

Andrei E. Tarkhov, PhD

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SUMMARY

A longevity researcher with a PhD in theoretical physics actively working towards a better understanding of the fundamental mechanisms of aging through computational biology, ML/AI, statistical physics, and chaos theory. Currently, I am working on leveraging AI-assisted protein engineering to find practical ways to extend healthy human longevity via enhanced cellular rejuvenation therapies. My life goal is to significantly impact human health and longevity with new life-extending therapies.

EXPERIENCE

Staff Scientist, Applied AI

Mar 2023 - now

Retro Biosciences, Inc.

Redwood City, CA

- Leading drylab efforts for AI-assisted protein reengineering for epigenetic reprogramming and life extension
- Leading the development of ML/AI-based biomarkers of cellular state, age, and function based on single cell multiomics, imaging, proteomics
- Supporting our clinical programs with data-driven insights from unique in-house high-throughput datasets
- Building the next generation of AI models, interpretable mathematical models and software tools for biotechnology and longevity

Research Fellow

Jan 2021 - Mar 2023

Harvard Medical School

Boston, MA

- Data- and physics-driven modelling of the quantitative aspects of the biology of aging processes in humans and model organisms
- Improving our understanding of the physical origin of age-related health changes
- Research on the fundamental mechanisms of aging
- Developing novel biomarkers of aging
- Identification of new targets for prospective anti-aging interventions and therapies

Principal Researcher

Apr 2016 - Dec 2021

Gero LLC

Moscow, Russia

- Uncovering the fundamental mechanisms of aging and quantification of physical changes associated with aging
- Supporting the development of rejuvenation therapies and treatments for aging-related diseases, such as dementia, cardiovascular disease and cancer
- Research, modelling, project management, design of experiments
- Data analysis and interpretation of biological –omics data, and other medical data from biobanks, writing papers on the biology of aging in humans and other species

Researcher

Nov 2013 - Apr 2016

Quantum Pharmaceuticals LLC

Moscow, Russia

- Aging and longevity research, computational analysis of biological data, writing scientific papers

EDUCATION

Postdoctoral training, Aging research

2022-2023

Harvard Medical School, Brigham and Women's

Hospital, Boston, MA, USA

Supervisor: Prof. Dr. Vadim Gladyshev

PhD, Physics

2016-2020

Skolkovo Institute of Science and Technology,

Moscow, Russia

Supervisor: Prof. Dr. Boris Fine

MSc degree with honors, Physics

2010-2016

Lomonosov Moscow State University, Moscow, Russia

Supervisor: Prof. Dr. V.I. Emel'yanov

SKILLS

AI/ML in bio (python, pytorch), computational biology, aging research, AI-assisted protein engineering, single-cell multiomics, perturbations (CRISPRa/i/ko, ORFs), stochastic modelling, physics (statistical physics, chaos theory, heavy numerical simulations, dynamics)

EDITORIAL ACTIVITIES

Editorial Board Member

- Aging Advances

Ad hoc Reviewer

- Biogerontology
 - Advances in Gerontology
 - Mechanisms of ageing and development
 - Computational and Structural Biotechnology Journal
 - Heliyon
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HONORS AND PRIZES

Prize for the best poster

2022

- The Gordon Research Conference on Systems Aging, ME, United States
-

Prize for the best oral presentation

2019

- Summer school on Bioinformatics in Aging and Development, Bioinformatics Institute, Russia
-

N.I. Koroteev Prize for the best graduate thesis

2016

- Lomonosov Moscow State University, Moscow, Russia
-

M.V. Keldysh Scholarship

2013-2014

- Lomonosov Moscow State University, Moscow, Russia
-

FUNDING INFORMATION

Statistical behavior of thermally isolated many-body quantum systems

2017-2019

- Russian Science Foundation (RSF) 17-12-01587. Investigator (PI: Boris Fine).
 - Present project aims at developing the theory of thermalization of isolated quantum systems: studying the limits of applicability of conventional statistical physics, and the universal aspects of relaxation.
-

Properties and dynamics of entangled quantum systems

2013-2016

- Russian Foundation for Basic Research (RFBR) 14-02-00389 A. Investigator (PI: Olga Tikhonova)
 - The main goal: studying the dynamics and quantum correlations in various complex quantum systems.
-

Influence of anisotropic effects on ionization in dielectric crystals: dependence of optical ionization dynamics on crystal orientation

2012-2013

- Russian Foundation for Basic Research (RFBR) 12-02-33099. Investigator (PI: Mitrofanov Alexander)
 - The main goal: studying the experimental dependence of ionization properties on the crystal anisotropy.
-

Supercomputer modeling of ultrashort pulse generation in the filamentation regime: from vacuum ultraviolet to terahertz frequencies.

2012-2013

- Russian Foundation for Basic Research (RFBR) 12-02-31728. Investigator (PI: Voronin Alexander).
- The main goals: studying the filamentation processes in the mid-IR frequency range for ultra-fast optical pulses.

PATENTS

Compounds, compositions and methods for treating age-related diseases and conditions

Patent Application
[WO2022173333A2](#), [EP4291239A2](#)
2021

- Anti-aging, senolytic and other therapeutic effects of compounds and their analogs and combinations described herein as well as related methods of treatment.

Methods of biological age evaluation and systems using such methods

Patent Application
[WO2021145798A2](#), [US20220351865A1](#)
2020

- A method for evaluation of biological age

Devices, methods, compositions and systems for the treatment of aging and age- related disorders

Patent Application
[WO2020018005A1](#), [US20210260113A1](#)
2018

- Methods for quantifying with biomarkers and treating aging and age-related diseases by removal, inhibition or deactivation of specific proteins circulating in the blood of old individuals.

PEER-REVIEWED PUBLICATIONS IN AGING

- **A.E. Tarkhov**, T. Lindstrom-Vautrin, S. Zhang, K. Ying, M. Moqri, B. Zhang, A. Tyshkovskiy, O. Levy, V.N. Gladyshev. Nature of epigenetic aging from a single-cell perspective. **Nature Aging** 4, 854–870 (2024). [10.1038/s43587-024-00616-0](#)
 - Featured on the cover of **Nature Aging** [<https://www.nature.com/nataging/volumes/4/issues/6>]
- **A.E. Tarkhov**, K.A. Denisov, P.O. Fedichev. Aging Clocks, Entropy, and the Challenge of Age Reversal. **Aging Biology** 2, e20240031 (2024). [10.59368/agingbio.20240031](#)
- **A. E. Tarkhov**, R. Alla, S. Ayyadevara, M. Pyatnitskiy, L. I. Menshikov, R. J. Shmookler Reis, P. O. Fedichev. A universal transcriptomic signature of age reveals the temporal scaling of *Caenorhabditis elegans* aging trajectories. **Scientific Reports** 9 (2019). [10.1038/s41598-019-43075-z](#)
 - *Top-1 among the Top 100 Downloaded in Cell and Molecular Biology in Scientific Reports in 2019* [<https://www.nature.com/collections/gbcaiiifcbh>]
- **A. E. Tarkhov**, L. I. Menshikov, P. O. Fedichev. Strehler-Mildvan correlation is a degenerate manifold of Gompertz fit. **J. Theor. Biol.** 416, 180–189 (2017). [10.1016/j.jtbi.2017.01.017](#)
- T. V. Pyrkov, K. Avchaciov, **A. E. Tarkhov**, L. I. Menshikov, A. V. Gudkov, P. O. Fedichev. Longitudinal analysis of blood markers reveals progressive loss of resilience and predicts ultimate limit of human lifespan. **Nature Communications** 12(1): 1-10 (2021). [10.1038/s41467-021-23014-1](#)
 - *Top-2 among the Top 25 Downloaded in Health Sciences Articles in Nature Communications in 2022* [<https://www.nature.com/collections/iahbbijbb>]
- A.V. Shindyapina, A. A. Zenin, **A. E. Tarkhov**, D. Santesmasses, P. O. Fedichev, V. N. Gladyshev. Germline burden of rare damaging variants negatively affects human healthspan and lifespan. **Elife**, 9, e53449 (2020). [10.7554/eLife.53449](#)
 - *Insight article*: J. Deelen, Aging: Searching for the genetic key to a long and healthy life. *Elife* 9 (2020): e57242. <https://doi.org/10.7554/eLife.57242>
 - *Selected to an eLife digest*
- K. Avchaciov, M. P. Antoch, E. L. Andrianova, **A. E. Tarkhov**, L. I. Menshikov, O. Burmistrova, A. V. Gudkov, P. O. Fedichev. Unsupervised learning of aging principles from longitudinal data. **Nature Communications** 13, 6529 (2022). [10.1038/s41467-022-34051-9](#)
- K. Ying, H. Liu, **A.E. Tarkhov**, M.C. Sadler, A.T. Lu, M. Moqri, S. Horvath, Z. Kutalik, X. Shen, V.N. Gladyshev. Causality-enriched epigenetic age uncouples damage and adaptation. **Nature Aging** 4, 231–246 (2024). [10.1038/s43587-023-00557-0](#)
- M. Moqri, ..., **A.E. Tarkhov**, ..., V.N. Gladyshev, S. Horvath, M.P. Snyder, V. Sebastiano. PRC2-AgeIndex as a universal biomarker of aging and rejuvenation. **Nature Communications** 15, 5956 (2024). [10.1038/s41467-024-50098-2](#)
- V.N. Gladyshev, ..., **A.E. Tarkhov**, ..., A. Zhavoronkov. Disagreement on foundational principles of biological aging. **PNAS Nexus** 3, pgae499 (2024). [10.1093/pnasnexus/pgae499](#)
- B. Zhang, **A. E. Tarkhov**, W. Ratzan, K. Ying, M. Moqri, J. R. Poganik, B. P. Barré, A. Trapp, J. A. Zoller, A. Haghani, S. Horvath, L. Peshkin, V. N. Gladyshev. Epigenetic profiling and incidence of disrupted development point to gastrulation as aging ground zero in *Xenopus laevis*. <https://www.biorxiv.org/content/10.1101/2022.08.02.502559.abstract> — 2022.

PEER-REVIEWED PUBLICATIONS IN PHYSICS

- **A. E. Tarkhov**, A. V. Rozhkov, B. V. Fine. Transient ordering in the Gross-Pitaevskii lattice after an energy quench within a nonordered phase. *Phys. Rev. B* 106, L201110 (2022). [10.1103/PhysRevB.106.L201110](https://doi.org/10.1103/PhysRevB.106.L201110)
 - *Letter in Physical Review B*
- **A. E. Tarkhov**, A. V. Rozhkov, B. V. Fine. Dynamics of topological defects after photo-induced melting of a charge-density wave. *Phys. Rev. B* 106, L121109 (2022). [10.1103/PhysRevB.106.L121109](https://doi.org/10.1103/PhysRevB.106.L121109)
 - *Letter in Physical Review B*
- **A. E. Tarkhov**, B. V. Fine. Estimating ergodization time of a chaotic many-particle system from a time reversal of equilibrium noise. *New J. Phys.* 20, 123021 (2018). [10.1088/1367-2630/aaf0b6](https://doi.org/10.1088/1367-2630/aaf0b6)
- **A. E. Tarkhov**, S. Wimberger, B. V. Fine. Extracting Lyapunov exponents from the echo dynamics of Bose-Einstein condensates on a lattice. *Phys. Rev. A* 96, 023624 (2017). [10.1103/PhysRevA.96.023624](https://doi.org/10.1103/PhysRevA.96.023624)
- A.Y. Vasiliev, **A. E. Tarkhov**, L. I. Menshikov, P. O. Fedichev, U.R. Fischer. Universality of the Berezinskii-Kosterlitz-Thouless type of phase transition in the dipolar XY-model. *New J. Phys* 16, 053011 (2014). [10.1088/1367-2630/16/5/053011](https://doi.org/10.1088/1367-2630/16/5/053011)
- V. I. Emel'yanov, **A. E. Tarkhov**. Two-stage mechanism of formation of ordered surface nanostructures under atomic deposition. *Computational Nanotechnology* 4, 37 (2015). mathnet.ru/rus/cn51
- P. E. Dolgirev, M. S. Kalenkov, **A. E. Tarkhov**, A. D. Zaikin. Phase-coherent electron transport in asymmetric crosslike Andreev interferometers. *Phys. Rev. B* 100, 054511 (2019). [10.1103/PhysRevB.100.054511](https://doi.org/10.1103/PhysRevB.100.054511)

DOCTORAL THESIS

A. E. Tarkhov. (2020). *Ergodization dynamics of the Gross-Pitaevskii equation on a lattice* (Doctoral thesis, Skolkovo Institute of Science and Technology, Moscow, Russia). Supervisor [Boris V. Fine](#). Retrieved from <https://www.skoltech.ru/en/education/phd-defenses/2020-2/andrei-tarkhov/>
