2025

SCIENTIFIC ACHIEVEMENTS

DR NATALIA SZÓSTAK

ATTACHMENT 4

ATTACHMENT 4: LIST OF SCIENTIFIC ACHIEVEMENTS CONSTITUTING A SIGNIFICANT CONTRIBUTION TO THE DEVELOPMENT OF A SPECIFIC DISCIPLINE

I. LIST OF SCIENTIFIC ACHIEVEMENTS, REFERRED TO IN ARTICLE 219, SECTION 1. POINT 2 OF THE ACT

1. SCIENTIFIC MONOGRAPHS, IN ACCORDANCE WITH ARTICLE 219, SECTION 1. POINT 2A OF THE ACT

Not applicable

2. A CYCLE OF THEMATICALLY RELATED SCIENTIFIC ARTICLES, IN ACCORDANCE WITH ARTICLE 219, SECTION 1. POINT 2B OF THE ACT

H1. **Szóstak N***, Szymanek A*, Havránek J, Tomela K, Rakoczy M, Samelak-Czajka A, Schmidt M, Figlerowicz M, Majta J, Milanowska-Zabel K, Handschuh L, Philips A.

The standardisation of the approach to metagenomic human gut analysis: from sample collection to microbiome profiling.

Scientific Reports 12 (1), 8470 (2022). doi: 10.1038/s41598-022-12037-3

IF_{2022} = 4,6; $5IF_{2022}$ = 4,9; MNiSW: 140

H2. **Szóstak N**, Handschuh L, Samelak-Czajka A, Tomela K, Schmidt M, Pruss Ł, Milanowska-Zabel K, Kozlowski P, Philips A.

Host factors associated with gut mycobiome structure.

mSystems 8 (2), e00986-22 (2023). doi: 10.1128/msystems.00986-22

IF_{2023} = 5; $5IF_{2023}$ = 6,1; MNiSW: 140

H3. **Szóstak N**, Handschuh L, Samelak-Czajka A, Tomela K, Pietrzak B, Schmidt M, Kaczmarek M, Galus Ł, Mackiewicz J, Mackiewicz A, Kozlowski P, Philips A.

Gut Mycobiota Dysbiosis Is Associated with Melanoma and Response to Anti–PD-1 Therapy.

Cancer Immunology Research 12 (4), 427-439 (2024). doi: 10.1158/2326-6066.CIR-23-0592

IF_{2023} = 8,1; $5IF_{2023}$ = 10,1; MNiSW: 200

H4. **Szóstak N**[#], Budnik M, Tomela K, Handschuh L, Samelak-Czajka A, Pietrzak B, Schmidt M, Kaczmarek M, Galus Ł, Mackiewicz J, Mackiewicz A, Kozlowski P, Philips A.

Exploring correlations between gut mycobiome and lymphocytes in melanoma patients undergoing anti-PD-1 therapy.

Cancer Immunology, Immunotherapy 74, 110 (2025). doi: 10.1007/s00262-024-03918-9

IF_{2023} = 4,6; $5IF_{2023}$ = 5,4; MNiSW: 140

H5. **Szóstak N**, Figlerowicz M, Philips A.

The emerging role of the gut mycobiome in liver diseases.

Gut Microbes 15 (1), 2211922 (2023). doi: 10.1080/19490976.2023.2211922

IF_{2023} = 12,2; $5IF_{2023}$ = 12,3; MNiSW: 100

*equal contribution
[#]corresponding author

3. ORIGINAL DESIGN, CONSTRUCTION, TECHNOLOGICAL OR ARTISTIC ACHIEVEMENTS PERFORMED, IN ACCORDANCE WITH ARTICLE 219, SECTION 1, POINT 2C OF THE ACT

Not applicable

4. SCIENTIFIC ACHIEVEMENTS OTHER THAN THOSE LISTED IN POINTS I.1-3

Before obtaining the doctoral degree:

N1. Pietal MJ*, **Szóstak N***, Rother KM, Bujnicki JM.

RNAmap2D – calculation, visualization and analysis of contact and distance maps for RNA and protein-RNA complex structures.

BMC Bioinformatics 13 (1), 1-11 (2012), doi: 10.1186/1471-2105-13-333

IF_{2012} = 3,024; $5IF_{2012}$ = 3,510; MNiSW: 100

N2. **Szóstak N**, Royo F, Rybarczyk A, Szachniuk M, Blazewicz J, del Sol A, Falcon-Perez JM.

Sorting signal targeting mRNA into hepatic extracellular vesicles.

RNA Biol. 11 (7), 836–844 (2014), doi: 10.4161/rna.29305

IF_{2014} = 4,974; $5IF_{2014}$ = 5,237; MNiSW: 100

N3. Rybarczyk A, **Szóstak N**, Antczak M, Zok T, Popenda M, Adamiak R, Blazewicz J, Szachniuk M.

New in silico approach to assessing RNA secondary structures with non-canonical base pairs.

BMC Bioinformatics 16 (1), 1-12 (2015), doi: 10.1186/s12859-015-0718-6

IF_{2015} = 2,435; $5IF_{2015}$ = 3,435; MNiSW: 100

N4. **Szóstak N**, Wasik S, Blazewicz J.

Hypercycle.

PLOS Comput Biol. 12 (4):e1004853 (2016), doi: 10.1371/journal.pcbi.1004853

IF_{2016} = 4,542; $5IF_{2016}$ = 5,044; MNiSW: 140

N5. **Szóstak N**, Wasik S, Blazewicz J.

Understanding Life: A Bioinformatics Perspective.

Eur Rev. 25 (2), 231–245 (2017), doi: 10.1017/S1062798716000570

F_{2017}= 0,434; $5IF_{2017}$ = 0,307; MNiSW: 70

N6. **Szóstak N**, Synak J, Borowski M, Wasik S, Blazewicz J.

Simulating the origins of life: The dual role of RNA replicases as an obstacle to evolution.

PLOS ONE 12 (7), e0180827 (2017), doi: 10.1371/journal.pone.0180827

F_{2017} = 2,766; $5IF_{2017}$ = 3,352; MNiSW: 100

N7. Mietchen D, Wodak S, Wasik S, **Szóstak N**, Dessimoz C.

Submit a Topic Page to PLOS Computational Biology and Wikipedia.

PLOS Comput Biol. 14 (5), e1006137 (2018), doi: 10.1371/journal.pcbi.1006137

F_{2018} = 4,428; $5IF_{2018}$ = 5,042; MNiSW: 140

After obtaining the doctoral degree:

N8. Wasik S, Szóstak N, Kudla M, Wachowiak M, Krawiec K, Blazewicz J.

Detecting life signatures with RNA sequence similarity measures.

J Theor Biol. 463;110–120 (2019), doi: 10.1016/j.jtbi.2018.12.018

F_{2019} = 2,327; $5IF_{2019}$ = 2,122; MNiSW: 70

N9. Carrascoza Mayén JF, Rydzewski J, Szóstak N, Blazewicz J, Nowak W.

Prebiotic Soup Components Trapped in Montmorillonite Nanoclay Form New Molecules: Car-Parrinello Ab Initio Simulations. doi: 10.3390/life9020046

Life 9 (2), 46 (2019)

F_{2019} = 2,991; $5IF_{2022}$ = 3,2; MNiSW: 70

N10. Wasik S, Jaroszewski M, Nowaczyk M, Szóstak N, Prejzendanc T, Blazewicz J.

VirDB: Crowdsourced Database for Evaluation of Dynamical Viral Infection Models.

Curr Bioinforma. 14 (8), 740–748 (2019), doi: 10.2174/1574893614666190308155904

F_{2019} = 2,068; $5IF_{2019}$ = 1,198; MNiSW: 40

N11. Lehmann TP, Miskiewicz J, Szóstak N, Szachniuk M, Grodecka-Gozdecka S, Jagodziński P.

In Vitro and in Silico Analysis of miR-125a with rs12976445 Polymorphism in Breast Cancer Patients.

Appl Sci.10 (20), 7275 (2020), doi: 10.3390/app10207275

IF_{2020} = 2,679; $5IF_{2020}$ = 2,736; MNiSW: 100

N12. Nawrocka P, Galka-Marciniak P, Urbanek Trzeciak MO, Szóstak N, Philips A, Sand M, Kozlowski P.

Profile of Basal Cell Carcinoma Mutations and Copy Number Alterations - Focus on Gene-Associated Noncoding Variants.

Front. Oncol. 11, 4991 (2021), doi: 10.3389/fonc.2021.752579

IF_{2021} = 5,738; $5IF_{2021}$ = 6,122; MNiSW: 100

N13. Janecki D*, Raneet S*, **Szóstak N***, Kajdasz A, Kordyś M, Plawgo K, Pandakov D, Philips A, Warkocki Z.

LINE-1 mRNA 3' end dynamics shape its biology and retrotransposition potential.

NAR 52 (6), 3327-3345 (2024), doi: 10.1093/nar/gkad1251

IF_{2023} = 16,7; $5IF_{2023}$ = 16,1; MNiSW: 200

N14. Budnik M, Wawrzyniak J, Grala Ł, Kadziński M, **Szóstak N#**.

Deep dive into RNA: a systematic literature review on RNA structure prediction using machine learning methods.

Artificial Intelligence Review 57 (9), 254 (2024), doi: 10.1007/s10462-024-10910-3

IF_{2023} = 10,7; $5IF_{2023}$ = 11,7; MNiSW: 140

*equal contribution
#corresponding author

II. LIST OF SCIENTIFIC ACTIVITY

1. LIST OF MEMBERSHIP IN SCIENTIFIC EDITORIAL BOARDS OF MONOGRAPHS

Not applicable

2. LIST OF SPEECHES AT NATIONAL OR INTERNATIONAL SCIENTIFIC CONFERENCES, WITH SPECIFICATION OF INVITED LECTURES AND PLENARY LECTURES

After obtaining the doctoral degree:

- International conference FEMS MICRO 2025, Milan, Italy, 14 – 17.07.2025, active participation – oral presentation "Gut Mycobiota Dysbiosis is Associated with Melanoma and Response to Immunotherapy"
- International conference Bioinformatics in Torun (BIT23), 29.06 – 01.07.2023, active participation – poster presentation "Associations between Host Factors and the Gut Mycobiota"
- PharmaPlanet, online, 03 – 04.11.2021, active participation – oral presentation "AI4.BIO – Innovative approach to RNA structure prediction" within TOP MEDTECH INNOVATIONS FROM POLAND
- InfoShare 2021, Gdansk, 13 – 15.10.2021, Startup Contest, active participation – oral presentation of the concept of AI4.BIO – a platform for RNA structure prediction
- BigDataTech Warsaw, 27.02.2020, active participation – oral presentation "Practical application of AI"

- DataMass Gdansk Summit, Gdansk, 04.10.2019, active participation – oral presentation ”Predictive Maintenance, or AI in Industry
- Generali Conference, Warsaw, 22.05.2019, active participation – oral presentation ”Big Data – knowledge in data”
- SQLDay 2019, Wroclaw, 13.05 – 15.05.2019, active participation – oral presentation ”From Big Data to knowledge contained in the data”
- Startup Poznan 2019, Poznan, 08.05.2019, active participation – oral presentation ”From Big Data to knowledge contained in the data – 2-hour live demo”
- AI Meet up 2019, Poznan, 25.04.2019, active participation – oral presentation ”AI for industry using the Azure platform”
- SQL Saturday 2019, Krakow, 08.02 – 09.02.2019, active participation – oral presentation ”Challenges in Big Data analysis”

Selected conference presentations before obtaining the doctoral degree:

- International conference ECCB 2016, The 15th European Conference on Computational Biology, Haga (The Netherlands), 03 – 07.09.2016, active participation – poster presentation “Modelling and simulations – an application to the RNA World Hypothesis”
- International conference Bio Congress 2016, Wroclaw, 13.09.2016 – 16.09.2016, active participation – poster presentation “Modelling and simulations – an application to the RNA World Hypothesis”
- PTBI 2016, 9th Symposium of the Polish Bioinformatics Society, Bialystok, 28 – 30.09.2016, active participation – poster presentation “Modelling and simulations – an application to the RNA World Hypothesis”
- International conference EURO 2016, The 28th European Conference on Operational Research, Poznań, 03 – 06.09.2016, active participation – oral presentation “Modelling and simulations – an application to the RNA World Hypothesis”
- International conference ICOLE 2015 – German - Polish Workshop on Computational Biology, Perspectives of Bioinformatics, Operations Research and Machine Learning, Lessach (Austria), 27.09 – 03.10.2015, active participation – oral presentation “New *in silico* approach to assess RNA secondary structures with non-canonical base pairs”
- VIII Symposium of the Polish Bioinformatics Society 2015, Lublin, 17 – 19.09.2015, active participation – oral presentation “New in silico approach to assess RNA secondary structures with non-canonical base pairs”
- International conference EURO 2015, The 27th European Conference on Operational Research, Glasgow (United Kingdom), 12 – 15.07.2015, active participation – oral presentation “New in silico approach to assess RNA secondary structures with non-canonical base pairs”
- International conference ECCO 2015, The 28th Annual Conference of the European Chapter of Combinatorial Optimization, Catania (Italy), 28 – 30.05.2015, active participation – oral presentation “New in silico approach to assess RNA secondary structures with non-canonical base pairs”

- International conference RECOMB 2015 - the 19th Annual International Conference on Research in Computational Molecular Biology, Warsaw, 12 – 15.04.2015, active participation – poster presentation "Sorting signals targeting mRNA into hepatic extracellular vesicles"
- International conference ICOLE 2014 German - Polish Workshop on Computational Biology, Perspectives of Bioinformatics, Operations Research and Machine Learning, Lessach (Austria), 15 – 20.09.2014, active participation – oral presentation "Cellular logistics – how to find zipcodes?"
- International conference Bio Congress 2014, Warsaw, 9 – 12.09.2014, active participation – oral presentation "Sorting signals targeting mRNA into hepatic extracellular vesicles"
- International conference IV EURO WG Conference on Operational Research in Computational Biology, Bioinformatics and Medicine, Poznan – Biedrusko, 26 – 28.06.2014 – oral presentation "Sorting signals targeting mRNA into hepatic extracellular vesicles"
- International conference Bioinformatics in Torun 2014, Torun, 12 – 14.06.2014, active participation – poster presentation "Sorting signals targeting mRNA into hepatic extracellular vesicles"

3. LIST OF PARTICIPATION IN ORGANIZATIONAL AND SCIENTIFIC COMMITTEES OF NATIONAL OR INTERNATIONAL CONFERENCES, WITH SPECIFYING THE FUNCTION PERFORMED

Not applicable

4. LIST OF PARTICIPATION IN WORKS OF RESEARCH TEAMS IMPLEMENTING PROJECTS FINANCED BY WAY OF NATIONAL OR INTERNATIONAL COMPETITIONS, WITH DIVISION INTO COMPLETED PROJECTS AND PROJECTS IN THE COURSE OF PERFORMANCE AND WITH TAKING INTO ACCOUNT THE INFORMATION ON THE FUNCTION PERFORMED WITHIN THE FRAMEWORK OF WORKS OF THE TEAMS

Completed after obtaining the doctoral degree:

- Researcher in the NCBR grant POIR.04.01.02-00-0025/17 – Operational Programme Intelligent Development, Measure 4.1 Research and Development Works, Sub-measure 4.1.2 Regional Scientific and Research Agendas

  "Polish Microbiome Map"

  02/01/2020 – present (project sustainability maintenance)

- Researcher in the grant POIR.04.02.00-00-D017/20 co-financed by the European Regional Development Fund under the Operational Programme Intelligent Development 2014-2020

  "ECBiG – European Centre for Bioinformatics and Genomics – MOSAIC"

06/01/2021 – 11/30/2023

- Researcher in the grant RPWP.02.01.01-30-0001/20 Priority II: Information Society, Measure 2.1: Development of electronic public services "Regional COVID-Hub"

  08/01/2020 – 12/31/2020

- Researcher in the grant POIR.04.02.00-30-A004/16 co-financed by the European Union from the European Regional Development Fund under the Operational Programme Intelligent Development (Measure 4.2 Development of modern research infrastructure in the science sector)

  "Genomic Map of Poland" within the framework of "ECBiG – European Centre for Bioinformatics and Genomics"

  08/01/2018 – 12/31/2018

Completed before obtaining the doctoral degree:

- Researcher in the OPUS grant, NCN 2016/23/B/ST6/03931

  "RNApolis – methods and algorithms for modeling and analysis of RNA structure," 2016 – 2017

- Researcher in the OPUS grant, NCN 2012/05/B/ST6/03026

  "Computational models and methods in cell biology," 2012 – 2015

5. LIST OF MEMBERSHIP IN INTERNATIONAL OR NATIONAL ORGANIZATIONS AND SCIENTIFIC SOCIETIES, TOGETHER WITH INFORMATION ON THE FUNCTIONS PERFORMED

- Member of the Polish Bioinformatics Society since 2010

6. LIST OF INTERNSHIPS AT SCIENTIFIC INSTITUTIONS, INCLUDING FOREIGN ONES, WITH SPECIFYING THE PLACE, DATE, DURATION OF THE INTERNSHIP AND ITS NATURE

11/2016-02/2017	University of Luxembourg, Luxembourg, research stay under the Etiuda scholarship, scientific supervisor Prof. Pascal Bouvry
09/2007-02/2008	University of Milan, Milan, Italy, internship at the Laboratory of Bioinformatics, Evolutionary Biology, and Comparative Genomics within the Erasmus scholarship, Prof. Giulio Pavesi

7. LIST OF MEMBERSHIP IN EDITORIAL COMMITTEES AND SCIENTIFIC COUNCILS OF JOURNALS, ALONG WITH INFORMATION ON THE FUNCTIONS PERFORMED

Not applicable

8. LIST OF PEER-REVIEWED SCIENTIFIC WORKS, PARTICULARLY THOSE PUBLISHED IN INTERNATIONAL JOURNALS

I have been a reviewer for four papers in internationally recognized journals:

- *Biotechnologia (2024) – two papers*
- *Frontiers in Microbiology* (2024)
- *Frontiers in Immunology* (2025)

9. LIST OF PARTICIPATION IN EUROPEAN OR OTHER INTERNATIONAL PROGRAMS.

Not applicable

10. LIST OF PARTICIPATION IN RESEARCH TEAMS IMPLEMENTING PROJECTS OTHER THAN THOSE SPECIFIED IN POINT II.4.

Not applicable

11. LIST OF PARTICIPATION IN TEAMS ASSESSING APPLICATIONS FOR RESEARCH FUNDING, APPLICATIONS FOR GRANTING SCIENTIFIC AWARDS, APPLICATIONS IN OTHER COMPETITIONS HAVING A SCIENTIFIC OR DIDACTIC NATURE

- Review of a grant application for the University of Warsaw in the competition “New Ideas POB III. Petabyte Challenges”, 2021.

III. COOPERATION WITH THE SOCIAL AND ECONOMIC ENVIRONMENT

1. LIST OF TECHNOLOGICAL ACHIEVEMENTS

Not applicable

2. COOPERATION WITH THE ECONOMIC SECTOR.

- In 2022–2023, I served as the R&D manager for two research and development projects carried out in collaboration with an external business entity concerning the use of artificial intelligence in the diagnosis of eye diseases: “Beautiful Eyes (TAM/1/2022) and “Demox” (No. 10/2021/M), co-financed by the European Regional Development Fund under the Operational Programme Intelligent Development (Measure 1.3: R&D works financed with the participation of venture capital funds, Sub-measure 1.3.1: Support for R&D projects in the pre-seed phase by proof of concept funds – BRIdge Alfa).

- "Beautiful Eyes" (TAM/1/2022) – The project aimed to conduct R&D works leading to the creation of a mobile application that, thanks to a unique combination of image processing algorithms and machine learning, allows recognition of the degree of complications in the anterior segment of the eyeball related to wearing contact lenses. The baseline assessment of complication severity is based on one of the most commonly used clinical grading scales, the Efron scale. As a result of the project, the following were developed: 1. A complete ontological description of 16 anterior eye conditions and their severity levels according to the Efron grading scale. 2. A knowledge graph describing 16 eye conditions according to the Efron grading scale. 3. A database containing over 146,000 reference images illustrating the 16 analyzed eye conditions, categorized by severity. 4. A model for recognizing anterior eye conditions according to the Efron scale with severity grading, which achieved over 80% accuracy on the validation set for all analyzed conditions. 5. A prototype mobile application utilizing the machine learning model developed during the project.
- "Demox" (No. 10/2021/M) – The project aimed to develop a technology for non-invasive diagnosis of the eye parasite *Demodex sp.* using machine learning and image analysis methods. The project resulted in: 1. A database containing over 33,300 reference images of eyes from patients showing symptoms of ocular demodicosis and healthy eyes. 2. An image recognition model for detecting signs of *Demodex sp.* infestation in the eye, achieving 99.61% accuracy on the training set and 97.14% on the test set. 3. A prototype mobile application using the machine learning model developed during the project.

The developed algorithms enable disease identification based on image analysis, supporting the diagnostic process. These studies contribute to advancements in the application of advanced technologies such as artificial intelligence in medicine, improving diagnostic accuracy and supporting healthcare.

- In 2020–2021, I was involved as a performer in the implementation of the NCBR grant (POIR.04.01.02-00-0025/17 - Operational Programme Intelligent Development, Measure 4.1 Research and Development Works, Sub-measure 4.1.2 Regional Scientific and Research Agendas "Map of the Microbiome of Poland"). I conducted scientific research and development work on behalf of ICHB PAN within a consortium with a business partner – Ardigen SA. The implementation of this project led to joint scientific publications (**H1**, **H2**) and a product in the form of a reference microbiome database, which Ardigen SA integrates into its operations.

3. LIST OF OBTAINED INDUSTRIAL PROPERTY RIGHTS, INCLUDING OBTAINED NATIONAL OR INTERNATIONAL PATENTS

- Co-inventor of the invention in the form of a reference microbiome database titled "Map of the Microbiome of Poland (MMP)," 2023.

4. LIST OF IMPLEMENTED TECHNOLOGIES

Not applicable

5. LIST OF PERFORMED EXPERT OPINIONS OR OTHER STUDIES MADE TO ORDER FOR PUBLIC INSTITUTIONS OR ENTREPRENEURS

Not applicable

6. LIST OF PARTICIPATION IN EXPERT OR COMPETITION TEAMS

Not applicable

7. LIST OF ARTISTIC PROJECTS IMPLEMENTED WITH NON-ARTISTIC ENVIRONMENTS

Not applicable

IV. SCIENTOMETRIC DATA

1. IMPACT FACTOR

Cumulative Impact Factor (IF) of journals in which I have published: **IF = 96.13**

Cumulative five-year Impact Factor (5IF) of journals in which I have published: **5IF = 104.4**

2. NUMBER OF CITATIONS OF THE APPLICANT'S PUBLICATIONS, WITH SEPARATE CONSIDERATION OF SELF-CITATIONS

Total number of citations according to the Web of Science Core Collection (excluding self-citations) as of 04.06.2025: **212**

Total number of citations according to the Web of Science Core Collection (including self-citations) as of 04.06.2025: **230**

3. HIRSCH INDEX

Hirsch index (h-index) according to the Web of Science Core Collection as of 04.06.2025: **9**

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