

# CURRICULUM VITAE

ANDRÁS SZILÁGYI

M.Sc. in physics, Ph.D. in biological physics, presently employed as research associate professor at Evolutionary Systems Research Group, Centre for Ecological Research of the Hungarian Academy of Science and MTA-ELTE Theoretical Biology and Evolutionary Ecology Research Group at Eötvös Loránd University (part time).

## CONTACT INFORMATION

**Institute addresses:** MTA Centre for Ecological Research  
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## PERSONAL INFORMATION

**Name:** András György Szilágyi

**Nationality:** Hungarian

**Place and date of birth:** Budapest, Hungary, 8<sup>th</sup> December 1979

**Marital status:** married, two children

**Private address:** Mátyás király út 41/A., Budapest H1121, Hungary

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## EDUCATION

2004–2007: Ph.D. in Biological physics at Eötvös Loránd University (Budapest), Physics Ph.D. School (summa cum laude).

1998–2003: M.Sc. in Physics at Budapest University of Technology and Economics (excellent).

1994–1998: Baár–Madas Calvinist Secondary School, specialized in mathematics

## RESEARCH EXPERIENCES

2017–present: **Research associate professor** at the Hungarian Academy of Science (HAS) Center for Ecological Research, Evolutionary Systems Research Group.

2017–present: **Research associate professor** (part time) at the Hungarian Academy of Science (HAS) Theoretical Biology and Evolutionary Ecology Research Group at Eötvös Loránd University.

2012–present: **Research assistant professor** at the Hungarian Academy of Science (HAS) Theoretical Biology and Evolutionary Ecology Research Group at Eötvös Loránd University.

2012–2015: **Member of the Parmenides team** in the FP7 ERC advanced grant project EVOEVO (*Evolution of Evolvable Systems*; PI: Eörs Szathmáry; 2012-2017; project #294332; total funding 2 616 700 €).

2012–2015: **Postdoctoral research fellow** at the Parmenides Centre for the Conceptual Foundation of Science, Pullach, Germany.

2009–2011: **Research assistant** at the Hungarian Academy of Science (HAS) Theoretical Biology and Evolutionary Ecology Research Group at Eötvös Loránd University.

2010–2011: Worked in the FP7 EU project e-Flux (*Evolutionary microfluidics*; PI: Eörs Szathmáry; 2009–2011; project #225167; total funding: 2 300 000 €).

2007–2010: **Research assistant** (scientific coworker) at Department of Organic Chemistry, Faculty of Pharmacy at Semmelweis Medical University.

2004–2007: Ph.D. thesis work at Eötvös Loránd University, Department of Biological Physics: "*Extension of a niche concept to spatially heterogeneous and time fluctuating environment*". Supervisor: Dr Géza Meszéna.

2003–2004: researcher as a university student at Hungarian Meteorological Service.

## AWARDS

2003: 1<sup>st</sup> prize at scientific competition of university students (TDK) mathematics—theoretical physics section

2003: TDK Special Award of the Pro Progressio Foundation

## LANGUAGES AND LEVELS

Hungarian: mother tongue.

English: intermediate level (C) state language exam.

Latin: intermediate level (C) state language exam.

## PROFESSIONAL ACTIVITIES

My scientific interest has a focus on theoretical evolutionary biology and theoretical ecology. My researches cover different topics in this field: origin of life, major evolutionary transitions, diversity maintaining mechanisms and stability of ecosystems, evolutionary dynamics at various levels, from chemistry to biology, and modeling neural networks

In the past years me (in collaboration with my colleagues) achieved the following results:

- formalized a mathematically rigorous concept of ecological “niche” for structured population;
- using the previously formalized niche concept, we analyzed the diversity maintaining ability of fluctuating environment in ecosystems;
- by computer simulation in a simplified model system we showed that efficient enzymes potentially emerged after the invention of chromosomes;
- *in-silico* analyzed the effect of taking the secondary structure of RNAs into account on the amount of sustainable information in prebiotics (the so called phenotypic error threshold);
- analyzed the stability and evolvability of an extended model of metabolically coupled surface bound replicator system as an important question in a possible scenario of the origin of life;
- presented an evolutionary scenario (in line with experimental data) of the emergence of mutualism in ant-plant symbiosis;

- by computer simulations we have proved the possibility of the evolutionary emergence of a primordial transcription-like system in model protocells;
- in a neuronal toy model we have demonstrated the possibility of real Darwinian dynamics on neural networks, as a proof-of-principle.

Presently I am working on the following topics:

- investigation of the origin and evolution of communication
- modeling Darwinian dynamics on in-silico neural network populations, analyzing the problem solving capacity of this kind of systems
- investigation of the appearance of chromosomes and the genic-enzymatic division of labor in early evolution

## TEACHING EXPERIENCE

Mathematical modeling in biology I—II. (Eötvös University)

Modern physics practice and laboratory for physicists and teachers in physics (Eötvös University)

Introductory modern physics for info-bionics students (Pázmány Péter Catholic University)

Molecular modeling for senior pharmaceutical students (Semmelweis Medical University)

Minor classes on theoretical evolutionary biology for biologists (Eötvös University)

Preparing students for competitions in physics at secondary school level (Baár–Madas Calvinist Secondary School)

## SCHOLARSHIPS AND GRANTS

2018. September – 2019. August: ÚNKP-18-4 New National Excellence Program of the Ministry of Human Capacities (1 year, total funding: 2 MHUF (~6 500 €)).

2018. September – 2020. August: Bolyai János Research Fellowship of the Hungarian Academy of Sciences (2 years, total funding: 3 MHUF (~10 000 €)).

2017. October – 2021. September: Postdoctoral research assistant in the OTKA project #124438: “*Cooperative and competitive evolutionary dynamics at different levels of organization*” (4 years, total funding: 32.3 MHUF (~108 000 €)).

2016. October – 2020. September: Postdoctoral research assistant in the OTKA project #119347: “*Dynamical models in the origin of life*” (4 years, total funding: 38.8 MHUF (~130 000 €)).

2016. September – 2017. March: Postdoctoral research fellow, II. New Central European Scholarship, Institute of Advanced Studies, Kőszeg, Hungary

2012 September – 2015 August: Postdoctoral scholarship at the Parmenides Foundation, Munich (Germany): FP7 ERC advanced grant project EVEEVO (*Evolution of Evolvable Systems*; PI: Eörs Szathmáry; 2012-2017; no. #294332)

2015. September – 2016. December: Postdoctoral research assistant in the OTKA project #100806: “*Simulation studies in prebiotic evolution: Infrabiological differentiation in the Metabolic Replicator System*” (4 years, total funding: 25.1 MHUF (~81 000 €)).

2009. March – 2011. December: Postdoctoral research assistant in the OTKA project #73047: “*Computational study of evolution in early life and extant model organisms*” (4 years, total funding: 56 MHUF (~181 000 €)).

2005. January – 2007. August: Research assistant in the OTKA project #49689: “*Adaptive ecology in variable environment*” (4 years, total funding: 7.8 MHUF (~25 000 €)).

2004. January – 2004. December: Research assistant in the OTKA project #47035: “*Problems of inverse scattering theory*” (5 years, total funding: 4.2 MHUF (~13 600 €)).

## PUBLICATIONS:

number of publications in peer-reviewed journals: 27 (cumulative IF: 129.8)

popular science articles (in Hungarian): 2

conference proceedings: 3

book co-edited (in Hungarian): 1

lecture notes in physics for biologist (in Hungarian): 1

introductory modern physics lecture notes for biologists (in Hungarian): 1

**Szilágyi, A.**, Meszéna, G.: *Two patch model of spatial niche segregation* *Evolutionary Ecology* **23**: 187-205 (2009)

**Szilágyi, A.**, Meszéna, G.: *Limiting similarity and niche theory for structured populations* *Journal of Theoretical Biology* **258**: 23-27 (2009)

Balogh, B., **Szilágyi, A.**, Gyires, K., Bylund, DB., Mátyus, P.: *Molecular modelling of alpha2A-C adrenoceptors: A comparative study* *Neurochemistry International* **55**: 355-361 (2009)

**Szilágyi, A.**, Scheuring, I., Edwards, D., Orivel, J., Yu, D.: *The evolution of intermediate castration virulence and ant coexistence in a spatially structured environment* *Ecology Letters* **12**: 1306-1316 (2009)

Móréh, Á., Jordán, F., **Szilágyi, A.**, Scheuring, I.: *Overfishing and regime shifts in minimal food web models* *Community Ecology* **10**(2): 236-243 (2009)

**Szilágyi, A.**, Meszéna, G.: *Coexistence in a fluctuating environment by the effect of relative nonlinearity: a minimal model* *Journal of Theoretical Biology* **267**: 502-521 (2010)

**Szilágyi, A.**, Kun, Á., Szathmáry, E.: *Early evolution of efficient enzymes and genome organization* *Biology Direct* **7**(38): 1-10 (2012)

**Szilágyi, A.**, Zachar, I., Szathmáry, E.: *Gause's principle and the effect of resource partitioning on the dynamical coexistence of replicating templates* *PLoS Computational Biology* **9**: e1-11 (2013)

**Szilágyi, A.**, Kun, Á., Szathmáry, E.: *Local neutral network help maintain inaccurately replicating ribozymes* *PLoS ONE* **9**(10): e109987 (2014)

Boza, G., **Szilágyi, A.**, Kun, Á., Santos, M., Szathmáry, E.: *Evolution of division of labor between genes and enzymes in the RNA world* *PLoS Computational Biology* **10**: e1003936 (2014)

Kun, Á., **Szilágyi, A.**, Könnnyü, B., Boza, G., Zachar, I., Szathmáry, E.: *The dynamics of RNA world: insights and challenges* *Annals of the New York Academy of Sciences* **1341**: 75-95 (2015)

Vasas, V., Fernando, C., **Szilágyi, A.**, Zachar, I., Santos, M., Szathmáry, E.: *Primordial evolvability: impasses and challenges* *Journal of Theoretical Biology* **381**: 29-38 (2015)

Könnnyü, B., **Szilágyi, A.**, Czárán, T.: *In silico ribozyme evolution in a metabolically coupled RNA population* *Biology Direct* **10**(30): 1-17 (2015)

**Szilágyi, A.**, Zachar, A., Fedor, A., Vladar, HP., Szathmáry, E.: *Breeding novel solutions in the brain: a model of Darwinian neurodynamics* *F1000Research* **5**:2416 (2016)

**Szilágyi, A.**, Podani, J.: *Bad math in Linné's *Philosophia botanica** *History and Philosophy of the Life Sciences* **38**:10 (2016)

- Matsumura, S., Kun, Á., Ryckelynck, M., Coldren, F., **Szilágyi, A.**, Jossinet, F., Rick, C., Nghe, P., Szathmáry, E., Griffiths, AD.: *Transient compartmentalization of RNA replicators prevents extinction due to parasites* Science **354**(6317):1293-1296 (2016)
- Fedor, A., Zachar, I., **Szilágyi, A.**, Öllinger, M., Vladar, HP., Szathmáry, E.: *Cognitive architecture with evolutionary dynamics solves insights problem* Frontiers in Psychology **8**:427 (2017)
- Szilágyi, A.**, Boza, G., Scheuring, I.: *Analysis of stability to cheaters in models of antibiotic degrading microbial communities* Journal of Theoretical Biology **423**:53-62 (2017)
- Szathmáry, E., **Szilágyi, A.**, Zachar, I., Fedor, A., de Vladar, H. P.: *Electronic devices, artificial evolutionary neural networks, methods and computer programs for implementing evolutionary search and optimization* Patent number: WO/2017/148536 (2017)
- Szilágyi, A.**, Zachar, I., Scheuring, I., Kun, Á., Könnnyű, B., Czárán, T.: *Ecology and Evolution in the RNA world: dynamics and stability of prebiotic replicator systems* Life **7**:48. (2017)
- Podani, J., Kun, Á., **Szilágyi, A.**: *How fast does Darwin's elephant population grow?* Journal of the History of Biology Online first: pp. 1-23. (2018)
- Garay, J. Csiszár, V., Móri, T. F., **Szilágyi, A.**, Varga, Z., Számadó Sz.: *Juvenile honest food solicitation and parental investment as a life history strategy. A kin demographic selection model* PLoS ONE **13**(3):1-13. (2018)
- Zachar, I. **Szilágyi, A.**, Számadó, Sz., Szathmáry, E.: *Farming the mitochondrial ancestor as a model of endosymbiotic establishment by natural selection* Proceedings of the National Academy of Sciences of the United States of America **115**(E1504):E1510. (2018)
- Móréh, Á., **Szilágyi, A.**, Scheuring, I., Müller, V.: *Variable effect of HIV superinfection on clinical status: insights from mathematical modeling* Frontiers in microbiology **9** (2018)
- Zachar, I. **Szilágyi, A.**, Számadó, Sz., Szathmáry, E.: Reply to Garg and Martin: The mechanism works Proceedings of the National Academy of Sciences of the United States of America, 201805021 (2018)
- Vig-Milkovics, Z., Zachar, I., Kun, Á., **Szilágyi, A.**, Szathmáry, E.: *Moderate sex between protocells can balance between a decrease in assortment load and an increase in parasite spread* Journal of theoretical biology **462**:304-310 (2019)
- Scheuring, I., Szilágyi, A.: *Diversity, stability and evolvability in models of early evolution* Current Opinion in Systems Biology **13**:115-121(2019)

**Google Scholar:** [Szilágyi András@Google Scholar](https://scholar.google.com/citations?user=SZilagy)

**ResearchGate:** [https://www.researchgate.net/profile/Andras\\_Szilagy](https://www.researchgate.net/profile/Andras_Szilagy)

## BOOK EDITING

Koch Sándor: Pillanat—ember—végtelenség, a 80 esztendő Koch Sándor köszöntése (in Hungarian) (Eds.: S. Juhász-Nagy, **A. Szilágyi**)

## PATENT

Szathmáry, E., **Szilágyi, A.**, Zachar, I., Fedor, A., de Vladar, H.: *Electronic devices, artificial evolutionary neural networks, methods and computer programs for implementing Evolutionary search and optimisation* (PCT/EP2016/054694, WO/2017/148536)

Budapest, 11 February 2019

András Szilágyi