Curriculum Vitae

Personal data



Name:	Bianka Kovács
Place and date of birth:	Budapest, March 2, 1995
E-mail:	kovacs.bianka@ecolres.hu

Education

September 2019–August 2023

Institute:	Eötvös Loránd University, Faculty of Science
Training program:	PhD in Physics
Doctoral program:	Statistical Physics, Biological Physics and Physics of Quantum Systems
Overall classification:	summa cum laude (dissertation submitted for examination on March 28, 2023; defense on January 19, 2024)
Dissertation:	*Hyperbolic geometry of complex networks: models of network growth and embeddings of real networks* Extending previous models of hyperbolic network growth (simulating the disappearance of links, generating networks in higher-dimensional hyperbolic spaces), examining the structural properties of networks obtained from hyperbolic models (e.g. analysing the emergent community structure of hyperbolic networks) and developing hyperbolic embedding techniques for directed networks.
Supervisor:	Gergely Palla, Eötvös Loránd University, Faculty of Science, Department of Biological Physics

September 2017–June 2019

Institute:	Eötvös Loránd University, Faculty of Science
Training program:	MSc in Physics
Specialization:	Biophysics
Overall classification:	outstanding
Thesis:	*Hyperbolic embedding of complex networks* Developing a new algorithm in Python for arranging the nodes of a network on the hyperbolic plane by combining a dimension reduction method from machine learning with a likelihood maximisation technique optimising for a hyperbolic model of network growth.
Supervisor:	Gergely Palla, Eötvös Loránd University, Faculty of Science, Department of Biological Physics

September 2013–June 2017

Institute:	Budapest University of Technology and Economics, Faculty of Natural Sciences
Training program:	BSc in Physics
Specialization:	Physicist
Overall classification:	excellent
Thesis:	*Versengő populációk térben explicit modellezése* *(Spatially explicit modelling of competitive populations)* Searching for the effect of using pairwise interactions instead of the mean-field approximation in the Lotka–Volterra model. Mathematical modelling of the time evolution of the density of different species occupying a continuous living space, examining time-scale separation, performing Monte Carlo simulations on a 2D lattice in MATLAB and C.
Supervisor:	Géza Meszéna, Eötvös Loránd University, Faculty of Science, Department of Biological Physics

Language skills

German language examination

Level:	intermediate (B2)
Type:	complex (C), general
Date of exam:	April 5, 2017

English language examination

Level:	intermediate (B2)
Type:	complex (C), general
Date of exam:	September 28, 2013

Professional experience

February 2024–

Institution:	HUN-REN Centre for Ecological Research, Institute of Evolution, Major Evolutionary Transitions Research Group
Position:	Research fellow

September 2023–January 2024

Institution:	Eötvös Loránd University, Faculty of Science, Department of Biological Physics
Position:	Assistant research fellow
Main tasks:	Studying the geometry of complex networks.

July–September 2017

Institution:	Femtonics Ltd.
Position:	Research assistant
Main tasks:	Evaluation of biological measurements in MATLAB, data processing using statistical methods.

Teaching

- Practice of the *Matematikai modellezés a biológiában I (Mathematical modeling in Biology I)* course of the Biology BSc at Eötvös Loránd University, 2025–2026
- Project leading at the *Scientific Modeling Computer Laboratory* course of the Physics MSc at Eötvös Loránd University, 2024–2025
- Practice of the *Valószínűségszámítás és statisztika a fizikában (Probability Theory and Statistics in Physics)* course of the Physics BSc at Eötvös Loránd University, 2021–2026
- Spectrophotometry measurement of the *Modern fizika laboratórium (Modern Physics Laboratory)* course of the Physics BSc at Eötvös Loránd University, 2019–2021

Supervising

- Botond Simon, Eötvös Loránd University, Physics BSc thesis, 2023
- Bertalan Álmos Kósz, Roskilde University, Mathematical Bioscience MSc thesis, 2026

Reviewing activities

- Thesis jury for Dániel Varga (thesis in Physics BSc, Budapest University of Technology and Economics, 2022)
- Doctoral thesis examination for András Gábor Hubai (Doctoral School of Biology, Eötvös Loránd University, 2026)
- Reviewing on behalf of *Communications Physics* (reviewer of the month for April 2026), *Scientific Reports*, *IEEE Transactions on Network Science and Engineering*, *Journal of Network and Systems Management*, *Applied Network Science*, *npj Complexity*, and *Quality & Quantity*

Publications and presentations

Manuscripts under preparation

- M. Paczkó, D. Vörös, A. Szilágyi, B. Kovács, *Group selection in prebiotic evolution: rethinking the role of fitness*

Refereed research publications

- B. Kovács, G. Barabás, G. Meszéna, E. Szathmáry & A. Szilágyi, *The ecology and evolution of sub-exponential replicators*, PLoS Computational Biology **22**(5): e1014247 (2026)
- B. Kovács, B. Benedek & G. Palla, *Community detection in hypergraphs through hyperedge percolation*, Scientific Reports **15**, 36032 (2025)
- B. Kovács, S. Kojaku, G. Palla & S. Fortunato, *Iterative embedding and reweigthing of complex networks reveals community structure*, Scientific Reports **14**, 17184 (2024)
- S. G. Balogh, B. Kovács & G. Palla, *Maximally modular structure of growing hyperbolic networks*, Communications Physics **6**, 76 (2023)
- B. Kovács & G. Palla, *Model-independent embedding of directed networks into Euclidean and hyperbolic spaces*, Communications Physics **6**, 28 (2023)
- B. Kovács, S. G. Balogh & G. Palla, *Generalised popularity-similarity optimisation model for growing hyperbolic networks beyond two dimensions*, Scientific Reports **12**, 968 (2022)
- B. Kovács & G. Palla, *The inherent community structure of hyperbolic networks*, Scientific Reports **11**, 16050 (2021)
- B. Kovács & G. Palla, *Optimisation of the coalescent hyperbolic embedding of complex networks*, Scientific Reports **11**, 8350 (2021)

Poster presentations

- *Community detection via hyperedge percolation*, Complex Networks 2026 – The 15th International Conference on Complex Networks and their Applications (Granada, 2026)
- *Csoportkeresés hipergráfokban hiperél-perkolációval (Community detection via hyperedge percolation)*, SciComp26 Konferencia (SciComp26 Conference) (Veszprém, 2026) – **Best Poster Award**
- *Angular optimisation in the hyperbolic embedding of complex networks*, NetSci 2020 (online, 2020)
- *Optimising the angular coordinates in the hyperbolic embedding of complex networks*, Complex Networks 2019 – The 8th International Conference on Complex Networks and their Applications (Lisbon, 2019)

Oral presentations

- *Ecology and evolution of sub-exponential replicators*, MiniLife Project Meeting (Pöcking, 2025)
- *Dimension reduction techniques for embedding networks into the hyperbolic space*, Network geometry. Theory and applications satellite of the conference NetSci 2024 (Québec, 2024)
- *Iterative spatial embedding of networks uncovers their community structure*, Complex Networks 2023 – The 12th International Conference on Complex Networks and their Applications (Menton, 2023)
- *Iterative spatial embedding of networks uncovers their community structure*, Communities in Networks satellite of the conference NetSci 2023 (Vienna, 2023)

- *Hiperbolikus hálózatok csoportstruktúrája (Community structure of hyperbolic networks)*, Statisztikus Fizikai Nap 2022 (Day of Statistical Physics 2022) (Budapest, 2022)
- *Model-independent hyperbolic embedding of directed networks*, Complex Networks 2022 – The 11th International Conference on Complex Networks and their Applications (Palermo, 2022)
- *Model-independent embedding of directed networks into geometric spaces*, NetSci 2022 (online, 2022)
- *The ingrained community structure of hyperbolic networks*, NetSci-X 2022 (online, 2022)
- *Popularity-similarity optimisation model beyond two dimensions*, Complex Networks 2021 – The 10th International Conference on Complex Networks and their Applications, (online, 2021)
- *The ingrained communities of hyperbolic networks*, Communities in Networks satellite of the conference Networks 2021: A Joint Sunbelt and NetSci Conference (online, 2021)
- *Unintended communities in hyperbolic networks*, Complex Networks 2020 – The 9th International Conference on Complex Networks and their Applications (online, 2020)