza DNA włosów znalezionych w kalendarzu należącym do Mikołaja Kopernika / DNA analysis of shed hairs from Nicolaus Copernicus calendar*. In: Gąssowski (ed.) (2008a), pp. 226–235.

2009a: *RE: Conference “Assesment of the results of search for Copernicus’s grave” (Cracow, the last quarter of the 2009)* (email of 28.09.2009 to M.K.).

²⁹ In a separate article in this volume, I discuss the question whether the DNA studies conducted by Swedish and Polish researchers constitute final, or at least sufficient evidence of the discovery of the remains of Nicolaus Copernicus.

2009b: RE: Conference “Assesment of the results of search for Copernicus’s grave” (Cracow, the last quarter of the 2009) (email of 05.10.2009 to M.K.).

2010: *Gruppens medlemmar / Group members*; <http://www.genpat.uu.se//node231>.

BARTOSZEWICZ Julian

1852: *Wspomnienie o Koperniku*, “Rocznik Warszawski Stanisława Strąbskiego”, pp. 6–16. Reprinted in: Polkowski (ed.) (1873–1875), vol. II, pp. 177–194.

BARWIŃSKI Eugeniusz, BIRKENMAJER Ludwik Antoni, ŁOŚ Jan

1914: *Sprawozdanie z poszukiwań w Szwecji dokonanych z ramienia Akademii Umiejętności*. Kraków: Akademia Umiejętności.

BATOWSKI Zygmunt

1933: *Wizerunki Kopernika*. Toruń: Towarzystwo Bibliofilów im. Lelewela z zasiłkami Funduszu Kultury Narodowej i Pomorskiego Starosty Krajowego.

BELZA Marta

2008: *Jerzy Sikorski. To on odszukał Kopernika*, “Gazeta Wyborcza. Olsztyn” (2008.11.20); http://miasta.gazeta.pl/olsztyn/1,93864,5971932,Jerzy_Sikorski__To_on_odszukiwal_Kopernika.html.

BENDER Georg

1881: *Archivalische Beiträge zur Familien-Geschichte des Nikolaus Copernicus. Nebst Beilagen*, “Mitteilungen des Copernicus-Vereins für Wissenschaft und Kunst zu Thorn”, H. 3, pp. 61–126.

BIRKENMAJER Ludwik Antoni

1900: *Mikołaj Kopernik. Część pierwsza. Studya nad pracami Kopernika oraz materiały biograficzne*. Kraków: Akademia Umiejętności.

1922: *O narodowości Kopernika. Własnoręczny list Kopernika*, “Zmartwychwstanie”, 1922/2–3, pp. 86–91.

1924: *Stromata Copernicana. Studia, poszukiwania i materiały biograficzne*. Kraków: Polska Akademia Umiejętności.

1937: *Nikolaus Copernicus und der Deutsche Ritterorden*. Kraków: Polska Akademia Umiejętności.

BOGDANOWICZ Wiesław

2007: see Paszkowska (2007).

2008: *Analiza DNA uzyskana z czaszki grobu nr 13/05 w katedrze we Fromborku / DNA analysis obtained from the skull of tomb no. 13/05 in the Frombork Cathedral*. In: Gąssowski (ed.) (2008a), pp. 204–211.

2010: *Sekwencje HVI i HVII* (email of 22.06.2010 to M.K.).

BOGDANOWICZ Wiesław, ALLEN Marie, BRANICKI Wojciech, LEMBRING Maria, GAJEWSKA Maria, KUPIEC Tomasz

2009: *Genetic identification of putative remains of the famous astronomer Nicolaus Copernicus*, “PNAS” (“Proceedings of the National Academy of Sciences of the United States of America”) July 28, vol. 106(30), pp. 12279–12282; edited by

Alan Walker, Pennsylvania State University, University Park, PA, and approved June 16, 2009; reviewed by Dr. Ronald Van Den Bussche (Oklahoma State University) and Dr. John H. Rappole (Smithsonian National Zoological Park); <http://www.pnas.org/content/106/30/12279.full>.

BOROWICZ Dorota

2004: *Mapy narodowościowe Górnego Śląska od połowy XIX wieku do II wojny światowej*, "Acta Universitatis Wratislaviensis", no. 2710. Wrocław: Wydawnictwo Uniwersytetu Wrocławskiego.

BRANICKI Wojciech

2008: see Kostrzewa (2008b).

BRANICKI Wojciech, KUPIEC Tomasz

2008: *Badania genetyczne domniemanych szczątków Mikołaja Kopernika/Genetic analysis of alleged remains of Nicolaus Copernicus*, In: Gąssowski (ed.) 2008a, pp. 212–225.

2009: see Landau 2009.

2010: *Analiza markerów DNA jądrowego w szczątkach z grobu 13/05*. A paper presented during the academic conference "Tajemnica grobu Mikołaja Kopernika. Dialog ekspertów" / "The Nicolaus Copernicus grave mystery. A dialogue of experts" (Kraków, 22–23 February 2010). An abstract of the paper in: Kokowski (ed.) 2010b, pp. 2–3.

CICHOCKI Ryszard

2008: *Poszukiwanie pochówku Łukasza Watzenrode techniką georadarową / Search for the tomb of Lucas Watzenrode using georadar technique*. In: Gąssowski (ed.) 2008a, pp. 156–157.

CURTZE Maximilian

(ed.) 1875: *Reliquiae Copernicanae*. Nach den Originalen in der Universitäts-Bibliothek zu Upsala. Hrsg. v. Maximilian Curtze (Leipzig).

(ed.) 1878: *Inedita Copernicana. Aus den Handschriften zu Berlin, Frauenburg, Uppsala und Wien*, "Mittheilungen des Copernicus-Vereins für Wissenschaft und Kunst zu Thorn", Ver. H. I.

CZARTORYSKI Paweł

1978: *The Library of Copernicus*, "Studia Copernicana", vol. XVI, pp. 355–396.

CZARTORYSKI-SZILER Piotr

2010: *Tajemnica grobu nr 13* (An interview with Dr Jerzy Sikorski, a researcher into the life and achievements of Nicolaus Copernicus, conducted by Piotr Czartoryski-Sziler), "Nasz Dziennik", 22–23 May, no. 118 (3744); (9.06.2010): <http://www.naszdziennik.pl/index.php?dat=20100522&typ=mk&id=mk21.txt>.

CZECHOWICZ Katarzyna

2008: see "PAP – Nauka w Polsce" 2008b.

DOBRZYCKI Jerzy

1973: *Uwagi o szwedzkich zapiskach M. Kopernika*, “Kwartalnik Historii Nauki i Techniki”, R. XVIII, nr 8, p. 712–713.

DREWNOWSKI Jerzy

1978: *Mikołaj Kopernik w świetle swej korespondencji*, “Studia Copernicana”, vol. XVIII. Wrocław: Ossolineum.

FLAMMARION Kamil

1873: *Życie Mikołaja Kopernika. 1473–1873*. Przekład: F. Sulimerski. Warszawa: Nakładem księgarni Ungra i Banarskiego.

FLIK Józef

1973: *Najnowsze badania portretu Mikołaja Kopernika ze zbiorów Muzeum Okręgowego w Toruniu*, “Rocznik Muzeum w Toruniu”, vol. 5, pp. 83–112.

1974: *Portrety Mikołaja Kopernika z katedry w Strasburgu i Muzeum Okręgowego w Toruniu*, “Ochrona Zabytków”, vol. 27/1, pp. 66–71.

1990: *Portret Mikołaja Kopernika w Toruniu. Studium warsztatu malarskiego*. Toruń: Uniwersytet Mikołaja Kopernika.

FLIK-FIZEK Małgorzata

1992: *Najstarsze wizerunki Mikołaja Kopernika w malarstwie i grafice z XVI i XVII wieku*, “Rocznik Muzeum w Toruniu”, vol. IX, pp. 153–181.

FUNDACJA KRONENBERGA PRZY CITI HANDLOWY

2008a: *Badania DNA finansowane przez Fundację Kronenberga przy Citi Handlowy pozwoliły na zidentyfikowanie szczątków astronoma*; <http://www.citibank.pl/poland/homepage/polish/kopernik/1.htm>.

2008b: *Film “Misterium cranii Nicolai Copernici”*, written and directed by Marcin Stefaniak.

2009: *Fundacja Kronenberga po raz drugi wyróżniona nagrodą Mocni Wizerunkiem (The Kronenberg Foundation honored with the Mocni Wizerunkiem Award (Strong Image Award) for the second time, granted during the 8th Congress of Public Relations, 22–24 April 2009, University of Information Technology and Management in Rzeszów, for funding the search for the grave of Copernicus and the promotion of these studies) (22.04.2009)*; on-line version (access: 14.06.2010): http://www.citibank.com/poland/kronenberg/polish/4026_9671.htm (in Polish).

GAWRYSZEWSKI Andrzej

1995: *Mapy narodowościowe, wyznaniowe i językowe Polski wykonane przez autorów obcych: bibliografia (lata 1846–1967)*. Dokumentacja Geograficzna. Polska Akademia Nauk. Instytut Geografii i Przestrzennego Zagospodarowania. Wrocław: Wydawnictwo Continuo.

GĄSSOWSKI Jerzy

2004a: *Frombork. Blisko sensacyjnego odkrycia. Ruszyły badania*, “Gazeta Olsztyńska” – “Dziennik Elbląski”, 18 August (reported by Wojciech Andrearczyk).

- 2004b: *Kanonik od św. Krzyża*, “Rzeczpospolita” (“Człowiek i Nauka”), 31 August, no. 204 (6887), p. A11 (reported by Krzysztof Kowalski); http://new-arch.rp.pl/artykul/503260_Kanonik_od_sw_Krzyza.html.
- 2004c: *Gdzie jest Kopernik?*, “Głos Uczelni”, September (interviewed by Winicjusz Schulz); <http://www.glos.uni.torun.pl/2004/09/kopernik/>.
- 2004d: *Kopernikus’ Gebeine. Polnische Archäologen fahnden nach dem Grab des großen Astronomen*, “Frankfurter Rundschau”, 24 September, Nr. 223 I D/H/R/S/ (reported by Thomas Roser).
- 2005a: *Szukamy czaszki Kopernika*, “Rzeczpospolita” z dn. 18 sierpnia, nr 192 (interviewed by Krzysztof Kowalski); http://www.rzeczpospolita.pl/gazeta/wydanie_050818/nauka/nauka_a_2.html.
- 2005b: *Poszukiwanie grobu Kopernika*. In: Gingerich, MacLachlan 2005b, pp. 127–136. (ed.) 2005c / (ed.) 2006a: *Poszukiwanie grobu Mikołaja Kopernika*. Pod redakcją Jerzego Gąssowskiego. “Castrı Dominae Nostrae Letterae Annales” vol. II. Pułtusk: Wyższa Szkoła Humanistyczna im. Aleksandra Gieysztora, Bałtycki Ośrodek Badawczy, 2005; (ed.) 2006a (English translation): *The Search for Nicolaus Copernicus’s Tomb*. Editor: Jerzy Gąssowski. Pułtusk: The Pułtusk Academy of Humanities, Institute of Anthropology and Archaeology; Fundacja Kronenberga, Citibank Handlowy, 2006.
- 2005d: *Etos pracy badawczej a kwestia dziennikarskiej sensacji*. W odpowiedzi na zarzuty dr. hab. Michała Kokowskiego. In: *Webiste of the Wyższa Szkoła Humanistyczna w Pułtusku* (last access: December 2006); http://www.wsh.edu.pl/redaktor.php?view=1&art_id=258&pid=2&ret_id=2.
- 2006b: see Kubisz 2006.
- 2006c: *Poszukiwanie grobu Mikołaja Kopernika. Druga faza badań. Próba identyfikacji odkrytych szczątków*; http://www.biblioteka.ah.edu.pl/palio/html.media?Instance=wsh-postgres&_Option=Other&_Connector=data&_tableName=w_media&_colID=id&_colFileName=file_name&_colLastUpdated=last_updated&_colSize=doc_size&_colContent=content&_ID=957&_Checksum=1673719646.
- 2007a: see Wojciechowska 2007.
- 2007b: see Paszkowska 2007.
- (ed.) 2008a: *Badania nad identyfikacją grobu Kopernika / The Search for identity of Copernicus Tomb*. Pułtusk: The Pułtusk Academy of Humanities, Institute of Anthropology and Archaeology; Fundacja Kronenberga przy Citi Handlowy.
- 2008b: *Badania nad odkryciem grobu Mikołaja Kopernika oraz identyfikacją jego szkieletu*. In: Gąssowski (ed.) 2008a, pp. 8–39; <http://archeologia.ah.edu.pl/kopernik%20dna.html>.
- 2008c: see Hofman-Wiśniewska 2008.
- 2009a: see Zielińska 2009.
- 2009b: *To jest czaszka Kopernika*. “Focus Historia”, 29 May, 2009, no. 6, pp. 48–49; www.focus.pl/historia/artykuly/zobacz/publikacje/kosmiczna-lamiglowka/storna-publikacji/2/nc/1/.
- 2009c: *Odkrycie grobu Kopernika*, “Archeologia Żywa”, no. 5 (45), October–November, pp. 12–19 (a version of the paper: Gąssowski 2008b); on-line version

(07.12.2009): <http://media.wp.pl/kat,1022945,wid,11754743,wiadomosc.html?ticaid=1d3c2>.

2010a: *Spotkanie z Kopernikiem. Kulisy odkrycia*. Toruń: Adam Marszałek.

(ed.) 2010b: *Grób Mikołaja Kopernika. Odkrycie i identyfikacja / Nicolaus' Copernicus's Tomb. Discovery and Identification*. Pułtusk: Akademia Humanistyczna im. Aleksandra Gieysztora. Instytut Antropologii i Archeologii.

GAŚSOWSKI Jerzy, JURKIEWICZ Beata

2005a: *Rzetelnie rzecz biorąc...*, portEl.pl Elbląska Gazeta Internetowa (an interview with Prof. Jerzy Gąssowski and Beata Jurkowska, MA reported by Joanna Torsh) (18.08.2005); <http://www.portel.pl/artykul.php3?i=14896>.

2005b/2006a: *Poszukiwanie grobu Mikołaja Kopernika*. In: Gąssowski (ed.) 2005, pp. 11–19; wersja internetowa: *Sezon 2005 – Poszukiwanie grobu Mikołaja Kopernika*, <http://web.archive.org/web/20070305112556/archeologia.ah.edu.pl/Frombork.html>; 2006a (English translation): Gąssowski (ed.) 2006, pp. 9–19.

2007–2008: *Sezon 2006: Badania architektoniczno-archeologiczne w Archikatedrze we Fromborku*; <http://web.archive.org/web/20070305112556/archeologia.ah.edu.pl/Frombork.html>.

GINGERICH Owen

2009: *The Copernicus grave mystery*, “PNAS” (“Proceedings of the National Academy of Sciences of the United States of America”) July 28, vol. 106, no. 30 12215–12216, published online before print July 21, 2009, doi: 10.1073/pnas.0907491106; <http://www.pnas.org/content/106/30/12215.full>.

2010a: *Tajemnica grobu Kopernika*. Przeł. Jarosław Włodarczyk (a Polish translation of the article Gingerich 2009). In: Kopiczko, Jezierski, Żywica (ed.) 2010, pp. 27–30.

2010b: *Cud w ekspresie, czyli jak zostałem zaproszony na pogrzeb Kopernika*. Translated by Jarosław Włodarczyk (a Polish translation of an abridged version of the article: Gingerich 2011a). In: Gąssowski (ed.) 2010b, pp. 225–230.

2011a: *In the Orbit of Copernicus. A discovery of the great astronomer's bones, and their reburial in Poland*, “The American Scholar”, Summer 2011, Vol. 80, no. 3, pp. 43–49.

2011b: *Owen Gingerich. Professor Emeritus of Astronomy and History of Science*; <http://www.fas.harvard.edu/~hsdept/bios/gingerich.html> (access: 10.10.2011).

GINGERICH Owen, MacLACHLAN James

2005: *Mikołaj Kopernik: gdy Ziemia stała się planetą*. Translated by Jarosław Włodarczyk. Preface Jacek Jezierski. Afterword by Jerzy Gąssowski. Pułtusk: Wyższa Szkoła Humanistyczna im. Aleksandra Gieysztora.

GODDU André

2007: *Copernicus in person*, “Journal for the History of Astronomy”, vol. 38, pp. 255–256.

2010: *Copernicus and the Aristotelian tradition: education, reading, and philosophy in Copernicus's path to heliocentrism* (Brill, 2010); (Brill series: “History of Science and Medicine Library”, vol. 15, “Medieval and Early Modern Science”, vol. 12); <http://books.google.com/books?id=iEjk13-1xSYC>.

GÓRKA Marcin

2005: *Jak astronom odnalazł Astronoma*, "Gazeta Wyborcza. Wały Chrobrego. Magazyn Szczeciński", 18 November, pp. 9–10.

GÓRSKI Karol

1968: *Dom i środowisko rodzinne Mikołaja Kopernika*. Toruń: Towarzystwo Naukowe w Toruniu, "Prace Popularnonaukowe" no. 8, "Biblioteczka Kopernikańska" no. 1.

1973a: *Mikołaj Kopernik. Środowisko społeczne i samotność*. Wrocław: Ossolineum.

1973b: *Lukasz Watzenrode. Życie i działalność polityczna (1447–1512)*, "Studia Copernicana", vol. X. Wrocław: Ossolineum.

HENRIKSSON Göran

2009a: *Copernicus's shed hairs* (email of 09.03.2009 15:18 to M.K.).

2009b: "Göran Henriksson", Upsalla University, Astronomi och rymdfysik / Department of Physics and Astronomy, Unit Astronomy and Space Physics; <http://katalog.uu.se/empInfo/?id=N96-3322>.

HIPLER Franz

1872: *Analecta Warmiensia. Studien zur Geschichte der ermländischen Archive und Bibliotheken von Professor Dr. Franz Hipler, Regens des ermlandischen Priesterseminars zu Braunsberg*. Braunsberg: Verlag von Ed. Peter; I Bltt., 173 S. 8°; <http://kpbc.umk.pl/dlibra/doccontent?id=23722&dirids=1>.

HOFMAN-WIŚNIEWSKA Justyna

2008: *Dwa włosy Kopernika*, "Sprawy Nauki" (29.11.2008) (An interview with Prof. Jerzy Gąssowski, an archaeologist, the director of the Institute of the Anthropology and Archaeology at the Pultusk Academy of Humanities, by Justyna Hofman-Wiśniewska); http://www.sprawynauki.edu.pl/index.php?option=com_content&task=view&id=885&Itemid=35.

JENDRZEJEWSKA Joanna, STACHOWSKA Anna

2008: *Genealogia żeńskiej linii krewnych Mikołaja Kopernika – charakterystyka i stan badań / Nicolaus Copernicus's matrilineal genealogy – characteristics and progress examination*. In: Gąssowski (ed.) 2008a, pp. 66–133.

JUSZCZAKIEWICZ Michał

2008: *Copernicus Code Mystery trailer*, written and directed by Michał Juszcakiewicz, Michał Juszcakiewicz Art's Agency; http://www.youtube.com/v/HgGCL_Buy2U&hl=en&fs=1.

2009a: *Tajemnica grobu Kopernika / Copernicus Tomb Mystery* (a documentary film, 60 min); written and directed by Michał Juszcakiewicz; camera: Grzegorz Dolecki, Wojtek Habasiński, Marian Gorlikowski, Michał Juszcakiewicz; edited by: Radeck Moenert, Michał Juszcakiewicz; music: Ars Nova; Michał Juszcakiewicz Art's Agency.

2009b: Website of the film *Tajemnica Grobu Kopernika / Copernicus Tomb Mystery*; <http://www.copernicuscodemystery.com/page3/page3.html>.

2009c: *Historia Projekcji "Tajemnicy Grobu Kopernika"*; <http://www.copernicuscode.mystery.com/page3/page4/page4.html>.

2010: "Copernicus Tomb Mystery" won "Golden Dragon"; 22.09.10 09:02; <http://www.copernicuscodemystery.com/page12/page12.html>.

KACZMAREK Ryszard

2006: *Górny Śląsk podczas II wojny światowej: między utopią niemieckiej wspólnoty narodowej a rzeczywistością okupacji na terenach wcielonych do Trzeciej Rzeszy*, "Prace Naukowe Uniwersytetu Śląskiego w Katowicach", no. 2442. Katowice: Wydawnictwo Uniwersytetu Śląskiego.

KOKOWSKI Michał

2001: *Thomas S. Kuhn (1922–1996) a zagadnienie rewolucji kopernikowskiej (Thomas S. Kuhn (1922–1996) and the Issue of the Copernican Revolution)*, "Studia Copernicana", vol. XXXIX (Warszawa). ISBN 83-86062-02-9; pp. 397.

2004: *Nicolaus Copernicus and the interdisciplinary problem of the integration...* In: *Abstracts. Science in Europe – Europe in Science: 1500–2000 (Maastricht, 4–6 November, 2004)*. Gewina: Genootschap voor de Geschiedenis van de Geneeskunde, Wiskunde, Natuurwetenschappen en Techniek, The European Society for the History of Science), p. 48.

2005a: *Poszukiwania grobu Kopernika. Refleksje advocati diaboli*, on-line version: Part I; http://www.cyfronet.pl/~n1kokows/poszukiwania_cz_1_pl.html.

2005b: *Poszukiwania grobu Kopernika. Refleksje advocati diaboli*; on-line version: Part II; http://www.cyfronet.pl/~n1kokows/poszukiwania_cz_2_pl.html.

2007a: *Poszukiwania grobu Kopernika. Refleksje advocati diaboli*. Part 1–2, "Kwartalnik Historii Nauki i Techniki", vol. 52/1, pp. 121–131, 131–151.

2007b: *Aktualne poszukiwania grobu Kopernika: Wątpliwości, Problemy i Perspektywy*; (www.cyfronet.pl/~n1kokows/poszukiwania_pl.html); English version: *The Current Quest for Copernicus' Grave: Doubts, Problems and Perspectives*; (http://www.cyfronet.pl/~n1kokows/poszukiwania_en.html).

2008: *Co dalej z Mikołajem Kopernikiem? Historia, stan aktualny i perspektywy badań kopernikańskich w Polsce*, "Kwartalnik Historii Nauki i Techniki", vol. 53/3–4, pp. 69–82. Paper delivered at the conference "Mikołaja Kopernika Opera Omnia – zwińczenie edycji 2007" (Warszawa, Pałac Staszica, 10 December 2007).

2009a: *Poszukiwania grobu Kopernika. Refleksje advocati diaboli*. Part 1–3. Presentation delivered at the "Symposium of the Copernicus Centre for Interdisciplinary Research" (Kraków, 20.03.2009).

2009b: *Różne oblicza Mikołaja Kopernika. Spotkania z historią interpretacji (Different faces of Nicholas Copernicus. Meetings with a history of interpretations)*. Warszawa–Kraków: Instytut Historii Nauki PAN, Polska Akademia Umiejętności. ISBN 978-83-87992-67-5; pp. 676.

2009c: *Copernicus's shed hairs* (email of 9.03.2009 to dr. G. Henriksson).

(ed.) 2010a: *The conference: "Tajemnica grobu Mikołaja Kopernika. Dialog ekspertów" / "The Nicolaus Copernicus grave mystery. A dialogue of experts"* (Kraków, 22–23 February 2010); http://www.cyfronet.krakow.pl/~n1kokows/konferencja_tajem

- nica_pl.html; http://www.cyfronet.krakow.pl/~n1kokows/konferencja_tajemnica_en.html; the conference programme: <http://www.cyfronet.krakow.pl/~n1kokows/The-Nicolaus-Copernicus-grave-mystery-22-23.02.2010-Program.pdf>; http://www.cyfronet.krakow.pl/~n1kokows/kokowski_red_prog_tajemnica_grobu_22-23.02.2010.pdf.
- (ed.) 2010b: *The conference: "Tajemnica grobu Mikołaja Kopernika. Dialog ekspertów" / "The Nicolaus Copernicus grave mystery. A dialogue of experts"* (Kraków, 22–23 February 2010). Abstracts: http://www.cyfronet.krakow.pl/~n1kokows/kokowski_red_tajemnica_grobu_22-23.02.2010.pdf.
- 2010c: *Procedura identyfikacji szczątków nr 13/05 jako szczątków Kopernika w świetle racjonalności uzasadniania i retoryki perswazji*. The presentation delivered at the conference "Tajemnica grobu Mikołaja Kopernika. Dialog ekspertów" / "The Nicolaus Copernicus grave mystery. A dialogue of experts" (Kraków, 22–23 February 2010), summarized in: Kokowski (ed.) 2010b, pp. 5–6.
- 2010d: *Różne oblicza Mikołaja Kopernika* (2009) – website; http://www.cyfronet.pl/~n1kokows/oblicza_pl.html.
- 2010e: *Komentarz nt. notki serwisu "PAP – Nauka w Polsce" o konferencji "Tajemnica grobu Mikołaja Kopernika. Dialog ekspertów" / "The Nicolaus Copernicus grave mystery. A dialogue of experts"* (Kraków, 22–23 February 2010) – see "PAP – Nauka w Polsce" 2010b.
- (ed.) 2012a: *Tajemnica grobu Mikołaja Kopernika. Dialog ekspertów* (Kraków, 22–23 lutego 2010). Kraków: Polska Akademia Umiejętności, Centrum Kopernika Badań Interdyscyplinarnych. ISBN 83-86062-02-9, pp. 320.
- 2012b: *O wadliwości argumentów za ostatecznym odkryciem szczątków Mikołaja Kopernika*. Cz. II. Wyniki i interpretacja badań genealogicznych, historycznych oraz genetycznych. In: Kokowski (ed.) 2012a, pp. 217–309.
- KOROLCZUK Ewa, (współpraca) KURSKI Tomasz
- 2008: *Potwierdzone: oto szczątki Mikołaja Kopernika*, "Gazeta Wyborcza", 20.11.2008; electronic edition (last changed 20.11.2008 09:20): http://wyborcza.pl/1,75476,5967964,Potwierdzone__oto_szczatki_Mikolaja_Kopernika.html.
- KOPERNIK Mikołaj
- 1970, 1983, 2007: *Locationes mansorum desertorum; Lokacje łanów opuszczonych*. Redakcja Marian Biskup. Olsztyn: Pojezierze, wyd. I 1970, wyd. II 1983; wyd. III 2007. In: *Kopernik 2007*; <http://kpbc.umk.pl/dlibra/doccontent?id=42178&dirids=1>.
- 1976: *Dzieła wszystkie*. T. II: *O obrotach sfer niebieskich*. Translated by M. Brożek (book I), S. Oświęcimski (books II–VI). Commented by A. Birkenmajer, J. Dobrzycki. Edited by J. Dobrzycki. Warszawa: Państwowe Wydawnictwo Naukowe.
- 1985: *Complete Works*, vol. III: *Minor Works*. Ed. Paweł Czartoryski, translation and commentary Edward Rosen with the assistance of Erna Hilfstein. Warsaw: Polish Scientific Publishers.
- 2007: *Dzieła wszystkie*. Vol. 3: *Dzieła pomniejszych*. Prepared for print by: Tadeusz Bieńkowski, Marian Biskup, Jerzy Dobrzycki, Małgorzata Golińska-Giertych and Le-

szek Zygnier. Foreworded and edited by Andrzej Wyczański. Warsaw: Instytut Historii Nauki PAN, Wydawnictwo Sejmowe (in Polish).

KOSTRZEWA Jarosław

- 2008a: *Kopernik niebieskooki* (relacja wg informacji podanych przez prof. Wiesława Bogdanowicza i prof. Aleksandra Głazka), "Dziennik Polski", 21 November, no. 272 (19 586), vol. LXIV, p. 1.
- 2008b: *Kopernik mógł mieć niebieskie oczy* (a report based on the information provided by Dr Wojciech Branicki), "Dziennik Polski", 21 November, no. 272 (19 586), vol. LXIV, p. A3; <http://www.dziennikpolski24.pl/pl/aktualnosci/kraj/883748-kopernik-mlgl-miec-niebieskie-oczy.html>.
- 2008c: *Mikołaj Kopernik na Zamku Królewskim*, "Dziennik Polski" 26 November; <http://www.dziennikpolski24.pl/pl/aktualnosci/kraj/884988-mikolaj-kopernik-na-zamku-krllewskim.html>.
- 2008d: *O włos Kopernika*, "Dziennik Polski", 6–7 December, no. 285 (19 599), vol. LXIV, p. A4; <http://www.dziennikpolski24.pl/pl/aktualnosci/kraj/888031-o-wlos-kopernika.html>.
- 2008e: *Naukowcy szukają włosa Kopernika*, "Dziennik Polski", 6–7 December, no. 285 (19599), vol. LXIV, p. A4; <http://www.dziennikpolski24.pl/pl/aktualnosci/kraj/888031-o-wlos-kopernika.html>.
- 2009: *Na tropie genów Kopernika*, "Dziennik Polski" (10. 02.2009 06:00), <http://oko.dziennik.krakow.pl/Artykul.100+M51558ebe04a.0.html>.

KOZŁOWSKI Tomasz

- 2009a: see Słocińska (2009).
- 2009b: *Wstrzymać Kopernika! Ad vocem*, "Archeologia Żywa", vol. 6(46), pp. 38–42.
- 2010: *Refleksje antropologa nad identyfikacją szczątków kostnych znalezionych w Katedrze we Fromborku jako należących do Mikołaja Kopernika. Próba krytycznego spojrzenia*. Presentation delivered at the conference "*Tajemnica grobu Mikołaja Kopernika. Dialog ekspertów*" / "*The Nicolaus Copernicus grave mystery. A dialogue of experts*" (Kraków, 22–23 February 2010); summarized in: Kokowski (ed.) 2010b, p. 6.

KROHN Knut

- 2008: *Astronom Kopernikus-Grab: Identifizierung war ein Geniestreich*, "Der Tagesspiegel" (30.11.2008); <http://www.tagesspiegel.de/weltspiegel/kopernikus-grab-identifizierung-war-ein-geniestreich/1384612.html>.

KRZYŻANOWSKI Adrian

- 1843a/1843b: *Kopernik w Walhalli (Kopernik, Walhalla's Genoss)*, "Kuryer Warszawski" 19 February. Reprinted in: Polkowski (ed.) 1873–1875, vol. II, pp. 111–119; German translation 1843b: *Kopernik gehört nicht in die Walhalla*, "Jahrbuch für slavische Literatur, Kunst u. Wissenschaft", vol. 1 (1943), pp. 247–252.

KUBISZ Bogusław

- 2006: *Spojrzyć w oczy Kopernikowi*. O odkryciu grobu Mikołaja Kopernika z prof. Jerzym Gąssowskim, archeologiem z Wyższej Szkoły Humanistycznej im. Alek-

sandra Gieysztora w Pułtusku, rozmawia Bogusław Kubisz, "Mówią Wieki", February, no. 02/06 (554), pp. 10–12; http://www.mowiaiewieki.pl/artukul.html?id_artukul=1642.

KUPIEC Tomasz

2009: *Tajemnica pochówku astronoma*, "Genetyka i Prawo. Kwartalnik Naukowy Zakładu Genetyki Molekularnej i Sądowej", no. 2(5) Spring (Uniwersytet Mikołaja Kopernika Collegium Medicum Katedra Medycyny Sądowej), p. 13; http://www.zgms.cm.umk.pl/kwartalnik/GiP_02_2009.pdf.

KUPIEC Tomasz, BRANICKI Wojciech

2010: *Zastosowanie analizy mtDNA do identyfikacji szczątków ludzkich z grobu 13/05*. Presentation delivered at the conference "Tajemnica grobu Mikołaja Kopernika. Dialog ekspertów" / "The Nicolaus Copernicus grave mystery. A dialogue of experts" (Kraków, 22–23 February 2010); summarized in: Kokowski (ed.) 2010b, p. 7.

LANDAU Marta

2009: *Kopernik – przeciętny Europejczyk*, "Wprost" no. 31 (1386), 2 August, pp. 50–51; reprinted at the website of the Museum and Institute of Zoology of the Polish Academy of Sciences in Warsaw: <http://www.miiz.waw.pl/pliki/media/kopernik1.jpg>; <http://www.miiz.waw.pl/pliki/media/kopernik2.jpg>.

LACH-SZYRMA Krystyn

1844: *Copernicus and his native land*, "The Foreign and Colonial Quarterly Review" (London: W. Smith, Elder & Co.), pp. 361–393; <http://books.google.com/books?id=ldwRAAAAYAAJ>.

MIKULSKI Krzysztof

1996: *Watzenrodowie i dom rodzinny Mikołaja Kopernika w Toruniu*. In: (ed.) Roman Czajka, Janusz Tandecki, *Studia nad dziejami miast i mieszczanstwa w średniowieczu*, vol. 2. Toruń: Wydawnictwo Uniwersytetu Mikołaja Kopernika, "Studia Polonica Historiae Urbanae", vol. 2, pp. 257–266; <http://kpbc.umk.pl/dlibra/doccontent?id=46264&dirids=1>.

1997: *Watzenrodowie i kapituła warmińska. Rola związków rodzinnych w duchownych karierach mieszczan toruńskich w XIV i XV wieku*. In: Tomasz Jasieński, Tomasz Jurek, Jan M. Piskorski (eds.), *Homines et societates: czasy Piastów i Jagiellonów*. Poznań: Wydawnictwo Poznańskiego Towarzystwa Przyjaciół Nauk, "Prace Komisji Historycznej Poznańskiego Towarzystwa Przyjaciół Nauk", vol. 55, pp. 359–371.

2008: *W kręgu toruńskich przodków Mikołaja Kopernika – Watzenrodowie i ich koligacje rodzinne/In the circle of Nicolaus Copernicus's Toruń ancestors – the Watzenrodes and their family relationships*. In: Gąssowski (ed.) 2008, pp. 40–65.

2009: *Mikołaj Kopernik. Rodzina*. In the website *Nicolaus Copernicus Thoruniensis*; <http://copernicus.torun.pl/biografia/1473-1491/4/>.

MIZWA Stephen

1943: *Nicholas Copernicus, 1543–1943*. New York: The Kosciuszko Foundation; <http://kpbc.umk.pl/publication/29729>.

MŁODZIEJOWSKI Bronisław

2010: *Wydolność metod rekonstrukcji wyglądu twarzy w świetle współczesnej antropologii sądowej*. Summary of the paper, read with permission by Michał Kokowski at the conference “*Tajemnica grobu Mikołaja Kopernika. Dialog ekspertów*” / “*The Nicolaus Copernicus grave mystery. A dialogue of experts*” (Kraków, 22–23 February 2010). In: Kokowski (ed.) 2010b, p. 8.

NOGOSEK Robert J., C.S.C. Rev.

1982: *Joseph Nogošek Pioneer Builder and Prominent Farmer*; <http://skroch.org/tree/history/joseph-nogosek-history.html>.

“PAP – NAUKA W POLSCE” / “SERWIS NAUKA POLSCE – PAP SA”

2008a: *Naukowcy: tajemnica grobu Kopernika – wyjaśniona* (21.11.2008 00:00) (jmy/wos/zig/jwo); http://www.naukawpolsce.pap.pl/palio/html.run?_Instance=cms_naukapl.pap.pl&_PageID=1&s=szablon.depesza&dz=lewaszpalta.naukadlagospodarki&dep=331442.

2008b: *Najważniejsze wydarzenia w nauce polskiej w 2008 roku* (Katarzyna Czechowicz) (30.12.2008 00:10);—http://www.naukawpolsce.pap.pl/palio/html.run?_Instance=cms_naukapl.pap.pl&_PageID=1&s=szablon.depesza&dep=357879.

2010a: *Uroczystości powtórnego pochówku Kopernika potrwały trzy dni* (15.04.2010 00:45) (hes/mow/agt), http://www.naukawpolsce.pap.pl/palio/html.run?_Instance=cms_naukapl.pap.pl&_PageID=1&s=szablon.depesza&dep=371603.

2010b: *Naukowcy o tajemnicach grobu Mikołaja Kopernika – część z nich powątpiewa*, (24.02.2010 04:02) (CZO/kap); http://www.naukawpolsce.pap.pl/palio/html.run?_Instance=cms_naukapl.pap.pl&_PageID=1&s=szablon.depesza&dz=konkurs=PL&dep=370462&data=&lang=PL&_Checksum=212373794.

PASZKOWSKA Joanna/BOGDANOWICZ Wiesław, GAŚSOWSKI Jerzy, PIASECKI Karol, ZAJDEL Dariusz

2007: *Audycja Twarzą w twarz z Kopernikiem*” “Czaszka wielkiego astronoma” (Interviews with Prof. W. Bogdanowicz, Prof. J. Gąsowski, Prof. K. Piasecki, D. Zajdel, MA), Polskie Radio Online (7 May 2007); <http://www.polskieradio.pl/nauka/temattygodnia/artykul6600.html>; http://www.polskieradio.pl/_files/200702221306-11/2007110904543523.mp3 (13,81 MB).

PIASECKI Karol

2005a: see Górka 2005.

2005b: see Szczepkowska 2005.

2005c: see Pohl, Zieliński 2005.

2005d: *Uwagi do tekstu dr. hab. Michała Kokowskiego*. In: The website of the Wyższa Szkoła Humanistyczna w Pułtusku (last accessed in December 2006); http://www.wsh.edu.pl/redaktor.php?view=1&art_id=258&pid=2&ret_id=2.

- 2007: see Paszkowska 2007.
- 2008: *Etyczne problemy odkrycia naukowego. Przypadek Mikołaja Kopernika / The ethical problems of scientific discovery. The case of Nicolaus Copernicus*. In: J. Gąsowski (ed.) 2008a, pp. 196–203.
- 2009: *Wstrzymać Kopernika!*, “Archeologia Żywa. Magazyn Popularnonaukowy”, no. 5 (45), October–November, pp. 20–25.

PIASECKI Karol, ZAJDEL Dariusz

- 2005a/2006a: *Badania antropologiczne we Fromborku. Grób nr 13. Rekonstrukcja wyglądu głowy na podstawie czaszki*. In: Gąsowski (ed.) 2005c, pp. 27–37; 2006a (English translation): *Anthropological Research in Frombork. Tomb no. 13. Reconstruction of the appearance of the head on the basis of the skull*. In: Gąsowski (ed.) 2006a, pp. 21–36.

POHL Krystyna, ZIELIŃSKI Łukasz

- 2005: *To jest Mikołaj Kopernik!* (A report on the search for Copernicus’s grave; citation of Karol Piasecki), “Głos Szczeciński”, 10–11 November, pp. 6–7; photos: Andrzej Szkocki; infography: “Rzeczpospolita”, Paweł Moszczyński, FORUM, EASTNEWS.

POLKOWSKI Ignacy, ks.

- (ed.) 1873: *Album Mikołaja Kopernika*. Gniezno: Towarzystwo Przyjaciół Nauk w Poznaniu; <http://kpbc.ukw.edu.pl/dlibra/doccontent?id=39479>.
- (ed.) 1873–1875: *Kopernikijana czyli materiały do pism i życia Mikołaja Kopernika*, vol. 1–3. Gniezno: Drukiem J. Langiego; <http://kpbc.umk.pl/dlibra/docmetadata?id=39448>, <http://kpbc.umk.pl/dlibra/docmetadata?id=39449>, <http://kpbc.umk.pl/dlibra/docmetadata?id=39465>.
- 1875: *Wizerunki Mikołaja Kopernika*. In: Polkowski (ed.) 1873–1875, vol. 3, pp. 229–307.

POPPER Karl R.

- 1977: *Logika odkrycia naukowego*. Translated by Urszula Niklas. Warszawa: Wydawnictwo Naukowe PWN, 1st ed. 1977; 2nd ed. 2002.

POTT August Friedrich

- 1859: *Die Personennamen und insbesondere die Familiennamen ihre Entstehungsarten; auch unter Berücksichtigung der Ortsnamen. Eine sprachliche Untersuchung*. Leipzig: F.A. Brockhaus; <http://books.google.pl/books?id=-H1BAAAAYAAJ>.

PROWE Leopold

- 1853a: *Zur Biographie von Nicolaus Copernicus*. Thorn: Druck und Verlag von Ernst Lambeck; http://books.google.com/books?id=pTg_AAAAYAAJ.
- 1853b: *Mittheilungen aus schwedischen Archiven und Bibliotheken*. Berlin: Verlag der Deckerschen Geheimen Ober-Hofbuchdruckerei; http://kpbc.umk.pl/dlibra/applet?content_url=/Content/39484/Pomorze_035_12.djvu.
- 1873: *Monumenta Copernicana. Festgabe Zum 19. Februar 1873*. Von Leopold Prowe. Berlin: Weidmannsche Buchhandlung, VIII, 164 S. gr. 8°.

1883–1884: *Nicolaus Copernicus*. Erster Band: *Das Leben* (1883). Zweiter Band: *Urkunden* (1884). Berlin: Weidmannsche Buchhandlung; <http://www.archive.org/details/nicolauscopern01prowgoog>; <http://www.archive.org/details/nicolauscopern05prowgoog>.

“PRZEKRÓJ”

2009: *Nominowani do nagrody Fenomen Przekroju 2008*; http://www.przekroj.pl/pub/fenomeny/fenomeny_2008_informacja_prasowa.pdf.

“RZECZPOSPOLITA”

2008: *Przeboje 2008 roku w polskiej nauce*, “Rzeczpospolita”; <http://www.rp.pl/artukul/2,239886.html>.

SIKORSKI Jerzy

1973 (2nd ed. 1985; 3rd ed., revised and supplemented, 1999): *Prywatne życie Mikołaja Kopernika*. Olsztyn: Wydawnictwo Pojezierze; 2nd ed. – Olsztyn: Wydawnictwo Pojezierze, 1985; 3rd ed., revised and supplemented – Warszawa: Wydawnictwo Prószyński i S-ka, 1999.

1989: *Marcin Kromer a tradycja kopernikowska na Warmii*, “*Studia Warmińskie*”, vol. 26, pp. 139–148.

2005: *Grób Mikołaja Kopernika w katedrze biskupów warmińskich we Fromborku na tle polityki grzebalnej kapituły w XV–XVI wieku / Nicolaus Copernicus's tomb in the Warmia bishops' cathedra in Frombork in the light of the chapter's burial practices in the 15th to the 18th centuries*. In: Gąssowski (ed.) 2005c, pp. 81–173 / Gąssowski (ed.) 2006a, pp. 73–165.

2008: *Praktyka pochówków biskupich w katedrze we Fromborku oraz kwestia grobu Łukasza Watzenrodego, wuja Mikołaja Kopernika / The practise of bishops' burials in Frombork cathedral and the question of the grave of Nicolaus Copernicus's uncle, Łukasz Watzenrode*. In: J. Gąssowski (ed.) 2008a, pp. 134–155.

SIKORSKI Jerzy/BELZA Marta

2008: see Belza 2008.

SIKORSKI Jerzy/CZARTORYSKI-SZILER Piotr

2010: see Czartoryski-Sziler 2010.

SŁOCIŃSKA Teresa

2009: *Spór o szczątki wielkiego astronoma. Rozmowa z dr. Tomaszem Kozłowskim z Zakładu Antropologii UMK o wiarygodności szczątków Mikołaja Kopernika znalezionych w katedrze we Fromborku*. Rozmawiała Teresa Słocińska, “*Gazeta Pomorska*”, 14 April; <http://www.pomorska.pl/apps/pbcs.dll/article?AID=/20090414/REPORTAZ/403656392>.

SOŁTYSIAK Andrzej

2010a: *Kilka uwag do tekstu Karola Piaseckiego pt. “Wstrzymać Kopernika!”*, “*Archeologia Żywa*”, vol. 1(47), pp. 62–63.

2010b: *Myślenie magiczne w interpretacji archeologicznej. Próba klasyfikacji, przykłady, perspektywy*. The presentation delivered at the conference “*Tajemnica grobu Mikołaja Kopernika. Dialog ekspertów*” / “*The Nicolaus Copernicus grave mystery. A dialogue of experts*” (Kraków, 22–23 February 2010); <http://www.anthropologia.uw.edu.pl/AS/as-028.pdf>; summarised in: Kokowski (ed.) 2010b, p. 10.

SOŁTYSIAK Andrzej, KOZŁOWSKI Tomasz

2009: *Komentarz do identyfikacji cranium 13/05 z Fromborka jako kości Mikołaja Kopernika*, “*Archeologia Polski*”, vol. 54(2), pp. 377–386.

STANISŁAWSKA Aleksandra, FILC REDLIŃSKA Izabela, KOWALSKI Krzysztof, URBAŃSKI Krzysztof, KOŚCIELNIAK Piotr

2008: *Przeboje 2008 roku w polskiej nauce*, “*Rzeczpospolita*” (27.12.2008); <http://www.rp.pl/artukul/2,239886.html>.

STANISŁAWSKA-KLOC Sybilla

2009: *Zasady wykorzystywania cudzych utworów: prawo autorskie i dobre obyczaje (etyka cytatu)*, “*Diametros*” no. 19 (March 2009), pp. 160–184; <http://www.diametros.iphils.uj.edu.pl/?pdf=209>.

STEFANIAK Marcin

2008: *Misterium cranii Nicolai Copernici* (29 min 12 s), written and directed by Marcin Stefaniak. Warsaw: Fundacja Kronenberga przy Citi Handlowy.

STÖFFLER Johann

1518: *Calendarium Romanum magnum, Caesareae maiestati dicatum*. Oppenheim: Jacob Köbel; a copy of the ETH-Bibliothek Zürich, sign.: Rar 8909 q; <http://www.e-rara.ch/zut/content/pageview/772508>; <http://www.e-rara.ch/download/pdf/725955?name=Calendarium%20Romanum%20magnum>.

SUPRUNIUK Mirosław Adam

2005: *Mikołaja Kopernika portret młodości*; <http://www.bu.umk.pl/cymelia/chapman.html>.

SZCZEPKOWSKA Magdalena

2005: *Grób astronoma. An interview with Prof. Karol Piasecki, the manager of the Department of Social Anthropology at the Institute of Sociology and Psychology of the University of Szczecin*, “*Kurier Szczeciński*” 25 November, p. 11 (conducted by Magdalena Szczepkowska).

ŚNIEGOCKI Józef, KIELA Paweł, ŚNIEGOCKI Robert

2008: *The film “Światowe odkrycie archeologów z Pułtusza. Poznana tajemnica grobu Kopernika”*; KOPERNIK_AH.flv; <http://pl.youtube.com/watch?v=H76Wf-928eKo>; written and directed by Józef Śniegocki and Paweł Kiela; camera: Robert Śniegocki.

TORWIRT Leonard

1953: *Zagadnienie autentyczności portretu Mikołaja Kopernika, znajdującego się w Muzeum Pomorskim w Toruniu*, “*Ochrona Zabytków*”, vol. 6 (1953), no. 1, pp. 4–46.

“TVN24.PL”

2008: *To są szczątki Kopernika*, 2008.11.20, “Gazeta Wyborcza”, tvn24.pl, PAP (sm//kdj); <http://www.tvn24.pl/12690,1573901,0,1,to-sa-szczatki-kopernika,wiadomosc.html>.

UPPSALA UNIVERSITY LIBRARY

2002: *The Waller Manuscript Collection, Full Record Waller Ms pl-00045*; <http://waller.ub.uu.se/object.xsql?DBID=26248>.

2009a: *Copernicus Collection* (45 volumes); <http://www.ub.uu.se/en/Collections/Early-imprints/Special-collections/Copernicus-Collection/>.

2009b: *Copernicus Collection: Copernicus Porträtt*; <http://www.ub.uu.se/Global/Kulturavsmaterial/Äldre%20tryck/Copernicus%20porträtt.jpg>.

WASIUTYŃSKI Jeremi

1938 (2nd ed. 2007): *Mikołaj Kopernik. Twórca nowego nieba*. Warszawa: Wydawnictwo Przeworskiego; 2nd ed. (2007) – Toruń: Wydawnictwo Adam Marszałek.

1963: *Uwagi o niektórych kopernikanach szwedzkich*, “Studia i Materiały z Dziejów Nauki Polskiej”, ser. C, iss. 7 (1965), pp. 68–85.

WEBER Paul

1914: *Die Polen in Oberschlesien. Eine statistische Untersuchung*. Mit einem Vorwort “Die Fehlerquellen in der Statistik der Nationalitäten” von Professor Dr. Ludwig Bernhard. Berlin: Verlag von Julius Springer.

WOCIECHOWSKA Joanna

2007: *Może szwedzkie księgi pomogą odnaleźć Kopernika*, “Gazeta Wyborcza”, Olsztyn (a report based on an interview with Prof. J. Gąssowski by Joanna Wojciechowska) (08.02.2007); <http://miasta.gazeta.pl/olsztyn/1,93864,3906723.html>.

ZAJDEL Dariusz

2005a: *Rekonstrukcja prawdopodobnego-przyżyciowego wyglądu głowy na podstawie czaszki*. CD-R; Zespół Badań Antroposkopijnych, Centralne Laboratorium Kryminalistyczne Komendy Głównej Policji. Frombork, 03.11.2005.

2005b: *Czy tak wyglądał Mikołaj Kopernik?*, “Centralne Laboratorium Kryminalistyczne Komendy Głównej Policji”, <http://www.policja.pl/portal.php?serwis=clk&dzial=388&id=10826&search=1125>.

2006: *Czy tak wyglądał Kopernik?*, “Problemy Kryminalistyki”, no. 251, pp. 39–44; <http://clk.policja.pl/download.php?s=4&id=27816>.

2007: see Paszkowska 2007.

ZIELIŃSKA Hanna

2009: *O poszukiwaniu grobu Kopernika* (An interview with Prof. Jerzy Gąssowski conducted by Hanna Zielińska); TOK FM radio station, 1 February, 12.00–13.00. Files nau0102a.mp3, nau0102b.mp3 with the recording of the programme obtained from TOK FM radio station, author’s personal archives.

Michał KOKOWSKI

Department of History of Science, Natural Sciences and Technology, Ludwik and Aleksander Birkenmajer Institute for the History of Science, Polish Academy of Sciences; Copernicus Center for Interdisciplinary Studies, Poland; www.cyfronet.pl/~n1kokows/home.html; michal.kokowski@gmail.com

On the defectiveness of the argument for the finality of the discovery of the remains of Nicolaus Copernicus.

Part 2: Results and interpretation of genealogical, historical and genetic research¹

Abstract

The article presents a comprehensive critique of the argument in favour of the discovery of the remains of Nicolaus Copernicus. It analyses the arguments based on genealogical, historical and most of all genetic considerations, including the mathematical fundamentals of estimation a random match of mtDNA profiles.

The following assertion results from the presented criticism: Based on the results provided by the team of Jerzy Gąssowski, it is not possible to reasonably claim that the grave of Nicolaus Copernicus was discovered. Therefore, this research should be continued in order to increase the strength of the argument and obtain new evidence.

Keywords: Nicolaus Copernicus, Copernicology, likenesses of Copernicus, Copernicus's ethnicity, genealogy, mtDNA, Y-DNA, mtDNA and Y-DNA population bases, methods for estimating the probability of a random match of mtDNA profiles for the general case and the extreme cases, genetic genealogy, ethnogenesis of Slavs and Germans, ethnic origin of the population of Silesia, ethnic origin of the Toruń burghers, methodology of interdisciplinary research.

¹ The following article was peer-reviewed by: Professor Karolina Targosz, Habilitated Doctor in Humanities (Ludwik and Aleksander Birkenmajer Institute for the History of Science, Polish Academy of Sciences) – the historical issues and the iconography of Copernicus; Professor Tadeusz Dobosz, Habilitated Doctor in Medical Sciences – the issues of DNA analyses (Department of Molecular Techniques, Chair of Forensic Medicine, Faculty of Medicine, Medical Academy in Wrocław; a member of the Forensic Genetics Commission of the Polish Society of Forensic Medicine and Criminology); Rev. Zbigniew Liana, PhD (Chair in Natural Philosophy, Philosophical Faculty, The Pontifical University of John Paul II in Kraków) – methodological issues.

This text develops a part of the theses outlined in the paper “The procedure of identification of the remains no. 13/05 as the remains of Copernicus in the light of rationality of reasoning and



1. Introduction

“According to the authors of the search for the grave of Nicolaus Copernicus for the discovery of this grave and the remains of this great thinker speak the irrefutable, consistent scientific arguments of varied nature:

1. In-depth reading of historical sources.
2. The results of the archaeological and anthropological-anthroposcopic research.
3. The comparison of the skull 13/05 with the portraits of Copernicus.
4. The comparison of the facial reconstruction from the skull 13/05 with the portraits of the astronomer.
5. The knowledge of the facts regarding the ethnicity of the population of Silesia and Toruń in 13th–14th century and the parents of Copernicus and Copernicus himself.
6. The knowledge of the history of the manuscripts of Copernicus’s writings and his personal library.
7. The results of the genetic research into the alleged remains of Copernicus and the hairs from the book by Johannes Stöffler (*Calendarium Romanum magnum, Caesariae maiestati dicatum*), which for a quarter of a century was used by the astronomer, including:
 - a) the comparison of the result of the analysis of HERC2 gene (determining eye colour) with the portraits of Copernicus;
 - b) proper understanding of the methods of statistical analysis of genetic data;
 - c) the knowledge of the mtDNA and Y-DNA population databases.

However, in the light of the detailed interdisciplinary analysis carried out by the author of this article, it appears that despite the public-wide acceptance of the argument presented by the authors in favour of the thesis of the ultimate discovery of the remains of Nicolaus Copernicus this argument *is flawed* for many relevant reasons” (Kokowski 2012b, pp. 179–180).

the rhetoric of persuasion” (delivered at the conference “The secret grave of Nicolaus Copernicus. Dialogue of experts”, Kraków, 22–23 February 2010) and the paper “The search for the grave of Copernicus. Reflections of *Advocati diaboli*” (delivered during the “Copernicus Center Colloquium” # 1, Kraków, 20 March 2009). This text is also a supplement of my previous article entitled “About defectiveness of argument for the ultimate discovery of the remains of Nicolaus Copernicus. Part 1: Results and interpretation of historical, archaeological, anthropological and anthroposcopic research”, published in this volume. The topics discussed here will be developed in more detail in a separate comprehensive interdisciplinary monograph, to which the interested reader is referred now.

2. Thematic scope

In the previous article published in this volume I synthetically explained the deficiencies of the evidence so far presented regarding the first, the third, and the fourth of the above issues. In this article I will focus on the analysis of the issues from the fifth to the tenth on the list.²

3. The failure of the quest for Copernicus's relatives

The following constituted very important parts of the programme of the search for the alleged remains of Nicolaus Copernicus:

1. Extensive genealogical research into the relatives of Copernicus in maternal and paternal lineages.
2. The search for the remains of Copernicus's relatives, which – in the absence of any knowledge about the potential location of the graves of other members of the immediate family of Copernicus – was limited only to the search for the tomb of bishop Watzenrode.

The genealogical research into the relatives of Copernicus in maternal and paternal lineages was carried out by a team of researchers, which consisted of Prof. Krzysztof Mikulski, Habilitated Doctor, Joanna Jendrzewska, MA, and Anna Stachowska, MA. It is an undisputed fact that these studies have yielded many important and valuable results. However, thanks to the research so far carried out, the family tree has been determined only to the mid-eighteenth century (cf. Mikulski 2008; Jendrzewska, Stachowska 2008; Mikulski, Jendrzewska, Stachowska 2010).

On the other hand, the search for the tomb of bishop Watzenrode was carried out by the team of archaeologists, which consisted of, among others, Prof. Jerzy Gąssowski, Habilitated Doctor, Beata Jurkiewicz, MA and Dr. Ryszard Cichocki.³ These works were targeted by the previous analysis of historical sources made by Dr. Jerzy Sikorski (Sikorski 2008).⁴ Unfortunately, despite the efforts made, the search did not yield a positive result.

² Cf. Kokowski 2012b, chapter 2. Incidentally, I would like to add that my interest in the subject of the assessment of the value of DNA typing methods conducted stems from my genealogical research. In the context of these studies, natural questions appeared: To what extent, in mathematical sense, are the results of the analyses of the DNA profile valid? How detailed must the analysis of the DNA profile be so that it does not lead to wasting (great!) sums of money?

³ Cf. Gąssowski 2008b; Cichocki 2008.

⁴ Let me add that I formulated myself the working hypothesis that we should look for the grave of bishop Watzenrode in the chancel near the main altar (cf. Kokowski 2005a/2007a; 2005b/2007b –

4. Lack of an independent test of the discovery

Finding the relatives of Nicolaus Copernicus (living or deceased) was an important element of the programme of the search for his burial, because it would lead to gaining genetic material that would be used to test the kinship with the genetic material of Nicolaus Copernicus. This test would simultaneously be a test for the results obtained so far by Gąssowski's team (that is the comparison of the skull 13/05 and the facial reconstruction by D. Zajdel with the portraits of Copernicus).

The failure in finding relatives meant it was impossible to conduct the DNA parentage testing. Thus, at this stage of the research one could not see any possibility of strengthening the argument for the discovery of the tomb of Copernicus. The output of this stalemate situation – in accordance with the assurances made by the authors of the search and a large group of their spokespeople – resulted in collaboration with Swedish researchers.

5. Swedish breakthrough in the research

On the initiative of Władysław Duczko,⁵ Habilitated Doctor (an archaeologist and a historian expert in the first millennium of the European history, employed at the University of Uppsala since the 1980s and at the Pułtusk Academy of Humanities since 2004), Jerzy Gąssowski was invited to give an inaugural lecture on the search for the grave of Copernicus during the “Polish Days,” organized in Uppsala by the Polish Institute in 2006. The lecture took place on 13th October. One of the listeners was Göran Henriksson, PhD, an astronomer and astro-historian, who for many years collaborated with Władysław Duczko in his archaeological research in Old Uppsala. During this lecture Henriksson came up with the idea of looking for traces of the DNA Copernicus left in several manuscripts of his own letters and extensive book collection, stored since 1626 years as spoils of war in the libraries in Uppsala. Göran Henriksson shared this idea with Władysław Duczko on October 19, 2006, after hearing his lecture on the study of Old Uppsala.

After returning to Poland, Władysław Duczko informed Jerzy Gąssowski about this idea. Soon, Associate Professor Marié Allen, PhD (a geneticist employed in the Department of Genetics and Pathology, Uppsala University) was invited to

these publications were known to the authors of the quests). And just there the Gąssowski team looked for this tomb in 2006 (cf., for example, Gąssowski 2010a, p. 4, the photograph under the misleading title “Getting DNA by professor Marié Allen”). However, as we know from the article by Thomas Węclawowicz (cf. Węclawowicz 2008, p. 188–191, p. 184 photograph 18, p. 186 photograph 18, p. 187 photograph 19), the search were unsuccessful, since no grave was found there.

⁵ Cf. Duczko 2010, p. 32–33.

the collaboration in the search for the traces of Copernicus's DNA (prior to that, she participated in, among others, the identification of the remains of St. Bridget of Sweden – see Nilsson, Possnert, Edlund, Buildings, Kjellström, Allen 2010):

A new thread of explorations occurred suddenly where it was not expected at all. during the 'Polish Days' organised in Uppsala in October 2006, in an inaugurating lecture I presented our achievements in the project searching for an identifying the remains of Nicolaus Copernicus. It is known that in the collections of the university library in Uppsala there are the books of our astronomer that were brought to Sweden as war booty in the year 1626. Ph.D. Göran Henriksson from the Institute of Physics and Astronomy of the University of Uppsala listened to the lecture. He undertook the task of analysing the authenticity (*sic*) of the letter of Nicolaus Copernicus that is a part of the collection of the University (it regards the alleged autograph of the letter of Nicolaus Copernicus to Bernard Wapowski pasted into the second edition of *De revolutionibus* (of 1566), which is held by the library of the University of Uppsala; see: Gąssowski 2008b, p. 34 photo 9 – M. K.). His examinations (*sic*) prove that the handwritten notes made on the margins of the book from Copernicus's collection in Uppsala were actually made by the great astronomer himself (Gąssowski 2008b, p. 35).

As we know from many publications, including the interviews given by M. Allen (2007), J. Gąssowski (2007c), and finally of the article by W. Duczko (2010, p. 33), what was originally planned were the analyses of the DNA traces, such as blood and saliva left in Copernicus's letter to Bernard Wapowski (also called in the literature "Copernicus's letter against Johann Werner"). The letter mentioned – as assured by Dr. Henriksson – was first thought to be the original.⁶ According to G. Henriksson, Paul Czartoryski, a historian of science, believed that.⁷ However, reportedly, the idea to conduct a DNA test was eventually abandoned due to the consequent necessity to destroy the sample of the letter collected for testing.⁸ It turned out that it was a very wise decision... since this research could not determine anything due to the two(interrelated) reasons shown below:

1. The alleged autograph of the letter of Nicolaus Copernicus to Bernard Wapowski can be found in the volume with the catalogue number *Collect. Hjärther H III. 34*, deposited in the library of the Astronomical Observatory in Uppsala. The volume, except the aforementioned letter, includes the second edition of *De revolutionibus* (Basel 1566; not the first edition of 1543!), and the work of Johannes Regiomontanus *De triangulis Planis et sphaericis libri V* (Basel 1561). The letter is written on the ante folio recto

⁶ Cf. Gąssowski 2007a; 2008b, p. 32–35; 2009b, p. 19, and Grabarczyk 2008; Duczko 2010, p. 33; Henriksson 2010a, p. 206; 2010b, p. 213.

⁷ Henriksson 2009a; 2009c; 2010a, p. 207; cf. also Korolczuk, Kurski 2008.

⁸ Henriksson 2009a, cf. also Duczko 2010, p. 33.

and verso of the entire volume, as well as on the post folio recto and verso, and it ends on the inner side of the second cover. Therefore the letter is only a copy of the lost autograph letter of 3 June 1524. All these facts were reported for the first time by Ludwik Antoni Birkenmajer, who discovered the copy in Uppsala (see 1900, pp. 497–501), and none of the specialists ever questioned this view (cf., for example, Drewnowski 1978, p. 13, illustration 1 after page 32; Rosen, 1985, p. 141; Dobrzycki 2007, p. 7). One can also easily make personally certain of the findings of L. A. Birkenmajer by comparing the handwriting styles of the author of the Uppsala copy of the letter and the handwriting style of Copernicus's autograph of *De revolutionibus* – they are completely different (fig. 1 and 2),⁹

2. There is no empirical evidence (historical source) that Prof. Paweł Czartoryski ever acknowledged the thesis that the above-mentioned manuscript of the letter belonging to the library of the Astronomical Observatory in Uppsala is the original letter of Copernicus to Bernard Wapowski. If he had even claimed that in 1973 in Uppsala – which is attributed to him by Dr. Henriksson in his interviews and lectures, and which he confirmed in the correspondence with me¹⁰ – Prof. Czartoryski would have had to oppose the thesis of Prof. Ludwik Antoni Birkenmajer (Birkenmajer 1900, pp. 497–498). This, however, is highly questionable (considering the research standards of Prof. Paweł Czartoryski, whom I personally knew).

Contrary to the claims of Jerzy Gąssowski,¹¹ Göran Henriksson is not the discoverer of the fact that there are handwritten notes that our great astronomer wrote himself on the margins of the books from Copernicus's personal library, kept now in Uppsala. This discovery is credited to Leopold Prowe, a German historian, who informed about it in 1853. (I would like to add that in addition to Copernicus's notes in his book collection, there are also notes of other authors, which... obviously complicates the study). Later, other scholars had great merit in this field, among others: Maximilian Curtze, Franz Hipler, Ludwik Antoni Birkenmajer (Jagiellonian University; Polish Academy of Arts and Sciences), Aleksander Birkenmajer (Jagiellonian University; Polish Academy of Arts and Sciences), Institute for History of Science, Polish Academy of Sciences), Jeremi Wasiutyński (Polish emigrant independent researcher, Sweden), Jerzy Dobrzycki (Institute for History of Science, Polish Academy of Sciences), Paweł Czartoryski (Institute for History of Science, Polish Academy of Sciences), Grażyna Rosińska (Insti-

⁹ I informed about this and related the facts to Doctor G. Henriksson in the email in March 2009 (Kokowski 2009c), and in two papers presented in 2009 and 2010 (Kokowski 2009a, 2010c).

¹⁰ *Ibidem*.

¹¹ Cf. Gąssowski 2008b, p. 32, 34–35.

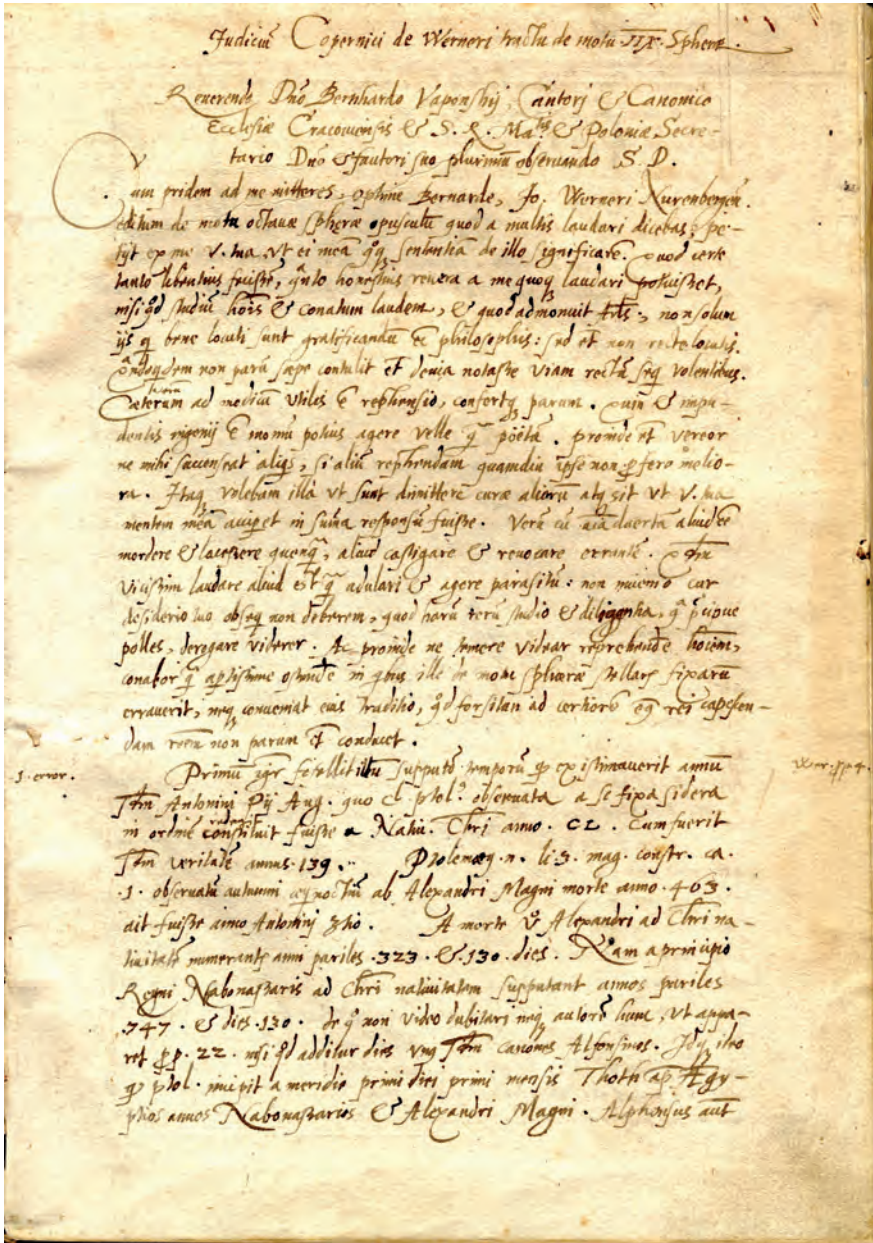


Fig. 1. N. Copernicus, *Letter against Werner*, p. 1 (source: Uppsala, Astronomiska Observatoriet, Collect. Hjärther H III. 34¹²).

¹² I would like to thank Ms. Laily Österlund, Head of the Section Old Prints of Carolina Rediviva Library in Uppsala, for the opportunity to reprint the illustration.

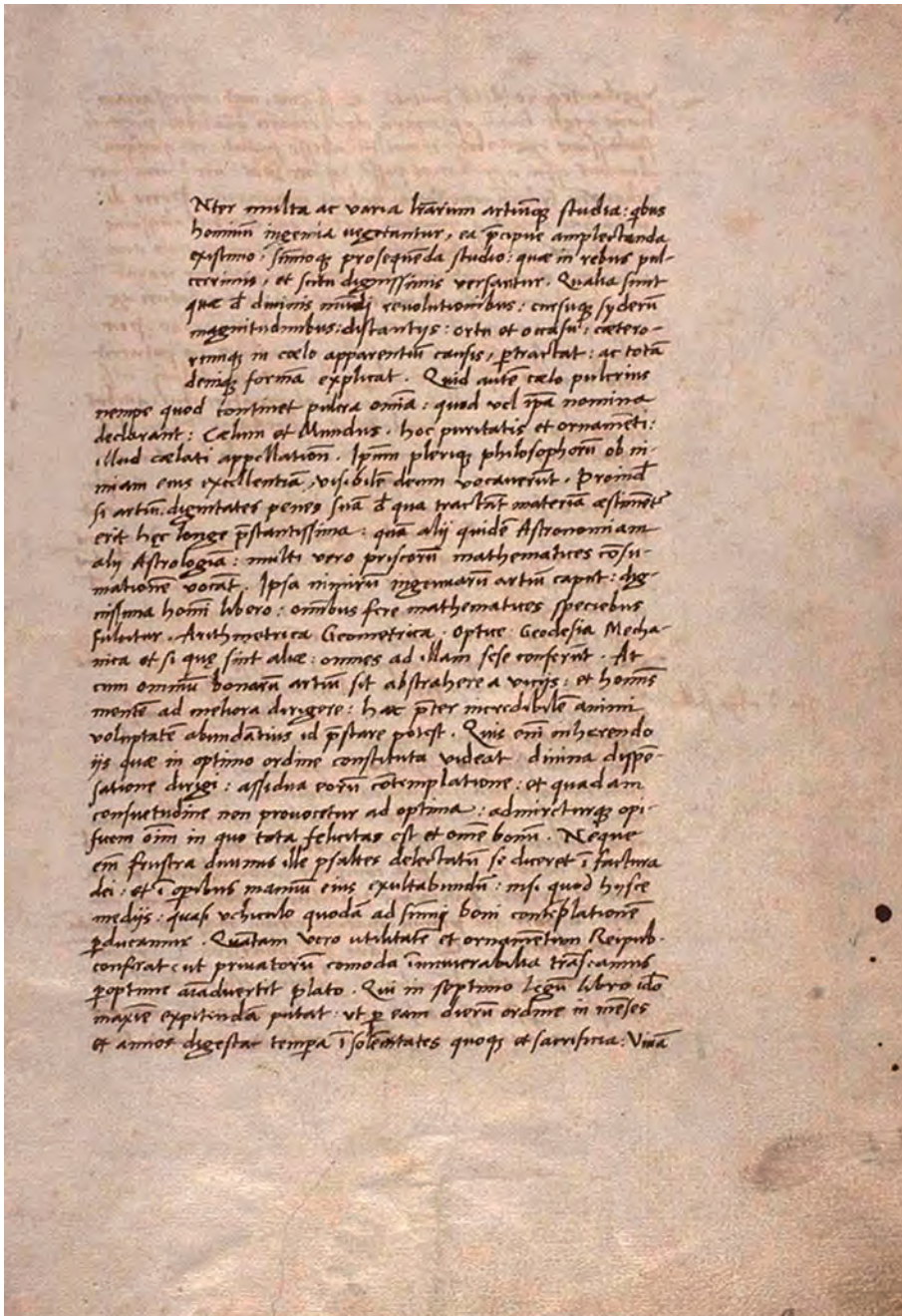


Fig. 2. N. Copernicus, The autograph *De revolutionibus*, bk. I, p. 1r (source: Jagiellonian Library, Manuscripts: *De revolutionibus*, <http://www.bj.uj.edu.pl/bjmanus/revol/images/001r.jpg>).

tute for History of Science, Polish Academy of Sciences) and Owen Gingerich (a collaborator of Dobrzycki, Harvard University).¹³

The above-quoted section of Gąssowski's text is by no means the only one in which the author spoke about the Copernican subject-matter, known to him only in informally. Here is another example taken from an interview he gave to J. Hofman-Wiśniewska in 2008:

Copernicus's personal library located in Sweden had been looked into by no one (*sic*). Not only is it in Latin, it is a very difficult, sixteenth-century Latin. In Poland, there are probably only two specialists who are able to read it. Besides, the astronomical works do not make fascinating reading (*sic*). They stood quietly on the shelf, and probably had not been opened since the time of Copernicus (*sic*). Among these books the personal calendar of the great astronomer (*sic*) was found. Formerly, calendars were downright compendia of knowledge. Copernicus had such a calendar with mathematical tables, which would come in very handy for his everyday use. It is in this calendar that the hairs were found; a few hairs. Each hair was analysed, on the basis of which four hairs were selected that potentially gave (potentially) a (high) probability of (making) a recognition (Gąssowski 2008c, p. 4; translation – M.K.).

In the quoted text there is the unambiguous assertion (very important for the issue of the thesis on finding the remains of Copernicus) that no one had studied the personal library of Copernicus. As I stated above already, this is an erroneous thesis. There were many scholars who dealt with this issue, and a particular interest was shown by German (in the second half of the 19th century), Polish (from the end of the 19th century to the 1970s) and American researchers (since the 1970s). They were, among others, Leopold Prowe, Franz Hipler, Maximilian Curtze, Ludwik Antoni Birkenmajer (UJ, AU), Aleksander Birkenmajer (JU, AAS, IHS PAS), Jeremi Wasiutyński (after World War II, Polish emigrant independent researcher, Sweden), Jerzy Dobrzycki (IHS PAS), Paweł Czartoryski (IHS PAS), Grażyna Rosińska (IHS PAS), Owen Gingerich (a collaborator of Dobrzycki, Harvard University).

In particular, all the works of Copernicus stored in Swedish libraries (as war booty) since 1626 were carefully examined by Polish scholars in the late 19th century, in July and August 1911, and in the 1970s.¹⁴ Moreover, to celebrate the

¹³ Cf., for example, Prowe 1853b; 1873, Hipler 1872; Curtze (ed.) 1875; Curtze (ed.) 1878; Birkenmajer 1900; Barwiński, Birkenmajer, Łoś 1914; Dobrzycki 1973; Czartoryski 1978; Wasiutyński 1963; Rosińska 2002 oraz Gingerich 2002; 2004a; 2004b. On the achievements of Gingerich cf. Maciejewska 2008.

¹⁴ Cf., among others, Birkenmajer 1900; Barwiński, Birkenmajer, Łoś 1914 and Czartoryski 1978.

United Nations' Year of Copernicus, held in 1973, all these works were lent to Poland and it was then when the microfilms of these works were made.¹⁵

On the other hand, Copernicus's works (and his book collection) *never* aroused in Sweden sufficient interest that would result in establishing there a scholarly tradition of Copernican research. (This explains the elementary mistakes made by G. Henriksson). Hence, it is not true that "Copernicus's personal library located in Sweden had been looked into by no one." I would like to emphasize that this is an important assertion, because the fact that supposedly no one had looked into these books, was to prove that the hairs found in those books *must have had to* belong to Copernicus!

Incidentally, I would like to add that it is impossible to agree with the other thesis of J. Gąssowski cited above that "the astronomical works do not make fascinating reading" (Gąssowski 2008c, p. 4). Though, the following, more precise statement should be considered as the unquestionable truth: "The astronomical works do not make... fascinating reading *for people not interested in astronomy*." For it is a truism to say that there are such people among ordinary mortals, including, among others, Nicolaus Copernicus, who valued this domain of science. Therefore, it will be reasonable to recall in this context the words of Nicolaus Copernicus from the preface to *De revolutionibus* (dedicated to Pope Paul III): "Mathemata mathematicis scribuntur" ("Mathematics is written for mathematicians"), directed against ignorant and arrogant people, such as Lactantius (otherwise a good writer), who had the audacity to scoff at mathematicians (astronomers) and philosophers who asserted that the Earth is a sphere (and not that it is flat)!

Moreover, it is wrong to claim that Copernicus, a Canon of the Warmia Chapter was a priest, a clergyman (that is he had received major holy orders, becoming a deacon or a priest), which is maintained by Jerzy Gąssowski and Beata Jurkiewicz (see Gąssowski 2005b, p. 129; Gąssowski, Jurkiewicz 2005b, p. 19), and a team of researchers involved in the analysis of DNA of the alleged remains of Nicolaus Copernicus (see Bogdanowicz *et al.* 2009, p. 12279). The experts, who have studied this issue, accept the opposite view – he had only minor orders (see Kokowski 2009b, pp. 369–370 fn. 335 – an overview of the discussion of this issue; Gingerich 2009, pp. 12216 and 2010, pp. 29 – a short note).

In the context of this kind of erroneous assertions proclaimed about Copernicus,¹⁶ I want to formulate the following strong thesis. In the above-cited state-

¹⁵ One of the sets of these microfilms can be found in the Jagiellonian Library in Kraków. I used them personally in my own research, among others, during the work on my post-doctoral dissertation (*habilitation thesis*).

¹⁶ I can even provide a much longer list, mentioning, among others, significant deficiencies in the knowledge of portraits of Copernicus – see chap. 7.6 of this article and my earlier publications, e.g. Kokowski 2005a/2007a; 2005b/2007a, 2011b.

ments by Jerzy Gąssowski an *implicitly accepted assumption* clearly manifests itself, namely that a lack of expertise in Copernicus and the historical context does not affect the soundness of the reasoning concerning the identification of the remains of the astronomer.¹⁷ Speaking more generally, according to Jerzy Gąssowski and his team, a specialized knowledge on the topic of Copernicus and the historical context are not *necessary* components of the *research hermeneutics* (that is the total interpretative tools used during the research), which should have been used to solve the puzzle of the identification of the remains of this person.¹⁸

In this article, on the example of a detailed analysis and interpretation of the results of DNA testing of Copernicus's putative remains, I will show that this seemingly reasonable assumption is incorrect. At the same time, I will claim that the adoption of this implicit assumption determined the overall rhetorical strategy of the publications on the identification of the remains of Copernicus and caused very serious weakening of the evidence presented in favour of the thesis that the remains of Copernicus had been found.

6. On the common opinion on the evaluation of the results of DNA analysis of the putative remains of Nicolaus Copernicus

According to the common opinion (formed by the authors of the research, the sponsors of these studies, journalists, etc.) the DNA analysis of the putative remains of Copernicus together with the interpretation of these results were carried out perfectly, which, among others, is amply suggested in three films: *Tajemnica grobu Kopernika / Copernicus Tomb Mystery* (60 min), written and directed by Michał Juszczakiewicz (Michał Juszczakiewicz Art's Agency, 2008); *Światowe odkrycie archeologów z Pułtuska. Poznana tajemnica grobu Kopernika / A world discovery of archaeologists from Pułtusk. The unveiled mystery of the grave of Copernicus* (6 min 13 s), written and directed by Józef Śniegocki, Paweł Kiela, photography: Robert Śniegocki (A. Gieysztor Higher School of Humanities in Pułtusk, 2008); and *Misterium cranii Nicolai Copernici* (29 min 12 s), written and directed by Marcin Stefaniak (The Kronenberg Foundation at Citi Hadlowy, 2008), and the verdicts of the award committees: *The "Przekrój" Phenomenon of 2008*, of the weekly magazine "Przekrój", *Polish science hits of 2008* of the daily newspaper "Rzeczpospolita" and *The most important events in Polish science in 2008* of the online service "PAP – Nauka w Polsce" (2008b).

¹⁷ I pointed to it in the previous article (Kokowski 2011b) and in two papers delivered in 2009 and 2010 (Kokowski 2009a, 2010c).

¹⁸ On research hermeneutics see my remarks in: Kokowski 2001, pp. 6–8.

According to this view, everything in these studies was perfect: the presented empirical evidence, the adopted research methodology (including conducting the DNA analyses by three independent teams), the choice of collaborators from different disciplines, the organization of their collaboration (so that they were able to exemplarily solve the problem of interdisciplinary character of the issue being examined) and the arguments in favour of the thesis of the final, definitive discovery of the remains of Copernicus based on the results of the DNA analyses of the putative remains of the astronomer.

7. Doubts

There exists a whole group of substantial doubts in regard to the alleged perfection of the DNA testing of the putative remains of Copernicus and the interpretation of these results. I present them in the following sub-sections.

7.1. Unsubstantiated character of the theses

From the point of view of a methodologist of empirical sciences, the authors of the DNA testing of the alleged remains of N. Copernicus adopted quite a surprising strategy in their scientific publications. By limiting themselves to merely giving the results of the mtDNA and Y-DNA analyses, they did not present any evidence that they had conducted such analyses, since they did not attach the detailed tables or graphs with measurements, for example, of the relevant chromatograms (also called electropherograms in the literature).¹⁹

However, there is one significant exception to this rule, which, read literally, negates the thesis proclaimed regarding the determined mtDNA sequences of the hairs. That is to say, in the article of Marié Allen (2008, p. 232) it is claimed that the chromatograms attached on page 233 show a difference (with respect to the so-called revised Cambridge Reference Sequence – rCRS, that is the corrected reference sequence determined originally by the team of Dr. Fred Sanger from the University of Cambridge) in position 16316 (A/G) of the four samples (teeth, three hairs) analysed. However (see above fig. 3), the charts suggest that what is shown here, is rather the difference in position 135 (A/G) – hence the expression visible in the so-called “currently selected option panel” (“agent Box”) “28 frag bases selected at a consensus position 135”, and under the chromatograms for the three samples (tooth, two hair) “Fragment base # 135” (additionally, I want to point out here that there is no “R” sign on the icon of the “Andersen” sample –

¹⁹ This regards empirical evidence (and probable knowledge) and not logical-epistemological evidence (and absolutely certain knowledge). Cf. also section 13, below.

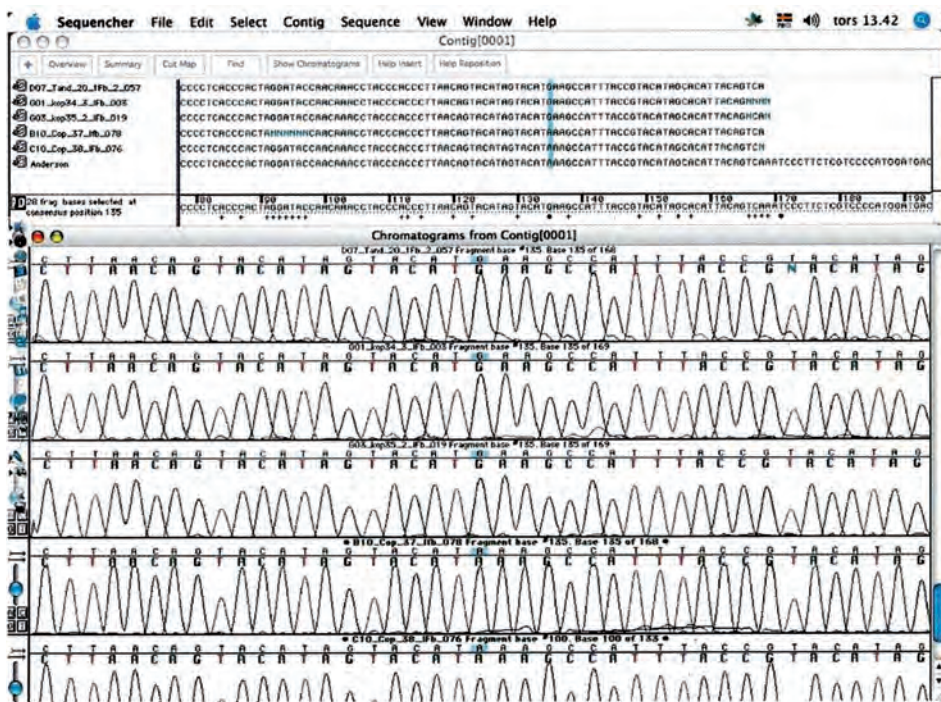


Fig. 3. M. Allen, *The sequences of the chromatograms of four samples of the teeth and the three hairs, showing a difference in position 16316 (A / G) with respect to rCRS* (source: Allen 2008, p. 233).²⁰

and this sign means that the “Reference sequence” or “comparative sequence” has been selected correctly).²¹

A similar discrepancy is also visible on the website of the Kronenberg Foundation (2008a) “Photo Gallery”, photo no. 4 (reproduced in fig. 4) and 5 (fig. 5): the chromatograms show the difference in position 135 (A/G), and not in position 16316 (A/G).

What can the indicated differences mean? I provide below four versions of response, *dependent on the different assumed level of knowledge* regarding the results provided by the measuring device used, which in this case was a program for DNA sequence analysis, namely Sequencher®, version 5.0.²² At the same time, I point out the erroneous theses in the responses provided:

²⁰ I would like to express my gratitude to the Aleksander Gieysztor Academy of Humanities in Pułtusk for the opportunity to reprint the full version of this illustration.

²¹ Cf. Ginsburg 2002; Gene Code Corporation 2007, 2008, 2009; Ginsburg 2011a; 2011b.

²² Sequence Analysis Software, Gene Codes Corporation, Ann Arbor, MI USA; <http://www.genecodes.com>.

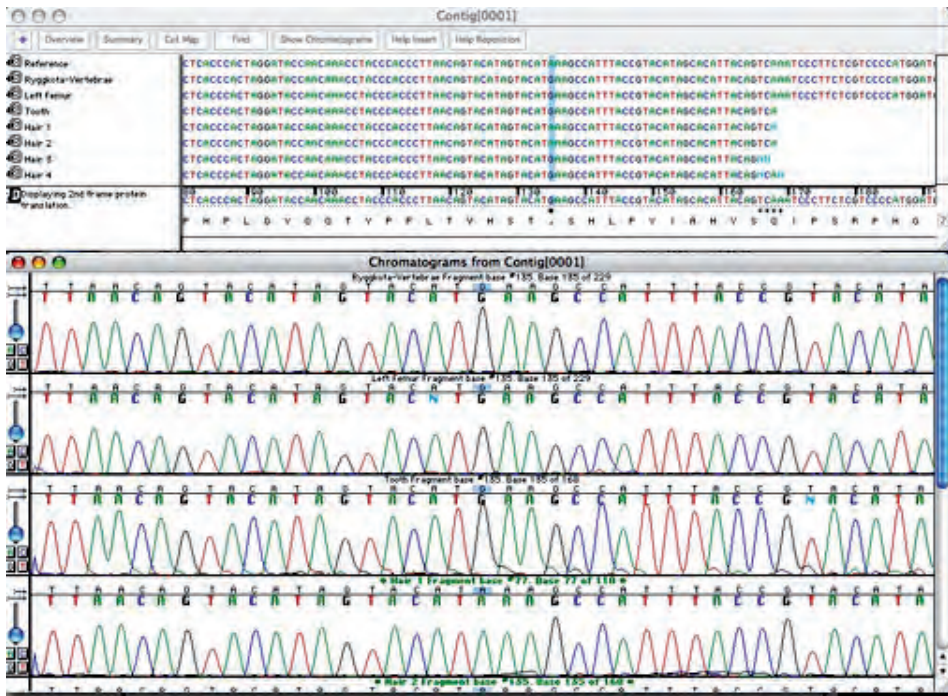


Fig. 4. M. Allen, *Comparative analysis of the DNA from the skull, the teeth, the forearm and the hairs found in the books of Nicolaus Copernicus* (source: Kronenberg Foundation 2008a, “Photo Gallery”, photo no. 4).²³

First answer (which ignores familiarity with the program Sequencher®): The researchers from Uppsala are actually right that they have definitely determined the difference in position 16316 (A/G), and *this can be seen in the chromatograms provided by them (sic)* (see, however, three other answers given below).

Second answer (which ignores *detailed* familiarity with the program Sequencher®): Although the charts are saying something else, the researchers from Uppsala are actually right that they have definitely determined the difference in position 16316 (A/G). But in the two only publications available, in which the corresponding graphs are given (Fundacja Kronenberga 2009, picture 4 and 5; Allen 2008, p. 233) (fig. 3–5), *the chromatograms included come from an earlier, preliminary phase of research, when it was still thought that the samples differed in position 135 (A/G) (sic)*.

²³ The image presented here has better resolution than the one posted on the website of the Kronenberg Foundation (see file: <http://www.citibank.pl/poland/homepage/polish/kopernik/images/4.jpg>). I would like to extend special gratitude to the Foundation for making the image available and for the possibility of its publication (see Senk 2012).

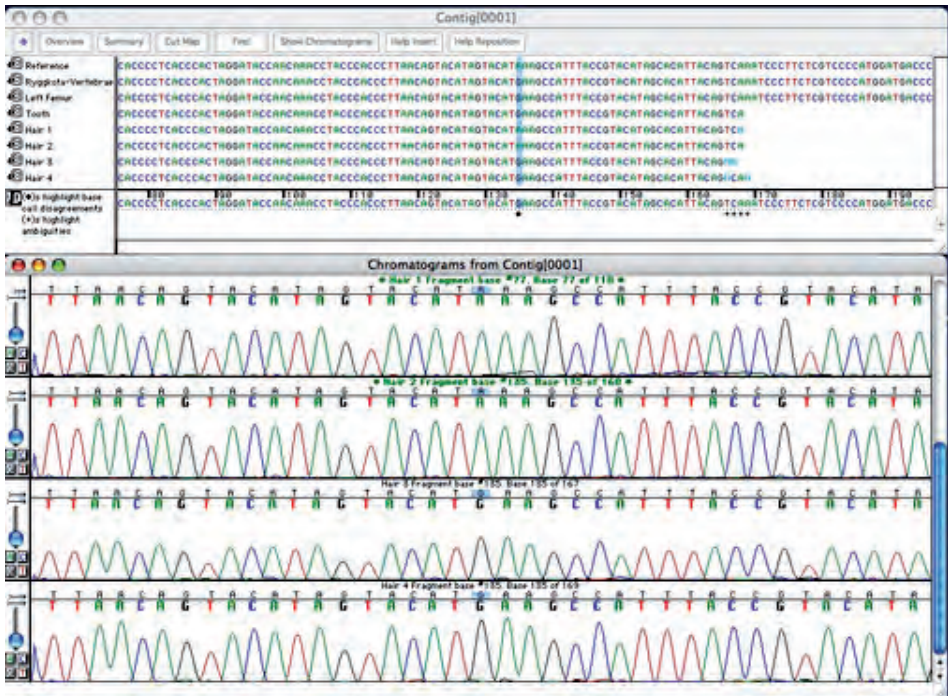


Fig. 5. M. Allen, *Comparative analysis of DNA from four hairs found in the books of Nicolaus Copernicus* (source: Kronenberg Foundation 2008a, “Photo Gallery”, photo no. 5).²⁴

Third answer (which ignores detailed familiarity with the program Sequencher®): When we literally read the statements of the researchers from Uppsala, *the indicated discrepancies show unambiguously (sic)* that the samples assayed in Sweden and Poland, despite opposing declarations, had incompatible mtDNA sequences! One can make sure of this strong and surprising assertion by comparing the illustrations given above (fig. 3–5) with fig. 6, which shows the sequence of chromatograms taken from the article by Nilsson, Possnert, Edlund, Buildings, Kjellström, Allen (2010) on the analysis of the alleged remains of St. Bridget (1303–1373), to which the author of the DNA testing of the alleged hairs of Copernicus also contributed.

Let us note in this context that *if we accept* that what is shown on fig. 6 is the *unequivocal evidence* for the existence of three *discrepancies* of mtDNA se-

²⁴ The image presented here has better resolution than the one posted on the website of the Kronenberg Foundation (cf. file: <http://www.citibank.pl/poland/homepage/polish/kopernik/images/5.jpg>). I would like to extend special gratitude to the Foundation for making the image available and for the possibility of its publication (see Senk 2012).

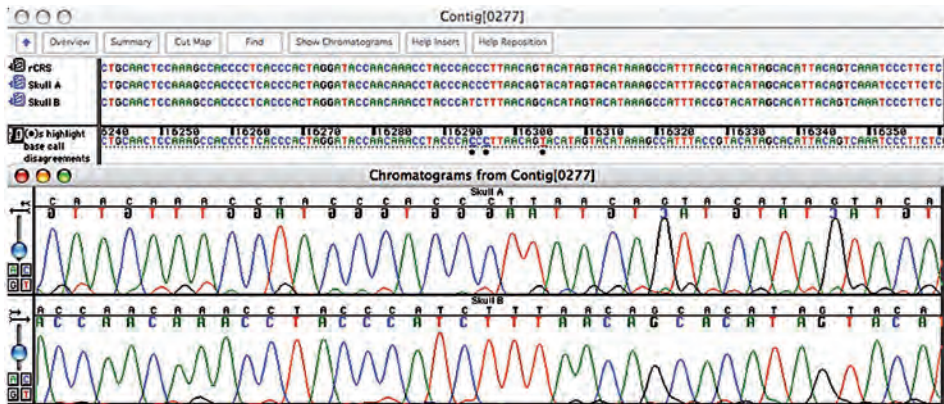


Fig. 6. M. Nilsson, G. Possnert, H. Edlund, B. Budowle, A. Kjellström, M. Allen, Chromatograms of the sequences of the skulls A and B, showing three sequence differences (with respect to rCRS sequence) at positions 16294, 16296 and 16304²⁵ (source: Nilsson, Possnert, Edlund, Budowle, Kjellström, Allen 2010, p. 3, fig. 6).

quence in the case of the skulls A and B (with respect to the sequence rCRS), namely at positions 16294, 16296 and 16304 (and so it is claimed!), then we must also recognize that the samples of the alleged remains of Copernicus, tested by Swedish and Polish researchers, despite opposing declarations, had incompatible mtDNA sequences, because the Swedes (see fig. 3–5) showed the difference in position 135 (A/G), and such was not provided by the Poles!

Fourth answer (taking into account the detailed familiarity with the program Sequencher®): the difference in position 135 (A/G) is shown on three chromatograms of the samples of putative of remains of Copernicus provided by Swedish researchers (fig. 3–5). Nevertheless, we cannot henceforth conclude unequivocally that the samples assayed in Sweden and Poland had incompatible mtDNA sequences. However, such a possibility cannot be ruled out.²⁶ Such statements are closely linked to the issue of appropriate calibration of the procedure of comparison of the sequences of the samples with the reference sequence in the pro-

²⁵ Attention: the differences in the sequence are marked with a black dot placed directly under the line of the following numbered items of the sequence.

²⁶ Moreover, the probability of this fact (that the samples assayed in Sweden and Poland had incompatible mtDNA sequences) is very high. That is:

$$1 - 1/(610^4) \approx 1 - 0.000044,$$

where $1/(610^4)$ – the probability of accidental match; since for the HVS–I region (16024–16365 base pairs) we have 342 available positions, and for the HVS–II region (73–340 base pairs) – 268 available positions, in total 610 available positions; in each position we have 4 possibilities (nucleobases A, C, G, T). (*A comment added in the English version of the article.*)

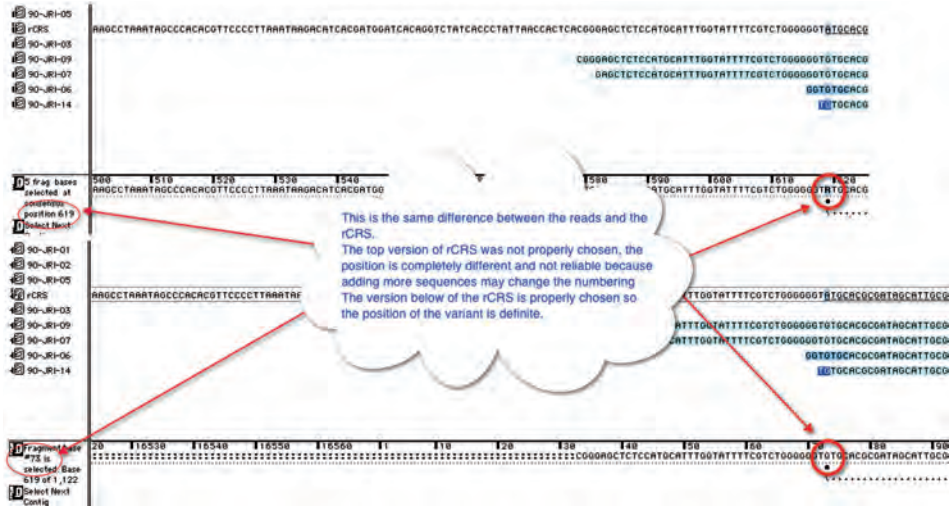


Fig. 7. The properly and improperly selected sample of reference sequence rCRS (source: Ginsburg 2011b).²⁷

gram Sequencher®. When this is done properly, the icon of the comparative sequence must contain the “R” symbol. Otherwise, our results of the comparison of the mtDNA sequence with the reference sequence rCRS are not correctly determined.²⁸ This is clearly illustrated by fig. 7, obtained from Michelle Ginsburg, PhD, the representative of the manufacturer of the program Sequencher®, and an expert of the Gene Codes Corporation responsible for contacts with Europe.

Moreover, to understand the content presented in fig. 3–7 even better, it is also worth:

- α) confronting these illustrations with the illustration taken from the study on the program Sequencher® from Gene Codes Corporation, which compares two example samples marked with symbols 082790 and 90 with the rCRS reference sample: “The Variance Table in Review Mode” sequencing of mtDNA (fig. 8) – cf. Gene Codes Corporation 2011d, p. 5;

²⁷ I am grateful to Michele Ginsburg, PhD and Gene Codes Corporation for the opportunity to publish this image (cf. Ginsburg 2012).

²⁸ What occurs here is fully analogous with measuring, for example, the length of a flat object with the help of a ruler. In order to determine the correct length of such an object, we should put the ruler at the point “0”, marked on the scale of the ruler, and to read the length of the object. If we put the ruler at a non-zero value, then we have to take that into account in the measurement of length, subtracting the final value read from the ruler from the initial value. Otherwise, the determined length of the measured object will be of course different and wrong.

β) becoming acquainted with a detailed description of the program Sequencher® – cf. Gene Codes Corporation 2011a–d; determining, on one’s own, the above-mentioned table (fig. 8), by using the free demo version of the program Sequencher®, version 5.0.

Thus, despite the high-profile global media announcements about the great success of Swedish researchers, who – thanks to the analysis of mtDNA of the putative remains of Copernicus (the bones, and especially the hairs) – definitely proved the discovery of the remains and the grave of the astronomer, so far no publication includes credible empirical evidence²⁹ of this assertion (that is the relevant chromatograms, tables of differences, etc.) – cf. Allen 2008, pp. 232–233; Kronenberg Foundation 2008a, “Photo Gallery”, photos 4–5; Bogdanovich *et al.* 2009.

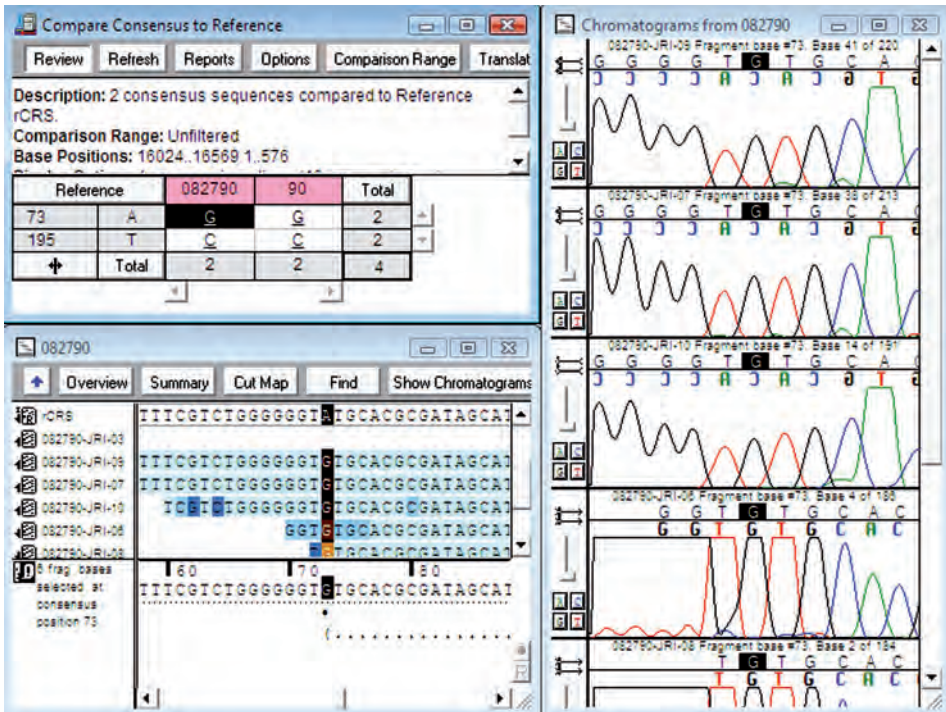


Fig. 8. The Variance Table in Review mode – among others: chromatograms of the sample 082790 at position 73 (source: *Mitochondrial DNA Typing*, Gene Codes Corporation 2011d, p. 5).³⁰

²⁹ Cf. above fn. 20.

³⁰ I am grateful to Gene Codes Corporation for the possibility to publish the image (cf. Ginsburg 2012).

7.2. Do two hairs from Stöffler's book have the same mtDNA sequence as the bone samples 13/05?

According to the consistent report of the proponents of the thesis in favour of the discovery of the grave of Copernicus, it is certain that two hairs from Stöffler's book have the same mtDNA sequence as the 13/05 bone samples. However, in 2008 the very author of this research presented a different view on the matter:

The other difference from rCRS in HVI (16129) that was seen in the remains was not covered by the shorter fragment amplified from the hairs. *Although the samples match in the sequences obtained now, differences may be found in other parts of the HVI region.* Further analyses will be attempted to try to cover this region of HVI as well. *However, as things stand, the chance of random match is about one in two hundred fifty. In conclusion, while this analysis cannot be regarded as definitive proof that the remains recovered from Frombork Cathedral belong to the astronomer Copernicus, it adds an important piece to puzzle of his final resting place* (Allen 2008, p. 232; italic – M.K.).³¹

The author made this claim because the Swedish team was unable to determine the position 16129 of the region HVI for hair samples. This raises a reasonable doubt as to whether this determination was made at a later time. I was assured by the head of the team (Allen 2009c), however, that this had indeed been done before the final publication of the team of geneticists: Bogdanowicz *et al.* 2009. Nevertheless, no documentation proving this thesis is known to me (what I mean here, among others, is a presentation of appropriate chromatograms, also called electropherograms – compare considerations in sect. 7.1).

7.3. Did Swedish researchers provide irrefutable evidence for the discovery of the remains of Nicolaus Copernicus?

According to the consistent report of the proponents of the thesis in favour of the discovery of the grave of Copernicus it is certain that a team led by Marié Allen provided such definite evidence on the basis of mtDNA analyses of the hairs found in *Calendarium Romanum magnum* by Johannes Stöffler, which for many years was used by Nicolaus Copernicus.

However, in my opinion, no publication gives evidence to this thesis, that is relevant documentation for such a thesis is not provided – compare considerations in sect. 7.1 and 7.2.

³¹ This thread was taken up by me for the first time in Kokowski 2009a.

7.4. The issue of the independence of the work of the teams and the issue of the independent confirmation of the results

According to the information published by Wojciech Kostrzewa in “Dziennik Polski” on 21 November 2008, received during the discussion with Prof. Aleksander Głazek, Habilitated Doctor, Prof. Wiesław Bogdanowicz, Habilitated Doctor, and Wojciech Branicki, PhD, it follows unanimously that the team of Swedish researchers had already known the results of the studies of skeletal remains carried out in Kraków and Warsaw, before they started their own research. In other words, these teams cooperated with each other. It strikes – in my opinion – at the very concept of independence of the confirmation of the results. Moreover, unlike Swedish researchers, Polish researchers (both from Krakow and Warsaw) did not perform hair analyses at all. It also strikes at the standard requirement for DNA studies, i.e. the confirmation of the results of DNA analysis by at least two independently operating laboratories.

The scientists from Sweden joined the research much later, when 10 hairs that could belong to the astronomer had been found in Uppsala in the book by Johannes Stoeffler, which Copernicus used for many years. Four of them were examined. It transpired that two of them contained mitochondrial DNA of the same characteristics as in the remains from Frombork. *The hairs were not studied by the Polish scientists, because, as Dr. Branicki stresses, they are very small fragments and are difficult to divide. So, their (Swedish) research was not verified by another centre, as it happened in the case of the bones.* In 2007, the Institute of Forensic Research in Kraków was visited by Prof. Marié Allen of the University of Uppsala, who became acquainted with the results of the genetic analyses of the bones. She received one tooth and a fragment of a bone from Prof. Gąssowski to repeat the results of Polish analyses. *In her correspondence with the FIR she admitted that she had confirmed the results of mitochondrial DNA examination, whereas her analyses of other markers tested in Kraków were unsuccessful. ‘So, we obtained more complete genetic data than Uppsala,’ says Dr. Branicki* (Branicki 2008b, p. A3; translation and italics – M.K.).

‘We collaborated with the Swedes in this matter. Over a year ago, our experts did genetic tests of the skeleton,’ explains Aleksander Głazek, director of Jan Sehn Institute of Forensic Research in Kraków. He adds that they had agreed with the Swedes for a joint announcement of the results of the research. (...) It is to the Swedes’ credit that they found ten hairs in the calendar of the astronomer located in Uppsala. The Swedish researchers determined that two hairs had the same DNA features as the bones from Frombork. *‘The researchers from Uppsala themselves studied the bones and isolated the genetic profiles, but earlier they had known the results of the work of the experts from Kraków and Warsaw,’* observes a representative of the Institute of Forensic Research from Kraków (Głazek 2008; translation and italic – M.K.).

7.5. Inconsistency of the results of the mtDNA analyses

The authors of the DNA analyses of the putative remains of Nicolaus Copernicus are not in agreement with each other as to an issue by no means trivial, namely how many people there are in the EMPOP database,³² who had the mtDNA haplotype they had determined. As many as five, including four explicit and one implicit, different answers to this question had been formulated:

1. Five (of which four live in Germany and one in Denmark) – Kupiec (“PAP – Nauka w Polsce” 2008a).
2. Six (five from the German population, and one from the Danish population) – Branicki, Kupiec 2008, p. 220, 222.
3. Two (one from the German population, one from the Danish population) – Bogdanowicz 2008, p. 206.
4. Four (three from Germany and one from Denmark), which corresponds to a random match 1:483 – Bogdanowicz *et al.* 2009, p. 1.
5. Nine or twenty five – Allen 2008, p. 232 (the numbers are the result of the analysis of the assumed value of a random match of samples 1:250 and the mathematical model of estimation of random match of sequences assumed by M. Allen which is identical to the model adopted in the final publication: Bogdanowicz *et al.* 2009; Allen 2009c; 2009d).

The discrepancies of this kind raise serious doubt whether the authors are speaking about the same finally determined sequence of mtDNA: 263G, 315.1C, 16129A, 16316G, or maybe about other sequences determined by them (despite the explicit declaration on having determined one sequence).

In the publications of the team, another piece of key information is not found: in what ranges the researchers made the review of the EMPOP database; whether it was the same range, or a different one, which could explain the disparate results of such searches for the same sequence.

7.6. Inconsistency of two theses: on the light-coloured eyes of Copernicus (resulting from the DNA analysis), and the dark-coloured eyes (resulting from the anthropological typology)

According to K. Piasecki (2005a), Copernicus was to have dark eye colour, which would be compatible with the mixed Mediterranean and Nordic anthropological type of the skull³³ (this position was shared fully by Zajdel 2007). This was,

³² Cf. EMPOP 2010.

³³ “A mixed Mediterranean and Nordic type. On the basis of the face we can determine hair colour and eye colour. Copernicus, when he was younger, had dark hair like you,” he says. “Eyes

however, denied by the authors of the DNA research of the alleged remains of Copernicus, who – having established *the C/C genotype of rs12913832 SNP*, located in the gene HERC2 – propagated the thesis on the bright blue colour of Copernicus’s eyes with 83.5% certainty and with 13.5% probability the thesis on the bright green colour; they, however, ruled out dark colour (hazel – 3% probability, and brown – 0%) – Branicki 2008b; Bogdanowicz *et al.* 2009; Branicki, Kupiec 2010. Furthermore, the authors of the DNA research of the alleged remains of Copernicus did not refer at all to the earlier thesis of K. Piasecki on the dark coloured eyes of Copernicus, and the theses mentioned contradict one another. It is important inasmuch as that the thesis of Piasecki regarding the eye colour was “materialized” by D. Zajdel during his creation of the facial reconstruction from the skull 13/05, which was to be one of the pieces of evidence for the discovery of the grave with, supposedly, 97% probability.

8. Unambiguous errors

In the allegedly perfectly carried out DNA research of the putative remains of Nicolaus Copernicus, an entire group of unambiguous errors were committed. I present them below.

8.1. Estimation of a random match of the determined mtDNA profile

With reference to the literature of the subject,³⁴ the authors of the DNA analyses of the putative remains of Copernicus chose the so-called *counting method* for estimation of a random match of the mtDNA sequences – Bogdanowicz *et al.* 2009, p. 2; Allen 2009c, 2009d; Kupiec, Branicki 2010 – which in mathematical statistics is called the simple asymptotic method or the Wald method. It is based on the so called asymptotic formula or on the Wilson formula. In accordance with this model, they made two assumptions:

also like you, mixed, but certainly they were neither bright nor dark. And the nose, long and narrow, also like your (...).

‘You are slightly similar to him... When he was younger, he also had dark hair, eyes similar to yours, a long face, maybe a little longer than yours. And a long, narrow nose (...),’ Prof. Karol Piasecki is watching me intently. On the table before him lay the images of the reconstructed face of the Great Astronomer” (Piasecki 2005a).

“Joanna Paszkowska: ‘And when you learned that the skull was attributed to Copernicus, did you only then create the eye colour or the hair type? Or the idea had come earlier?’

Chief Commissioner D. Zajdel, MA: The idea came earlier. Besides, the hair colour, the hair shape closely follows the anthropological analysis” (Paszkowska 2007).

³⁴ Cf. Evett, Weir 1998, p. 56–59, p. 142; Holland, Parsons 1999, p. 32.

1. The lower and upper values of the haplotype frequency can be approximated with the following formula:

$$p'_{\mp} = p \mp z_{1-\frac{\alpha}{2}} \sqrt{\frac{p(1-p)}{n}},$$

where:

$$p = \frac{m}{n},$$

- p – the frequency of a specific haplotype for the given metapopulation according to the population database;
- m – the number of a particular haplotype in the given metapopulation according to the population database (that is the number of samples of the same chosen haplotype);
- n – the total number of haplotypes in the given metapopulation in the population database (the size of the metapopulation);
- $z_{1-\alpha/2}$ – the quantile of order $1-\alpha/2$ of the standard normal distribution for the given confidence level of 100 $(1-\alpha)\%$.

2a. For the evaluation of the frequency of the determined haplotype it is sufficient to adopt a 95% confidence level of calculations.

2b. This corresponds to the value of $z_{1-\alpha/2}=1.96$ (it is worth adding here immediately that the actual value of the $z_{1-\alpha/2}$, rounded to six decimal places, is 1.959964 not 1.96).

With those assumptions (for $z_{1-\alpha/2}=1.96$), the authors determined the maximum frequency (proportion) of the determined haplotype (for the case when for forensic data there were 3830 samples of the West Eurasian metapopulation in the EMPOP database, including four samples with a determined haplotype) and the maximum value of a random match ($Przg_{\max}$) of this profile at 95% confidence level. They obtained the following values:

$$p_{\max} \approx 0.2067\% = 0.002067,$$

$$p_{\max} = 1 : Przg_{\max},$$

$$Przg_{\max} \approx 1:0.002067 \approx 483,$$

$$p_{\max} = 1 : 483.$$

However, for the adopted model, the same data and the same accuracy of calculations (six significant digits after the decimal point), we obtain a slightly different value for the maximum value of a random match of this profile:

$$\text{Przg}_{\max'} = \text{Entier} (1 : 0.002067) = \text{Entier} (483.792936) = 484,$$

$$p_{\max''} = 1 : \text{Przg}_{\max''} = 1 : 484.$$

Let us note that, for the adopted accuracy of the calculations, the result of the calculation is not affected whether we accept the value of $z_{1-\alpha/2} = 1.959964$ or its approximation 1.96. The error mentioned above resulted from the replacement of the number 0.002067 with its approximation 0.002070:

$$\text{Przg}_{\max} = \text{Entier} (1 : 0.002070) = \text{Entier} (483.091787) = 483,$$

$$p_{\max} = 1 : \text{Przg}_{\max} = 1 : 483.$$

I want to emphasize that I do not attribute much significance to the calculation error indicated here, because it has no effect on the falsification or corroboration of the thesis on the discovery of the remains of Copernicus.

In this context, I would like, however, to draw attention to another much more serious mathematical error, which was committed by the above-mentioned authors. To understand it, we should take note of the following three issues:

Let us note that at the basis of the approximation of the asymptotic model assumed above lays the assumption that the probability of finding k samples of a given haplotype in the database consisting of n all samples with different haplotypes is described by the binomial distribution:

$$P(k) = \binom{n}{k} p^k (1 - p)^{n-k},$$

where: p – the probability of success.

(To be exact we must note that this happens only when we *randomly* select n -element sample from an infinitely large general population ($N = \infty$). In the case of a finite general population ($N \neq \infty$), the distribution of such a *random* sample is not governed by the binomial distribution but hypergeometric distribution! In other words, in the considered problem an additional implicit idealized assumption is accepted, i.e. that for practical reasons general population may be treated as infinite).

2. As it is known to those skilled in statistical calculation, for very large values of n and $p \approx 0.5$ the binomial distribution can be very well approximated by the normal distribution, while for small values of the probability of success – by Poisson distribution,³⁵ and for the intermediate values, we must make direct calculations from the binomial distribution.

³⁵ This distribution should properly be called Bortkiewicz distribution, because it was Władysław Bortkiewicz (born 7 August 1868 in St. Petersburg, died 15 July 1931 in Berlin) who was

3. Let us note finally that what is used for the evaluation of the value of the frequency of a haplotype in a population on the basis of the data contained in a population database is the so-called interval estimation of population proportion (or the confidence intervals for population proportions) at a given confidence level.³⁶ When we apply the approximation of the binomial distribution with the normal distribution, we obtain the above-specified formula for the upper and lower value of the estimation of haplotype frequencies at a given confidence level of $1-\alpha$.

In this context, the authors of the DNA analyses of the putative remains of Copernicus overlooked a crucial fact that binomial distribution can be approximated with good accuracy by normal distribution only around the value of $p = 0.5$,³⁷ however, in the case analysed here, this value is only $p = 4/3830 \approx 0.001$ (Bogdanowicz *et al.* 2009). Hence, because of the small value of this parameter, the so-called *asymptotic formula* must not be used here.³⁸

In *partial* defence of the authors of the DNA analyses of the alleged remains of Copernicus, we must add, however, that the error of this kind is systematically

the first to write extensively on the subject. For clarification, let me add that Bortkiewicz was a mathematician and an economist of Polish origin. He had Russian citizenship, and (maybe) German. He worked as a researcher in Strasbourg, St. Petersburg and Berlin. From 1901 he held the function of Associate Professor of statistics and political economy at the University of Berlin, and from 1920 – Professor. Cf. Bortkiewicz 1898; Good 1986; *Wikipedia* 2010h; Feller 1980, vol. I, p. 138–144 and Evett, Weir 1998, p. 52–53 (this last study is addressed directly to the forensic geneticists).

³⁶ It should be emphasized that the formulation of the interval estimation is a merit of Jerzy Sława-Neyman (1894–1981), a Polish mathematician, who emigrated to the USA in 1938, but had already achieved weighty results working in Poland – cf. Bartoszyński, Klonecki 1977; Bartoszyński 1980; O'Connor, Robertson 1980; Chiang 2011.

³⁷ It is a generally known property of this expansion, described in standard studies in the fields of probability calculus and mathematical statistics, also in the studies on mathematical statistics for forensic geneticists, including the monograph by Ian W. Evett and Bruce S. Weir (1998) and the review article by Mitchell M. Holland and Thomas J. Parsons (1999) referred to by the authors of the genetic research of the alleged remains of the astronomer.

“In chapter 3 we showed that the binomial distribution $B(n,P)$ from the sample proportion P' is well approximated by the normal distribution $N(P,P(1-P)/n)$. This requires a large sample size n and a population proportion P that is not too far from 0.5” (Evett, Weir 1998, p. 142).

“We note that the normal approximation of the binomial applies to frequency estimates near 0.5, and the low estimated frequencies of even common mtDNA types approach the range where the normal approximation may be problematic” (Holland, Parsons 1999, p. 32). See also the next footnote.

³⁸ There exists an additional serious argument for not using the asymptotic formula. It is a known fact that the standard formula for the determination of the confidence interval, based on the premise that we can make expansion of the binomial distribution with the normal distribution, leads to erroneous results even close to the value of 0.5 for selected values of n . It is linked with the issue of the existence of the effect of the oscillation of the distribution function of such approximation (and thus with the effect of the oscillation of confidence intervals) – see, e.g., Newcombe 1998; Brown, Cai, Dasgupta 2001; 2002; 2005.

committed in genetic-population research, including forensic research. For example, Tomasz Grzybowski and his colleagues did not avoid this error:

In the calculation of the frequency of rare haplotypes on the basis of a searchable database we used 95% confidence interval, with the use of the natural logarithm of frequency, the normal approximation to the binomial distribution and the antilogarithm [1, 14]. To exercise caution, the maximum frequencies of the haplotypes (the upper limit of the confidence interval) were used in the LR calculations (Grzybowski, Malyarchuk, Bednarek, Woźniak, Papuga, Stopińska, Łuczak 2006, p. 193; translation – M.K.).

Following the guidelines in force in the international milieu of forensic geneticists for assessing the frequency of rare haplotypes in the population the 95% confidence interval should be applied here, with the use of the natural logarithm of frequency, the normal approximation to the binomial distribution, and the antilogarithm [3, 17] (Daca, Mielnik-Sikorska, Bednarek, Grzybowski 2010, p. 268; translation – M.K.).³⁹

With a view to the above comments, I claim that if we accept with the authors of the mtDNA analyses of the putative remains of Copernicus that: 1) there were 3830 samples of the West Eurasian metapopulation in the forensic data of the database EMPOP, 2) 4 samples with haplotype sequences consistent with the sequence of mtDNA haplotype of the alleged remains of Copernicus were found in the EMPOP database, and 3) we carry out calculations at the 95% confidence level, then (using the calculator of John C. Pezzulo 2009) we obtain from the binomial distribution and the Poisson approximation the approximated values of the random match, respectively:

³⁹ Professor Tomasz Grzybowski, Habilitated Doctor, a creator of many important and interesting studies in the field of population genetics and forensic genetics, is also the author of the negative comment on my paper presented during the scientific conference *The Nicolaus Copernicus grave mystery. A dialogue of experts (Kraków, 22–23 February 2010)*, initiated and run by me. According to him (then Associate Professor), “the vast majority of critical remarks on genetics made by Michał Kokowski, PhD (then Associate Professor, Habilitated Doctor – M.K.), the head of the conference, arose as a result of misunderstandings and unskilful usage of the DNA databases” (translation – M.K.).

In my view, however, this assessment was wrong – as I announced in the commentary to the PAP’s report on the conference organized by me (cf. Kokowski 2010f; “PAP – Nauka w Polsce” 2010b, 2010c), promising on this occasion that the readers would be able to find out in the published text. I hereby fulfil that commitment. In this context, I am extremely curious of the current opinion of my conference opponent on the allegedly erroneous understanding of the issues regarding genetic databases, statistical analyses, genetic genealogy, etc. I would be glad if he pointed out any actual errors committed by me (it is obvious to me that I can be wrong on some issues, so I appreciate any rational criticism of my theses). If, however, he could not find them, I would like to read in any of his publications that he had been mistaken in his first, superficial assessment of my paper.

$$p_{\max 0.95D} = 1 : \text{Przg}_{\max 0.95D} = 1 : 370,$$

$$p_{\max 0.95P} = 1 : \text{Przg}_{\max 0.95P} = 1 : 374,$$

while the asymptotic approximation gives an underestimated value:

$$p_{\max 0.95} = 1 : \text{Przg}_{\max 0.95} \approx 1 : 484.$$

When the conventionally chosen confidence level is 99.999%, we receive from the binomial distribution and Poisson's approximation respectively:

$$p_{\max 0.99999D} = 1 : \text{Przg}_{\max 0.99999D} \approx 1 : 179,$$

$$p_{\max 0.99999P} = 1 : \text{Przg}_{\max 0.99999P} \approx 1 : 178,$$

while the asymptotic approximation gives an underestimated value:

$$p_{\max 0.99999} = 1 : \text{Przg}_{\max 0.99999} \approx 1 : 299.$$

When the conventionally chosen confidence level is 99.9999%, we receive from the binomial distribution and the Poisson approximation respectively:

$$p_{\max 0.999999D} = 1 : \text{Przg}_{\max 0.999999D} \approx 1 : 158,$$

$$p_{\max 0.999999P} = 1 : \text{Przg}_{\max 0.999999P} \approx 1 : 159,$$

while the asymptotic approximation gives an underestimated value:

$$p_{\max 0.999999} = 1 : \text{Przg}_{\max 0.999999} \approx 1 : 278.$$

An additional comment is necessary here. Let us note that the choice of a definite level of confidence has a considerable impact on the estimation of the value of the random match of the haplotype sequence of the putative remains of Copernicus with the haplotypes from the EMPOP1 database, i.e. the higher the confidence level, the more accurate estimation of the random match. In the present case (for 4 samples from the 3830 samples from the Eurasian population), for the confidence level of 99.9999% and the data taken from the EMPOP1 database we obtained an estimation of the value of the random match of 1:258. (It is more precise than the estimation given above 1:370, determined for the confidence level of 95%.)

In this context, I would like to stress with all firmness that the practice of determining the random match of the DNA sequence only at the 95% confidence level, common around the world in genetic studies (including forensic genetics!), is simply a waste of the information contained in the databases. In other words,

it is possible to extract a more precise estimation of this match from the available databases without a greater computational difficulty. Of course, the 95% confidence level is sufficient in many practical issues, such as technical measurements, but not very useful when we touch upon such important issues as the court rulings, which determine further lives of the accused, are based on the test of a random match.⁴⁰

Moreover, contrary to the thesis formulated by Ms M. Landau of the weekly “Wprost” (and whose source were ultimately the authors of the DNA research, who had given her an authorized interview, which was evidenced by the fact that this text was distributed at the website of the Museum and Institute of Zoology, PAS),⁴¹ The determined values of the random match are *by no means infinitesimally small*, because, for example:

- For the confidence level of 95% the probability of the random match of 1:370 (not 1:483 as the authors of the research of the alleged remains of Copernicus claimed) is more than 18.4 times higher than the probability of death in a road accident in Poland in 2007 per capita and over 1.6 times higher than the likelihood of injury in a road accident in Poland in 2007 per capita.⁴²
- For the confidence level of 99.999% the probability of the random match of 1:179 is more than 38.1 times higher than the probability of death in

⁴⁰ The authors of the statistics textbook of StatSoft company (2006, 2007, pp. 5–6; 2011) show a good understanding of the issue of the conventionality level of confidence, also called the statistical significance – cf. Chap. “Getting Started with Statistics Concepts”, the topics: “What is «Statistical Significance» (p-value)?” and “How to Determine that a Result is «Really» Significant?”

⁴¹ “Such a profile occurs once per 483 cases. The probability that the same mtDNA profile, belonging to two different persons was discovered both in the cathedral and in the book of Copernicus (that is *Calendarium Romanum magnum, Caesareae maiestati dicatum* – M.K.), virtually does not exist” (Landau 2009, p. 51; translation – M.K.).

Let me add here a purely linguistic remark. I believe that the expression “the probability of an event virtually does not exist” is a stylistic error. We should instead use the phrase “the probability of an event is small, very small, little or virtually equal to zero.”

It is worth recalling that the thesis propagated by Ms. Landau was strengthened by the assurances of Prof. Jerzy Gąssowski that the works from the library of Copernicus had not been viewed by anyone, because they had been completely forgotten (cf. the statement of Jerzy Gąssowski, quoted above in chapter 4). As I already mentioned, this thesis is false: many scholars studied Copernicus’s books held in Sweden since 1626 as the spoils of war (see above, chapter 5, fn.12).

⁴² According to the estimates of Główny Urząd Statystyczny (Central Statistical Office in Poland) at the end of 2007, Poland had 38 126 000 inhabitants, and according to the data of the Polish Police (cf. Portal Policja 2010), 5,583 people were killed and 63 224 were injured in 49 536 accidents in Poland in 2007.

a road accident in Poland in 2007 per capita and more than 3.3 times higher than the likelihood of injury in a road accident in Poland in 2007 per capita.

- For the confidence level of 99.9999% the probability of an accidental conformity of 1:158 is more than 43.2 times higher than the probability of death in a road accident in Poland in 2007 per capita and more than 3.8 times higher than the likelihood of injury in a road accident in Poland in 2007 per capita.

Hence, on the basis of the probability values of the random match given above, one cannot conclude that these probabilities are virtually equal to zero, and thus exclude the possibility of a random match of the mtDNA sequence of the putative remains of Copernicus and the mtDNA of other persons who used the library of Copernicus.

8.2. The estimation of the random match of the determined mtDNA profile and the samples in the EMPOP1 database for forensic and literature data

The EMPOP database, in addition to forensic data, also includes literature data. The latter, however, were ignored by the authors of the DNA analyses of the alleged remains of Copernicus. When we take all these data into account, it appears that the first version of the EMPOP database (referred to as EMPOP1) with forensic and literature data, contained in total 4476 samples of the Eurasian populations, including 5 samples (not only 4) with a haplotype sequence matching the sequence of the haplotype of the mtDNA of the putative remains of Copernicus, with the additional (fifth) sample coming from Kościerzyna (Poland)!

In this part of the paper I will focus on the analysis of the purely quantitative aspect of this issue (I will discuss the aspect of this being a Polish sample in the latter part of this article, i.e. in section 8.4).

When we carry out the calculations for the 95% confidence level, then we obtain (approximately) the same value of the random match from the binomial distribution and the Poisson's approximation, respectively:

$$p_{\max 0.95D}^{\text{bin}} = 1 : \text{Przg}_{\max 0.95D}^{\text{bin}} = 1 : 384,$$

$$p_{\max 0.95P}^{\text{bin}} = 1 : \text{Przg}_{\max 0.95P}^{\text{bin}} = 1 : 384,$$

while the asymptotic approximation gives an underestimated value:

$$p_{\max 0.95}^{\text{bin}} = 1 : \text{Przg}_{\max 0.95}^{\text{bin}} \approx 1 : 477.$$

When the conventionally chosen confidence level is 99.999%, we receive the approximated values of the random match from the binomial distribution and the Poisson approximation, respectively:

$$p_{\max 0.99999 D}''' = 1 : \text{Przg}_{\max 0.99999 D}''' \approx 1 : 192,$$

$$p_{\max 0.99999 P}''' = 1 : \text{Przg}_{\max 0.99999 P}''' \approx 1 : 191,$$

while the asymptotic approximation gives an underestimated value:

$$p_{\max 0.99999}''' = 1 : \text{Przg}_{\max 0.99999}''' \approx 1 : 301.$$

When the conventionally chosen confidence level is 99.9999%, we obtain the approximate values of the random match from the binomial distribution and the Poisson approximation, respectively:

$$p_{\max 0.999999 D}''' = 1 : \text{Przg}_{\max 0.999999 D}''' \approx 1 : 169,$$

$$p_{\max 0.999999 P}''' = 1 : \text{Przg}_{\max 0.999999 P}''' \approx 1 : 170,$$

while the asymptotic approximation gives an underestimated value:

$$p_{\max 0.999999}''' = 1 : \text{Przg}_{\max 0.999999}''' \approx 1 : 281.$$

Analogously, as in the case under consideration above, the determined values of the random match are not at all infinitesimally small, because for the confidence level of 95% the probability of random match 1:384 is more than 18.7 times higher than the probability of death in a road accident in Poland in 2007 per capita and more than 1.5 times greater than the likelihood of injury in a road accident in Poland in 2007. For the confidence level of 99.999% the probability of the random match of 1:192 is more than 35.5 times higher than the probability of death in a road accident in Poland in 2007 and more than 3.1 times higher than the likelihood of injury in a road accident in Poland in 2007; and for the confidence level of 99.9999% the probability of random match of 1:169 is more than 40.4 times higher than the probability of death in a road accident in Poland in 2007 and more than 3.5 times greater than the likelihood of injury in a road accident in Poland in 2007.

Hence, based on the considerations carried out here, I want to draw an analogous conclusion as in section 8.1. Based on the above values of the probability of a random match, one cannot conclude that these probabilities are virtually equal to zero, and thus to rule out the possibility of a random match of the mtDNA sequences of the putative remains of Copernicus and of other people who had used the personal library of Copernicus.

8.3. Selective knowledge of the mtDNA population databases and incomplete knowledge in the field of genetic genealogy

The search in the EMPOP mtDNA database (17) showed that the mtDNA profile found in St. Cross Altar skeletal remains occurred in 4 of 3,830 West Eurasian haplotypes present in the database. The matching profiles were previously seen in individuals derived from Germany (1 from Rostock and 2 from Ulm) and Denmark (Copenhagen). No identical haplotype was found in other population groups (of total of 4,527 haplotypes in the database). The result of the EMPOP database is interesting from the perspective of Copernicus' maternal lineage. His maternal ancestors may have originated from Silesia, and can thus be of German descent (Bogdanowicz *et al.* 2009, p. 2–3).

As I already mentioned, the authors of the DNA research of the putative remains of Nicolaus Copernicus accepted the EMPOP mtDNA database as the

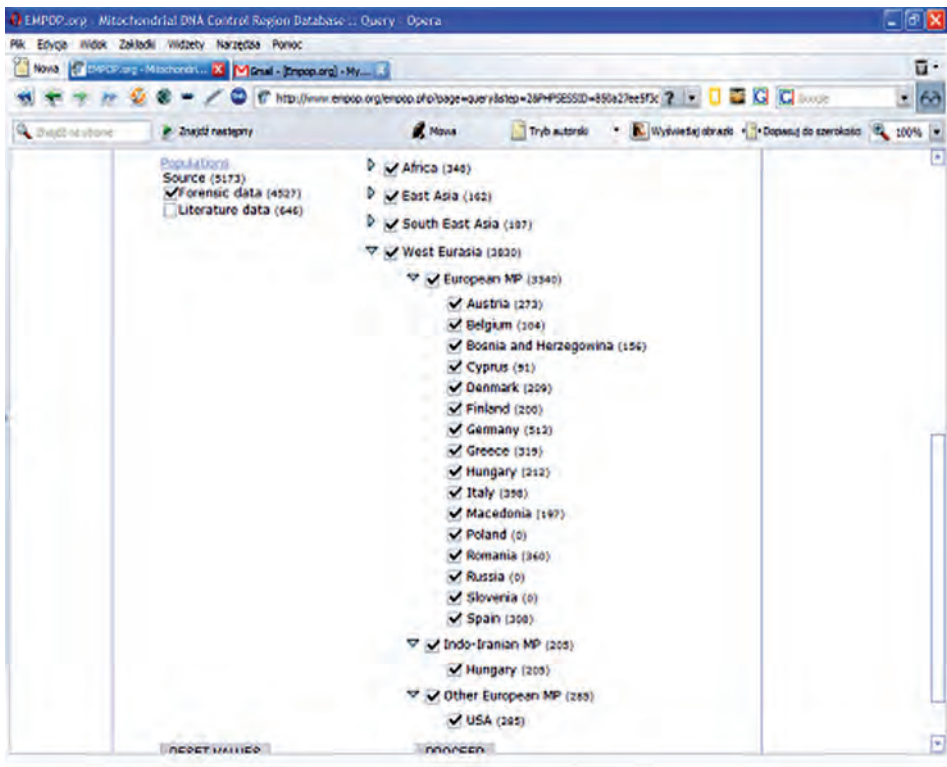


Fig. 9. EMPOP1 database – forensic data (screenshot). *We can see that for the forensic data the EMPOP1 database contained 3830 samples for the Eurasian population, including Denmark – 209, Germany – 513, Poland – 0.*

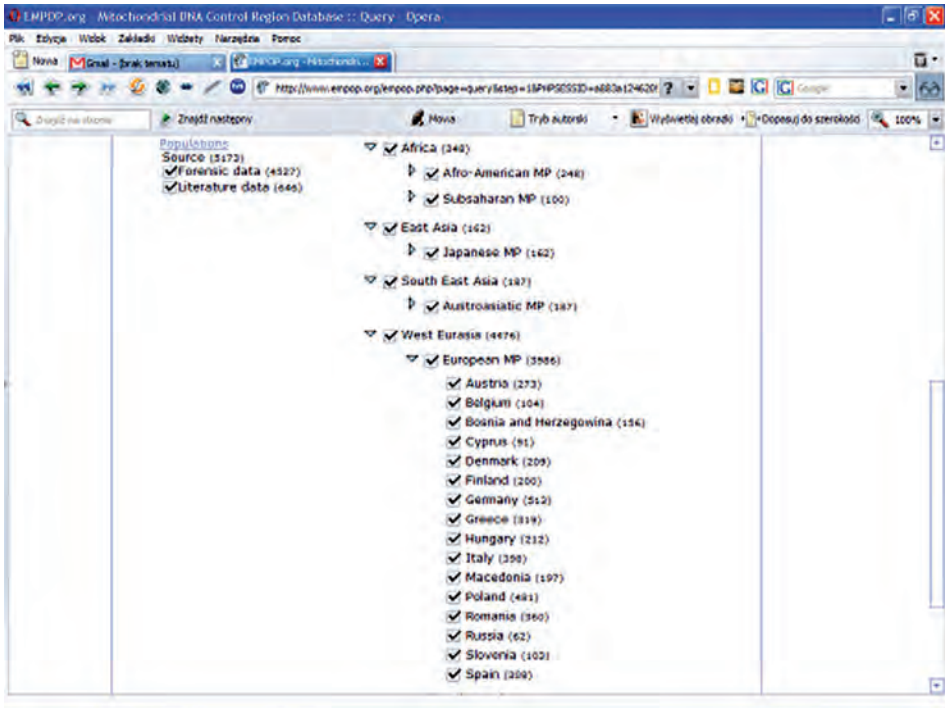


Fig. 10. EMPOP1 database – forensic and literature data (screenshot). We can see that for the forensic and literature data the EMPOP1 database contains 4476 samples for the Eurasian population, including Denmark – 209, Germany – 513, Poland – 481. There was no room in the screenshot for the data from the Indo-Iranian metapopulation (Hungary – 205) and other European metapopulations (USA – 285; see above fig. 9).

reference population mtDNA database. At the same time, they used only forensic data of this database, ignoring (without giving any reason) literature data. However, they made an even more serious mistake arguing that in the so-called *forensic EMPOP1 database* (that is the mtDNA database collecting the samples that were tested in court cases) there are no samples from Poland with the haplotype they had determined, but there are such samples from Germany (three) and Denmark (one). On claiming that these authors *did not provide the key information* that the forensic EMPOP1 database did not contain any samples from Poland – see fig. 9! Consequently, by definition, one could not find samples from Poland in this database, regardless of the profile they had. This means that the forensic EMPOP database was useless with regards to reliable inferences about the possible distribution of samples with a determined haplotype in Poland (I will resume this topic later in this article).

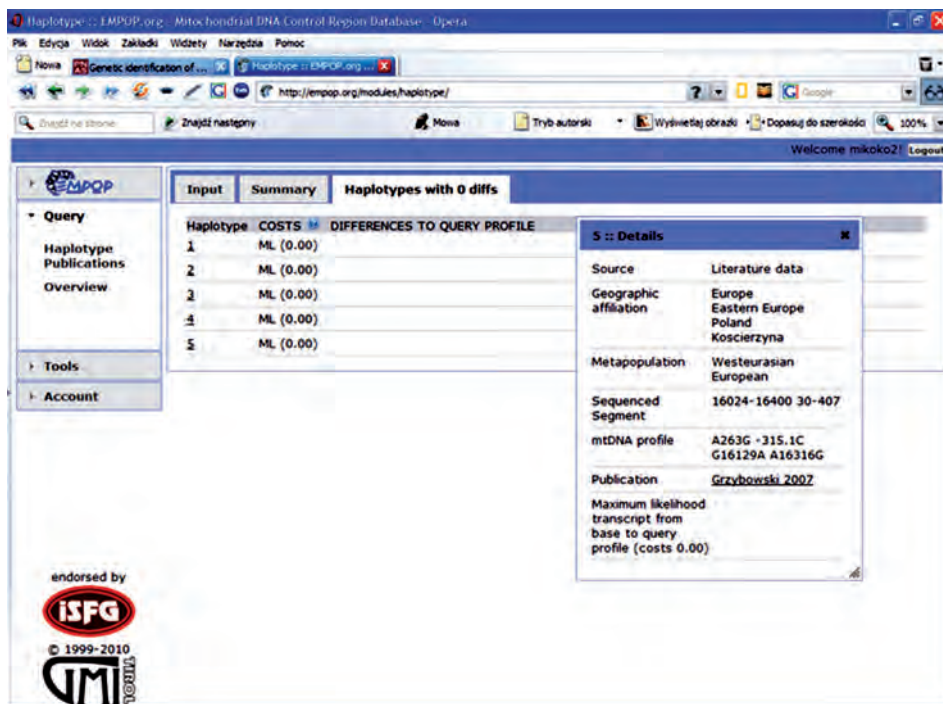


Fig. 11. EMPOP2 database – the sample from Kościerzyna, Poland (this sample had already been stored in the EMPOP1 database) (screenshot).

Let me add yet another piece of puzzling information. The authors of these studies did not mention that in the so-called *literature EMPOP1 database* (that is in the database including samples cited in the scientific literature), there were and are samples from Poland (in the EMPOP1 version: 481 samples out of all merely 646 samples of the European population), including one sample from Kościerzyna matching the haplotype determined for the putative remains of N. Copernicus – see. fig. 10 and 11 (in the case of the second image I have a screenshot from the second version of the EMPOP database (EMPOP2), but the sample from Kościerzyna had been already stored in the EMPOP1 database). The authors also overlooked that in another population database of mtDNA, namely the MitoSearch DNA Database,⁴³ an open public website of the Family Tree DNA company (dealing with genetic research for genealogical purposes), up to 16 samples of the haplotype determined by them can be found, including two from Poland but none from Germany (I will resume this topic later in this article). Moreover, they did not pay attention to the fact of the small number of samples in the fo-

⁴³ Cf. MitoSearch DNA Database 2010.

rensic and the literature databases of the EMPOP1 (both regarding the size of the European metapopulation and the sizes of individual national metapopulations), which requires circumspection in formulating statistically meaningful conclusions on the basis of the data included in this database, which particularly refers to the analysis of rare and unique haplotypes (I will resume this topic later in this article, see also the considerations set out above in sections 8.1 and 8.2).

8.4. Selective knowledge of the Y–DNA population databases and incomplete knowledge in the field of genetic genealogy

In the case of the paternal lineage, the search of the YHRD Y chromosome population database did not reveal the haplotype found in the examined human remains among the 2,595 complete haplotypes comprising the Eurasian metapopulation and among all of the 10,243 complete haplotypes included in the database originating from all over the world. The YHRD database size varies significantly based on the number and character of loci that are included in the search profile. By limiting their number to the core set called the minimal haplotype (most often analyzed Y–STR loci) the searchable data in the YHRD database were significantly extended, giving the total number of 63,369 haplotypes. In this larger dataset, a minimal Y–chromosomal haplotype, derived from the putative Copernicus remains, was present 47 times, 44 in a European metapopulation consisting of 31,762 minimal Y–chromosome haplotypes. The same haplotype has been found in individuals from many countries, including Austria, Germany, Poland, and the Czech Republic. It is interesting to note that Copernicus’ paternal ancestors may also have originated from Silesia (Bogdanowicz *et al.* 2009, p. 2).

The authors of the DNA research of the alleged remains of Nicolaus Copernicus did not avoid an essential error in the interpretation of the Y–DNA haplotype they had determined for these remains, that is the seventeen STR positions. Using the data from the YHRD (Y Chromosome Haplotype Reference Database⁴⁴) for the interpretation of these results, the authors limited their interest only to an examination of the European distribution of the samples of the so-called minimal set for the Y–chromosomal haplotype (that is a combination of nine positions: DYS19, DYS385(1+2), DYS389 I/II, DYS390, DYS391, DYS392, DYS393) in the haplotype determined by them. It had seventeen determined positions (beside those, already listed, nine positions, there were also positions: DYS437, DYS438, DYS439, DYS448, DYS456, DYS458, Y–GATA–C4 (= DYS635) and Y GATA H4). By adopting this assumption, the authors of the DNA research of the alleged remains of Copernicus determined that such a nine-positional haplotype appeared 47 times in the YHRD database, including 44 in the European metapopulation, among others, in Austria, Germany, Poland and the Czech Republic. In this context, the research-

⁴⁴ Cf. the YHRD – Y Chromosome Haplotype Reference Database 2010.

ers re-announced the information that also Copernicus's family from his paternal lineage could have come from Silesia (I will return to this thread later in the article).

However, the examination of the spread of only the minimal Y-DNA haplotype of the alleged remains is a mistake, because from genetic genealogy we know very well that the minimal haplotype is poorly suited for the analysis of the issue of the spread of a selected group of the European metapopulation due to its low selectivity. Therefore, to increase the accuracy of the findings in the issue under discussion, we should increase the number of the analyzed haplotype positions, without restricting our attention only to the European metapopulation. When this is done in a systematic way (by gradually increasing the number of considered positions), we receive the following results:

- For 9 positions of the minimal haplotype of the alleged remains of Copernicus, the YHRD database contains 60 samples (including 47 in the European metapopulation),⁴⁵ most from Germany – 12 samples, 6 from the USA (European Americans), 4 from the USA (Spanish Americans), 3 from Poland and from many other countries in Northern Europe, Western Europe and Central Europe, and Argentina, Brazil and Peru.
- For 11 positions – 16 samples, including 12 in the European metapopulation: 4 – the USA (European Americans), 1 – the USA (Spanish Americans), 1 – Manaus (Brazil, mixed population), 1 – Macapá (Brazil, mixed population), 1 – Southern Poland, 1 – Hradec Kralove (Czech Republic), 1 – Wrocław (Poland), 1 – Stuttgart (Germany), 1 – Gotland (Sweden), 1 – Northern Portugal, 1 – Peru, 1 – Madrid (Spain), 1 – Belgium (Flanders).
- For 12 positions – 9 samples: 2 – the USA (European Americans), 1 – the USA (Spanish Americans), 1 – Macapá (Brazil, mixed population), 1 – Southern Poland, 1 – Hradec Kralove (Czech Republic), 1 – Wrocław (Poland), 1 – Peru, 1 – Belgium (Flanders).
- For 13 positions – 6 samples: 2 – the USA (European Americans), 1 – the USA (Spanish Americans), 1 – Macapá (Brazil, mixed population), 1 – Peru, 1 – Southern Poland, 1 – Wrocław (Poland).
- For 14 and 15 positions – 4 samples: 1 – the USA (European Americans), 1 – the USA (Spanish Americans), 1 – Macapá (Brazil, mixed population), 1 – Southern Poland.
- For 16 and 17 positions – there is no sample with the haplotype determined for the alleged remains of Copernicus.

⁴⁵ It is worth noticing that these data differ from those given by the authors of the research into the alleged remains of Copernicus. They mentioned 47 samples in the YHRD database, including 44 from the European metapopulation. The difference is due to the fact that I used this database later than the authors mentioned, namely on 29 August 2009. In the meantime, subsequent samples were added to the database.

Hence, on the basis of a systematic survey of the YHRD database, we can reasonably conclude that the Europeans (but not necessarily relatives of Copernicus!) – with the haplotype whose core is identical to the subset of the Y–DNA haplotype of the putative remains of Copernicus – emigrated to North America and South America. (This is hardly a surprising conclusion – after all, it is known from historical sources that many Europeans, including also Poles, did so.) If we accept the additional strong assumption that the families coming from Europe, whose members' Y–DNA samples are contained in the YHRD database, are indigenous families (that is families that did not change the area of residence, which would obviously have to be independently proved), it turns out that the above data taken from the YHRD database (samples from Wrocław – Silesia and Małopolska) are consistent with the thesis based on the historical records that Copernicus's family came from Silesia and Małopolska.

I want to emphasize, however, that an objective mathematical measure of this match is the estimation of the so-called most likely TMRCA (Time to the Most Recent Common Ancestor) in the male lineage. For the recorded above 15-position match (of the 17-position haplotype of the alleged remains of Copernicus) the TMRCA is: 98 generations (that is $98 \cdot 31 = 3038$ years ago) for probability of 97.5%; 85.5 generations (2650.5 years ago) for probability of 95.0%; 72.5 generations (2247.5 years ago) for probability of 90.1%; 58 generations (1798 years ago) for probability of 80.0%; 53.5 generations (1658.5 years ago) for probability of 75.4%, etc.⁴⁶

Let us note next that the Sorenson Molecular Genealogy Foundation (SMGF), Y-Chromosome Database (2010) gives 1 sample with a full match in the 17 positions of the Y–DNA haplotype determined for the alleged remains of Nicolaus Copernicus, and this haplotype belongs to the Wallace family from the United States (living there since the second half of the 18th century). It follows from the analysis of the TMRCA that this family could have had a common ancestor with Copernicus in the male lineage before 47 generations (that is 1457 years ago) with the probability of 97.5%, before 38 generations (1178 years ago) with the probability of 94.9%, before 29.5 generations (914.5 years ago) with the probability of 90.0%, before 21 generations (651 years ago) with the probability of 80.6%, before 18 generations (558 years ago) with the probability of 75.5%, etc.⁴⁷

⁴⁶ In order to make these calculations I used the TMRC calculator designed by J. Douglas McDonald (2006), with the mutation rate of 0.0023, and the average generation of 31 years (such value is applied in the Sorenson Molecular Genealogy Foundation (SMGF), Y–Chromosome Database 2010). The results given overwrite the values presented in the Polish version of the article. (*A comment added in the English version of the article.*)

⁴⁷ Cf. above footnote. I want to add that the set of 17 loci of the Y–DNA haplotype is insufficient for the needs of genetic genealogy. Currently sets of 33, 37, 46, 67, or, most recently, even 101

8.5. Ignorance of the history of the portraits of Copernicus and the inferences about eye colour of Copernicus

The authors of the DNA research into the alleged remains of Copernicus (Branicki and Kupiec) – having determined *the genotype C/C of rs12913832 SNP*, located in the gene *HERC2* – propagated the thesis about the light blue eye colour of Copernicus with 83.5% probability, and the light green colour with 13.5% probability. However, they ruled out the dark colours (hazel – with 3% probability and brown – with 0%) – Branicki 2008b; Branicki, Kupiec 2009; Bogdanowicz *et al.* 2009; Branicki, Kupiec, 2010. On this basis, these researchers claimed that the following portraits of Copernicus should be considered credible: the portrait by Domenico Ghirlandaio of 1505 (or 1508) and the portrait modelled on it, namely the portrait by John Chapman of 1802; each of these portraits presented a light eye colour of the astronomer. They questioned, however, in this respect, the verity of other portraits, which showed a dark eye colour. According to the authors of the final article on the DNA analyses of the alleged remains of the astronomer (Bogdanowicz *et al.* 2009, p. 3), one of the possible explanations of this fact was that the early portraits were made with the use of the technique of chalcography,⁴⁸ which does not render eye colour correctly. This was to have effect, in their opinion, on establishing the tradition of painting Copernicus with dark eyes.

Propagating the above theses, the authors had assumed an initial premise that portraits by Domenico Ghirlandaio of 1505 (or 1508) and John Chapman of 1802 were authentic and reliable (the reliability of the latter portrait was dependent on the credibility of the former one, because it was modelled on it). However, they were not right regarding the assumed authenticity and credibility of the former portrait and the credibility of the latter one. Namely, the former portrait was not created during the life of Copernicus at all, i.e. in 1505 or 1508, but long after his death, soon after the publication (Florence, 1962) of the work of Galileo Galilei *Dialogo sopra i due sistemi del mondo massimi tolemaico e Copernic (Dialogue Concerning the Two Chief World Systems: Ptolemaic and Copernican)*.

This is evidenced by three facts: 1) in the years 1505–1508 the heliocentric theory of Copernicus had not yet been formulated, 2) the simplified version, cor-

Y–DNA markers are in use. Due to this increasing number of markers, the match of the compared haplotypes in many loci means that the TMRCAs are significantly shorter.

⁴⁸ “Chalcography (gr. *chalkós* ‘copper’ + *gráphein* ‘to write’) printing, a method of preparation and implementation of intaglio printing by engraving a pattern on a copper plate and printing it after the application of paint” (*Słownik wyrazów obcych*. Scientific Editor: Prof. Irena Kamińska-Szmaj. Authors: Mirosław Jarosz *et al.* Wrocław: Wydawnictwo Europa, 2001, p. 109; translation – M.K.).

rected by Galileo Galilei, of the Copernican theory became widely known only after the publication of the work mentioned, 3) it is precisely in that work of Galileo Galilei that the emblem “tellurium” (i.e. the symbol of the solar system) was used for the first time. Hence, these two portraits cannot be considered reliable sources of information about the eye colour of Copernicus.

Furthermore, claiming that the use of the chalcography technique had effect on establishing the tradition of painting Copernicus with dark eyes, the authors of this conjecture in their deliberations completely neglected the fact that, according to historical records, there were images of Copernicus painted during his lifetime, which shaped the subsequent images based on these portraits.

8.6. Attribution to J. Adamczewski of the thesis on the German character of Silesia and that Copernicus’s maternal grandmother came from the Reuss (Russe), not the Modlibóg family

The result of the EMPOP database search is interesting from the perspective of Copernicus’ maternal lineage. His maternal ancestors may have originated from Silesia, and can thus be of German descent. Copernicus’ grandmother, Catherina, was first married to Heinrich Peckau, who was a member of the council of Thorun. After Heinrich’s death, Catherina was married to a trader and famous enemy of the Teutonic Knights – Lucas Watzenrode. Together they had 3 children, Christina, Lucas, and Nicolaus Copernicus’ mother, Barbara [Adamczewski J. (1972), *Nicolaus Copernicus and His Epoch* (Interpress, Warszawa) (in Polish)] (Bogdanowicz *et al.* 2009, p. 3).

The reference to the work by Jan Adamczewski suggests that it is in this historical and biographical study where the information on the German origin of Copernicus in his maternal lineage appears. But this is not true: J. Adamczewski (1972) accepted the old thesis of Polish Copernicologists, which was propagated, among others, by Krzyżanowski (1843, reprinted: Polkowski (ed.), 1873–1875, vol. II, p. 113; 1843b, 1843c, reprinted Polkowski (ed.), 1873–1875, vol. II, p. 134); Lach-Szyrma (1844, p. 367), Polkowski (1873, pp. 3–75) and L.A. Birkenmajer (1924, pp. 245–247). It said that the maternal grandmother of Copernicus was Catherine “de gente Modlibog,” i.e. née Modlibóg, coming from a family connected by marriages with rich bourgeois families of Toruń, Kraków, Elbląg, Gdańsk and known, noble families, such as Działyński, Kościelecki, Konopacki, Czapski and Gosiewski (see Adamczewski 1972, p. 22).

This thesis, in turn, referred to the information on the genealogy of the Watzenrode-Copernicus family provided by Gottfried Reinhold Centner (1762, p. 406; 1763, p. 46), according to whom Copernicus’s maternal grandmother was “Catharina Rüdigerin Modlibog gente,” and, therefore, she was the wife of an un-

specified Rüdiger and her maiden name had a uniquely Polish sound – Modlibóg (“to pray to God”).

In addition, Adamczewski also claimed – in full accordance with Krzyżanowski, Polkowski and L.A. Birkenmajer – that from the 13th to the 15th century Silesia was inhabited by both Polish and German populations, and provided information about the origin of the Copernicus family:

The Copernicus family originated from the Silesian village Koperniki, located in the area of Nysa and Otmuchów. Since the end of the 12th century Koperniki belonged to the estate of the Bishopric of Wrocław, and were located within the area of the Kingdom of Poland. The village, founded before 1272, was inhabited mainly by Polish population, as indeed the whole Otmuchów and Nysa district (Adamczewski 1972, p. 7).

Adamczewski also repeated – in full accordance with L.A. Birkenmajer (1924, pp. 1–48) – the information about the origin of the Watzenrode family from Silesia and their emigration to Chełmno district in about 1360. He did not mention, however, the additional hypothesis of L.A. Birkenmajer, explaining the reason behind this move. According to it, the Watzenrodes left Silesia, when in 1356 the last free Silesian Duchies of Jawor, Ziębica and Świdnica (they had lived so far in the latter two) lost political contact with the Kingdom of Poland and were incorporated into the Bohemian Crown (being in union with Germany and Hungary).

Propagating the thesis described above “that, among others, Copernicus’s maternal grandmother came from the family of Reuss (Russe) and her first husband was to be Heinrich Peckau” (contrary to Adamczewski’s thesis), the authors of the publications on the DNA analyses of the putative remains of Copernicus should have relied on the publication of another author. It was Karol Górski who had written that (1968, pp. 8–10, 1973, pp. 32–33, 215; 1973b, pp. 6–7), and who had accepted the findings of Leopold Prowe (1853; 1883, vol. I, pp. 68–69 and fn.* and vol. II, pp. 452–453) and George Bender (1881, p. 71). However, unlike the authors of the publications on the DNA analyses of the putative remains of Copernicus, Karol Górski did not conceal the fact that Silesia was inhabited by both the Germans and the Poles.

I would like to add yet another important complement. According to the recent studies by Krzysztof Mikulski (1997a; 2008), both variants of the origin of Copernicus’s maternal grandmother should be rejected in the light of the detailed analysis of historical sources. In the first publication Mikulski postulated that Copernicus grandmother came from the Lodel family (Mikulski 1997a, p. 251). In the second publication, he denied such a possibility: he held that “it is difficult to establish her maiden name” (Mikulski 2008, p. 50), and as *quite probable* he adopted the thesis that the maternal grandmother of Copernicus came from the

family of Kordelitz, belonging to the patriciate of Toruń (Mikulski 2008, pp. 62, 64). As we can see, the issue of the origin of the maternal grandmother of Copernicus has not been unequivocally resolved yet.

To be precise, it is worth recalling that Toruń belonged to the Hanseatic League. The patriciate of the city used the German language in its administrative, judicial and economic matters, and in 13th–16th century very few of its members had Polish-sounding names (cf. Gumowski 1970; Jasinski 1999, pp. 138–139; Tandecki 1999, pp. 203–206; Mikulski 1997b; Bishop 1992, pp. 80–86). However, such facts about Toruń, do not prove the German character of Silesia.

8.7. Ignorance of the history of the ethnic geography of Silesia and the lack of knowledge about the history of the debate on the ethnic origin of Copernicus

What results from the above statements of the researchers of the DNA of the alleged remains of Copernicus (Bogdanowicz *et al.* 2009, p. 3) is a proposition that Silesia was dominated by the German population already at the time the family of Waczinrod / Waczelrodt / Waczenrod / Watzenrod / Watzenrode⁴⁹ lived in Silesia (that is at least since the mid-thirteenth century to the mid-fourteenth century) or the lifetime of the astronomer (that is at the turn of the fifteenth and sixteenth centuries). This proposition, however, stems from the ignorance of the issues under consideration.

I would like to recall the basic historical findings: it is not elsewhere, but in the Lower Silesia or in the Middle Silesia as it used to be called, in the Cistercian monastery in Henryków in 1270 that the first Polish-known phrase was recorded: “Daj, ac ja pobruszę, a ty poczuiwaj”⁵⁰ (“Let me grind, and you rest”), and it is not elsewhere, but in the Lower Silesia or the Middle Silesia as it used to be called, in Wrocław, in a Latin church register, in 1475 the first printed Polish words of the prayers “Our Father”, “Hail Mary” and “I believe” were published.

The Polish character of Silesia, from the 10th to 16th century, is evidenced by historical research⁵¹ and the etymological studies of geographical names;⁵² this also applies to the Otmuchów and Nysa districts, where the family of Copernicus

⁴⁹ On the subject of a number of different spellings of the name, cf. Birkenmajer 1924, pp. 5–21.

⁵⁰ Cf. *Wikipedia* 2011 and Piotr (an abbot of the Monastery of St. Mary the Virgin in Henryków) 1268–1273, p. XXIII.

⁵¹ Cf. A. Galas, A. Galas 2001; Czapliński, Kaszuba, Wąs, Żerelik 2002; *Wikipedia* 2010e.

⁵² Cf., for example, Rospond, Borka, Sochacka (eds.) 1970–2007, vol. 1–13.

originated from, and the Świdnica district, where the family of Watzenrod came from.⁵³ What is more, despite the fact that in 1741 Silesia came under the rule of Prussia,⁵⁴ and was subjected to organized Germanisation (such as, among others, the *Kulturkampf*),⁵⁵ the Polish population remained here. Its existence – especially in Opolski Silesia and Upper Silesia, even in the 18th, 19th and 20th century (until 1945) – is evidenced unequivocally in the studies of even German scientists, including:

- α) “Karte der Sprachgenzen in Ober- u. Mittelschlesien 1790 u. 1890” (“Map of linguistic boundaries of Upper and Middle Silesia in 1790 and 1890”), included in the work of Joseph Partsch, a German professor of geography of the University of Wrocław, *Schlesien: eine Landeskunde für das deutsche Volk*, vol. 1: *Das ganze Land* (Breslau: Ferdinand Hirt, Königliche Universitäts- und Verlags – Buchhandlung, 1896), between p. 364 and 365 (fig. 12).
- β) “Sprachen Karte von Mittel- und Oberschlesien 1905” (“Language Map of Middle and Upper Silesia in 1905”) by Richard Andree, included in: *Andrees Handatlas* (6th ed. Leipzig 1914) (fig. 13).
- γ) A monograph (with many maps) by dr Paul Weber, *Die Polen in Oberschlesien. Eine statistische Untersuchung...* (Berlin: Verlag von Julius Springer, 1914).
- δ) There are also Polish authors of such studies – cf. for example Kuroński 1939; Hajduk, Popiołek 1939; Lehr, Osmańczyk 1972; Osmańczyk 1985; 1989a; 1989b; Gawryszewski 1995; Borowicz 2004; Kaczmarek 2006; *Wikipedia* 2010c; 2010i.

To illustrate this problem I enclose the following two maps: “The stages of Germanisation of Silesia” by Z. Kaczmarczyk from 1953 (fig. 14) and “The map of the Polish minority in the Third Reich in 1934” (fig. 15). The latter should be supplemented with additional information about the number of members of the Union of Poles in Germany (under the sign of Rodło),⁵⁶ established in 1922 (fig. 14).

According to the post-war findings on the basis of the surviving archives, in the middle of 1924 the Union of Poles in Germany had about 32 000 members. In the Silesian District I there were 104 sections with more than 5100 members, that is 16.5% of

⁵³ Cf. Rospond 1973, pp. 57–80, 140–145.

⁵⁴ Silesia lost unity with the Kingdom of Poland in the mid-fourteenth century, when it became a part of the Crown of the Kingdom of Bohemia. Since then, the process of Germanisation increased gradually, and was even intensified, when after the death of Ludwik Jagiello in 1526, along with the entire Crown of the Kingdom of Bohemia, it came under the power of the Habsburg dynasty (cf. A. Galas, A. Galas 2001; Czaplinski, Kaszuba, Wąs, Żerelik 2002).

⁵⁵ Cf. Trzeciakowski 1970; 1990.

⁵⁶ On the activities of the Union of Poles in Germany, cf. e.g. Hajduk, Popiołek 1939; Lehr, Osmańczyk 1972; Osmańczyk 1985; 1989a; 1989b; *Wikipedia* 2010i.



Fig. 12. “Karte der Sprachgrenzen in Ober- u. Mittelschlesien 1790 u. 1890” (source: Partsch 1896, after p. 364; in the electronic version: p. 0381).

the total number of members; in District II, that is in Berlin and the Polabian Lands – about 6200, that is almost 20% of the total, in Westphalia–Rhine District III in 160 sections – about 13 000, that is almost 45% of the total, in the East Prussian District IV – around 4000, that is close to 12.5% and, finally, on the Kashubian-Lubusz border of the District V – around 2700, that is almost 6% of the total. In subsequent

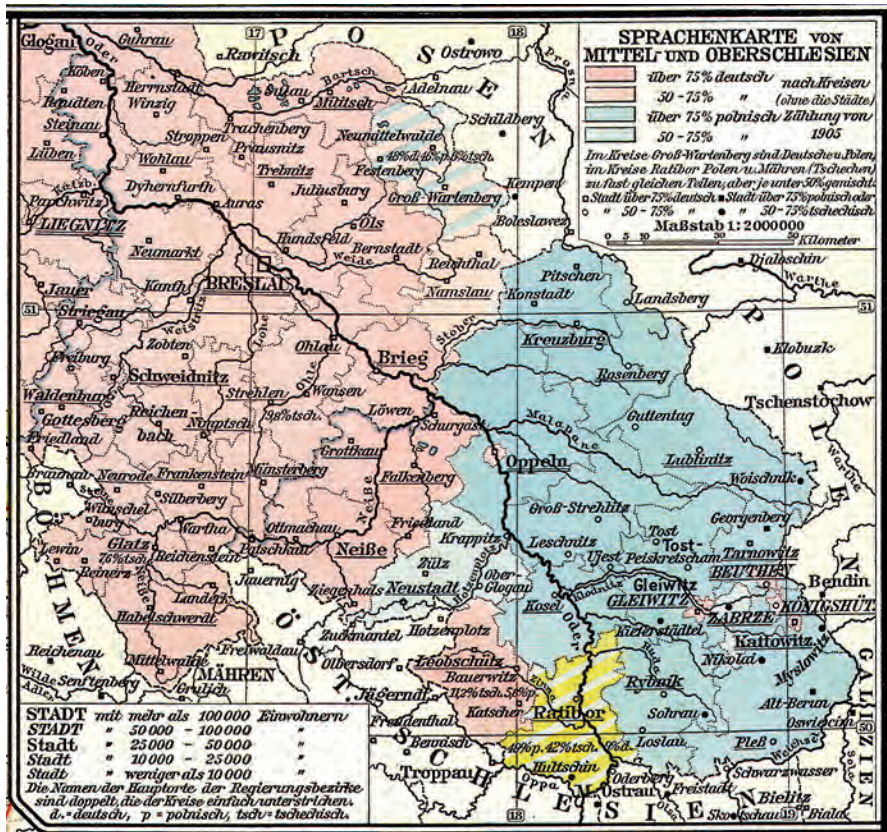


Fig. 13. R. Andree, "Sprachen Karte von Mittel- und Oberschlesien 1905" (source: Andree 1914; <http://www.atlassen.info/atlassen/velhagen/andha06/piclarge/andha1914k051b.jpg>).

years, until 1930 the number of members nearly doubled, exceeding 60 000, however the proportions hardly changed, and all in all in favour of the Land of the Oder. The years of the economic crisis and the open terror 1931 – 1933 resulted in a decrease of several thousands, which slowed briefly in 1934–1935. The next years of the pressure of the total Nazi machine caused a decrease in the number of active members of the Union, but in 1938–1939 it was estimated as not less than in the summer of 1924 (Osmańczyk 1989a, p. 22–23).

It is worth remembering in this context that the Union of Poles in Germany acted so dynamically that on 6 March 1938 it could organize the 1st Congress of this Union in the very centre of Berlin, at the largest – at that time – theatre hall of the city (for five thousand people), Theater des Volkes (The People's Theatre). It was attended by the representatives of all the five districts: 1) Śląsk Opolski (Op-

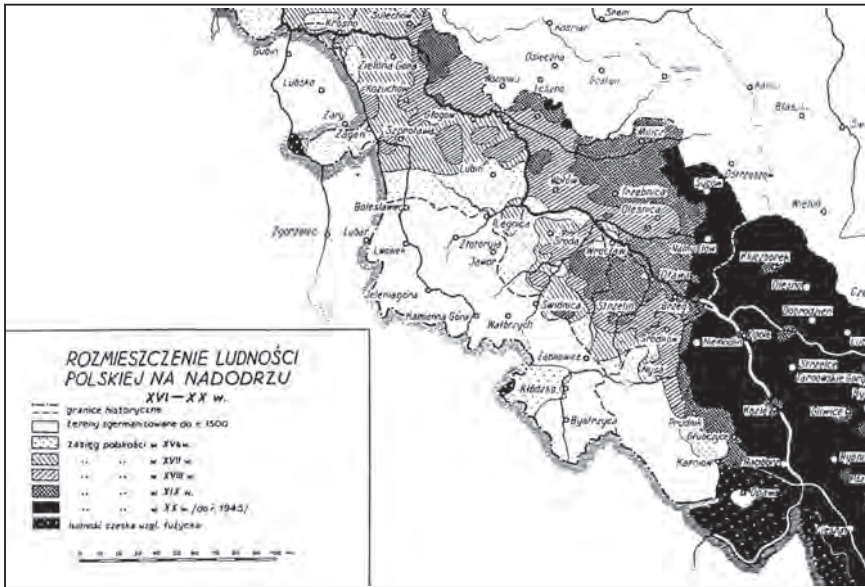


Fig. 14. “The stages of Germanisation of Silesia according to Z. Kaczmarczyk” (source: Kaczmarczyk 1953, p. 24; Borowicz 2004, p. 32, fig. 3).



Fig. 15. “The map of the Polish minority in the Third Reich in 1934” (source: “Tygodnik Ilustrowany” of 12 August 1934, reprinted in: Osmańczyk 1985, p. 21).

pelner Schlesien), 2) Berlin – the Polabian districts (Brandenburg, Saxony, Lower Silesia, and Pomerania), 3) Westphalia and Rhineland, 4) the Frontier March of Posen-West Prussia and Kashubia, 5) East Prussia.⁵⁷

Hence, even in Nazi Germany, it was not doubted that large clusters of Poles lived in different parts of the country, including Silesia. The awareness of this fact made that, with reference to the Prussian-German nationalist tradition of the 18th – 20th century, actions aiming at total intimidation and Germanisation of this Polish population were strengthened, which was something this population particularly dramatically experienced during the World War II.

Thus, formulating the proposition of the German character of Silesia without mentioning in this context even briefly that also Poles (and Czechs) lived in Silesia, the authors of the genetic studies of the alleged remains of Copernicus demonstrated a lack both of the political sensitivity in understanding Polish-German relationships and of the knowledge of the difficult history of Polish-German relationships,⁵⁸ including the history of the debate on the ethnic origin of Copernicus.⁵⁹

8.8. Erroneous inferences about the ethnic origin of Copernicus and his parents

The authors of the DNA studies of the putative remains of Nicolaus Copernicus undertook the thread of ethnic origin of Copernicus and his parents, among others, in the following publications: Kupiec 2008; Branicki, Kupiec 2008; Bogdanowicz 2008 and Bogdanowicz *et al.* 2009. From the analyses of mtDNA and Y-DNA sequences of these remains, a conclusion resulted on the German origin of Nicolaus Copernicus. The authors of these studies themselves explicitly formulated this thesis in relation to the origin of his mother (Kupiec 2008; Branicki, Kupiec 2008; Bogdanowicz 2008 oraz Bogdanowicz *et al.* 2009):

‘We started with the study of the mitochondrial DNA inherited in the female lineage, which allows for a comparison with up to modern living relatives of the maternal lineage. After checking in the European population database, it turned out that five individuals have the same mitochondrial type, including four people living in Ger-

⁵⁷ Cf. Lehr, Osmańczyk 1972; Ambasada Polski w Berlinie 2005.

⁵⁸ By claiming it all, I would also like to note clearly two issues: I highly appreciate the German culture and I am a strong supporter of a genuine Polish-German reconciliation based on mutual equality and historical truth, and in particular on the respect for the idea of a small homeland (*Heimat*) or a private homeland (cf. Fundacja Kultury 2000; *Lublin: Pamięć Miejsca* 2010; *Wikipedia* 2010d; Ossowski 1984, p. 26).

⁵⁹ I extensively describe the history of the debate on the ethnic origin of Copernicus in: Korkowski 2009b, p. 115–136, 402–431.

many, which would confirm the maternal lineage of Copernicus, whose mother was German. During the study we also determined the Y chromosome, possessed only by men,' – said Tomasz Kupiec of the Institute of Forensic Research to PAP (Kupiec 2008, in Polish).

The search in the EMPOP mtDNA database showed that the mtDNA profile found in St. Cross Altar skeletal remains occurred in 4 of 3,830 West Eurasian haplotypes present in the database. The matching profile were previously seen in individuals derived from Germany (1 from Rostock and 2 from Ulm) and Denmark (Copenhagen). No identical haplotype was found in other population groups (of total of 4,527 haplotypes in the database).

The result of the EMPOP database is interesting from the perspective of Copernicus' maternal lineage. His maternal ancestors may have originated from Silesia, and can thus be of German descent (Bogdanowicz *et al.* 2009, p. 2–3).

On the other hand, these authors implicitly formulated the thesis of the German origin of the paternal lineage of Copernicus (Branicki, Kupiec 2008; Bogdanowicz 2008 and Bogdanowicz *et al.* 2009):

In the case of the paternal lineage, the search of the YHRD Y chromosome population database did not reveal the haplotype found in the examined human remains among the 2,595 complete haplotypes comprising the Eurasian metapopulation and among all of the 10,243 complete haplotypes included in the database originating from all over the world. The YHRD database size varies significantly based on the number and character of loci that are included in the search profile. By limiting their number to the core set called the minimal haplotype (most often analyzed Y–STR loci) the searchable data in the YHRD database were significantly extended, giving the total number of 63,369 haplotypes. In this larger dataset, a minimal Y–chromosomal haplotype, derived from the putative Copernicus remains, was present 47 times, 44 times in a European metapopulation consisting of 31,762 minimal Y–chromosome haplotypes. The same haplotype has been found in individuals from many countries, including Austria, Germany, Poland, and the Czech Republic. *It is interesting to note that Copernicus' paternal ancestors may also have originated from Silesia* (emphasis added) (Bogdanowicz *et al.* 2009, p. 2).

Given that in the previously quoted paragraph of the said article (Bogdanowicz *et al.* 2009, p. 3), the authors argued that Silesian origin of Copernicus's mother's family (that is the family of Watzenrode) suggests their German descent, it should also be stated – in order to be consistent – that the male ancestor of Copernicus coming from Silesia would be ethnically German. However, such thesis was not openly propagated by them in their publications. Nevertheless, such a conclusion presents itself, particularly in the context of the determination

made by Wojciech Branicki and Tomasz Kupiec that Copernicus was a carrier of the gene called HERC2 (Branicki 2008b; Branicki, Kupiec 2009; Bogdanowicz *et al.* 2009; Branicki, Kupiec 2010). This gene determines the blue color of eyes and fair complexion – and such appearance had been connected for a long time with the “master race”: “racially pure Aryans”.

Such conclusion was drawn by a Polish journalist of the “Dziennik.pl” newspaper (“Dziennik.pl” 2009) on the basis of the findings of the HERC2 gene,⁶⁰ and by the members of two German forums: “Skadi Forum” (2009) (the largest Germanic online forum of more than 40 000 members)⁶¹ and “The Apricity Forum” (2009), based on the entire ethnogenetic argumentation.

A natural question arises now: what is the value of this inference about the German origin of Copernicus, on the basis of the mtDNA and Y–DNA analyses of his alleged remains? I think this inference is based on the following premises:

3. the implicit assumption that a match of a particular DNA profile of the sample of the “donor” (including archaeological samples) with the profile of the samples included already in the population DNA database (coming always from a particular country) can provide evidence for the determination of the ethnic origin of the “donor”;
4. the thesis about the German character of Silesia, where the families of Kopernik and Watzenrode came from;
5. the information on the occurrence of DNA sequences of the samples in the mtDNA and Y–DNA population databases.

I would like to state then, that the inference presented above is void because of the assumption of erroneous and selective premises.

The (a) premise ignores the issue of the family history of the person from whom the DNA sample was taken, including the effect of migration in comparatively recent and very remote times. These effects lead to mixing of the gene pool. For example, let us hypothetically suppose that, at some point in his-

⁶⁰ The Polish journalist kept his presence of mind, criticizing such a view. “The surprising results of the analysis of DNA samples, which were taken from the bones found in 2005 in Frombork are, of course, no evidence of the Germanness of the famous scientist. Despite this, they may, however, become an argument for the most extreme proponents of this thesis. Because the dispute on the nationality of the astronomer has been going on at least since the 1930s. But not only the Nazis wanted to make a German out of Nicolaus Copernicus. Guenter Verheugen, Deputy Head of the European Commission, also said that the astronomer »had German parents from Prussia«” (“Dziennik.pl” 2009, in Polish).

⁶¹ “Copernicus’ haplotype places him almost certainly in haplogroup R1b. While this haplogroup has a very wide distribution, it is the case that it is one of the haplogroups which differentiate Germans from Poles. So, while this is insufficient to ascertain the ethnic origin of Copernicus’ patrilineage, it certainly suggests a higher probability for it being of ethnic German rather than Polish origin” (“Skadi Forum” 2009).

tory there was a tribe which had so far been “purely Germanic” (with “a purely Germanic” mtDNA), who kidnapped into slavery Slav women with a “purely Slavic” mtDNA. As you might imagine, this led to the birth of members of the Germanic tribe of “purely Slavic” mtDNA (because mtDNA is inherited from the mother).

The (b) premise is inconsistent with the historical knowledge (on which I already wrote enough in Sect. 8.7 above).

The (c) premise is contrary to the knowledge about the mtDNA and Y-DNA databases, the resolutions on the ethnogenesis of Slavs and Germans and the historical and historical genetic knowledge about the origin of the Torun burghers.

As I explained previously (in Section 8.4), a detailed overview of the mtDNA population database EMPOP proves that the authors took into account only a part of this database, namely the forensic data, and left out the literature data. It is true that for the forensic data there is no sample from Poland on the sequence determined by the authors, but there are three from Germany and one from Denmark. However, this fact does not at all constitute evidence that Copernicus’s mother could have come from the German ethnic group since this database did not contain (and still – as of 2013 – does not contain) Polish forensic samples. When we additionally take the literature data into account, it appears that one sample (out of all 646 samples from the literature data) comes from Poland (Kościerzyna), which refutes the authors’ thesis that the genetic studies have proved the Germanness of Copernicus’s mother. In other words, a mere attentive review of the EMPOP database falsifies the authors’ thesis that this database can be used to demonstrate the German origin of Copernicus in his maternal lineage!⁶²

In the above argumentation I *accepted the implicit assumption* of the authors of the DNA research of the alleged remains of Copernicus that the presence or the absence of the samples in the database with current data can provide unambiguous evidence for the ethnic origin of the DNA traces of the person under study. However, this assumption is erroneous. In reality, the situation is much more complex. It is not enough just to have the information from which country a given sample

⁶² Following this reasoning, we might also take into account here the (deprecated) thesis of Polish researchers in Nicolaus Copernicus’s life (discussed in subsection 8.6) that the maternal grandmother of Copernicus was Catherine Modlibog (e.g., Polkowski 1873, pp. 73–75; Birkenmajer 1923, pp. 98–99; 1924, pp. 1–54, 142–151, 241–251; Rospond 1973, pp. 146–147), and such a name hints at Slavic origin of this person. Hence, accepting the assumptions (a) – (c) of the authors of the DNA analyses, we might, essentially, draw a no less reasonable conclusion: on the strength of the mechanisms of inheritance, the DNA results prove genetically Slavic roots (after Catherine Modlibog) of four people (three from Germany, one of Denmark), whose mtDNA samples are listed in the EMPOP database. Cf. also Kokowski 2009b, pp. 135–136, 430–431.

comes. We also need to know the ethnic history of the family of the person this sample came from.

Let me give an unequivocal illustration of this problem on the example of the MitoSearch DNA Database – a public service of the Family Tree DNA company involved in genetic testing for genealogical purposes. It turns out that for the sixteen samples in the database matching the haplotype of the alleged remains of Nicolaus Copernicus, no sample comes from the indigenous areas of Germany, and two come from current Polish territory. The first of these samples belongs to an American citizen who came from Rosalie Suchla née Halama (1846–1906), coming from Opolski Silesia, from the village of Poppelau (that is Popielowo near Opole). That Rosalie came from a Polish-speaking family, and in 1882 (that is, at the times when Silesia was under the rule of Prussia) emigrated to the USA, where she settled in Independence (Wisconsin); she did not speak English.⁶³ And the second sample belongs to an American citizen who comes from Florentyna Chmielewska (1887(?)–1945), born probably in the vicinity of Płock (the capital of Mazovia, 80 km from Lidzbark Warmiński, 147 km from Olsztyn and 84 km from Toruń). In 1900 in the USA Florentyna married Wincenty Franciszek Bączek / Banczek (the name was changed in the USA to Frank Vincent Bonczek), in a Polish Church of St. Stanislaus in Newark (New Jersey).⁶⁴

Did I just thereby prove that the two currently living American citizens (and their female ancestors) are Copernicus's relatives? Not at all, because the common female ancestor of Copernicus and all those currently living people (and their female ancestors) who share the same mtDNA sequence as Copernicus and come from many different countries (England, Denmark, Ireland, Finland, France, German, Polish and the USA), can have lived several thousand years ago.⁶⁵ In order to prove blood relationship of these people we should carry out a huge research project to build complete family trees of such families from the times of Copernicus to the present day. It is unlikely (albeit logically possible) that such a task could be completely executed in any particular case. As we know from the research of the family tree of the relatives of Copernicus in the female lineage, *due to the lack of source data* the researchers only managed to reproduce this tree from Catharine Watzenrode, the grandmother of the astronomer (ca. 1400 – ca. 1462), to the relatives living in the middle of the 18th century (see Mikulski 2008; Jendrzewska, Stachowska 2008). Premise (c) neglects the

⁶³ Cf. Nogosek 1982; J.W. Day 2009; J. Day 2010; Kokowski 2010d.

⁶⁴ Cf. Mayka 2009b; Tamara 2001; 2006; 2007; 2009; 2010; 2011. I must emphasize, however, that after carrying out the analysis of archival documents available to me, I have some doubts about the accuracy of the information about the place and date of birth of aforementioned Florentyna.

⁶⁵ Lawrence Mayka, the volunteer administrator of the Polish Project of the Family Tree DNA, is aware of this problem – cf. Mayka 2009a; 2009b.

knowledge of the ethnogenesis of Slavs and Germans, based on the results of the linguistic research, the genetic studies (of the history) of migration of tribes (Y-DNA analyses) and the archaeological research of the past 60 years – cf. for example *Eupedia* 2011a (and the numerous literature references there), “Historia – forum historyczne Histmag.org” 2011 (and the numerous literature references there) and Pietrzak 2011. According to these results, it is certain that the Slavic languages derive from the Indo-European languages. The Slavic languages are used by the populations coming from the population of the Indo-European tribes, in which the dominant haplogroup is haplogroup R1a. This does not mean at all that other haplogroups, for example R1b, I1 or I2, are not present there. It is also known that the Germanic languages developed relatively late, that is around (or after) 500 BC, as a result of mixing of proto-Celtic and proto-Slavic languages, which were spoken by populations with different haplotypes – mainly R1b, I1, and R1a. This mixing results in the fact the mere finding a haplotype R1b sample does not necessarily prove its Germanic origin, just like finding a haplotype R1a sample does not prove its Slavic origin.

The premise (c) also neglects the knowledge of the empirically confirmed fact of the similarity between the genetic structures of Slavs and Germans, and the similarity of morphological characteristics of human populations living in Central Europe in the period from the Bronze Age to modern times (this also applies to the Western Slavs and Germans in the Middle Ages and modern times) (see Malyarchuk 2001, Grzybowski *et al.* 2002; Piontek, Iwanek, Segeda 2008, specially pp. 67–83). In consequence, the Western Slavs and the Germans may have the same haplogroups.

Premise (c) also ignores the historical knowledge and the historical genetic knowledge of the origin of the burghers of Toruń. The earliest historical information on the subject can be found in the sources from the second half of the 13th century: the newcomers from Silesia and Lausitz and all Poland, including the nearby Kujawy, Wielkopolska and the Chełmno district, are listed in them; the fourteenth-century sources mention the influx of a large population group from Westphalia (cf. Jasiński 1999, pp.138–139 ; Tandecki 1999, pp. 203–206; Mikulski 1997b; Biskup 1992, pp. 80–86). It results from the historical genetic research that in these regions, with the exception of Westphalia, the haplogroup R1a has prevailed for 2,000 years – cf. *Eupedia* 2011a (and the literature references there). In consequence, a discovery of the sample with haplotype R1b would suggest that if the sample is of Germanic origin, the person from whom this sample was taken, should have come from a family originating from Westphalia. This, however, is by no means settled by historical sources.

8.9. The problem of the reliability of DNA analyses of the remains from the grave 13/05 as the definite criteria for identification of the remains of Nicolaus Copernicus and the issues of kinship, ethnicity and sampling saturation in DNA population databases

According to popular ideas, a match of the DNA tests (mtDNA and Y-DNA) of compared samples of given individuals is *the definite proof for*: (a) the identicalness of the DNA profile of the biological material and (b) the family blood relationship between these individuals, and even (c) their ethnicity. However, this is not true for a very simple reason, namely the existence of a possible random match of *partial DNA profiles* of the samples analysed (the effect is well-known in the so-called genetic genealogy) as a result of mixing genes of one or many populations, which I mentioned in Chapter 8.8. In other words, it is possible to find a *partial match* between the DNA profiles of people who are not related at all and have different ethnic origin.

As I showed above (in chapter 8.1 and 8.2), when we determine the random match of the mtDNA sequence for rare and unique samples (*in the mathematical meaning of these terms*), instead of the normal approximation of the binomial distribution we should use the Poisson approximation of the binomial distribution or directly the binomial distribution.

Nevertheless, in cases of rare and unique DNA profiles, we should always be very careful in unambiguous interpretations of the results obtained. It results from the fact that the *currently* existing population databases are not fully representative, which is due to: 1) the relatively small number of samples in these databases (only a few or several thousands of samples from all over the world, though about 6.8 billion people live on our planet, of which about 724 million live in Europe); 2) the lack of the so-called saturation of the population DNA databases, both national and international; and 3) the poor structure of the sample sets in such databases – for example, the databases do not include samples from certain areas of countries or even form entire countries. (We should remain particularly critical when we use population databases to draw conclusions regarding somebody's ethnic origin – compare above Chapters 8.4 and 8.8).⁶⁶ I mentioned this issue in the paper delivered at the conference in Kraków in 2010 (see Kokowski 2010c), which, however, met with an overwhelming criticism of Tomasz Grzybowski, a DNA research expert,⁶⁷ who was present at this conference.

⁶⁶ I formulated this issue for the first time in: Kokowski 2009b, pp. 135–136, 430–431.

⁶⁷ Cf. fn. 38. I would like to add that this author in his own paper presented during the conference (cf. Grzybowski 2010) made the thesis of *almost achieving sampling saturation* in the Polish population mtDNA database regarding the nucleotide diversity and number of polymorphic positions and the lack of sampling saturation in this database regarding the number of different haplotypes.

It transpires, however, that the theses made by me during the Kraków conference are correct, which is easy to demonstrate on the specific example of the EMPOP database, greatly acclaimed by researchers. The set of samples in the EMPOP database is not a representative sample of the Western metapopulation. The reason is elementary: the forensic data in EMPOP (which was used by the researchers of the alleged remains of Copernicus) did not include samples from many European countries, including Belarus, the Czech Republic, Estonia, the Netherlands, Ireland, Latvia, Malta, Norway, Poland (!), Portugal, Russia, Serbia, Slovakia, Slovenia, Switzerland, Sweden, Turkey or the United Kingdom (see fig. 3; a similar remark, but – I want to emphasize – with some differences!, also refers to the literature data in EMPOP – see fig. 4).

In addition, it is easy to construct a qualitative and quantitative test of the correctness of my thesis on the *statistical* unrepresentativeness of population databases, which is caused by the effect of the lack of sampling saturation, on the example of the so-called Western metapopulation.

For this purpose, I have chosen the data taken from the article by Pereira, Cunha, Amorim (2004), who analysed the problem of sampling saturation of Portuguese mtDNA haplotypes in the national database, as the model for the sampling saturation of mtDNA haplotypes for HV1, HV2, and HV1+HV2 regions for all countries.

The aforementioned researchers have found that in the case of Portugal in order to achieve sampling saturation in the national database, 1000 samples is sufficient in the case of HV1, 900 in the case of HV2, and 1300 in the case of HV1 + HV2. (I take the idealized assumption that national metapopulations are as homogeneous as the Portuguese metapopulation⁶⁸). Then, based on the data regarding the number of samples in the EMPOP database (in the opinion of specialists, this database is considered as a master database of European mtDNA) and the Portuguese data (because these data were not included in the EMPOP database – see fig. 11 and fig. 12), I have calculated two magnitudes: *the Sampling Saturation Rate in the mtDNA Population Database for the Country Given (CSC)* and *the Normalized Sampling Saturation Rate in the mtDNA Population Database for the Country Given (NCSC)*, in accordance with the following definitions:

1. *The Sampling Saturation Rate in the mtDNA Population Database* (respectively: HV1, HV2, HV1+HV2) *for the Country Given (SSRC)* is the ratio of the number of the mtDNA samples (respectively: HV1, HV2,

⁶⁸ This is consistent with the thesis accepted that the frequencies of the mtDNA haplogroups in different European metapopulations take similar values – cf. for example Torroni *et al.* 1996; Salas *et al.* 1998; Pereira, Prata, Amorim 2000; Mogentale-Profizi *et al.* 2001; Grzybowski *et al.* 2007; Eupedia. *European travel and history* 2011b.

HV1+HV2) from the given country (with the exception of Portugal) included in the EMPOP database to the total population of the country.

2. *The Normalized Sampling Saturation Rate in the mtDNA Population Database* (respectively: HV1, HV2, HV1+HV2) *for the Country Given (NSSRC)* is the ratio of *the Sampling Saturation Rate in the mtDNA Population Database* (respectively: HV1, HV2, HV1+HV2) *for the Country Given* to *the Sampling Saturation Rate in the mtDNA Population Database* (respectively: HV1, HV2, HV1+HV2) *for Portugal* (these values are determined from the data given in article: Pereira, Cunha, Amorim 2004); by definition in the case of Portugal the NSSR is 1 for HV1, HV2, HV1+HV2 regions.

Tab. 1. The Sampling Saturation Rate in the population of mtDNA and the Normalized Sampling Saturation Rate of mtDNA for the European metapopulation (Europe) for the data from EMPOP (version 1a), the data on the population from Wikipedia 2010f, on the metapopulation of Portugal from: Pereira, Cunha, Amorim 2004.

Country	European MP (Europe) Forensic data – Literature data	Population	SSR * 100 000	SSR/NSSR		
				HV1	HV2	HV1+HV2
Austria	273 S	8 210 281	3,325	0,356	0,396	0,274
Belgium	104 S	10 414 336	0,999	0,107	0,119	0,082
Bosnia and Herzegovina	156 S	4 613 414	3,381	0,362	0,402	0,278
Cyprus	91 S	796 740	11,422	1,223	1,359	0,941
Denmark	209 S	5 500 510	3,800	0,407	0,452	0,313
Finland	200 S	5 250 275	3,809	0,408	0,453	0,314
Germany	513 S	82329758	0,623	0,067	0,074	0,051
Greece	319 S	10 737 428	2,971	0,318	0,353	0,245
Hungary (European mp.)	212 S	9 905 596	2,140	0,229	0,255	0,176
Italy	398 S	58 126 212	0,685	0,073	0,081	0,056
Latvia	–	2 231 503	–	–	–	–
Macedonia	197 S	2 066 718	9,532	1,021	1,134	0,785
Spain	308 S	40 525 002	0,760	0,081	0,090	0,063
Poland	481 L	38 482 919	1,250	0,134	0,149	0,103

Tab. 1. (continued)

Country	European MP (Europe) Forensic data – Literature data	Population	SSR * 100 000	SSR/NSSR		
				HV1	HV2	HV1+ HV2
Romania	360 S	22 215 421	1,620	0,173	0,193	0,133
Russia	62 L	140 041 247	0,044	0,005	0,005	0,004
Slovenia	103 L	2 005 692	5,135	0,550	0,611	0,423
Sweden	–	9 059 651	–	–	–	–
Portugal	1000	10 707 924	9,339	1	–	–
Portugal	900	10 707 924	8,405	–	1	–
Portugal	1300	10 707 924	12,141	–	–	1

Tab. 2. The Sampling Saturation Rate of the population of mtDNA and the Normalized Sampling Saturation Rate of mtDNA for European metapopulation (Europe) for the data from EMPOP (version 2.1), the data on population from *Wikipedia* 2010f, on the metapopulation of Portugal from Pereira Cunha, Amorim, 2004. (The data in this table differ from the data in Table 1 in the following countries: Denmark, Hungary, Latvia, Macedonia, Poland, Russia, and Sweden, as a result of expanding the database with new samples).

Country	European MP (Europe) Forensic data – Literature data	Population	SSR * 100 000	SSR/NSR		
				HV1	HV2	HV1+ HV2
Austria	273 S	8 210 281	3,325	0,356	0,396	0,274
Belgium	104 S	10 414 336	0,999	0,107	0,119	0,082
Bosnia and Herzegovina	156 S	4 613 414	3,381	0,362	0,402	0,278
Cyprus	91 S	796 740	11,422	1,223	1,359	0,941
Denmark	206 S	5 500 510	3,745	0,401	0,446	0,308
Finland	200 S	5 250 275	3,809	0,408	0,453	0,314
Germany	513 S	82 329 758	0,623	0,067	0,074	0,051
Greece	319 S	10 737 428	2,971	0,318	0,353	0,245
Hungary (European mp.)	594 S	9 905 596	5,997	0,642	0,714	0,494

Tab. 2. (continued)

Italy	398 S	58 126 212	0,685	0,073	0,081	0,056
Latvia	131 L	2 231 503	5,870	0,629	0,698	0,483
Macedonia	200 S	2 066 718	9,677	1,036	1,151	0,797
Poland	894 L	38 482 919	2,323	0,249	0,276	0,191
Romania	360 S	22 215 421	1,620	0,173	0,193	0,133
Russia	290 S+L	140 041 247	0,207	0,022	0,025	0,017
Slovenia	103 L	2 005 692	5,135	0,550	0,611	0,423
Spain	308 S	40 525 002	0,760	0,081	0,090	0,063
Sweden	335 S	9 059 651	3,698	0,396	0,440	0,305
Portugal	1000	10 707 924	9,339	1	–	–
Portugal	900	10 707 924	8,405	–	1	–
Portugal	1300	10 707 924	12,141	–	–	1

From the tables presented it results clearly that, against the background of the Portuguese database, the national sub-databases of the EMPOP database, with the exception of Cyprus sub-database (HV1, HV2) and Macedonian sub-database (HV1, HV2), have not yet reached saturation. This remark applies of course to the ideal case: a homogeneous population structure of individual countries. All the more so it applies to minority groups in these countries! I suppose, however, that the Cyprus sub-database and the Macedonian sub-database have not reached the point of saturation, since it is known that both Cyprus and Macedonia are not ethnically nor genetically homogeneous: Cyprus is populated mainly by Greeks (77% of the total population), the second group are ethnic Turks (18% of the population), the remaining 5% of the population are Armenians, Englishmen, Jews and refugees from Lebanon (cf. *Wikipedia* 2010a, 2010b); Macedonia is populated by different ethnic groups, mainly Macedonians (66% of the population) and Albanians (25%), and Turks (3.9%), Romani people (2.6%), Serbs (1.8%) and other nationalities (0.7%); the ethnic Macedonians themselves are descendants of, among others, Slavs and Greeks (cf. *Wikipedia* 2010g).

All of this convinces me of the *statistical* unreliability of the existing mtDNA population databases, and I refer this thesis particularly to the rare and unique samples in a *statistical sense*, i.e. when the Poisson distribution should be used as an approximation to the binomial distribution. I would like to add that the usage of the Poisson distribution as an approximation is of course correct; my doubts regard only the reliability of the initial parameters (the frequency value of the

samples in the database) and the calculations, made on the basis of such databases (this is an empirical problem associated with the lack of sampling saturation). What resulted from the considerations presented here but unambiguously formulated already in the paper given at the Kraków conference (Kokowski 2009a, 2010c), is the unequivocal postulate that the specialists of the mtDNA population databases should empirically test the thesis made by me. What is interesting, it transpires that this has already happened! My conference opponent, i.e. Tomasz Grzybowski (together with collaborators), had abandoned his primary idea of the *almost achieved saturation* in the mtDNA population databases he had announced during that conference. He did that in his following article entitled *Oce-
na stopnia wysycenia bazy danych mitochondrialnego DNA dla populacji Polski (Saturation of the Polish mitochondrial DNA database)*, “Archiwum Medycyny Sądowej i Kryminologii” 2010, vol. LX, pp. 263–269, which was published after the Kraków conference. Let us quote a key part of this publication:

From the above analyses it can be concluded that the Polish population database of mitochondrial DNA profiles, just like other discussed databases with European or global range, has not reached the point of saturation for all possible mtDNA haplotypes yet (sic). This database in its current form may be used for genetic and forensic purposes, but with caution in regards to estimating the frequency of rare and unique haplotypes (sic). According to the guidelines in force in the international milieu of forensic geneticists, in order to assess the frequency of rare haplotypes in the population 95% confidence interval (sic) should be applied here, with the use of the natural logarithm of frequency, the normal approximation to the binomial distribution (sic) and antilogarithm (...). In the assessment of the frequency of the haplotypes the connected databases for different ethnic groups of Central Europe can also be used, since it has been demonstrated that the population of this part of the Old Continent bears no visible features of stratification at the level of the mtDNA control region (...) (Daca, Mielnik-Sikorska, Bednarek, Grzybowski 2010, p. 268; translation – M.K.).

Thus, we see that the authors mentioned make now the thesis about *the lack of sampling saturation in the mtDNA population databases which I formulated earlier*, and which was negated by Tomasz Grzybowski during the Kraków conference. (The authors of this publication present solid empirical evidence for my thesis, which confirms the qualitative and quantitative evidence given in the Tab. 1 and Tab. 2). At the same time, the same authors, “according to the guidelines in force in the international milieu of forensic geneticists” (sic), repeat the thesis of the applicability of the normal approximation to the binomial distribution to the model of a random match for rare or unique haplotypes. However, this is an unequivocal error, which I have explained extensively in this article (see chap. 8.1, 8.2): in such cases, as an approximation for the binomial distribution the Poisson distribution should be applied.

Reflecting more deeply on the issue of statistical reliability of population databases, I have come to differentiate now between two concepts: *the numerical sampling saturation* and *the frequency sampling saturation*. By *numerical sampling saturation* I understand the effect that after including other groups of samples into the database, no fundamentally new types of samples (in this case mtDNA haplotypes) appear in the database. On the other hand, I understand *the numerical sampling saturation* as a subtler effect: i.e. when after including other groups of samples into the database, the frequencies of appearance of certain sample types in the database do not change, in principle. For obvious reasons, this second type of sampling saturation is much more difficult to achieve, which is related to the *a priori* unknown geographical distribution of samples (our ignorance on this point can only be removed by a detailed empirical study combined with a great expansion of the population databases).

In the context of the considerations carried out in previous sections, it is also clear that the general issues indicated above are fully reflected in the particular case of the evaluation of the DNA analyses of *the remains from the grave 13/05*, which – I think – does not need any further explanation here.

8.10. Comments on the anachronistic notions of “nationality” and “ethnicity” in Copernicus’s days

As it is well known, the multinational Kingdom of Poland for centuries boasted liberties, both religious and economic (that is relatively, at the time, low taxes). These liberties were a strong incentive for many Europeans (for example ethnic Germans, Scandinavians, Dutchmen) to settle in this country. The issue of the descent of these new citizens, of their “nationality” and “ethnicity” did not play a significant role at the time, and so was it in Copernicus’s time. Such a role was however played by the consciousness of being a subject of a certain royal power. The aforementioned concepts of “nationality” and “ethnicity” are the product of only the 18th and 19th centuries. They became the foundation for the terms of “nation” and “national consciousness”, created then.

Nicolaus Copernicus and his family, both from his paternal and maternal lineages, living in Prussia, one of the provinces of the multinational Kingdom of Poland, identified themselves with the interests of the kingdom, of which they were citizens, as well as with the interests of their province. Therefore, due to the fact that modern Poland is the political successor of this national tradition, it is entirely legitimate to talk about the Polish scientist Nicolaus Copernicus.⁶⁹ This is all the

⁶⁹ The editors of the online edition of the British tabloid “Daily Mail” did not remember about this fact. In the first version of the article on the addition of three new elements to the periodic table

more justified, as it is known from historical research that, in addition to Latin, Greek and German, Copernicus also knew the Polish language, as is evidenced, for example, by the faultless records of Polish names in the *Locationes mansorum desertorum* (*Allocations of the Deserted Acres in Warmia in the Years 1516–1521*) edited by Marian Biskup (cf. Copernicus 1970/1983, 2007). It is however anachronism to speak of Copernicus as a Pole or a German in the ethnic sense.⁷⁰

At this point I wish to emphasize that in the current political context of the European Union Nicolaus Copernicus may be regarded as one of the leading figures of the European cultural integration understood in all possible (i.e. scientific, philosophical, political, educational, economic, social, and linguistic...) contexts and aspects.⁷¹ It is quite obvious that the condition of acceptability of this interpretation is its relevancy: the reliance on reliable (historical and current) sources, the openness to dialogue and the avoidance of various types of anachronism.

On the one hand, let us remember that from the perspective of the exact sciences the value of Copernicus's achievements does not depend on whether he was a Pole or a German in an ethnic sense (in the meaning given to that term in the 19th and 20th centuries), or even someone else (for example, a local Prussian patriot, a "universalist" – a citizen of Europe). On the other hand, we must not overlook another very important perspective: the thorny Polish-German relationships and their significance in the history of the debate on the ethnic origin of Copernicus. The study of this intricate issue calls for keeping the highest scientific standards.

9. The defectiveness of the authoritative argument in the reasoning in favour of the acceptance of the discovery of the grave of Nicolaus Copernicus

As we know from rhetorics, the art of persuasion, one of the tools used in the procedure of argumentation (for or against any thesis) is *argumentum ad verecundiam*, that is the argument appealing to respectability, the argument from authority. It means that to justify the thesis made by us we refer to authority: a person

by the International Union of Pure and Applied Physics (IPUAP), published on 4 November 2011 in this journal, they said that one of these elements, numbered 112, i.e. "Copernicium," was named after the "name of a PRUSSIAN astronomer" ("Daily Mail" 2011). The error was removed on 8 November 2011 following the reaction of readers and the influence of other texts that had appeared in the media, including "Gazeta.pl" 2011a.

⁷⁰ I discuss this issue extensively in: Kokowski 2009b, pp. 115–136, 402–431.

⁷¹ I made this thesis for the first time in the paper delivered in a symbolic place of the European Union, that is in Maastricht, during the 1st International Conference of the European Society for the History of Science, "Science in Europe – Europe in Science" (Maastricht, 4–6 November 2004) – cf. Kokowski 2004a.

or a whole environment who already accepted our thesis. This argument was used by the team of Jerzy Gąssowski in two ways: both to confirm the theses propounded by them and also to defend the theses criticized by the opponents. The argument has the following structure (*I provide it here in my own synthetic formulation*): “You are criticizing our research, in particular, the genetic studies, however: (a) we published an article (Bogdanowicz *et al.* 2009) on the subject in the PNAS (“Proceedings of the National Academy of Sciences of the United States of America”),⁷² a prestigious journal from the Master Journal List (called in Poland *the Philadelphia list*⁷³), (b) our findings were accepted by a world-renowned Professor, Owen Gingerich also in the journal mentioned (Gingerich 2009).”

Such an argument (*in a different, but semantically equivalent verbal form*) was reported in, among others, Bogdanowicz *et al.* 2009 (cf. Jezierski 2010, p. 178), Gąssowski 2010b, p. 26; Gąssowski 2010c, pp. 121–123 (this argument was also voiced during the Kraków conference by the advocates of the discovery of the grave of Nicolaus Copernicus, present at this conference). Nevertheless, I think that this argument is defective, because the article mentioned (Bogdano-

⁷² This article was edited by Dr. Alan Walker, professor of anthropology and biology at the Department of Anthropology at Penn State Pennsylvania State University, University Park, PA (Walker 2011), and reviewed by Dr. Ronald Van Den Bussche, professor of zoology at the Life Sciences East Oklahoma State University, the manager of the Van Den Bussche Laboratory of Molecular Systematics and Conservation Genetics and, among others, the holder of the scholarship of Fulbright Commission in Museum and Institute of Zoology of PAS in Warsaw in 2005 (Fulbright Senior Specialist Fellowship) (Van Den Bussche 2011a; 2011b), and Dr. John H. Rappole, a zoologist and ecologist, a researcher at the Smithsonian National Zoological Park, Smithsonian Conservation Institute, Conservation Ecology Center specializing in the ecology and evolution of birds and their importance for the conservation of the species (Rappole 2011).

⁷³ The Master Journal List, also known in Poland as the Philadelphia List is developed and regularly updated by the Institute for Scientific Information (Philadelphia, USA). The Polish name was introduced by Kajetan Andrzej Wróblewski (Wróblewski 1999), which, among others, is, of several terms, the chairman of the Scientific Council of the Institute for the History of Science, Polish Academy of Sciences and is currently the Vice-President of the Polish Academy of Arts and Sciences.

According to the list of scientific journals of 2009 arranged by the Polish Ministry of Science and Higher Education, an institute employing the author of each article published in the “Proceedings of the National Academy of Sciences of the United States of America” received 24 points. For comparison, for each article published in the world’s top specialist journal on the history of Polish science, namely “Kwartalnik Historii Nauki i Techniki” (“Quarterly Journal of the History of Science and Technology”), only 6 points were given (cf. Ministerstwo Nauki i Szkolnictwa Wyższego 2009, p. 107, no. 6877 and p. 137, no. 578). According to the analogous list of 2010, it was as follows: 32 points for an article published in “PNAS” and 9 points for an article published in “KHNiT” (cf. Ministerstwo Nauki i Szkolnictwa Wyższego 2010, p. 216, no. 7207 and, respectively, p. 281 no. 738). On the ministerial list of 2012 these points were, respectively, 45 and 10 (cf. Ministerstwo Nauki i Szkolnictwa Wyższego 2012a, p. 216, no. 8474; 2012c, p. 59, no. 2268). This scoring is an expression of an apparent discrimination of the history of Polish science – paradoxically – by an institution of the Polish government!

wicz *et al.* 2009) contains numerous shortcomings and errors indicated above, which were overlooked by even the most successful and famous commentators of that article.

I entirely agree with the team of Jerzy Gąsowski that the famous professor Owen Gingerich (see Gingerich 2011b) in his article (Gingerich 2009) unambiguously implied that he accepted the scientific value of the DNA analyses of the alleged remains of Copernicus:

When in 2005 Polish archaeologists led by Jerzy Gąsowski found fragments of a skeleton tentatively identified as the remains of the 16th-century astronomer Nicolaus Copernicus, some doubts remained. Now, in this issue of PNAS (...), these issues are resolved with high confidence through DNA analysis (Gingerich 2009, p. 12215).⁷⁴

He also formulated three relevant critical remarks: 1) Copernicus was not a priest after all, 2) we can see on Copernicus's portraits that he had dark eyes and 3) one of the hairs from the *Calendarium Romanum magnum...* can belong to Professor Gingerich himself, because he studied this work (Gingerich 2009, p. 12216; 2010, pp. 29–30). He, however, did not in any way refer to the German thread. It is worth recalling that he had done so in his earlier publications, among others: Gingerich 2004a/2004b; 2004c; 2004d:

[Piotr Majewski:] Polish and German researchers still have a dispute over the nationality of Copernicus: was he Polish or German? What is your opinion?

[Owen Gingerich:] This dispute has a long history. I have found in many German publications a statement that Copernicus was a German astronomer. Those scholars derive their arguments from the indisputably established fact that the scholar spoke German. There was nothing extraordinary about it, because at the time the German language had the role of an international language, especially in the centres of the Hanseatic League. It was the language of trade relations, and let us remember that

⁷⁴ He consistently repeated this view in his subsequent publications: Gingerich 2010a, p. 29; 2010b, p. 230; 2011a, p. 48. As a side note, I would like to add that in the last two articles Gingerich provides fictitious information saying that Copernicus was supposedly nearly elected the bishop of Warmia in 1537, but he refused because he wanted to follow his vocation, that is writing *De revolutionibus* (Gingerich 2010b, p. 225; 2011a, p. 43).

The historical facts are as follows: on 1 July 1537 Bishop Maurice Ferber dies. Therefore, the Warmia Chapter appoints from among themselves four candidates for the bishop post in the following order: Johannes Dantiscus, Bishop of Chełmno, Jan Zimmermann, Custodian, Doctor Nicolaus Copernicus and Achacy von Trenck. Sigismund I, King of Poland, approves this list and in the letter of 4 September 1537, prepared in Lwów, he puts forward the proposal that the first person on the list, Dantiscus, should be chosen Bishop of Warmia, which is then unanimously accepted by the Warmia Chapter in Frombork on 20 September 1537 (Biskup 1973a & 1973b records no.: 364–368, 370–371, 373–374). With regards to *De revolutionibus*, in 1537 most of this work had already been written (cf. Birkenmajer 1900, p. 350–388; Veselovskij / Weselowski 1965).

Copernicus came from a family of merchants living in Toruń, which belonged to the Hansa. However, there is no clear evidence that he used Polish (*sic*; this is misinformation; cf. above chapter 8.10 – M.K.). He used Latin in writing, which was the official language and one used in correspondence. Also scientific works were created in Latin. I do not think, therefore, that the language was the decisive criterion in assessing the nationality of Copernicus. What is more suitable is the place of birth. Since Copernicus was born in Toruń, which belonged to Poland – under law he became a subject of the Polish King. He studied in the royal city of Kraków, and in his activities he often emphasized his devotion to the Polish King. In my opinion, this loyalty proves conclusively that he felt himself Polish. Since, however, the era of the European nation-states had not begun at the time, I would call Copernicus “a European citizen” devoted to the affairs of Poland (Gingerich 2004c).

[Jakub Ostalowski:] There was a dispute between Poles and Germans over whose Copernicus is: theirs or ours. What is your opinion on this?

[Owen Gingerich:] It seems to me that in my book (i.e. Gingerich 2004a/2004b – M.K.). I clearly argued in favour of one party of the dispute: Poland. There was a time when the Germans claimed that the family name of the astronomer is the Germanic Coppernigk or Koppernig. However, the Padua document is signed “Nicolaus Copernic”, but the scholar happened to sign his works sometimes as Coppernicus (*sic*)⁷⁵ (Gingerich 2004d; translation – M.K.).⁷⁶

10. The fundamental defect – the insufficient sensitivity to the problems of interdisciplinary research

As I showed in the earlier sections of this article, the authors engaged in the research into the identification of the putative remains of Nicolaus Copernicus left a variety of (material and formal) flaws and errors in these studies. These arose from two main reasons:

1. The lack of specialized knowledge of several disciplines, such as the iconography of Copernicus, the history of Copernicus’s life, the history and ethnic geography of Silesia, the genetic genealogy and the statistical calculus, and the selective knowledge of the mtDNA i Y–DNA population databases.

⁷⁵ I would like to note that the two-character -pp- was the traditional spelling of the names of the family of Copernicus who had arrived from Silesia. A detailed explanation of this issue is given by Stanisław Rospond (Rospond 1973, p. 99–118).

⁷⁶ I would like to add that I know Professor Gingerich personally and I really appreciate his input in the field of the history of science, especially in the Copernican studies – cf. many positive references to his publications, among others, in Kokowski 2001, 2004b, 2009b. This does not mean, however, that I cannot see the minor errors committed by him in this field – cf. Kokowski 2006; 2008a.

2. The insufficient sensitivity of the authors of these studies to the problems of interdisciplinary research. Since the authors mentioned did not feel a strong need to conduct *integrated interdisciplinary research*, they did not feel the necessity to collaborate closely with methodologists of interdisciplinary research, experts in Copernicus's portraits, experts in genetic genealogy, specialists of statistical calculus, experts in the history and ethnic geography of Silesia, etc.

11. The key conclusion

The above considerations falsify:

- 1) *the implicit research assumption* made by the team of Jerzy Gąssowski during the search for the relevant genetic material and the interpretation of the genetic analyses (see above, chapter 5), according to which a lack of expert knowledge of Copernicus and the historical context does not affect the correctness of the reasoning concerning the identification of the remains of the astronomer;
- 2) *the fundamental, explicit thesis of the research*, according to which the genetic studies of the putative remains of Copernicus were conducted perfectly, from the scientific point of view.

Having this in mind, I claim that despite the broad social acceptance of the thesis of the definite discovery of the grave of Nicolaus Copernicus, the irrefutable scientific evidence based on DNA analysis has not been provided yet. (This does not mean that I claim that there are no Copernicus's remains in his alleged grave. They may be there, but they need not be).

12. Further research perspectives

Since there is so far no convincing empirical evidence in favour of the discovery of the grave of Nicolaus Copernicus, it is worth looking for further possible methods and tests to confirm the results, for example: re-examining the putative remains of Copernicus, using more sophisticated empirical methods, such as e.g. measuring the concentration of the ^{14}C isotope by applying the technique of accelerator mass spectrometry;⁷⁷ additionally, in the light of the recent advances in molecular biology, it would be worth considering a plan to execute the full genome sequencing of these remains; conducting a very careful empirical comparison of

⁷⁷ Cf. Walanus, Kokowski 2012 (in this volume, pp. 157–166).

the alleged skull with the oldest portraits of Copernicus;⁷⁸ repeating the procedure of facial reconstruction from the skull 13/05 and thoroughly comparing the outcomes with the existing portraits of Copernicus;⁷⁹ examining the hairs from the entire book collection of Copernicus (according to the information received from Marié Allen in March 2009, Johannes Stöffler's *Calendarium Romanum magnum* and *Euclid's Elements* (1482) were researched in this respect);⁸⁰ examining the hairs in the autograph of *De revolutionibus*;⁸¹ looking for the grave of Bishop Watzenrode or other relatives of Nicolaus Copernicus (it is invariably a very important research topic).

In order to be able to judge better the credibility of the above tests – for methodological reasons – we should admit several independent professional teams to such research. It would be advantageous if, in addition to the teams already involved in this type of research, new teams, which have not had such an opportunity before, were allowed to participate. The work of such research groups should be subject to an inspection of a group of experts, who already before the start of the study would develop a way of analysing and interpreting the results. No pressure should be exerted on the researchers involved in conducting such projects – they would not have to find in the objects studied any traces of the DNA matching the profile of the samples of the alleged remains of Copernicus. The groups of such researchers could establish contacts with the press only until after the research has been concluded and reliable interpretation of the results received has been performed.

13. Methodological comments

At the basis of the type of tests sketched above there must be a developed methodological awareness of interdisciplinary research and extended expertise in many disciplines. In this context, two well-known theses of the methodology of empirical science should be recalled here:

⁷⁸ I postulated it already in 2005 – cf. Kokowski 2005b/2007a.

⁷⁹ *Ibidem*, cf. also Kokowski 2008b.

⁸⁰ I passed on to Associate Professor Marié Allen specific suggestions that she should devote particular attention to examining several other books which for many years had been used by Copernicus – cf. Allen 2009a; 2009b; Kokowski 2009c; 2009d; 2009e.

⁸¹ I would like to remind in this context that I am the author of this idea (the researchers involved in the analysis of DNA of the alleged remains of Copernicus did not know that the autograph of *De revolutionibus* is stored in Kraków) – cf. Kostrzewa 2008d; 2008e. Bearing in mind the information presented in this article, it should be, however, remembered that it is very difficult to carry out mtDNA examinations of archaeological hair samples, and then perform a reliable interpretation of the results received.

1. The conformity of correctly carried out tests (that is an “overlap” of confirmations) can only lend credence to the obtained results, or probabilize them. This is caused by the fact that the confirmatory tests never provide conclusive evidence due to the existence of formal constraints (of methodological nature, since, for example, one cannot prove the principle of induction) and material constraints (of the applied research methods).
2. It is also known that, so far, no mathematical measure of this probability has been developed on the grounds of the methodology of empirical sciences.⁸²

14. The urgent need to change the atmosphere in the media around the search for the grave of Nicolaus Copernicus

Because of the complexity of the interdisciplinary issues regarding the search for the grave of Nicolaus Copernicus and the identification of his remains, there is an urgent need to change the style of reporting such research in the media. In other words, it is necessary to avoid an atmosphere of haste, or premature publishing of any hypothesis that has not been fully developed, or the use of propaganda methods and techniques for creating a positive image, etc.. A tone of factual and rational scientific discourse and popular science discourse should be maintained. In this context, let me point out that I addressed this issue already in December 2005, in my second publication on the search for the grave of Copernicus (cf. Kokowski 2005b/2007a, the chapter entitled “Etos uczonego, strategia popularyzowania osiągnięć naukowych a niebezpieczeństwa popularyzacji” (“The ethos of the scholar, the strategy of popularizing scientific achievements and the dangers of popularization”)).⁸³

Moreover, the style of expression of ill-considered statements, such as the fabricated characteristic of: me, the reasons for my interest in the subject of the

⁸² Cf. for example Popper 1977; Hempel 1968; Nekrašas 1992.

⁸³ My appeal, however, met with quite an unexpected reaction, since Jerzy Gąssowski found my critique of the style of spreading premature information on the research results – in his interpretation – to be slanderous in nature (cf. Gąssowski 2005d & 2010c, p. 58–59).

What is interesting in this story from the methodological perspective is that the considerations of Jerzy Gąssowski on the subject under discussion are not consistent. The author does consistently deny in public both the value of my criticism and of my person (cf. Gąssowski 2005d & 2010c), and at the same time (Gąssowski 2010c, pp. 93–94, 98–107) complains about numerous serious trials and tribulations in the final phase of the research in 2008, caused by... the premature dissemination in the media of some important information on the search for the grave of Nicolaus Copernicus and the identification of his remains. Hence, it transpires that Jerzy Gąssowski is now a supporter of my own thesis about the danger of premature popularization of the results of research still in progress, which I already articulated in December 2005!

grave of Copernicus and the theses proclaimed by me, as well as the peculiar “report” of Jerzy Gąssowski from the scientific conference “The Nicolaus Copernicus grave mystery. A dialog of experts” (Kraków, 22–23 February 2010), in which he did not take part out of his own choice. The style of Jerzy Gąssowski’s reasonings is perfectly captured in the following quote:

The Kraków conference was a sum of a concentrated attack (*sic* – M.K.) on our achievements. “Stöfler’s work was used by the other, numerous canons”, “the research was sloppy”, “it is a coincidence that a hair of some canon got entangled in the book, and this canon was recognized as Copernicus”, “the reconstruction of Under-inspector Dariusz Zajdel is unbelievable”, “why was the analysis of radioactive carbon not performed?”, “the grave of canon Gąsiorowski refutes the idea that every canon was buried at his own altar”. It is impossible to mention here all the allegations, indicating the ignorance and bad will of debaters who did not allow matter-of-fact explanations (*sic* – M.K.). The meeting was chaired and “moderated” (*sic* – M.K.) by Habilitated Doctor Michał Kokowski. He strived not to allow those who were trying to provide explanations to the allegations to speak (*sic* – M.K.) (Gąssowski 2010c, p. 121).⁸⁴

I must admit that if I had not been one of the organizers of the Kraków conference, and if I had not participated in it, if I had not known in detail a number of research publications on the grave of Copernicus and much additional unofficial information, having read the book of Jerzy Gąssowski I would have been willing to think that *all Polish researchers*, who dare to identify any gaps in the argumentation in favour of the discovery of the grave of Nicolaus Copernicus, are perfidious and jealous people and pseudo-scientists, and also the co-creators of the toxic public atmosphere in Poland (the so-called Polish hell). Hence, I am not surprised that this message was so read by Rev. Jan Rosłań (2011) and other even more titled prelates who are not engaged in Copernican research have no source knowledge in this matter.

I also think that Jerzy Gąssowski commits a serious mistake when he undertakes the assessment my knowledge in the field of *Copernican interdisciplinary scientific research*, and especially when he counts me among the ignoramuses in this matter. Let me give a simple justification of this thesis: he himself has never dealt in a systematic way with such research. In contrast, I have been long involved with the Institute of History of Science PAS and the Commission of History of Science PAAS, which have the world’s longest continuous tradition of such research.⁸⁵ “In addition, (alas) I am, so far, the only researcher in Poland,

⁸⁴ Cf. also Gąssowski 2005d & 2010c, pp. 58–59.

⁸⁵ The following facts express the continuity of this research at both these institutions: Who was actively involved in the Academy of Arts and Sciences was Ludwik Antoni Birkenmajer (1855–1929), the author of numerous publications on Nicolaus Copernicus, the most important of which

who earned his doctorate (1998) and habilitation (2005) in such subject-matter. Moreover, in 2010 I was also awarded the Nicolaus Copernicus scientific prize of Kraków City Council for the monograph, which is an introduction to the Copernican studies, entitled *Różne oblicza Mikołaja Kopernika. Spotkania z historią interpretacji* (*Different faces of Nicolaus Copernicus. Meetings with the history of interpretation*; published in 2009, 676 pp.).

I also kindly ask Jerzy Gąssowski to rein in his prodigious polemical talent and cease to formulate and disseminate in the media of erroneous speculations about the Kraków conference and myself, including:

1. To formulate the thesis that, allegedly, inviting Professor Owen Gingerich to participate in this conference “was (...) to make plausible the overthrow of the results of our discoveries and research” (Gąssowski 2010c, p. 120; translation – M.K.).
2. To equate the Kraków conference to “a parliamentary inquiry commission” (understood by him as a synonym for a witch-hunt and an unfair court of law), which was to have been the reason not to participate in the Kraków conference for several researchers from Jerzy Gąssowski’s team, and especially for him himself (Gąssowski 2010c, p. 120).
3. To ascribe to me the role of an animator of the toxic public atmosphere in Poland, who during the Kraków conference, among others, “strived not to allow those who were trying to provide explanations to the (unfair – M.K.) allegations to speak” (Gąssowski 2010c, p. 121; translation – M.K.).⁸⁶

Three issues amaze me in this context. Firstly, regarding the fact that Jerzy Gąssowski has openly opposed the idea of conducting *an open scientific debate*, and thus trying to give himself and his followers the exclusive right to rule on the interdisciplinary issues of the grave of Nicolaus Copernicus. Secondly, although

were published by this Academy (cf. Kokowski (ed.) 2002). It was in my home institute where Aleksander Birkenmajer (1890–1967), the son of Ludwik Antoni worked. From 1954 until his death he developed there Copernican research and raised a group of followers, including, among others, the previously mentioned Jerzy Dobrzycki and Paweł Czartoryski. They intensified the Copernican research in my home institute, resulting in founding the Department of Copernican Research and the release of numerous publications in this field. In reference to this tradition, since 17 May 2011, my home institute has been called the Ludwik and Aleksander Birkenmajer Institute for the History of Science of the Polish Academy of Sciences.

⁸⁶ Let me add that Jerzy Gąssowski overlooked in his book (cf. Gąssowski 2010c, pp. 58–59) a non-trivial fact in this context, namely that as an expert of the Polish Academy of Arts and Sciences, I had taken part in the final stage of editorial works on the formulation of the text of the *Frombork Declaration* (the idea of which had been born in Pułtusk), had improved its several shortcomings, and on behalf of this Academy I had signed the final text of the Declaration during the ceremony in Frombork on 3 November 2005, during which we were notified about the discovery of the grave of Nicolaus Copernicus (cf. Kokowski 2012b, fn. 2).

the issue of interdisciplinary Copernican research is poorly known to him, he has the courage to publicly scold various experts in such research for an alleged lack of scientific solidity. Thirdly, although he did not participate in the Kraków conference, he formulates very serious allegations, including accusations *ad personam*, which, however, stand in stark contrast to the very programme and the contents of the conference deliberations – see Kokowski (ed.), 2010a.

I think that by doing it all Jerzy Gąssowski abandons scientific discourse and proves at the same time that he is not aware of the existence of the world's longest tradition of scientific Copernican investigations in Poland, which imposes on every disciple of such studies very high standards of research! (Unfortunately, I detected clear symptoms of these problems already in 2005 – cf. Kokowski 2005a; 2005b/2007a).

Let me take this opportunity to make one general reflection. In the contemporary world, including Poland, there is a noticeable decline in scientific ethos, a symptom of which is the ever more frequent replacement in scientific debates of the concept of *quality of scientific publications* with the concept of *dissemination of publications*. As it does not serve science at all, it is high time we openly opposed this increasingly intensifying dangerous mannerism.

15. The fundamental merit of Jerzy Gąssowski's research team

Despite the multilateral criticism of the methodology of Jerzy Gąssowski's research team and the results achieved by them and the interpretation thereof, presented in this article and in my previous studies, I never had and I still do not have doubts that it is possible to indicate a significant merit of these investigations. Basically, they have attracted back the attention of the general public in Poland to the personage of Nicolaus Copernicus. Thanks to this, it turned out with great clarity that the knowledge of one of the most important thinkers of the turn of the 15th and 16th century is in Polish society very superficial, even among its educated part. This points to the urgent need of intensification of scientific research into the history of science in Poland, and especially of organizational changes at Polish universities, where chairs for the history of science should be founded, whose task would be to conduct full-time and part-time studies of the first, second and third level in the history of science. This entails the necessity to include the history of science in the list of scientific disciplines in Poland. In order to achieve the best effects of this kind of reform of higher education, this discipline should be developed in a close contact with, on the one hand, particular disciplines (exact sciences, etc.), and on the other hand, philosophy of science and the sociology of scientific knowledge.

16. Summary

I have presented in this article a comprehensive critique of the results of the DNA analyses of the putative remains of Copernicus and of their interpretation. I want to emphasize that it of original character as far as the subject literature is concerned (I have had no predecessors in this field). The considerations presented here refer to my earlier publications and papers on this topic, developing and sometimes clarifying earlier findings. The value of these considerations is not limited to the analysis of the specific case of Copernicus and has a much wider significance.

I have pointed out in the article numerous inconsistencies, gaps and flaws in the arguments made by the team of authors involved in the identification research of the alleged remains of Nicolaus Copernicus, which make the issue of the identification of the grave 13/05 and the remains coming from this grave is still open to questions. The analysed deficiencies resulted from the overly limited knowledge of the authors of these studies regarding:

1. Copernican historiography, including the history of his letters and his collection of books, his images and their history, the ethnic origin of the family of Copernicus, the knowledge of the Copernican cited literature;
2. The methodology of empirical sciences (the issue of estimation of the errors of the facial reconstruction from a skull);
3. Genetic genealogy (the insufficiency of the application of the minimum haplotype sequence, that is a set of 9-elements, to draw definitive conclusions on the issue of the spread of the haplotype);
4. The ethnogenesis of Slavs and Germans;
5. The ethnic origin of the population of Silesia;
6. The historical and historical and genetic knowledge of the origin of the Toruń burghers;
7. The mtDNA population databases (including the EMPOP database) and Y-DNA databases, including the possibility of using this kind of databases to research the ethnic origin of persons;
8. The methods for estimating the probability of a random compliance between mtDNA profiles for statistically rare samples;
9. The methodology of interdisciplinary research.

What is particularly noteworthy in this article are the deliberations on the statistical analysis of a random match of mtDNA profiles (I was the first to announce it in the literature):

1. Pointing to the fundamental mistake of many publications on DNA analysis of rare samples (for estimating a random match of profiles, the bino-

- mial distribution should be approximated with the Poisson distribution, and not – as it being done – the normal distribution);
2. Pointing to the conventional nature of the confidence level of calculations (of which is often not realized by practitioners) and emphasizing the necessity to determine the random match of the DNA profiles with a very high level of confidence (that is 99.999% and 99.9999%, not only 95%), which particularly regards DNA research for forensic purposes!;
 3. Correcting the value of the random match of the mtDNA profile of the alleged remains of Nicolaus Copernicus based on the data from the EMPOP database for a 95% confidence level, and – for the first time in the literature – setting the values of the random match for 99.999% and 99.9999% confidence levels;
 4. Demonstrating the unrepresentativeness of the EMPOP mtDNA database (due to the lack of samples from many countries);
 5. Pointing to the qualitative-quantitative evidence of a lack of sampling saturation in the mtDNA EMPOP database.

References

ADAMCZEWSKI Jan

1972: *Mikołaj Kopernik i jego epoka*. Warszawa: Interpress.

ALLEN Marié

2007: *Drops of blood may hold DNA key to positive Copernicus ID*, “Science News”; (2007-02-20); http://www.monstersandcritics.com/science/news/article_1266140.php/Drops_of_blood_may_hold_DNA_key_to_positive_Copernicus_ID.

2008: Analiza DNA włosów znalezionych w kalendarzu należącym do Mikołaja Kopernika/DNA analysis of shed hairs from Nicolaus Copernicus calendar. In: Gąssowski (ed.) 2008a, pp. 226–235.

2009a: *Re: Your research on the DNA of Copernicus that preserved in Copernicus’s manuscripts in Uppsala Library* (email of 9 March 2009 to M.K.).

2009b: *Re: Your research on the DNA of Copernicus that preserved in Copernicus’s manuscripts in Uppsala Library* (email of 11 March 2009 to M.K.).

2009c: *RE: Conference “Assesment of the results of search for Copernicus’s grave” (Cracow, the last quarter of the 2009)* (email of 28 September 2009 to M.K.).

2009d: *RE: Conference “Assesment of the results of search for Copernicus’s grave” (Cracow, the last quarter of the 2009)* (email of 5 October 2009 to M.K.).

2010: *Gruppens medlemmar / Group members*; <http://www.genpat.uu.se//node231>.

AMBASADA POLSKI W BERLINIE

2005: *Kongres Polaków w Niemczech* (Berlin, 6 March 1938); <http://www.berlin.polemb.net/index.php?document=1088>; Parts 1–2 (radio recording of 12 March 1938);

http://www.berlin.polemb.net/gallery/nasze_obrazy/polonia/kongres/strona1.mp3;
http://www.berlin.polemb.net/gallery/nasze_obrazy/polonia/kongres/strona2.mp3.

ANDREE Richard

1914: *Andrees Handatlas*, 6th ed. Lipsk.

THE APRICITY FORUM

2009: *Nikolaus Kopernikus Was a German*; <http://www.theapricity.com/forum/showthread.php?t=11778> (12.20.2009).

BARTOSZEWICZ Julian

1852: *Wspomnienie o Koperniku*, "Rocznik Warszawski Stanisława Strąbskiego", pp. 6–16; reprinted in: Polkowski (ed.) 1873–1875, vol. II, pp. 177–194.

BARTOSZYŃSKI Robert

1980: *Some thoughts about Jerzy Neyman*. In: W. Klonecki, A. Kozek, J. Rosiński (eds), *Mathematical statistics and probability theory*. New York: Springer-Verlag, pp. ix–xvi.

BARTOSZYŃSKI Robert, KLONECKI Witold

1977: *Some thoughts about the contribution of Jerzy Neyman to statistics*. In: Robert Bartoszyński, Eugeniusz Fidelis, Witold Klonecki (eds), *Proceedings of the Symposium to Honour Jerzy Neyman, Warszawa, April 3–10, 1974*. Warszawa: PWN-Polish Scientific Publishers, pp. 9–15.

BARWIŃSKI Eugeniusz, BIRKENMAJER Ludwik Antoni, ŁOŚ Jan

1914: *Sprawozdanie z poszukiwań w Szwecji dokonanych z ramienia Akademii Umiejętności*. Kraków: Akademia Umiejętności.

BELZA Marta

2008: *Jerzy Sikorski. To on odszukał Kopernika*, "Gazeta Wyborcza. Olsztyn"; http://miasta.gazeta.pl/olsztyn/1,93864,5971932,Jerzy_Sikorski__To_on_odszukal_Kopernika.html (2008.11.20).

BENDER Georg

1881: *Archivalische Beitrage zur Familien-Geschichte Des Nikolaus Copernicus. Nebst Beilagen*, "Mitteilungen des Copernicus-Vereins für Wissenschaft und Kunst zu Thorn", H. 3, pp. 61–126.

BIRKENMAJER Ludwik Antoni

1900: *Mikołaj Kopernik. Część pierwsza. Studya nad pracami Kopernika oraz materiały biograficzne*. Kraków: Akademia Umiejętności.

1922: *O narodowości Kopernika. Własnoręczny list Kopernika*, "Zmartwychwstanie", no. 2–3, pp. 86–91.

1923: *Mikołaj Kopernik jako uczony, twórca i obywatel*. Kraków: Polska Akademia Umiejętności.

1924: *Stromata Copernicana. Studia, poszukiwania i materiały biograficzne*. Kraków: Polska Akademia Umiejętności.

1937: *Nikolaus Copernicus und der Deutsche Ritterorden*. Kraków: Polska Akademia Umiejętności.

BISKUP Marian

1970, 1983, 2007 – see Kopernik 1970, 1983, 2007.

1973a: *Regesta Copernicana*, “*Studia Copernicana*” vol. VII. Wrocław: Ossolineum.

1973b: *Regesta Copernicana. Calendar of Copernicus’ Papers*, “*Studia Copernicana*” vol. VIII Wrocław: Ossolineum.

1992: *Historia Torunia*, vol. II, Part 1: *U schyłku średniowiecza i w początku odrodzenia (1454–1548)*. Toruń: Wydawnictwo: Towarzystwo Naukowe w Toruniu.

BISKUP Marian

(ed.) 1999: *Historia Torunia*, vol. I: *Do roku 1454*. Toruń: Wydawnictwo: Towarzystwo Naukowe w Toruniu.

BOGDANOWICZ Wiesław

2007: see Paszkowska 2007.

2008: *Analiza DNA uzyskana z czaszki grobu nr 13/05 w katedrze we Fromborku / DNA analysis obtained from the skull of tomb no. 13/5 in the Frombork Cathedral*. In: Gąssowski (ed.) 2008a, pp. 204–211.

2009: *Badania genetyczne na podstawie DNA* (referat wygłoszony podczas “Konferencji sumującej wyniki badań nad odkryciem i identyfikacją grobu Kopernika”, Pułtusk, 12–13 grudnia 2009).

2010: *Sekwencje HVI i HVII* (email of 22.06.2010 to M.K.).

BOGDANOWICZ Wiesław, ALLEN Marié, BRANICKI Wojciech, LEMBRING Maria, GAJEWSKA Maria, KUPIEC Tomasz

2009: *Genetic identification of putative remains of the famous astronomer Nicolaus Copernicus*, “PNAS” (“Proceedings of the National Academy of Sciences of the United States of America”) 2009 July 28, vol. 106 (30), pp. 12279–12282; ed. by Alan Walker, Pennsylvania State University, University Park, PA, and approved June 16, 2009; reviewed by Dr. Ronald Van Den Bussche (Oklahoma State University) and Dr. John H. Rappole (Smithsonian National Zoological Park); <http://www.pnas.org/content/106/30/12279.full>.

BOROWICZ Dorota

2004: *Mapy narodowościowe Górnego Śląska od połowy XIX wieku do II wojny światowej*, “Acta Universitatis Wratislaviensis” no. 2710. Wrocław: Wydawnictwo Uniwersytetu Wrocławskiego.

BORTKEWITSCH Ladislaus, von (BORTKIEWICZ Władysław)

1898: *Das Gesetz der kleinen Zahlen*, “Monatshefte für Mathematik”, vol. 9, p. A39; Internet Archive; <http://www.archive.org/download/dasgesetzderklei00bortrich/dasgesetzderklei00bortrich.pdf>.

BRANICKI Wojciech

2008a: see Sadecki 2008.

2008b: see Kostrzewa 2008b.

BRANICKI Wojciech, KUPIEC Tomasz

2008: *Badania genetyczne domniemanych szczątków Mikołaja Kopernika/Genetic analysis of alleged remains of Nicolaus Copernicus*. In: Gąssowski (ed.) 2008a, pp. 212–225.

2009: see Landau 2009.

2010: *Analiza markerów DNA jądrowego w szczątkach z grobu 13/05*. Prezentacja przedstawiona podczas konferencji naukowej “Tajemnica grobu Kopernika. Dialog ekspertów” (Kraków, 22–23 lutego 2010); summarized in: Kokowski (ed.) 2010b, pp. 2–3.

BROWN Lawrence D., CAI T. Tony, DASGUPTA Anirban

2001: Interval Estimation for a Binomial Proportion, “Statistical Science”, vol. 16, iss. 2 (2001), pp. 101–133; http://projecteuclid.org/DPubS/Repository/1.0/Disseminate?view=body&id=pdf_1&handle=euclid.ss/1009213286.

2002: *Confidence Intervals for a binomial proportion and asymptotic expansions*, “The Annals of Statistics” 2002, vol. 30, no. 1, pp. 160–201; http://projecteuclid.org/DPubS/Repository/1.0/Disseminate?view=body&id=pdf_1&handle=euclid.aos/1015362189.

2005: *Comment: Fuzzy and Randomized Confidence Intervals and P-Values*, “Statistical Science” 2005, vol. 20, no. 4, pp. 375–379; http://projecteuclid.org/DPubS/Repository/1.0/Disseminate?view=body&id=pdfview_1&handle=euclid.ss/1137076655.

CENTNER M. Gottfried

1762: *Vermehrtes Verzeichniss der Zerneckischen geehrten u. gelehrten Thorner ausser ihrem Vaterlande*, “Thornische wöchentliche Nachrichten und Anzeigen nebst einem Anhang von gelehrten Sachen”, 23. December, pp. 404–410; <http://kpbc.umk.pl/dlibra/docmetadata?id=39105>.

1763: *Geehrte und Gelehrte Thorner ausser ihrer Vaterstadt nebst gelegentlich angebrachten Stamtafeln und Nachrichten von alten Thornischen Familien verfasst und vermehrter als in den Anzeigen herausgegeben*. Thorn: gedruckt bey Paul Marcus Bergmann, E. Hochedl; Hochweisen Raths und des löbl. Gymnasii Buchdrucker.

CICHOCKI Ryszard

2008: *Poszukiwanie grobu Łukasza Watzenrode techniką geo radarową / Serch for the tomb of Lukas Watzenrode using georadar technique*. In: Gąssowski (ed.) 2008a, pp. 156–159.

CHIANG Chin Long

2011: *Jerzy Neyman 1894–1981*. In: *Statisticians in history*. The American Statistical Association; <http://www.amstat.org/about/statisticiansinhistory/index.cfm?fuseaction=biosinfo&BioID=11>.

CURTZE Maximilian

(ed.) 1875: *Reliquiae Copernicanae*. Nach den Originalen in der Universitäts-Bibliothek zu Upsala. Hrsg. v. Maximilian Curtze. Leipzig.

(ed.) 1878: *Inedita Copernicana. Aus den Handschriften zu Berlin, Frauenburg, Uppsala und Wien*, “Mittheilungen des Copernicus-Vereins für Wissenschaft und Kunst zu Thorn”, Ver. H. I.

CZAPLIŃSKI Marek, KASZUBA Elzbieta, WĄS Gabriela, ŻERELIK Rościśław

2002: *Historia Śląska*, “Acta Universitatis Wratislaviensis”, No. 2364. Wrocław: Wydawnictwo Uniwersytetu Wrocławskiego.

CZARTORYSKI Paweł

1978: *The Library of Copernicus*, “Studia Copernicana”, vol. XVI, pp. 355–96.

CZARTORYSKI-SZILER Piotr

2010: *Tajemnica grobu nr 13* (An interview with Dr Jerzy Sikorski, a researcher into the life and achievements of Nicolaus Copernicus, conducted by Piotr Czartoryski-Sziler), “Nasz Dziennik”, 22–23 May, no. 118 (3744); (9.06.2010): <http://www.naszdziennik.pl/index.php?dat=20100522&typ=mk&id=mk21.txt>.

CZECHOWICZ Katarzyna

2008: see “PAP – Nauka w Polsce” 2008b.

DACA Patrycja, MIELNIK-SIKORSKA Marta, BEDNAREK Jarosław, GRZYBOWSKI Tomasz

2010: *Ocena stopnia wysycenia bazy danych mitochondrialnego DNA dla populacji Polski/Saturation of the Polish mitochondrial DNA database*, “Archiwum Medycyny Sądowej i Kryminologii”, vol. LX, pp. 263–269.

“DAILY MAIL”

2011: *Elementary, dear Copernicus! Three new members join the Periodic Table*, “Daily Mail”, 4 XI; verified version 8 XI; <http://www.dailymail.co.uk/sciencetech/article-2058054/Elementary-dear-Copernicus-Three-new-members-join-periodic-table.html>.

DAY Jean Wyngarden

2009: *The Family History from 1740 for the Ascendants of the Woychik and Suchla Families*; http://www.lulu.com/items/volume_68/7813000/7813941/5/print/7813941.pdf.

DAY Jonathan

2010: *Re: Message from a mitosearch user: Rosalia Holama and Nicolaus Copernicus* (email of 14.09.2010 to M.K.).

DOBRZYCKI Jerzy

1973: *Uwagi o szwedzkich zapiskach M. Kopernika*, “Kwartalnik Historii Nauki i Techniki”, vol. XVIII, no. 8, pp. 712–713.

2007: *List do Bernarda Wapowskiego*. In: *Kopernik 2007*, pp. 6–9.

DREWNOWSKI Jerzy

1978: *Mikołaj Kopernik w świetle swej korespondencji*, "Studia Copernicana", vol. XVIII. Wrocław: Ossolineum.

DUCZKO Władysław

2010: *Genom Mikołaja Kopernika i księgozbiór astronoma w Uppsali*. In: Kopiczko, Jezierski, Żywica (ed.) 2010, pp. 31–35 (referat wygłoszony podczas Międzynarodowej Konferencji Naukowej: "Warmińska Kapituła Katedralna. Dzieje i wybitni przedstawiciele", Olsztyn-Kortowo, Wydział Humanistyczny UWM, 20–21.05.2010).

"DZIENNIK.PL"

2007: *Szwedzi wpadli na ślad DNA Mikołaja Kopernika*, "Dziennik.pl" (20 lutego 2007); <http://nauka.dziennik.pl/artykuly/201357,szwedzi-wpadli-na-slada-dna-mikolaja-kopernika.html>.

2009: *Germanizujący astronom mają nowy argument. Kopernik był blondynem. To ucieszy Niemców*; "Dziennik.pl" (10 lipca 2009) (mp); http://wiadomosci.dziennik.pl/wydarzenia/artykuly/154761_kopernik-by-blondynem-to-ucieszy-niemcow.html.

EMPOP – the EDNAP mtDNA Population Database (Mitochondrial DNA Control Region Database)

2010: *Homepage*; <http://empop.org/>.

EUPEDIA. EUROPEAN TRAVEL AND HISTORY

2011a: *Origins, age, spread and ethnic association of European haplogroups and subclades*; http://www.eupedia.com/europe/origins_haplogroups_europe.shtml.

2011b: *Distribution of European mitochondrial DNA (mtDNA) haplogroups by region in percentage*; http://www.eupedia.com/europe/european_mtdna_haplogroups_frequency.shtml.

EVETT Ian W., WEIR Bruce S.

1998: *Interpreting DNA evidence. Statistical genetics for forensic scientists*. Sunderland, MA: Sinauer Associates.

FELLER William

1980: *Wstęp do rachunku prawdopodobieństwa*, vols 1–2, wyd. IV. Warszawa: PWN.

FUNDACJA KRONENBERGA PRZY CITI HANDLOWY

2008a: *Badania DNA finansowane przez Fundację Kronenberga przy Citi Handlowy pozwoliły na zidentyfikowanie szczątków astronoma*; <http://www.citibank.pl/poland/homepage/polish/kopernik/1.htm>.

2008b: Film pt. *Misterium crania Nicolai Copernici*. Reż. i scen. Marcin Stefaniak.

2009: *Fundacja Kronenberga po raz drugi wyróżniona nagrodą Mocni Wizerunkiem* (the 8th Congress of Public Relations, 22–24 April 2009, University of Information Technology and Management in Rzeszów); online article about the award honouring the foundation for funding the search for the grave of Copernicus and the promotion of Copernican studies (access: 14.06.2010): http://www.citibank.com/poland/kronenberg/polish/4026_9671.htm.

FUNDACJA KULTURY

2000: *Małe ojczyzny. Tradycja dla przyszłości*. Fundacja Kultury.

GAJEWSKA Marta, BOGDANOWICZ Wiesław

2006: *Kopalny DNA czyli lekcja z przeszłości*, "Kosmos. Problemy Nauk Biologicznych", vol. 55, no. 1 (270), pp. 117–128. Polskie Towarzystwo Przyrodników im. Kopernika; <http://kosmos.icm.edu.pl/PDF/2006/117.pdf>.

GALAS Alicja, GALAS Artur

2001: *Dzieje Śląska w datach*. Wrocław: Wydawnictwo "Rzeka".

GAWĘDA-WALERYCH Katarzyna, SOŁTYSZIEWSKI Ireneusz

2005: *Zastosowanie analizy mitochondrialnego DNA w badaniach kryminalistycznych – perspektywy*, "Problemy Kryminalistyki" no. 248, pp. 5–13; <http://clk.policja.pl/download.php?s=4&id=28115>.

GAWRYSZEWSKI Andrzej

1995: *Mapy narodowościowe, wyznaniowe i językowe Polski wykonane przez autorów obcych: bibliografia (lata 1846–1967)*. Dokumentacja Geograficzna. Polska Akademia Nauk. Instytut Geografii i Przestrzennego Zagospodarowania. Wrocław: Wydawnictwo Continuo.

"GAZETA.PL"

2011a: *Pruski astronom Mikołaj Kopernik w "Daily Mail"*, "Gazeta.pl", 5 XI 2011; http://wiadomosci.gazeta.pl/wiadomosci/1,114873,10608046,_Pruski_astronom_Mikolaj_Kopernik_w_Daily_Mail.html.

2011b: *Kopernik jednak był Polakiem*. "Daily Mail" zmienia tekst, "Gazeta.pl", 10 XI 2011; http://www.alert24.pl/alert24/1,84880,10615268,Kopernik_jednak_byl_Polakiem_Daily_Mail_zmienia_tekst.html.

GĄSSOWSKI Jerzy

2004a: *Frombork. Blisko sensacyjnego odkrycia. Ruszyły badania*, "Gazeta Olsztyńska" – "Dziennik Elbląski" z 18 sierpnia (stan badań relacjonował Wojciech Andrearczyk).

2004b: *Kanonik od św. Krzyża*, "Rzeczpospolita" ("Człowiek i Nauka") z 31 sierpnia, no. 204 (6887), p. A11 (relacja Krzysztof Kowalski); http://new-arch.rp.pl/artukul/503260_Kanonik_od_sw_Krzyza.html.

2004c: *Gdzie jest Kopernik?*, "Głos Uczelni", wrzesień (rozmowę przeprowadził Winićjusz Schulz); <http://www.glos.uni.torun.pl/2004/09/kopernik/>.

2004d: *Kopernikus' Gebeine. Polnische Archäologen fahnden nach dem Grab des großen Astronomen*, "Frankfurter Rundschau", 24 September, no. 223 I D/H/R/S/ (relacjonował Thomas Roser).

2005a: *Szukamy czaszki Kopernika*, "Rzeczpospolita", 18.08.2005, no. 192 (interviewed by Krzysztof Kowalski); http://www.rzeczpospolita.pl/gazeta/wydanie_050818/nauka/nauka_a_2.html.

2005b: *Poszukiwanie grobu Kopernika*. In: Gingerich, MacLachlan 2005, pp. 127–136.

- (ed.) 2005c / (ed.) 2006a: *Poszukiwanie grobu Mikołaja Kopernika*. Pod redakcją Jerzego Gąssowskiego. "Castrī Dominae Nostrae Letterae Annales" vol. II. Pułtusk: Wyższa Szkoła Humanistyczna im. Aleksandra Gieysztor, Bałtycki Ośrodek Badawczy, 2005; (ed.) 2006a (English translation): *The Search for Nicolaus Copernicus's Tomb*. Editor: Jerzy Gąssowski. Pułtusk: The Pułtusk Academy of Humanities, Institute of Anthropology and Archaeology; Fundacja Kronenberga, Citibank Handlowy.
- 2005d: *Etos pracy badawczej a kwestia dziennikarskiej sensacji. W odpowiedzi na zarzuty dr hab. Michała Kokowskiego*. In: Website of the Pułtusk School of Humanities (last accessed: December 2006); http://www.wsh.edu.pl/redaktor.php?view=1&art_id=258&pid=2&ret_id=2.
- 2006b: see Kubisz 2006.
- 2006c: *Poszukiwanie grobu Mikołaja Kopernika. Druga faza badań. Próba identyfikacji odkrytych szczątków*; http://www.biblioteka.ah.edu.pl/palio/html.media?_Instance=wsh-postgres&_Option=Other&_Connector=data&_tableName=w_media&_colID=id&_colFileName=file_name&_colLastUpdated=last_updated&_colSize=doc_size&_colContent=content&_ID=957&_Checksum=1673719646.
- 2007a: see Wojciechowska 2007.
- 2007b: see Paszkowska 2007.
- 2007c: see "Dziennik.pl" 2007.
- (ed.) 2008a: *Badania nad identyfikacją grobu Kopernika / The Search for identity of Copernicus Tomb*. Pułtusk: The Pułtusk Academy of Humanities, Institute of Anthropology and Archaeology; Fundacja Kronenberga przy Citi Handlowy.
- 2008b: *Badania nad odkryciem grobu Mikołaja Kopernika oraz identyfikacji jego szkieletu*. In: Gąssowski (ed.) 2008a, pp. 8–39; <http://archeologia.ah.edu.pl/kopernik%20dna.html>.
- 2008c: see Hofman-Wiśniewska 2008.
- 2009a: see Zielińska 2009.
- 2009b: *To jest czaszka Kopernika*, "Focus Historia", 29.05, no. 6, pp. 48–49; www.focus.pl/historia/artykuly/zobacz/publikacje/kosmiczna-lamiglowka/strona-publicacji/2/nc/1/.
- 2009c: *Odkrycie grobu Kopernika*, "Archeologia Żywa", no. 5 (45), October–November, pp. 12–19 (wersja artykułu: Gąssowski 2008b); wersja internetowa (7.12.2009): <http://media.wp.pl/kat,1022945,wid,11754743,wiadomosc.html>.
- 2010a: *Jak odkryto grób Kopernika?*, "Archeologia Żywa"; wersja internetowa (2010.02.12 12:34); (wersja artykułu: Gąssowski 2008b i 2009b); http://odkrywcy.pl/kat,116794,title,Jak-odkryto-grob-Kopernika-,wid,11967745,wiadomosc.html?smg4_sticaid=6d3c2.
- 2010b: *Badania w archikatedrze fromborskiej w celu odnalezienia i identyfikacji grobu Mikołaja Kopernika*. In: Kopiczko, Jezierski, Żywica (eds) 2010, pp. 19–26 (referat wygłoszony podczas Międzynarodowej Konferencji Naukowej "Warmińska Kapituła Katedralna. Dzieje i wybitni przedstawiciele", Olsztyn-Kortowo, Wydział Humanistyczny UWM, 20–21 maja 2010).

- 2010c: *Spotkanie z Kopernikiem. Kulisy odkrycia*. Toruń: Adam Marszałek.
(ed.) 2010d: *Grób Mikołaja Kopernika. Odkrycie i identyfikacja / Nicolaus' Copernicus's Tomb. Discovery and Identification*. Pułtusk: Akademia Humanistyczna im. Aleksandra Gieysztor. Instytut Antropologii i Archeologii.
- GAŚSOWSKI Jerzy, JURKIEWICZ Beata
2005a: *Rzetelnie rzecz biorąc...*, portEl.pl Elbląska Gazeta Internetowa (rozmowę z prof. Jerzym Gąsowskim i mgr Beatą Jurkowską zrelacjonowała Joanna Torsh, 2005.08.18); <http://www.portel.pl/artukul.php3?i=14896>.
- 2005b/2006a: *Poszukiwanie grobu Mikołaja Kopernika*. In: Gąsowski (ed.) 2005, pp. 11–19; wersja WWW: “Sezon 2005 – Poszukiwanie grobu Mikołaja Kopernika”; <http://web.archive.org/web/20070305112556/archeologia.ah.edu.pl/Frombork.html>; 2006 (English translation): Gąsowski (ed.) 2006, pp. 9–19.
- 2007–2008: *Sezon 2006: Badania architektoniczno-archeologiczne w Archikatedrze we Fromborku*; <http://web.archive.org/web/20070305112556/archeologia.ah.edu.pl/Frombork.html>.

GENE CODES CORPORATION

- 2011a: *Sequencher™ tutorials*; <http://www.genecodes.com/sequencher/tutorials.html>.
- 2011b: *Sequencher™ Tutorial for Windows and Macintosh, Reference Sequence*; <http://genecodes.com/sites/default/files/documents/Reference%20Sequence.pdf>.
- 2011c: *Sequencher™ Tutorial for Windows and Macintosh, Tour Guide*; <http://genecodes.com/sites/default/files/documents/Tour%20Guide.pdf>.
- 2011d: *Sequencher™ Tutorial for Windows and Macintosh, Mitochondrial DNA Typing*; <http://genecodes.com/sites/default/files/documents/Mitochondrial%20DNA%20Typing.pdf>.

GINGERICH Owen

- 2002: *An Annotated Census of De revolutionibus*. Leiden: Brill.
- 2004a: *The Book Nobody Read: Chasing the Revolutions of Nicolaus Copernicus*. USA: Walker & Company.
- 2004b: *Książka, której nikt nie przeczytał*. Przeł. Jarosław Włodarczyk. Warszawa: Wydawnictwo Amber (tłumaczenie polskie książki: Gingerich 2004a).
- 2004c: *Dość kręcenia o obrotach* (rozmowa z prof. Owenem Gingerichem z Harvard University o Koperniku, jego “De revolutionibus” (*O obrotach*), kobiecie, narodowości, a także o tym, za co spłonął Giordano Bruno; rozmowę przeprowadził Piotr Majewski), “Polityka”, nr 40 (2472) z 02.10, “Nauka”/”Astronomia”, pp. 84–86; <http://archiwum.polityka.pl/art/dosc-krecenia-onbsp;obrotach,395107.html>; <http://www.bu.uz.zgora.pl/bu/gingerich/pdf/kopernik.pdf>.
- 2004d: *Kopernikowskie sekrety* (rozmowa z Owenem Gingerichem, amerykańskim astronomem, pisarzem i kolekcjonerem: rozmowę przeprowadził Jakub Ostalowski), “Rzeczpospolita” (dział “Kultura”) z 06.10; http://archiwum.rp.pl/artukul/508914_Kopernikowskie_sekrety.html; www.bu.uz.zgora.pl/bu/gingerich/pdf/kopernik.pdf.
- 2009: *The Copernicus grave mystery*, “PNAS” (“Proceedings of the National Academy of Sciences of the United States of America”) July 28, vol. 106, no. 30, pp. 12215–

- 12216, published online before print July 21, 2009, doi: 10.1073/pnas.090749-1106; <http://www.pnas.org/content/106/30/12215.full>.
- 2010a: *Tajemnica grobu Kopernika*. Przeł. Jarosław Włodarczyk (przekład polski artykułu Gingerich 2009). In: Kopiczko, Jezierski, Żywica (ed.) 2010, pp. 27–30.
- 2010b: *Cud w ekspresie, czyli jak zostałem zaproszony na pogrzeb Kopernika*. Przeł. Jarosław Włodarczyk (przekład polski skróconej wersji artykułu: Gingerich 2011a). In: Gąssowski (ed.) 2010b, pp. 225–230.
- 2011a: *In the Orbit of Copernicus. A discovery of the great astronomer's bones, and their reburial in Poland*, “The American Scholar”, Summer 2011, vol. 80, no. 3, pp. 43–49.
- 2011b: *Owen Gingerich. Professor Emeritus of Astronomy and History of Science*; <http://www.fas.harvard.edu/~hsdept/bios/gingerich.html> (access: 10.10.2011).
- GINGERICH Owen, MacLACHLAN James
- 2005: *Mikołaj Kopernik: gdy Ziemia stała się planetą*. Transl. Jarosław Włodarczyk, Foreword: Jacek Jezierski, Afterword: Jerzy Gąssowski. Pułtusk: Wyższa Szkoła Humanistyczna imienia Aleksandra Gieysztora.
- GINSBURG Michelle
- 2002: *Gene Codes BRIN slides* (Gene Codes Corporation 2002); <http://www.dbi.udel.edu/pdfs/CashGeneCodes.pdf>.
- 2011a: *Sequencher Technical Support* (e-mail of 18.10.2011, 18:13, to M.K.).
- 2011b: *Sequencher Technical Support* (e-mail of 18.10.2011, 20:36, to M.K.).
- 2012: *Sequencher Technical Support* (e-mail of 23.03.2012, 16:08, to M.K.).
- GLĄZEK Aleksander
- 2008: see Sadecki 2008.
- GODDU André
- 2010: *Copernicus and the Aristotelian tradition: education, reading, and philosophy in Copernicus's path to heliocentrism* (Brill, 2010); (Brill series: “History of Science and Medicine Library”, vol. 15, “Medieval and Early Modern Science”, vol. 12); <http://books.google.com/books?id=iEjk13-1xSYC>.
- GOOD I.J.
- 1986: *Some statistical applications of Poisson's work*, “Statistical Science”, vol. 1, no. 2, pp. 157–180.
- GÓRKA Marcin
- 2005: *Jak astronom odnalazł Astronoma*, “Gazeta Wyborcza. Wały Chrobrego. Magazyn Szczeciński”, piątek, 18 listopada, pp. 9–10.
- GÓRSKI Karol
- 1968: *Dom i środowisko rodzinne Mikołaja Kopernika*, “Prace Populamonaukowe” nr 8, “Biblioteczka Kopernikańska” nr 1. Toruń: Towarzystwo Naukowe w Toruniu.
- 1973a: *Mikołaj Kopernik. Środowisko społeczne i samotność*. Wrocław: Zakład Narodowy im. Ossolińskich Wydawnictwo Polskiej Akademii Nauk.

1973b: *Łukasz Watzenrode. Życie i działalność polityczna (1447–1512)*, “*Studia Copernicana*”, vol. X. Wrocław: Ossolineum.

GRABARCZYK Artur

2008: *Szwedzcy uczeni na tropie kodu Kopernika*, “*Polska*”, środa, 5 listopada; <http://www.polskatimes.pl/rozmaitosci/52137,szwedzcy-uczeni-na-tropie-kodu-kopernika,id,t.html>.

GRZYBOWSKI Tomasz

2010: *Statystyczna i filogenetyczna interpretacja wyników badań mitochondrialnego DNA domniemanych szczątków Mikołaja Kopernika z archikatedry fromborskiej*. Presentation delivered at the conference “*Tajemnica grobu Mikołaja Kopernika. Dialog ekspertów*” / “*The Nicolaus Copernicus grave mystery. A dialogue of experts*” (Kraków, 22–23 February 2010), summarized in: Kokowski (ed.) 2010b, p. 4.

GRZYBOWSKI Tomasz, MALYARCHUK Boris A., BEDNAREK Jarosław, WOŹNIAK Marcin, PAPUGA Marta, STOPIŃSKA Katarzyna, ŁUCZAK Sylwia

2006: *Zastosowanie analizy filogeograficznej w interpretacji wyników sekwencjonowania mitochondrialnego DNA dla celów sądowych / Phylogeographic approach in the interpretation of mitochondrial DNA sequencing results in forensics*, “*Archiwum Medycyny Sądowej i Kryminologii*”, vol. LVI, pp. 191–197.

GRZYBOWSKI Tomasz, MALYARCHUK Boris A., DERENKO Miroslava V., CZARNY Jakub, WOŹNIAK Marcin, MIŚCICKA-ŚLIWKA Danuta,

2002: *Mitochondrial DNA variability in Poles and Russians*, “*Annals of Human Genetics*”, vol. 66, pp. 261–283; <http://www.zgms.cm.umk.pl/prace/261-283.pdf>.

GRZYBOWSKI Tomasz, MALYARCHUK Boris A., DERENKO Miroslava V., PERKOVA Maria A., BEDNAREK Jarosław, WOŹNIAK Marcin

2007: *Complex interactions of the Eastern and Western Slavic populations with other European groups as revealed by mitochondrial DNA analysis*, “*Forensic Science International: Genetics*”, vol. 1, pp. 141–147; <http://www.zgms.cm.umk.pl/prace/141-147.pdf>.

GUMOWSKI Marian

1970: *Lista patrycjatu toruńskiego*. In: *Herbarz patrycjatu toruńskiego*, “*Roczniki Towarzystwa Naukowego w Toruniu*”, R. 74, z. 3. Toruń: Państwowe Wydawnictwo Naukowe, Oddział w Poznaniu; http://akromer.republika.pl/herbarz_patr_tor.html.

HAJDUK Ryszard, POPIOŁEK Stefan

1939/1973: *Leksykon Polactwa w Niemczech, Związek Polaków w Niemczech* (Opole); wydanie fototypiczne: Warszawa: PWN, 1973.

HEMPEL Carl G.

1968: *Podstawy nauk przyrodniczych*. Przeł. Barbara Stanosz. Warszawa: Wydawnictwa Naukowo-Techniczne.

HENRIKSSON Göran

2009a: *Re: Copernicus's shed hairs* (email z 09.03.2009 15:18).

2009b: "Göran Henriksson", Uppsala University, Astronomi och rymdfysik / Department of Physics and Astronomy, Unit Astronomy and Space Physics; <http://katalog.uu.se/empInfo/?id=N96-3322>.

2009c: *Historic and biological research in Uppsala*. Referat wygłoszony podczas konferencji naukowej "Wyniki badań nad odkryciem i identyfikacją grobu Kopernika" (Pułtusk, 12–13 grudnia 2009).

2010a: *Nicolaus Copernicus' DNA found in Uppsala*. In: Gąssowski (ed.) 2010d, pp. 205–212.

2010b: *DNA Mikołaja Kopernika znalezione w Uppsali. Streszczenie*. In: Gąssowski (ed.) 2010d, pp. 213–214.

HILL Thomas, LEWICKI Paul

2007: *STATISTICS: Methods and Applications* (StatSoft, Tulsa, OK); on-line version: <http://books.google.com/books?id=TI2TGjeilMAC>.

HIPLER Franz

1872: *Analecta Warmiensia. Studien zur Geschichte der ermländischen Archive und Bibliotheken von Professor Dr. Franz Hipler, Regens des ermlandischen Priesterseminars zu Braunsberg*. Braunsberg: Verlag von Ed. Peter; I Bltt., 173 pp.; <http://kpbk.umk.pl/dlibra/doccontent?id=23722&dirids=1>.

"HISTORIA – FORUM HISTORYCZNE HISTMAG.ORG"

2011: *Czy Praslówianie to Praindoeuropejczycy?*; <http://histmag.org/forum/index.php?topic=8836.0>.

HOFMAN-WIŚNIEWSKA Justyna

2008: *Dwa włosy Kopernika, "Sprawy Nauki"* (29.11.2008) (An interview with Prof. Jerzy Gąssowski, an archaeologist, the director of the Institute of the Anthropology and Archaeology at the Pultusk Academy of Humanities, by Justyna Hofman-Wiśniewska); http://www.sprawynauki.edu.pl/index.php?option=com_content&task=view&id=885&Itemid=35.

HOLLAND Mitchell M., PARSONS Thomas J.

1999: *Mitochondrial DNA sequence analysis forensic – Validation and use for forensic casework*, "Forensic Science Review", vol. 11, pp. 21–50; http://www.bioforensics.com/conference08/mtDNA_YSTR/Holland_and_Parsons_1999.pdf.

JASIŃSKI Tomasz

1999: *Rozdział III "Toruń XIII–XIV wieku – lokacja miast toruńskich i początki ich rozwoju (1231–około 1350)"*. In: Marian Biskup (ed.), *Historia Torunia*, vol. 1 (*Do roku 1454*). Toruń: Wydawnictwo: Towarzystwo Naukowe w Toruniu, pp. 100–166.

JEFFREYS Alec

2009: *Jeffreys reflects on DNA finding*; http://news.bbc.co.uk/local/leicester/hi/people_and_places/history/newsid_8242000/8242497.stm (last updated at 11 September 2009).

JEFFREYS Alec J., WILSON Victoria, THEIN Swee Lay, WEATHERALL David J., PONDER Bruce A.J.

1986: *DNA fingerprinting and segregation analysis of multiple markers in human pedigrees*, "American Journal of Human Genetics", vol. 39, pp. 11–24.

JENDRZEJEWSKA Joanna, STACHOWSKA Anna

2008: *Genealogia żeńskiej linii krewnych Mikołaja Kopernika – charakterystyka i stan badań/Nicolaus Copernicus's matrilineal genealogy – characteristics and progress examination*. In: Gąssowski (ed.) 2008a, pp. 66–133.

JEZIERSKI Jacek, bp

2010: *Podsumowanie badań nad odkryciem i nad identyfikacją grobu Mikołaja Kopernika*, "Teologia w Polsce", vol. 4, iss. 1, pp. 177–178; [http://www.dogmatyka.pl/TwP/4,1/TwP_04,1\(2010\)spr.pdf](http://www.dogmatyka.pl/TwP/4,1/TwP_04,1(2010)spr.pdf).

JUSZCZAKIEWICZ Michał

2008a: *Copernicus Code Mystery trailer*, written and directed by Michał Juszcakiewicz, Michał Juszcakiewicz Art's Agency; http://www.youtube.com/v/HgGCL_Buy2U&hl=en&fs=1.

2008b: *Tajemnica grobu Kopernika / Copernicus Tomb Mystery* (a documentary film, 60 min); written and directed by Michał Juszcakiewicz; camera: Grzegorz Dolecki, Wojtek Habasiński, Marian Gorlikowski, Michał Juszcakiewicz; edited by: Radeck Moenert, Michał Juszcakiewicz; music: Ars Nova; Michał Juszcakiewicz Art's Agency.

KACZMARCZYK Zdzisław

1953: *Rozprzestrzenienie się narodowości polskiej nad Odrą i Bałtykiem w późnym feudalizmie*, "Przegląd Zachodni", vol. 9, pp. 9–30.

KACZMAREK Ryszard

2006: *Górny Śląsk podczas II wojny światowej: między utopią niemieckiej wspólnoty narodowej a rzeczywistością okupacji na terenach wcielonych do Trzeciej Rzeszy*, "Prace Naukowe Uniwersytetu Śląskiego w Katowicach", no. 2442. Katowice: Wydawnictwo Uniwersytetu Śląskiego.

KOKOWSKI Michał

2001: *Thomas S. Kuhn (1922–1996) a zagadnienie rewolucji kopernikowskiej (Thomas S. Kuhn (1922–1996) and the Issue of the Copernican Revolution)*, "Studia Copernicana" vol. XXXIX. Warszawa. ISBN 83-86062-02-9; pp. 397.

(ed.) 2002: *Ludwik Antoni Birkenmajer. W stulecie wydania przez Akademię Umiejętności dzieła "Mikołaj Kopernik" (On the centenary of the publication of "Nicolaus Copernicus" by the Academy of Arts and Sciences)*. Komisja Historii Nauki. Monografie, no. 5. Kraków: Polska Akademia Umiejętności. ISBN 83-88857-41-X; pp. 75.

2004a: *Nicolaus Copernicus and the interdisciplinary problem of the integration...* In: *Abstracts. Science in Europe – Europe in Science: 1500–2000 (Maastricht, 4–6 November, 2004)*. Gewina: Genootschap voor de Geschiedenis van de Ge-

- neeskunde, Wiskunde, Natuurwetenschappen en Techniek, The European Society for the History of Science, p. 48.
- 2004b: *Copernicus's Originality: Towards Integration of Contemporary Copernican Studies*. Warsaw–Cracow: Wydawnictwa IHN PAN. ISBN 83-86062-27-4; pp. XVI+340.
- 2005a: *Poszukiwania grobu Kopernika. Refleksje advocati diaboli*, wersja internetowa: Part I; http://www.cyfronet.pl/~n1kokows/poszukiwania_cz_1_pl.html.
- 2005b: *Poszukiwania grobu Kopernika. Refleksje advocati diaboli*, wersja internetowa: Part II; http://www.cyfronet.pl/~n1kokows/poszukiwania_cz_2_pl.html.
- 2006: *Omówienie bestsellera pt. "Książka, której nikt nie przeczytał" Owena Gingricha (Przekład Jarosław Włodarczyk; Warszawa: Wydawnictwo Amber, 2004), "Kwartalnik Historii Nauki i Techniki"*, vol. 51, 2006/3–4, pp. 273–298.
- 2007a: *Poszukiwania grobu Kopernika. Refleksje advocati diaboli*. Parts 1–2, "Kwartalnik Historii Nauki i Techniki", vol. 52, 2007/1, pp. 121–131, 131–151.
- 2007b: *Aktualne poszukiwania grobu Kopernika: wątpliwości, problemy i perspektywy*; www.cyfronet.pl/~n1kokows/poszukiwania_pl.html / *The Current Quest for Copernicus' Grave: Doubts, Problems and Perspectives*; http://www.cyfronet.pl/~n1kokows/poszukiwania_en.html.
- 2008a: *Przeciwko nieracjonalnemu kultowi popularyzowania historii nauki – w odpowiedzi Jarosławowi Włodarczykowi*, "Kwartalnik Historii Nauki i Techniki", vol. 53, 2008/3–4, pp. 363–372.
- 2008b: *Co dalej z Mikołajem Kopernikiem? Historia, stan aktualny i perspektywy badań kopernikańskich w Polsce*, "Kwartalnik Historii Nauki i Techniki", vol. 53, 2008/3–4, pp. 69–82. Paper delivered at the conference "Mikołaja Kopernika Opera Omnia – zwieńczenie edycji 2007" (Warszawa, Pałac Staszica, 10 December 2007).
- 2009a: *Poszukiwania grobu Kopernika. Refleksje advocati diaboli*. Parts 1–5. Presentation delivered at the "Symposium of the Copernicus Centre for Interdisciplinary Research" (Kraków, 20.03.2009).
- 2009b: *Różne oblicza Mikołaja Kopernika. Spotkania z historią interpretacji (Different faces of Nicholas Copernicus. Meetings with a history of interpretations)*. Warszawa–Kraków: Instytut Historii Nauki PAN, Polska Akademia Umiejętności. ISBN 978-83-87992-67-5; pp. 676.
- 2009c: *Copernicus's shed hairs* (email of 9.03.2009 to Dr G. Henriksson).
- 2009d: *Your research on the DNA of Copernicus that preserved in Copernicus's manuscripts in Uppsala Library* (email of 9.03.2009 to Ass. Prof. Marié Allen, Habilitated Doctor).
- 2009d: *Your research on the DNA of Copernicus that preserved in Copernicus's manuscripts in Uppsala Library* (email of 11 March 2009 to Assoc. Prof. Dr Marié Allen).
- 2009e: *Re: mtDNA Copernicus and Florentyna* (email of 2.10.2009 to Ms Carol Tamary).
- (ed.) 2010a: *The conference: "Tajemnica grobu Mikołaja Kopernika. Dialog ekspertów" / "The Nicolaus Copernicus grave mystery. A dialogue of experts"* (Kraków, 22–23 February 2010); http://www.cyfronet.krakow.pl/~n1kokows/konferencja_tajemnica_pl.html; http://www.cyfronet.krakow.pl/~n1kokows/konferencja_tajemnica_en.html; the conference programme: <http://www.cyfronet.krakow.pl/~n1kokows/>

- The-Nicoluas-Copernicus-grave-mystery-22-23.02.2010-Program.pdf; http://www.cyfronet.krakow.pl/~n1kokows/kokowski_red_prog_tajemnica_grobu_22-23.02.2010.pdf.
- (ed.) 2010b: *The conference: "Tajemnica grobu Mikołaja Kopernika. Dialog ekspertów" / "The Nicolaus Copernicus grave mystery. A dialogue of experts"* (Kraków, 22–23 February 2010). Abstracts: http://www.cyfronet.krakow.pl/~n1kokows/kokowski_red_tajemnica_grobu_22-23.02.2010.pdf.
- 2010c: *Procedura identyfikacji szczątków nr 13/05 jako szczątków Kopernika w świetle racjonalności uzasadniania i retoryki perswazji*. Presentation delivered at the conference "Tajemnica grobu Mikołaja Kopernika. Dialog ekspertów" / "The Nicolaus Copernicus grave mystery. A dialogue of experts" (Kraków, 22–23 February 2010), summarized in: Kokowski (ed.) 2010b, pp. 5–6.
- 2010d: *Re: Message from a mitosearch user: Rosalia Holama and Nicolaus Copernicus* (email of 16.09.2010 to Mr Jonathan Day).
- 2010e: *Różne oblicza Mikołaja Kopernika* (2009). Website; http://www.cyfronet.pl/~n1kokows/oblicza_pl.html.
- 2010f: *Komentarz nt. notki serwisu "PAP – Nauka w Polsce" o konferencji "Tajemnica grobu Mikołaja Kopernika. Dialog ekspertów"* (Kraków, 22–23.02.2010) – see "PAP – Nauka w Polsce" 2010b; 2010c.
- (ed.) 2012a: *Tajemnica grobu Mikołaja Kopernika. Dialog ekspertów* (Kraków, 22–23 lutego 2010). Kraków: Polska Akademia Umiejętności, Centrum Kopernika Badań Interdyscyplinarnych.
- 2012b / 2014a: *O wadliwości argumentów za ostatecznym odkryciem szczątków Mikołaja Kopernika*. Part I. *Wyniki i interpretacja analiz historycznych, archeologicznych, antropologicznych oraz antroposkopijnych*. In: Kokowski (ed.) 2012a, pp. 177–215. (An English translation in this monograph.)
- KOPERNIK Mikołaj
- 1970, 1983, 2007: *Locationes mansorum desertorum; Lokacje lanów opuszczonych*. Ed. Marian Biskup. Olsztyn: Pojezierze, wyd. I 1970, wyd. II 1983; wyd. III 2007 in: Kopernik 2007; <http://kpbc.umk.pl/dlibra/doccontent?id=42178&dirids=1>.
- 1976: *Dzieła wszystkie*, vol. II: *O obrotach sfer niebieskich*. Trans. M. Brożek (bk I), S. Oświęcimski (bks II–VI), commentary: A. Birkenmajer, J. Dobrzycki, ed.: J. Dobrzycki. Warszawa: Państwowe Wydawnictwo Naukowe.
- 1985: *Complete Works*. Vol. III: *Minor Works*. Ed. Paweł Czartoryski, translation and commentary Edward Rosen with the assistance of Erna Hilfstein. Warsaw: Polish Scientific Publishers.
- 2007: *Dzieła wszystkie*. Vol. 3: *Dzieła pomniejszych*. Prepared for print by: Tadeusz Bieńkowski, Marian Biskup, Jerzy Dobrzycki, Małgorzata Golińska-Giertych and Leszek Zygnier. Foreworded and edited by Andrzej Wyczański. Warsaw: Instytut Historii Nauki PAN, Wydawnictwo Sejmowe (in Polish).
- KOPICZKO Andrzej, JEZIEFSKI Jacek, ŻYWICA Zdzisław
- (ed.) 2010: *Warmińska kapituła katedralna. Dzieje i wybitni przedstawiciele*. Olsztyn: Instytut Historii i Stosunków Międzynarodowych UWM.

KOROLCZUK Ewa, (współpraca) KURSKI Tomasz

2008: *Potwierdzone: oto szczątki Mikołaja Kopernika*, “Gazeta Wyborcza”, 2008.11.20; electronic edition (last update: 2008.11.20, 09:20); http://wyborcza.pl/1,75476,5967964,Potwierdzone__oto_szczatki_Mikolaja_Kopernika.html.

KOSTRZEWA Jarosław

2008a: *Kopernik niebieskooki* (a report based on the information provided by Prof. Wiesław Bogdanowicz and Prof. Aleksander Głazek), “Dziennik Polski”, 21 November, vol. LXIV, no. 272 (19 586), p. 1.

2008b: *Kopernik mógł mieć niebieskie oczy* (a report based on the information provided by Dr Wojciech Branicki), “Dziennik Polski”, 21 November, vol. LXIV, no. 272 (19586), p. A3; <http://www.dziennikpolski24.pl/pl/aktualnosci/kraj/883748-kopernik-mgl-miec-niebieskie-oczy.html>.

2008c: *Mikołaj Kopernik na Zamku Królewskim*, “Dziennik Polski”, 26.11.2008; <http://www.dziennikpolski24.pl/pl/aktualnosci/kraj/884988-mikolaj-kopernik-na-zamku-krillewskim.html>.

2008d: *O włos Kopernika*, “Dziennik Polski”, 6–7 December, vol. LXIV, no. 285 (19 599), p. A4; <http://www.dziennikpolski24.pl/pl/aktualnosci/kraj/888031-o-wlos-kopernika.html>.

2008e: *Naukowcy szukają włosa Kopernika*, “Dziennik Polski”, 6–7 December, vol. LXIV, no. 285 (19 599), p. A4; <http://www.dziennikpolski24.pl/pl/aktualnosci/kraj/888031-o-wlos-kopernika.html>.

2009: *Na tropie genów Kopernika*, “Dziennik Polski”, 2009.02.10, 06:00; <http://oko.dziennik.krakow.pl/Artykul.100+M51558ebe04a.0.html>.

KROHN Knut

2008: *Astronom Kopernikus-Grab: Identifizierung war ein Geniestreich*, “Der Tagesspiegel”, 30.11.2008, 00:00; <http://www.tagesspiegel.de/weltspiegel/kopernikus-grab-identifizierung-war-ein-geniestreich/1384612.html>.

KRZYŻANOWSKI Adryan

1843a/1843b: *Kopernik w Walhalli (Kopernik, Walhalla's Genoss)*, “Kuryer Warszawski” z 19 lutego 1843; reprinted in: Polkowski (ed.) 1873–1875, vol. II, pp. 111–119; 1843b (German translation): *Kopernik gehört nicht in die Walhalla*, “Jahrbuch für slavische Literatur, Kunst u. Wissenschaft” vol. 1 (1943), pp. 247–252.

1843c: *Mikołaja Kopernika w 300 lat skonu i objawienia jego układu wspomnienia jubileuszowe* (Warszawa); reprinted in: Polkowski (ed.) 1873–1875, vol. II, pp. 127–147.

KUBISZ Bogusław

2006: *Spojrzyć w oczy Kopernikowi*. O odkryciu grobu Mikołaja Kopernika z prof. Jerzym Gąssowskim, archeologiem z Wyższej Szkoły Humanistycznej im. Aleksandra Gięysztora w Pułtusk, rozmawia Bogusław Kubisz, “Mówią Wieki”, February, no. 02 (554), pp. 10–12; http://www.mowiawieki.pl/artukul.html?id_artukul=1642.

KUPIEC Tomasz

2008: see “PAP – Nauka w Polsce” 2008a.

2009: *Tajemnica pochówku astronoma*, “Genetyka i Prawo. Kwartalnik Naukowy Zakładu Genetyki Molekularnej i Sądowej” no. 2 (5), Spring. Uniwersytet Mikołaja Kopernika, Collegium Medicum, Katedra Medycyny Sądowej, p. 13; http://www.zgms.cm.umk.pl/kwartalnik/GiP_02_2009.pdf.

KUPIEC Tomasz, BRANICKI Wojciech

2010: *Zastosowanie analizy mtDNA do identyfikacji szczątków ludzkich z grobu 13/05*. Presentation delivered at the conference “*Tajemnica grobu Mikołaja Kopernika. Dialog ekspertów*” / “*The Nicolaus Copernicus grave mystery. A dialogue of experts*” (Kraków, 22–23 February 2010); summarized in: Kokowski (ed.) 2010b, p. 7.

KUROŃSKI Emil

1939: *Polacy w Niemczech w urzędowych spisach ludności*. Series “Biblioteka Spraw Narodowościowych” no. 37. Warszawa: Instytut Badań Spraw Narodowościowych; Pomorska Biblioteka Cyfrowa; <http://pbc.gda.pl/dlibra/docmetadata?id=3924>.

LACH-SZYRMA Krystyn

1844: *Copernicus and his native land*, “The Foreign and Colonial Quarterly Review”. London: W. Smith, Elder & Co., pp. 361–393; <http://books.google.com/books?id=ldwRAAAAYAAJ>.

LANDAU Marta

2009: *Kopernik – przeciętny Europejczyk*, “Wprost”, no. 31 (1386), 2 August 2009, pp. 50–51 (distributed from the website of the Museum and Institute of Zoology of the Polish Academy of Sciences: <http://www.miiz.waw.pl/pliki/media/kopernik1.jpg>; <http://www.miiz.waw.pl/pliki/media/kopernik2.jpg>).

LEHR Helena, OSMAŃCZYK Edmund

1972: *Polacy spod znaku Rodła*. Warszawa: MON.

LUBLIN. PAMIĘĆ MIEJSCA

2010: *Mała Ojczyzna*; <http://www.tnn.pl/pm,1558.html>.

MACIEJEWSKA Urszula

2008: *Owen Gingerich – astrofizyk i historyk nauki Doctor honoris causa Uniwersytetu Zielogórskiego*; <http://www.bu.uz.zgora.pl/bu/gingerich/>.

MALYARCHUK Boris A.

2001: *Differentiation and genetic position of Slavs among Eurasian Ethnic Groups as Inferred from Variation in Mitochondrial DNA*, “Russian Journal of Genetics”, vol. 37, pp. 1437–1443.

MAYKA Lawrence

2009a: *Y-DNA and mtDNA of Copernicus* (10.06.2009), “Genealogy-DNA-L Archives”; <http://archiver.rootsweb.ancestry.com/th/read/GENEALOGY-DNA/2009-07/1247244768>.

2009b: *Copernicus mtDNA match* (email of 1.10.2009 to M.K.).

MELTON T., DIMICK G., HIGGINS B., LINDSTROM L., NELSON K.

2005: *Forensic mitochondrial DNA analysis of 691 casework hairs*, "Journal of Forensic Science", January, vol. 50 (1), pp. 73–80; <http://www.hartnell.cc.ca.us/faculty/jhughey/Files/mitoDNAcaseworkers.pdf>.

MIKULSKI Krzysztof

1995: *Wymiana elity władzy w Toruniu w II połowie XV wieku (Przyczynek do badań nad mechanizmami kształtowania się elit)*. In: Jacek Staszewski (ed.), *Elity mieszczańskie i szlacheckie Prus Królewskich i Kujaw w XIV–XVIII w.* Toruń: Uniwersytet Mikołaja Kopernika, pp. 51–93; <http://kpbc.umk.pl/dlibra/plain-content?id=47916>.

1996: *Wątenrodowie i dom rodzinny Mikołaja Kopernika w Toruniu*. In: Roman Czaja, Janusz Tandecki (ed.), *Studia nad dziejami miast i mieszczaństwa w średniowieczu*, "Studia Polonica Historiae Urbanae", vol. 2. Toruń: Wydawnictwo Uniwersytetu Mikołaja Kopernika, pp. 257–266; <http://kpbc.umk.pl/dlibra/doccontent?id=46264>.

1997a: *Wątenrodowie i kapituła warmińska. Rola związków rodzinnych w duchownych karierach mieszczan toruńskich w XIV i XV wieku*. In: Tomasz Jasieński, Tomasz Jurek, Jan M. Piskorski (ed.), *Homines et societas: czasy Piastów i Jagiellonów*, "Prace Komisji Historycznej Poznańskiego Towarzystwa Przyjaciół Nauk", vol. 55. Poznań: Wydawnictwo Poznańskiego Towarzystwa Przyjaciół Nauk, pp. 359–371.

1997b: *Struktura etniczna mieszkańców i status społeczny ludności pochodzenia polskiego w Toruniu od końca XIV wieku do połowy XVII wieku*, "Roczniki Historyczne", vol. 63, pp. 111–129.

2008: *W kręgu toruńskich przodków Mikołaja Kopernika – Wątenrodowie i ich koligacje rodzinne/In the circle of Nicolaus Copernicus's Toruń ancestors – the Wątenrodes and their family relationships*. In: Gąssowski (ed.) 2008, pp. 40–65.

2009: *Mikołaj Kopernik. Rodzina*. In: website *Nicolaus Copernicus Thoruniensis*; <http://copernicus.torun.pl/biografia/1473-1491/4/>.

MIKULSKI Krzysztof, JENDRZEJEWSKA Joanna, STACHOWSKA Anna

2010: *Przodkowie i najbliżsi krewni Mikołaja Kopernika oraz ich żeńskie potomstwo*. In: Kokowski (ed.) 2010f, p. 7.

MINISTERSTWO NAUKI I SZKOLNICTWA WYŻSZEGO (MNiSW)

2009: *Wykaz wybranych czasopism wraz z liczbą punktów za umieszczoną w nich publikacją naukową z dn. 5.05.2009 r.*; http://www.bm.cm-uj.krakow.pl/pdf/Ujednolicony_wykaz_z_dnia_2009_05_05.pdf.

2010: *Ujednolicony wykaz czasopism naukowych (z liczbą punktów za umieszczoną w nich publikacją naukową)* (25 June 2010); http://www.nauka.gov.pl/fileadmin/user_upload/Finansowanie/finansowanie_nauki/Listy_czasopism/20100628_UJEDNOLICONY_WYKAZ_ZA_2007_-_2010_11_06_2010.pdf.

MITOSEARCH DNA DATABASE

2010: Homepage; <http://www.mitosearch.org/>.

MIZWA Stephen

1943: *Nicholas Copernicus, 1543–1943*. New York: The Kosciuszko Foundation; <http://kpbc.umk.pl/publication/29729>.

MOGENTALE-PROFIZI N., CHOLLET L., STÉVANOVITCH A., DUBUT V., POGGI C., PRADIÉ M.P., SPADONI J.L., GILLES A., BÉRAUD-COLOMB E.

2001: *Mitochondrial DNA sequence diversity in two groups of Italian Veneto speakers from Veneto*, “Ann Hum Genet.”, Mar, vol. 65 (Pt 2), pp. 153–166.

MP

2009: *Germanizujący astronoma mają nowy argument. Kopernik był blondynem. To ucieszy Niemców*; 10 July 2009; <http://wiadomosci.dziennik.pl/wydarzenia/artykuly/154761,kopernik-byl-blondynem-to-ucieszy-niemcow.html>.

NEKRAŠAS Evaldas

1992: *Wiedza prawdopodobna. Powstanie i rozwój w empiryzmie logicznym programu probabilistycznej oceny wiedzy naukowej*. Warszawa: Wydawnictwo Naukowe PWN. Translated from Russian by Zygmunt Simbierowicz.

NEWCOMBE Robert G.

1998: *Two-sided confidence intervals for the single Proportion: Comparison of seven methods*, “Statistics in Medicine”, vol. 17 (1998), pp. 857–872; <http://www.stats.org.uk/statistical-inference/Newcombe1998.pdf>.

NILSSON Martina, POSSNERT Göran, EDLUND Hanna, BUDOWLE Bruce, KJELLSTRÖM Anna, ALLEN Marie

2010: *Analysis of the Putative Remains of a European Patron Saint—St. Birgitta*, “PLoS ONE”, vol. 5(2): e8986. doi:10.1371/journal.pone.0008986; <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2821883/>; <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2821883/pdf/pone.0008986.pdf>.

NOGOSEK Robert J., C.S.C. Rev.

1982: *Joseph Nogosek Pioneer Builder and Prominent Farmer*; <http://skroch.org/tree/history/joseph-nogosek-history.html>.

O’CONNOR J.J., ROBERTSON E.F.

2003: *Jerzy Neyman*. In: *Biographies*; <http://www-history.mcs.st-andrews.ac.uk/Biographies/Neyman.html>.

OSMAŃCZYK Edmund Jan

1985: *Wisła i Kraków to Rodło*. Warszawa: Nasza Księgarnia.

1989a: *Matka Boska Radosna, patronka Polaków spod znaku Rodła*. Paris: Éditions du Dialogue.

1989b: *Niezłomny proboszcz z Zakrzewa, rzecz o Księdzu Patronie Bolesławie Domańskim*. Warszawa: Czytelnik.

OSSOWSKI Stanisław

1984: *O ojczyźnie i narodzie*. Warszawa: PWN.

“PAP – NAUKA W POLSCE” / “SERWIS NAUKA W POLSCE – PAP SA”

- 2008a: *Naukowcy: tajemnica grobu Kopernika – wyjaśniona*, (21.11.2008, 00:00) (jmy/wos/zig/jwo); http://www.naukawpolsce.pap.pl/palio/html.run?Instance=cms_naukapl.pap.pl&_PageID=1&s=szablon.depesza&dz=lewaszpalta.naukadlagospodarki&dep=331442.
- 2008b: *Najważniejsze wydarzenia w nauce polskiej w 2008 roku* (Katarzyna Czechowicz) (30.12.2008, 00:10); http://www.naukawpolsce.pap.pl/palio/html.run?Instance=cms_naukapl.pap.pl&_PageID=1&s=szablon.depesza&dep=357879.
- 2010a: *Uroczystości powtórnego pochówku Kopernika potrwać trzy dni* (2010.04.15, 00:45) (hes/mow/agt/); http://www.naukawpolsce.pap.pl/palio/html.run?Instance=cms_naukapl.pap.pl&_PageID=1&s=szablon.depesza&dep=371603.
- 2010b: *Naukowcy o tajemnicach grobu Mikołaja Kopernika – część z nich powątpiewa*, (2010.02.24, 04:02) (CZO/kap); <http://naukawpolsce.pap.pl/aktualnosci/news,370462,naukowcy-o-tajemnicach-grobu-mikolaja-kopernika---czesc-z-nich-powatpiewa.html>;
- 2010c: *Komentarz do depeszy: Naukowcy o tajemnicach grobu Mikołaja Kopernika – część z nich powątpiewa* (by Michał Kokowski); <http://naukawpolsce.pap.pl/aktualnosci/news,370462,naukowcy-o-tajemnicach-grobu-mikolaja-kopernika---czesc-z-nich-powatpiewa.html>.

PARSON Walther

- 2010: *EMPOP 2* (Paper delivered at the conference “Haploid DNA Markers in Forensics”, Berlin, April 22–24, 2010); http://empop.org/modules/downloads/2/0/Parson_Berlin2010.pdf.

PARSON Walther, BRANDSTAETTER Anita, ALONSO Antonio, BRANDT Nathalie, BRINKMANN Bernd, CARRACEDO Angel, CORACH Daniel, FROMENT Olivier, FURAC Ivana, GRZYBOWSKI Tomasz, HEDBERG Karin, KEYSER-TRACQUI Christine, KUPIEC Tomasz, LUTZ-BONENGER Sabine, MEVAG Bente, PLOSKI Rafal, SCHMITTER Hermann, SCHNEIDER Peter, SYNDERCOMBE-COURT Denise, SØRENSEN Eric, THEW Heather, TULLY Gillian, SCHEITHAUER Richard

- 2004: *The EDNAP mitochondrial DNA population database (EMPOP) collaborative exercises: organisation, results and perspectives*, “Forensic Science International”, Jan 28, vol. 139 (2–3), pp. 215–226.

PARSON Walther, BRANDSTÄTTER Anita, PIRCHER Martin, STEINLECHNER Martin, SCHEITHAUER Richard

- 2004: *EMPOP – The EDNAP mtDNA population database concept for a new generation, high-quality mtDNA database*, “International Congress Series”, vol. 1261, April, pp. 106–108 (“Progress in Forensic Genetics”, vol. 10).

PARSON Walther, DÜR Arne

- 2007: *EMPOP – A forensic mtDNA database*, “Forensic Science International: Genetics”, vol. 1, pp. 88–92; <http://www.bioforensics.com/conference08/mtDNAdb/EMPOPdb.pdf>.

PARTSCH Joseph

- 1896: *Schlesien: eine Landeskunde für das deutsche Volk*, vol. 1: *Das ganze Land*. Breslau: Ferdinand Hirt, Königliche Universitäts- und Verlags – Buchhandlung; <http://www.sbc.org.pl/dlibra/doccontent?id=3315>.
- 1911: *Schlesien: eine Landeskunde für das deutsche Volk*, vol. 2: *Landschaften und Siedelungen*. Breslau: Ferdinand Hirt; <http://www.sbc.org.pl/dlibra/doccontent?id=3316>.

PASZKOWSKA Joanna/BOGDANOWICZ Wiesław, GAŚSOWSKI Jerzy, PIASECKI Karol, ZAJDEL Dariusz

- 2007: *Audycja Twarzą w twarz z Kopernikiem*, “Czaszka wielkiego astronoma” (Interviews with Prof. W. Bogdanowicz, Prof. J. Gaśowski, Prof. K. Piasecki, and D. Zajdel, MA), Polskie Radio Online (7 May 2007); <http://www.polskieradio.pl/nauka/temattygodnia/artikul6600.html>; http://www.polskieradio.pl/_files/20-070222130611/2007110904543523.mp3 (13,81 MB).

PEREIRA Luísa, CUNHA Carla, AMORIM António

- 2004: *Predicting sampling saturation of mtDNA haplotypes: an application to an enlarged Portuguese database*, “International Journal of Legal Medicine”, vol. 118, no. 3, pp. 132–136.

PEREIRA L., PRATA M.J., AMORIM A.

- 2000: *Diversity of mtDNA lineages in Portugal: not a genetic edge of European variation*, “Annals of Human Genetics”, vol. 64, pp. 491–506; <http://backintyme.com/admixture/pereira01.pdf>.

PIASECKI Karol

- 2005a: see Górka 2005.
- 2005b: see Szczepkowska 2005.
- 2005c: see Pohl, Zieliński 2005.
- 2005d: *Uwagi do tekstu dr. hab. Michała Kokowskiego*. In: Website of the Pultusk School of Humanities (last accessed: December 2006); http://www.wsh.edu.pl/redaktor.php?view=1&art_id=258&pid=2&ret_id=2.
- 2007: see Paszkowska 2007.
- 2008: *Etyczne problemy odkrycia naukowego. Przypadek Mikołaja Kopernika/The ethical problems of scientific dsicovery. The case of Nicolaus Copernicus*. In: Gaśowski (ed.) 2008a, pp. 196–203.
- 2009: *Wstrzymać Kopernika!*, “Archeologia Żywa”, no. 5 (45), October–November, pp. 20–25.

PIASECKI Karol, ZAJDEL Dariusz

- 2005a/2006a: *Badania antropologiczne we Fromborku. Grób nr 13. Rekonstrukcja wyglądu głowy na podstawie czaszki*. In: Gaśowski (ed.) 2005c, pp. 27–37; 2006a (English translation): *Anthropological research in Frombork. Tomb no. 13. Reconstruction of the appearance of the head on the basis of the skull*. In: Gaśowski (ed.) 2006a, pp. 21–36.

PIETRZAK Stanisław

2011: *Skąd pochodzą Polacy – Słowianie – Europejczycy – inne ludy*; <http://www.tropie.tarnow.opoka.org.pl/polacy.htm>.

PIONTEK Janusz, IWANEK Beata, SEGEDA Sergey

2008: *Antropologia o pochodzeniu Słowian*, Series „Monografie Instytutu Antropologii UAM”, vol. 12; Poznań, 2008); <http://www.staff.amu.edu.pl/~anthro/pdf/mono/vol012/01piontek.pdf>.

PIOTR (*abbot of the monastery of St Mary the Virgin in Henryków*)

1268–1273: *Liber foundationis claustris Sancte Marie Virginis in Henrichow = Księga henrykowska*; <http://digital.fides.org.pl/dlibra/docmetadata?id=744&from=publication>.

POHL Krystyna, ZIELIŃSKI Łukasz

2005: *To jest Mikołaj Kopernik!* (A report on the search for Copernicus’s grave; citation of Karol Piasecki), “Głos Szczeciński”, 10–11 November, pp. 6–7; photos: Andrzej Szkoceki; infography: “Rzeczpospolita”, Paweł Moszczyński, FORUM, EASTNEWS.

POLKOWSKI Ignacy, ks.

(ed.) 1873: *Album Mikołaja Kopernika*. Gniezno: Towarzystwo Przyjaciół Nauk w Poznaniu; <http://kpbc.umk.pl/dlibra/doccontent?id=39479>; <http://kpbc.ukw.edu.pl/dlibra/doccontent?id=39479>.

(ed.) 1873–1875: *Kopernikijana czyli materiały do pism i życia Mikołaja Kopernika*, vols 1–3. Gniezno: Drukiem J. Langiego; <http://kpbc.umk.pl/dlibra/docmetadata?id=39448>; <http://kpbc.umk.pl/dlibra/docmetadata?id=39449>; <http://kpbc.umk.pl/dlibra/docmetadata?id=39465>.

1875: *Wizerunki Mikołaja Kopernika*. In: Polkowski (ed.) 1873–1875, vol. 3, pp. 229–307.

POPPER Karl R.

1977: *Logika odkrycia naukowego*. Translated by Urszula Niklas. Warszawa: Wydawnictwo Naukowe PWN, 1st ed. 1977; 2nd ed. 2002.

PORTAL POLICJA.PL

2010: *Wypadki drogowe w Polsce w latach 1985–2008* (access: 17.12.2010); http://www.policja.pl/portal/pol/8/160/Wypadki_drogowe_w_latach_1985__2008.html.

POTT August Friedrich

1859: *Die Personennamen und insbesondere die Familiennamen ihre Entstehungsarten; auch unter Berücksichtigung der Ortsnamen. Eine sprachliche Untersuchung*. Leipzig: F.A. Brockhaus; <http://books.google.pl/books?id=-H1BAAAAYAAJ>.

PROWE Leopold

1853a: *Zur Biographie von Nicolaus Copernicus*. Thorn: Druck und Verlag von Ernst Lambeck; http://books.google.com/books?id=pTg_AAAAYAAJ.

- 1853b: *Mittheilungen aus schwedischen Archiven und Bibliotheken*. Berlin: Verlag der Deckerschen Geheimen Ober-Hofbuchdruckerei; http://kpbc.umk.pl/dlibra/applet?content_url=/Content/39484/Pomorze_035_12.djvu.
- 1873: *Monumenta Copernicana. Festgabe Zum 19. Februar 1873*. Von Leopold Prowe. Berlin: Weidmannsche Buchhandlung, pp. VIII + 164.
- 1883–1884: *Nicolaus Copernicus*. Erster Band: *Das Leben* (1883). Zweiter Band: *Urkunden* (1884). Berlin: Weidmannsche Buchhandlung; <http://www.archive.org/details/nicolauscoppem01prowgoog>; <http://www.archive.org/details/nicolauscoppem05prowgoog>.

PRZEKRÓJ

- 2009: *Nominowani do nagrody Fenomen Przekroju 2008*; http://www.przekroj.pl/pub/fenomeny/fenomeny_2008_informacja_prasowa.pdf.

RAPPOLE John H.

- 2011: *Staff profile for John H. Rappole*; http://nationalzoo.si.edu/SCBI/Scientific_Staff/staff_scientists.cfm?id=61 (access: 10.10.2011).

ROSEN Edward

- 1939, 1959, 1971: *Three Copernican Treaties: The Commentariolus of Copernicus, The Letter against Werner, and The Narratio prima of Rheticus*. New York: Columbia University Press, 1939, 2nd ed. 1959; 3rd ed. Octagon Press 1971.
- 1985: see Kopernik 1985.

ROSIŃSKA Grażyna

- 2002: *Krakowski księgozbiór Mikołaja Kopernika w kodeksach Copernicana 4 i Copernicana 6 Biblioteki Uniwersyteckiej w Uppsali*, “Res Historica”, vol. 13, pp. 105–123.

ROŚLAN Jan, Rev.

- 2011: *O Koperniku prawie sensacyjnie*, “Debata. Miesięcznik Regionalny”, no. 6 (45), pp. 32–33; http://debata.olsztyn.pl/index.php?option=com_content&view=article&id=1769.

ROSPOND Stanisław

- 1973: *Mikołaj Kopernik. Studium językowe o rodowdziej i narodowości*. Opole: Opolskie Towarzystwo Przyjaciół Nauk.

ROSPOND Stanisław, BORKA Henryk, SOCHACKA Stanisława

- 1970–2007: *Słownik etymologiczny nazw geograficznych Śląska*, vols 1–13. Warszawa: PWN.

RYBICKI Paweł

- 2007: see “Dziennik.pl” 2007.

RZECZPOSPOLITA

- 2008: *Przeboje 2008 roku w polskiej nauce*, “Rzeczpospolita”; <http://www.rp.pl/artukul/2,239886.html>.

- SADECKI Jerzy/GLĄZEK Aleksander, BRANICKI Wojciech, BOGDANOWICZ Wiesław
2008: *Kopernik po krakowsku*, “Rzeczpospolita”; <http://www.rp.pl/artykul/222510.html> (20.11.2008). An interview with Aleksander Głazek, Wojciech Branicki and Wiesław Bogdanowicz.
- SALAS Antonio, COMAS David, LAREU Maria Victoria, BERTRANPETIT Jaume, CARRACEDO Angel
1998: *mtDNA analysis of the Galician population: a genetic edge of European variation*, “European Journal of Human Genetics”, vol. 6, pp. 365–375; http://class.csueastbay.edu/faculty/gmiller/3710/DNA_PDFS/mtDNA/mtDNA_Galicia.pdf.
- SENK Aleksander
2012: *Re: Prośba o zgodę na przedruk ilustracji ze strony internetowej Fundacji Kronenberga “Poznaj tajemnicę Mikołaja Kopernika”* (email of 14.05.2012, 16:17, to M.K.).
- SIKORSKI Jerzy
1989: *Marcin Kromer a tradycja kopernikowska na Warmii*, “Studia Warmińskie”, vol. 26, pp. 139–148.
2005: *Grób Mikołaja Kopernika w katedrze biskupów warmińskich we Fromborku na tle polityki grzebalnej kapituły w XV–XVI wieku / Nicolaus Copernicus’s tomb in the Warmia bishops’ cathedra in Frombork in the light of the chapter’s burial practices in the 15th to the 18th centuries*. In: Gąssowski (ed.) 2005c, pp. 81–173 / Gąssowski (ed.) 2006a, pp. 73–165.
2008: *Praktyka pochówków biskupich w katedrze we Fromborku oraz kwestia grobu Łukasza Watzenrodego, wuja Mikołaja Kopernika / The practise of bishops’ burials in Frombork cathedral and the question of the grave of Nicolaus Copernicus’s uncle, Łukasz Watzenrode*. In: Gąssowski (ed.) 2008a, pp. 134–155.
- SIKORSKI Jerzy/BELZA Marta
2008: see Belza 2008.
- SIKORSKI Jerzy/CZARTORYSKI-SZILER Piotr
2010: see Czartoryski-Sziler 2010.
- “SKADI FORUM”
2009: *Germanic Copernicus*; <http://forums.skadi.net/showthread.php?t=124392> (9.06.2009).
- SOLTYSIAK Andrzej
2010a: *Kilka uwag do tekstu Karola Piaseckiego pt. “Wstrzymać Kopernika!”*, “Archeologia Żywa”, vol. 1(47), pp. 62–63.
2010b: *Myślenie magiczne w interpretacji archeologicznej. Próba klasyfikacji, przykłady, perspektywy*. The presentation delivered at the conference “Tajemnica grobu Mikołaja Kopernika. Dialog ekspertów” / “The Nicolaus Copernicus grave mystery. A dialogue of experts” (Kraków, 22–23 February 2010); <http://www.antropologia.uw.edu.pl/AS/as-028.pdf>; summarised in: Kokowski (ed.) 2010b, p. 10.

SORENSEN MOLECULAR GENEALOGY FOUNDATION (SMGF)

2010: *Website*; <http://www.smgf.org/pages/ydatabase.jspx>.

STANISŁAWSKA Aleksandra, FILC REDLIŃSKA Izabela, KOWALSKI Krzysztof,
URBAŃSKI Krzysztof, KOŚCIELNIAK Piotr

2008: *Przeboje 2008 roku w polskiej nauce*, "Rzeczpospolita", 27.12.2008; <http://www.rp.pl/artykul/2,239886.html>.

STANISŁAWSKA-KLOC Sybilla

2009: *Zasady wykorzystywania cudzych utworów: prawo autorskie i dobre obyczaje (etyka cytatu)*, "Diametros" no. 19 (March 2009), pp. 160–184; <http://www.diametros.iphils.uj.edu.pl/?pdf=209>.

STATSOFT, Inc.

2006: *Elektroniczny podręcznik statystyki PL* (Kraków); chap. "Podstawowe pojęcia statystyki"; <http://www.statsoft.pl/textbook/stathome.html>.

2007: Wersja drukowana podręcznika – see Hill, Lewicki (2007).

2011: *Electronic Statistics Textbook* (Tulsa, OK); <http://www.statsoft.com/textbook/>.

STEFANIAK Marcin

2008: *Misterium cranii Nicolai Copernici* (29 min 12 s), written and directed by Marcin Stefaniak, Fundacja Kronenberga przy Citi Handlowy.

STÖFFLER Johann

1518: *Calendarium Romanum magnum, Caesareae maiestati dicatum*. Oppenheim: Jacob Köbel; a copy of the ETH-Bibliothek Zürich, sign.: Rar 8909 q; <http://www.e-rara.ch/zut/content/pageview/772508>; <http://www.e-rara.ch/download/pdf/725-955?name=Calendarium%20Romanum%20magnum>.

SUPRUNIUK Mirosław Adam

2005: *Mikołaja Kopernika portret młodzięncy*; <http://www.bu.umk.pl/cymelia/chapman.html>.

SZCZEPKOWSKA Magdalena

2005: *Grób astronoma. An interview with Prof. Karol Piasecki, the manager of the Department of Social Anthropology at the Institute of Sociology and Psychology of the University of Szczecin*, "Kurier Szczeciński" 25 November, p. 11 (conducted by Magdalena Szczepkowska).

ŚNIEGOCKI Józef, KIELA Paweł, ŚNIEGOCKI Robert

2008: *The film "Światowe odkrycie archeologów z Pułtuska. Poznana tajemnica grobu Kopernika"*; KOPERNIK_AH.flv; <http://pl.youtube.com/watch?v=H76Wf-928eKo>; written and directed by Józef Śniegocki and Paweł Kiela; camera: Robert Śniegocki.

TAMARA Carol (maiden Witkowski)

2001: *Grandfather*; "Message boards. Ancestry.com", 20.03.2001; <http://boards.ancestry.com/surnames.bonczek/15/mb.ashx>.

- 2006: *Searching Chmielewski grandmother*; “Message boards. Ancestry.com”, 10.08.2006; <http://boards.ancestry.com/surnames.chmielewski/91/mb.ashx>.
- 2007: *Reply to: Chmielewski family tree by Michael Chmielewski*; “Genforum Genealogy.com”, 7.05.2007; <http://genforum.genealogy.com/chmielewski/messages/120.html>.
- 2009: *mtDNA of Copernicus and your mtDNA* (email of 29.09.2009 to M.K.).
- 2010: *Re: mtDNA Copernicus and Florentyna Chmielewski Bonczek Baczek* (email of 05.08.2010 to M.K.).

TANDECKI Janusz

- 1999: Rozdz. IV: *Rozkwit ośrodka handlowego i produkcyjnego w latach 1350–1410*. In: Biskup (ed.) 1999, pp. 167–220.

TORRONI Antonio, HUOPONEN Kirsi, FRANCALACCI Paolo, PETROZZI Maurizio, MORELLI Laura, SCOZZARI Rosaria, OBINU Domenica, SAVONTAUS Marja-Liisa, WALLACE Douglas C.

- 1996: *Classification of European mtDNAs from an Analysis of Three European Populations*, “Genetics”, vol. 144, pp. 1835–1850 (December, 1996); <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1207732/pdf/ge14441835.pdf>.

TRZECIAKOWSKI Lech

- 1970: *Kulturkampf w zaborze pruskim*. Wydawnictwo Poznańskie (Poznań 1970).
- 1990: *The Kulturkampf in Prussian Poland*. “East European Monographs”. New York: Columbia University Press.

“TVN24.PL”

- 2008: *To są szczątki Kopernika*, 2008.11.20, “Gazeta Wyborcza”, tvn24.pl, PAP (sm//kdj); <http://www.tvn24.pl/12690,1573901,0,1,to-sa-szczatki-kopernika,wiadomosc.html>.

UPPSALA UNIVERSITY LIBRARY

- 2002: *The Waller Manuscript Collection, Full Record Waller Ms pl-00045*; <http://waller.ub.uu.se/object.xsql?DBID=26248>.
- 2009a: *Copernicus Collection* (45 tomów); <http://www.ub.uu.se/en/Collections/Early-imprints/Special-collections/Copernicus-Collection/>.
- 2009b: *Copernicus Collection: Copernicus Porträtt*; [http://www.ub.uu.se/Global/Kulturarvs material/Äldre%20tryck/Copernicus%20porträtt.jpg](http://www.ub.uu.se/Global/Kulturarvs%20material/Äldre%20tryck/Copernicus%20porträtt.jpg).

VAN DEN BUSSCHE Ron

- 2011a: *Curriculum: Ron Van Den Bussche, Associate Dean for Research*; http://cas.okstate.edu/index.php?option=com_content&view=article&id=27&Itemid=71 (access: 10.10.2011).
- 2011b: *Welcome to the Van Den Bussche Laboratory of Molecular Systematics and Conservation Genetics*; <http://www.okstate.edu/artsci/zoology/ravdb/index.htm> (access: 10.10.2011).

WESELOVSKIJ I. N. / WESEŁOWSKI I. N.

1965: *Jak powstało "De revolutionibus" Kopernika*, "Studia i Materiały z Dziejów Nauki Polskiej", ser. C, iss. 11 (1965), pp. 49–53.

WALANUS Adam, KOKOWSKI Michał

2012: *Możliwość wykorzystania radiowęglowej metody datowania w badaniach grobu Mikołaja Kopernika*. In: Kokowski (ed.) 2012a, pp. 157–166; (*An English translation in this monograph.*)

WALKER Alan

2011: *Department of Anthropology. Alan Walker*; http://www.anthro.psu.edu/faculty_staff/walker.shtml (access: 11.11.2011).

WASIUTYŃSKI Jeremi

1963: *Uwagi o niektórych kopernikanach szwedzkich*, "Studia i Materiały z Dziejów Nauki Polskiej", ser. C, iss. 7 (1965), pp. 68–85.

WEBER Paul

1914: *Die Polen in Oberschlesien. Eine statistische Untersuchung*. Mit einem Vorwort "Die Fehlerquellen in der Statistik der Nationalitäten" von Professor Dr. Ludwig Bernhard. Berlin: Verlag von Julius Springer.

WĘCŁAWOWICZ Tomasz

2008: *Kościół archikatedralny we Fromborku. Badania architektoniczne w krypcie pod prezbiterium w roku 2006 / The archicathedral in Frombork. Architectural examinations carried out in the crypt under the presbytery in 2006*. In: Gąssowski (ed.) 2008a, pp. 160–195.

WIKIPEDIA

2010a: *Cypr*; <http://pl.wikipedia.org/wiki/Cypr>.

2010b: *Cyprus*; <http://en.wikipedia.org/wiki/Cyprus>.

2010c: *Germanizacja*; <http://pl.wikipedia.org/wiki/Germanizacja>.

2010d: *Heimat*; <http://de.wikipedia.org/wiki/Heimat>;

2010e: *Historia Śląska*; http://pl.wikipedia.org/wiki/Historia_Slaska.

2010f: *Lista państw świata według liczby ludności*; [http://pl.wikipedia.org/wiki/Lista_państw_swiata_wedlug_liczby_ludności](http://pl.wikipedia.org/wiki/Lista_państw_swiata_wedlug_liczby_ludnosci).

2010g: *Macedonia*; <http://pl.wikipedia.org/wiki/Macedonia>.

2010h: *Poisson distribution*; http://en.wikipedia.org/wiki/Poisson_distribution.

2010i: *Związek Polaków w Niemczech*; [http://pl.wikipedia.org/wiki/Związek_Polaków_w_Niemczech](http://pl.wikipedia.org/wiki/Zwiazek_Polakow_w_Niemczech).

2011: "Księga henrykowska"; [http://pl.wikipedia.org/wiki/Księga_henrykowska](http://pl.wikipedia.org/wiki/Ksiega_henrykowska).

WOJCIECHOWSKA Joanna

2007: *Może szwedzkie księgi pomogą odnaleźć Kopernika*, "Gazeta Wyborcza" Olsztyn (a report based on an interview with Prof. J. Gąssowski by Joanna Wojciechowska) (2007.02.08); <http://miasta.gazeta.pl/olsztyn/1,93864,3906723.html>.

WRÓBLEWSKI Andrzej Kajetan

1999: *Kryteria są jasne*, "Forum Akademickie", no. 4, April; <http://www.forumakad.pl/archiwum/99/4/artykuly/14-przeglad.htm>.

The YFiler Haplotype Database Applied Biosystems

2010: *Homepage*; <http://www.appliedbiosystems.com/yfilerdatabase/>.

YHRD – Y Chromosome Haplotype Reference Database

2010: *Homepage*; <http://www.yhrd.org/>.

ZAJDEL Dariusz

2005: *Czy tak wyglądał Mikołaj Kopernik?*, "Centralne Laboratorium Kryminalistyczne Komendy Głównej Policji"; <http://www.policja.pl/portal.php?serwis=clk&dzial=388&id=10826&search=1125>.

2006: *Czy tak wyglądał Kopernik?*, "Problemy Kryminalistyki", no. 251, pp. 39–44.

2007: see Paszkowska 2007.

ZIELIŃSKA Hanna

2009: *O poszukiwaniu grobu Kopernika* (An interview with Prof. Jerzy Gąssowski conducted by Hanna Zielińska); TOK FM radio station, 1 February, 12.00–13.00. Files nau0102a.mp3, nau0102b.mp3 with the recording of the programme obtained from TOK FM radio station, author's personal archives.

Michał KOKOWSKI

Department of History of Science, Natural Sciences and Technology, Ludwik and Aleksander Birkenmajer Institute for the History of Science, Polish Academy of Sciences; Copernicus Center for Interdisciplinary Studies, Poland; www.cyfronet.pl/~n1kokows/home.html; michal.kokowski@gmail.com

A postscript to the conference: Is a dialogue always possible?

The academic conference “The Nicolaus Copernicus’s grave mystery. A dialogue of experts” (Kraków, 22–23 February 2010) has so far been the first when not only supporters of the claim that the remains of Nicolaus Copernicus had been found in the Frombork Cathedral but also critics thereof could speak in public on equal terms.

During the conference, all invited speakers took the opportunity to freely choose their topics and their interpretation. For this reason the conference, in the organizers’ intention was to be an opportunity to conduct an open and rational dispute over the sometimes contradictory interpretations of the same facts, and the term “dialogue”, used in the name of the conference, was to encourage the speakers to look for a common ground for agreement.

In response to these desiderata the authors of papers presented a large scope of these proclaimed, styles of argument used, means of interpretation applied, etc., and this was true equally for the researchers believing that the grave of Copernicus had been found, as well as for those who had serious doubts about that, and for the authors who neither spoke openly in favour nor against this claim.

A common ground for agreement for all the speakers of the Kraków conference was a conviction that Nicolaus Copernicus greatly contributed to the world’s culture, and, consequently, the need to formulate particularly thorough argumentation on any matter relating to him.

Unfortunately, during the conference it turned out with great clarity that generally there is no possibility of dialogue regarding the finding mentioned, because, according to its supporters, everything has already been proven, which however did consistently defied by the critics, who point to many gaps in the presented evidence and chosen arguments.

Which of the parties to the dispute about the alleged discovery of the remains of the most famous Canon of Warmia is right? What are the main arguments for

or against? Who of the authors formulated them for the first time? In my view, these and similar issues can only be decided about in a competent, detailed, interdisciplinary discussion between a narrow group of experts, and not by the general public's findings of questionable quality.

The reader interested in understanding the detailed arguments of both parties of the controversy is referred to a careful study of their publications. As a criticism of the findings of Jerzy Gąssowski's team predominates on the pages of this volume (which is connected with the fact that several researchers involved in the search rejected the invitation to participate in the conference), for the balance I would like to recommend reading carefully the texts defending the theses propounded by the representatives of this team — see bibliography attached, especially: Gąssowski 2005, 2010a, 2010b, Piasecki 2005, 2008, 2009.

At the same time, I would like to express hope that the problem of the grave and the remains of Nicolaus Copernicus will be a subject of further careful interdisciplinary research and that the authors of the new publications will competently refer to the issues addressed in the texts presented in this volume.

References

ALLEN Marié

2008: *Analiza DNA włosów znalezionych w kalendarzu należącym do Mikołaja Kopernika / DNA analysis of shed hairs from Nicolaus Copernicus calendar*. In: Gąssowski (ed.) 2008a, pp. 226–235.

BOGDANOWICZ Wiesław, ALLEN Marié, BRANICKI Wojciech, LEMBRING Maria, GAJEWSKA Maria, KUPIEC Tomasz

2009: *Genetic identification of putative remains of the famous astronomer Nicolaus Copernicus*, “PNAS” (“Proceedings of the National Academy of Sciences of the United States of America”) 2009 July 28, vol. 106(30), pp. 12279–12282; ed. by Alan Walker, Pennsylvania State University, University Park, PA, and approved June 16, 2009; reviewed by Dr. Ronald Van Den Bussche (Oklahoma State University) and Dr. John H. Rappole (Smithsonian National Zoological Park); <http://www.pnas.org/content/106/30/12279.full>.

BRANICKI Wojciech

2008: see “PAP – NAUKA W POLSCE”.

BRANICKI Wojciech, KUPIEC Tomasz

2008: *Badania genetyczne domniemanych szczątków Mikołaja Kopernika / Genetic analysis of alleged remains of Nicolaus Copernicus*. In: Gąssowski (ed.) 2008, pp. 212–225.

GĄSSOWSKI Jerzy

(ed.) 2005 / (ed.) 2006: *Poszukiwanie grobu Mikołaja Kopernika*. Pod redakcją Jerzego Gąssowskiego. “Castrı Dominae Nostrae Letterae Annales” vol. II. Pułtusk:

- Wyższa Szkoła Humanistyczna im. Aleksandra Gieysztora, Bałtycki Ośrodek Badawczy, 2005; (ed.) 2006a (English translation): *The Search for Nicolaus Copernicus's Tomb*. Editor: Jerzy Gąssowski. Pułtusk: The Pułtusk Academy of Humanities, Institute of Anthropology and Archaeology; Fundacja Kronenberga, Citybank Handlowy, 2006.
- 2005: *Etos pracy badawczej a kwestia dziennikarskiej sensacji. W odpowiedzi na zarzuty dr. hab. Michała Kokowskiego*. In: Website of the Pułtusk School of Humanities (last accessed: December 2006); http://www.wsh.edu.pl/redaktor.php?view=1&art_id=258&pid=2&ret_id=2.
- 2007: see Paszkowska 2007.
- (ed.) 2008a: *Badania nad identyfikacją grobu Kopernika / The Search for identity of Copernicus Tomb*. Pułtusk: The Pułtusk Academy of Humanities, Institute of Anthropology and Archaeology; Fundacja Kronenberga przy City Handlowy.
- 2008b: *Badania nad odkryciem grobu Mikołaja Kopernika oraz identyfikacją jego szkieletu*. In: Gąssowski (ed.) 2008a, pp. 8–39; <http://archeologia.ah.edu.pl/kopernik%20dna.html>.
- 2009a: see Zielińska 2009.
- 2009b: *Odkrycie grobu Kopernika*, “Archeologia Żywa”, nr 5 (45) październik–listopad 2009, pp. 12–19 (a modified version of the article: Gąssowski 2008b); an online version (7.12.2009): <http://media.wp.pl/kat,1022945,wid,11754743,wiadomosc.html?ticaid=1d3c2>.
- 2010a: *Jak odkryto grób Kopernika?*, “Archeologia Żywa”; 12.02.2010 (a version of the articles: Gąssowski 2008b & 2009b); <http://odkrywcy.pl/kat,116794,title,Jak-odkryto-grob-Kopernika-,wid,11967745,wiadomosc.html?smg4sticaid=6d3c2>.
- 2010b: *Spotkanie z Kopernikiem. Kulisy odkrycia*. Toruń: Adam Marszałek.
- (ed.) 2010c: *Grób Mikołaja Kopernika. Odkrycie i identyfikacja / Nicolaus' Copernicus's Tomb. Discovery and Identification*. Pułtusk: The Pułtusk Academy of Humanities, Institute of Anthropology and Archaeology.

JEZIERSKI Jacek

- 2012: *Spór wokół grobu i drugiego pochówku Mikołaja Kopernika / Dispute over the grave of Nicolaus Copernicus and his second burial*. In: *Człowiek i Wszechświat. Materiały z interdyscyplinarnej sesji naukowej “Człowiek i Wszechświat” zrealizowanej dla uhonorowania księdza profesora Konrada Rudnickiego w 85-rocznicę jego urodzin. Kraków, 15 października 2011*. Edited by Bogdan Wszolek, Agnieszka Kuźmich and Marek Jamroz. Częstochowa – Kraków: Stowarzyszenie Astronomia Nova, Obserwatorium Astronomiczne Uniwersytetu Jagiellońskiego w Krakowie, pp. 49–56; <http://www.astronomianova.org/pdf/czlowieki-wszechswiat.pdf>.

KUPIEC Tomasz

- 2008: see “PAP – NAUKA W POLSCE”
- 2009: *Tajemnica pochówku astronoma*, “Genetyka i Prawo. Kwartalnik Naukowy Zakładu Genetyki Molekularnej i Sądowej”, nr 2(5) Wiosna 2009, pp. 12–13; http://www.zgms.cm.umk.pl/kwartalnik/GiP_02_2009.pdf.

“PAP – NAUKA W POLSCE” / ALLEN Marié, BRANICKI Wojciech, GĄSSOWSKI Jerzy, KUPIEC Tomasz

2008: *Naukowcy: tajemnica grobu Kopernika – wyjaśniona*, “PAP – Nauka w Polsce” (21 November, 2008) (jmy/wos/zig/jwo); http://www.naukawpolsce.pap.pl/palio/html.run?_Instance=cms_naukapl.pap.pl&_PageID=1&s=szablon.depesza&dz=lewaszpalta.naukadlagospodarki&dep=331442.

PASZKOWSKA Joanna / BOGDANOWICZ Wiesław, GĄSSOWSKI Jerzy, PIASECKI Karol, ZAJDEL Dariusz

2007: *Audycja Twarzą w twarz z Kopernikiem* / “Czaszka wielkiego astronoma” (Interviews with Professor W. Bogdanowicz, Professor J. Gąssowski, Professor K. Piasecki and D. Zajdel, MA), Polskie Radio Online (7 May, 2007); <http://www.polskieradio.pl/nauka/temattygodnia/arttykul6600.html>; http://www.polskieradio.pl/_files/20070222130611/2007110904543523.mp3 (13,81 MB).

PIASECKI Karol

2005: *Uwagi do tekstu dr. hab. Michała Kokowskiego*. In: Website of the Pultusk School of Humanities (last accessed: December 2006); http://www.wsh.edu.pl/redaktor.php?view=1&art_id=258&pid=2&ret_id=2.

2007: see Paszkowska 2007.

2008: *Etyczne problemy odkrycia naukowego. Przypadek Mikołaja Kopernika / The ethical problems of scientific discovery. The case of Nicolaus Copernicus*. In: Gąssowski (ed.) 2008a, pp. 196–203.

2009: *Wstrzymać Kopernika!*, “Archeologia Żywa”, no. 5 (45) October – November 2009, pp. 20–25.

PIASECKI Karol, ZAJDEL Dariusz

2005a/2006a: *Badania antropologiczne we Fromborku. Grób nr 13. Rekonstrukcja wyglądu głowy na podstawie czaszki*. In: Gąssowski (ed.) 2005c, pp. 27–37; English translation: 2006a: *Anthropological Research in Frombork. Tomb no. 13. Reconstruction of the appearance of the head on the basis of the skull*. In: Gąssowski (ed.) 2006a, pp. 21–36.

ZAJDEL Dariusz

2005: *Czy tak wyglądał Mikołaj Kopernik?*, “Centralne Laboratorium Kryminalistyczne Komendy Głównej Policji”, <http://www.policja.pl/portal.php?serwis=clk&dzial=388&id=10826&search=1125>.

2006: *Czy tak wyglądał Kopernik?*, “Problemy Kryminalistyki”, no. 251, pp. 39–44.

2007: see Paszkowska 2007.

ZIELIŃSKA Hanna

2009: *O poszukiwaniu grobu Kopernika* (An interview with Prof. Jerzy Gąssowski conducted by Hanna Zielińska); TOK FM radio station, 1 February, 12.00–13.00. Files nau0102a.mp3, nau0102b.mp3 with the recording of the programme obtained from TOK FM radio station, author’s personal archives.

Authors

dr Jarosław Bednarek

Zakład Genetyki Molekularnej i Sądowej,
Katedra Medycyny Sądowej,
Collegium Medicum, Uniwersytet Mikołaja Kopernika,
ul. M. Skłodowskiej-Curie 9, 85-094 Bydgoszcz;
<http://www.zgms.cm.umk.pl>
bednarek@cm.umk.pl

dr hab. Wojciech Branicki, prof. UJ

Pracownia Genetyki Sądowej,
Instytut Ekspertyz Sądowych im. Prof. dra Jana Sehna,
ul. Westerplatte 9, 31-033 Kraków;
<http://ies.krakow.pl/blog/struktura/pracownia-genetyki-sadowej/>

Zakład Genetyki i Ewolucjonizmu,
Instytut Zoologii,
Wydział Biologii i Nauk o Ziemi,
Uniwersytet Jagielloński,
ul. Gronostajowa 9, 30-387 Kraków;
http://www.binoz.uj.edu.pl/iz/index.php?idz=zakl_prac&id=23
wojciech.branicki@uj.edu.pl

prof. dr art. kons. Józef Flik

Instytut Zabytkoznawstwa i Konserwatorstwa,
Wydział Sztuk Pięknych,
Uniwersytet Mikołaja Kopernika,
ul. Sienkiewicza 30/32, 87-100 Toruń;
<http://www.art.umk.pl/ttmFlik.php>
Jozef.Flik@umk.pl

prof. dr hab. Tomasz Grzybowski

Zakład Genetyki Molekularnej i Sądowej,
Katedra Medycyny Sądowej,
Collegium Medicum, Uniwersytet Mikołaja Kopernika,
ul. M. Skłodowskiej-Curie 9, 85-094 Bydgoszcz;
<http://www.zgms.cm.umk.pl>
tgrzyb@cm.umk.pl

dr Peter Gwozdz

21865 Regnart Road
Cupertino CA 95014 USA;
<http://www.gwozdz.org>
pete2g2@comcast.net

mgr Joanna Jendrzewska

Gdańsk,
aisa@op.pl

dr hab. Michał Kokowski, prof. IHN PAN

Zakład Historii Nauk Ścisłych, Przyrodniczych i Techniki, Instytut Historii Nauki im. Ludwika i Aleksandra Birkenmajerów PAN,
ul. Sławkowska 17, 31-016 Kraków;
<http://www.cyfronet.pl/~n1kokows/index.html>
michal.kokowski@gmail.com

dr Tomasz Kozłowski

Zakład Antropologii, Instytut Ekologii i Ochrony Środowiska,
Uniwersytet Mikołaja Kopernika,
ul. Gagarina 9, 87-100 Toruń;
<http://www.biol.uni.torun.pl/~kozlow/antrop/antrop.htm>
kozlow@umk.pl

dr Tomasz Kupiec

Pracownia Genetyki Sądowej,
Instytut Ekspertyz Sądowych im. prof. dra Jana Sehna,
ul. Westerplatte 9, 31-033 Kraków;
<http://ies.krakow.pl/blog/struktura/pracownia-genetyki-sadowej/>
tkupiec@ies.krakow.pl

dr Boris A. Malyarchuk / Борис А. Малярчук

Instytut Biologicznych Problemów Północy, Dalekowschodni Odział Rosyjskiej Akademii Nauk / Институт Биологических Проблем Севера, Дальневосточное Отделение Российской Академии Наук,
Portovaya str. 18, 685000 Magadan, Federacja Rosyjska;
http://ibpn.ru/index.php?option=com_content&task=view&id=22
malyarchuk@ibpn.ru

prof. dr hab. Krzysztof Mikulski

Instytut Historii i Archiwistyki, Uniwersytet Mikołaja Kopernika,
ul. Władysława Bojarskiego 1, 87-100 Toruń;
http://www.historia.umk.pl/index.php?option=com_content&task=view&id=940
kmik@umk.pl

**dr hab. Bronisław Młodziejowski, prof. UWM,
Prezes Polskiego Towarzystwa Kryminalistycznego**

Katedra Kryminalistyki i Medycyny Sądowej, Uniwersytet Warmińsko-Mazurski,
Centrum Konferencyjne, ul. B. Dybowskiego 11 pok. 204, 10-719 Olsztyn;
http://wpia.uwm.edu.pl/v2/index.php?option=com_content&view=article&id=141adam87br@wp.pl

mgr Urszula Rogalla

Zakład Genetyki Molekularnej i Sądowej,
Katedra Medycyny Sądowej,
Collegium Medicum, Uniwersytet Mikołaja Kopernika,
ul. M. Skłodowskiej-Curie 9, 85-094 Bydgoszcz;
<http://www.zgms.cm.umk.pl>
ulvroth@gmail.com

dr Jerzy Sikorski

Wojewódzki Urząd Ochrony Zabytków w Olsztynie,
ul. Podwale 1, 10-076 Olsztyn;
<http://www.wuoz.olsztyn.pl>
wuoz.olsztyn@wuoz.olsztyn.pl

mgr Katarzyna Skonieczna

Zakład Genetyki Molekularnej i Sądowej,
Katedra Medycyny Sądowej,
Collegium Medicum, Uniwersytet Mikołaja Kopernika,

ul. M. Skłodowskiej-Curie 9, 85-094 Bydgoszcz;
<http://www.zgms.cm.umk.pl>
k.skoneczna@gmail.com

Studium Medycyny Molekularnej,
ul. Żwirki i Wigury 61, pok. 623, 02-091 Warszawa;
<http://www.smm.edu.pl>

dr Arkadiusz Sołtysiak

Zakład Bioarcheologii, Instytut Archeologii, Uniwersytet Warszawski,
ul. Krakowskie Przedmieście 26/28, 00-927 Warszawa;
<http://www.antropologia.uw.edu.pl/as.html>
A.Soltysiak@uw.edu.pl

mgr Anna Stachowska

Instytut Historii PAN,
Zakład Historii Pomorza i Krajów Bałtyckich,
ul. Szeroka 36, 87-100 Toruń;
<http://www.ihpan.edu.pl/?id=217>
ania@stachowska.com, astachowska@ihpan.edu.pl

dr hab. inż. Adam Walanus, prof. AGH

Katedra Geoinformatyki i Informatyki Stosowanej,
Wydział Geologii, Geofizyki i Ochrony Środowiska,
Akademia Górniczo-Hutnicza im. St. Staszica,
al. Mickiewicza 30, A0, p. 324b, 30-059 Kraków;
<http://www.adamwalanus.pl>
walanus@geol.agh.edu.pl

Reviewers

prof. dr hab. Tadeusz Dobosz

Zakład Technik Molekularnych, Katedra Medycyny Sądowej, Wydział Lekarski, Akademia Medyczna we Wrocławiu, ul. M. Curie-Skłodowskiej 52, 50-369 Wrocław

prof. dr hab. Krzysztof Kaczanowski

Zakład Antropologii, Instytut Zoologii, Wydział Biologii i Nauk o Ziemi, Uniwersytet Jagielloński, ul. Ingardena 6, 30-060 Kraków

prof. dr hab. Sławomir Kadrow

Oddział Krakowski Instytutu Archeologii i Etnologii PAN, ul. Sławkowska 17, 31-016 Kraków; Zakład Archeologii Protohistorycznej, Instytut Archeologii, Uniwersytet Rzeszowski, ul. Hoffmanowej 8, 35-016 Rzeszów

prof. dr hab. inż. Marek Krąpiec

Pracownia Dendrochronologii i Malakologii, Katedra Analiz Środowiskowych, Kartografii i Geologii Gospodarczej, Wydział Geologii, Geofizyki i Ochrony Środowiska, Akademia Górniczo-Hutnicza, al. A. Mickiewicza 30, 30-059 Kraków

prof. dr hab. Guido Kriesel

Zakład Antropologii, Instytut Ekologii i Ochrony Środowiska, Wydział Biologii i Nauk o Ziemi, Uniwersytet Mikołaja Kopernika, ul. Gagarina 9, 87-100 Toruń

ks. dr Zbigniew Liana

Katedra Filozofii Przyrody, Wydział Filozoficzny, Uniwersytet Papieski Jana Pawła II, ul. Kanonicza 25, 31-002 Kraków

dr hab. Krzysztof Maślanka, prof. PAN

Instytut Historii Nauki im. Ludwika i Aleksandra Birkenmajerów PAN, ul. Sławkowska 17, 31-016 Kraków

prof. dr hab. Zofia Szczerkowska

Katedra i Zakład Medycyny Sądowej, Akademia Medyczna w Gdańsku, ul. Dębowa 23, 80-204 Gdańsk

prof. dr hab. Karolina Targosz

Instytut Historii Nauki im. Ludwika i Aleksandra Birkenmajerów PAN, ul. Sławkowska 17, 31-016 Kraków

dr Marcin Woźniak

Zakład Genetyki Molekularnej i Sądowej, Katedra Medycyny Sądowej, Collegium Medicum, Uniwersytet Mikołaja Kopernika, ul. Marii Skłodowskiej-Curie 9, 85-094 Bydgoszcz



On 22–23 February 2010 a scientific conference "The Nicolaus Copernicus grave mystery. A dialogue of experts" was held in Kraków.

The institutional organizers of the conference were: the European Society for the History of Science, the Copernicus Center for Interdisciplinary Studies, the Polish Academy of Arts and Sciences with its two commissions (the Commission on the History of Science, and the Commission on the Philosophy of Natural Sciences), the Institute for the History of Science of the Polish Academy of Sciences, and the Tischner European University.

The purpose of this conference was to discuss the controversy surrounding the discovery of the grave of Nicolaus Copernicus and the identification of his remains. For this reason, all the major participants of the search for the grave of Nicolaus Copernicus and critics of these studies were invited to participate in the conference. It was the first, and so far only such meeting when it was possible to speak openly and on equal terms for both the supporters and the critics of the thesis that the grave of the great astronomer had been found and the identification of the found fragments of his skeleton had been completed. [...]

In this book, we present the aftermath of the conference – full texts or summaries of them, sent by the authors. In the latter case, where possible, additional information is included on other texts published by the author(s) on the same subject. The texts of articles presented in this monograph were subjected to several stages of review process, both explicit and implicit. [...]

I would like to draw the readers of this collective monograph to the fact that on its pages one can find contrary theses proclaimed by various authors. By no means does it constitute a flaw in this study. It emphasizes a conscious decision: the idea was to show the diversity of opinions present in the scientific community, and thus to create the possibility of a future creative exchange of views – because the progress in science entails continuous improvement of the theses propounded and enriches argumentation in favour of them. [...]

Professor Michał Kokowski,
Habilitation Doctor in Humanities
the initiator and the manager of the conference
and the scientific editor of the monograph

