CURRICULUM VITAE – ARTO ANNILA

1. PERSONAL DETAILS

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Google Scholar page, Homepage
Date and place of birth, November 5, 1962, Helsinki Finnish citizenship
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2. DEGREES

Ph.D. (Doctor of Technology), Aalto University (Helsinki University of Technology), Technical Physics, 20.8.1991,
Docent in Physical Chemistry, University of Helsinki, 28.4.1999
M.Sc. in Biochemistry, University of Helsinki, 26.4.1996
Qualified teacher in mathematics and physics, University of Helsinki, 08.06.2017 (60 ETCS)

3. LANGUAGE SKILLS

Native in Finnish
English: Fluent (exchange student in the USA); Swedish: Fluent (military service in Swedish speaking garrison);
German: Laudatur in student examination; Danish: tolerable at best; French: one year course at Aalto University.

4. CURRENT EMPLOYMENT

Senior Scientist at a startup, Nanoform Finland Ltd, since 01.07.2017.

5. PREVIOUS WORK EXPERIENCE

Professor of Biophysics from 2001 to 2016 at the University of Helsinki.

In 2016, when the University of Helsinki was subject to cuts, I was dismissed, as were a few other professors. The true reason for my dismissal was that the then Head of the Physics Department deemed my research results as if questioning contemporary doctrines. Please, get acquainted with the book *Back to Reality: A Revision of the Scientific Worldview* (also available as pdf). The book explains to the lay audience how to address fundamental questions using statistical physics. This revelation of the renowned least-time principle raised unwarranted distrust among the indoctrinated and led to my groundless dismissal.

Timeline from the present to the past.

2017	Looking for new opportunities as Senior Scientist at Nanoform Finland Ltd, since dismissal from the University of Helsinki 2016
2008	Professor of Biophysics, University of Helsinki (tenured)
2001	Professor of Biophysics, University of Helsinki (tenure)
2001	Senior Researcher, Academy of Finland
2000	Group Leader, VTT Biotechnology, the State Technical Research Centre of Finland
1998	Group Leader, Structural Biology and Biophysics Program at Viikki Biocenter
1996	Group Leader, Senior Scientist, VTT Chemical Technology, State Technical Research Centre of Finland
1993	Researcher, Academy of Finland
1992	Senior Scientist, VTT Chemical Technology, State Technical Research Centre of Finland
1991	Visiting Scientist at University of Lund, Department of Physical Chemistry 2
1990	Research Assistant at Low Temperature Laboratory, Helsinki University of Technology
1989	Research Fellow, Danish Research Academy at National Laboratory at Risø, Denmark
1988	Research Assistant, Academy of Finland at Low Temperature Lab., Helsinki University of Technology
1987	Researcher, Low Temperature Laboratory, Helsinki University of Technology
1986	Research Assistant, Low Temperature Laboratory, Helsinki University of Technology

6. RESEARCH FUNDING

Since July 1, 2017, I have been in charge of getting funding from public sources for a startup company, Nanoform Finland Ltd. Granted 1 M€ for the development of nanoparticle formulation.

Previously obtained funding
(full years for the salary of one researcher, Ph.D.)
1994-1995 Academy of Finland, Cardiac Troponin C Molecular Structure and Function
1993-1996 Academy of Finland, Cellulase-Cellulose Interaction
1995-1997 Academy of Finland, Cyanobacterial Toxins and Protein Phosphatase Interaction
1995 Orion-Farmos International, Conformation of a Segment from a Membrane Receptor
1996 Orion-Farmos International, Structure of a Membrane-Bound Oligomer
1998-2000 Academy of Finland, Cardiac Troponin C Structure and Function
1997-1999 TEKES and Orion Pharmaceuticals, Structure Determination of Proteins and Peptides in Drug Discovery
1999-2000 TEKES and Orion Pharmaceuticals, Structure Determination of Proteins and Peptides in Drug Discovery
1999-2001 Academy of Finland, Structure Determination of Protein Folds by Anisotropy Based NMR Methods
1999-2000 TEKES NMR Studies of Metabolic Routes of Genetically Modified Yeast
2000-2002 Academy of Finland, Structural Biology Program
2001-2004 TEKES Development of NMR Methods for Drug Discovery (Drug 2000 Program)
2004-2006 TEKES Development of NMR Methods for Drug Discovery (Drug 2000 Program)
2003-2006 Research grant, protein folding in a confined medium. Academy of Finland
2004-2007 Determination of weakly structured protein conformations. the three-year grant, University of Helsinki
2006-2007 TEKES Development of NMR Methods for Drug Discovery (Drug 2000 Program)

My cross-disciplinary expertise and comprehensive experience allow me to compete for funding, particularly via collaborations beyond the traditional scope of physics. Moreover, my experience complies with the general understanding that it takes time for the scientific community to realize the merits of pioneering work and reward it. On the other hand, when receiving recognition, groundbreaking research will acquire funding from many sources.

7. RESEARCH OUTPUT

The following ten publications out of more than 120 give an idea of my capacity and scope.

1. Sharma V, Annila A. Natural process – Natural selection. *Biophys. Chem.* 2007 127, 123–128. doi: 10.1016/j.bpc.2007.01.005
   Evolution is formulated as a systemic equation of motion by the principle of increasing entropy.
2. Kaila VRI, Annila A. Natural selection for least action. *Proc. R. Soc. A*. 2008 464, 3055–3070. doi:10.1098/rspa.2008.0178
   The principle of least action is shown as equivalent to the 2nd law of thermodynamics and Newton's 2nd law.
3. Tuisku P, Pernu TK, Annila A. In the light of time. *Proc. R. Soc. A*. 2009 465, 1173–1198. doi:10.1098/rspa.2008.0494
   A flow of time relates to a quantized flow of energy from a system to its surroundings and vice versa.
4. Karnani M, Pääkkönen K, Annila A. The physical character of information. *Proc. R. Soc.A*. 2009 465, 2155–75. doi:10.1098/rspa.2009.0063
   Information is physical and communication is a dissipative process among other natural processes given by the 2nd law.
5. Annila A, Salthe S. Physical foundations of evolutionary theory. *J. Non-equilb. Therm.* 2010 35, 301–321. doi:10.1515/jnetdy.2010.019
   The theory of evolution by natural selection is subsumed by the 2nd law of thermodynamics.
6. Mäkelä T, Annila A. Natural patterns of energy dispersal. *Phys. Life Rev.* 2010 7, 477–498. doi:10.1016/j.plrev.2010.10.001
   Many mathematical models of systems are found as approximations of the evolutionary equation of motion.
7. Annila A. Least-time paths of light. *Mon. Not. R. Astron. Soc.* 2011 416, 2944–2948. doi:10.1111/j.1365-2966.2011.19242.x
   The principle of least action gives paths of light through space without dark energy and dark matter.
8. Hartonen T, Annila A. Natural networks as thermodynamic systems. *Complexity* 2012 18, 53–62. doi:10.1002/cplx.21428
   Natural networks are considered thermodynamic systems that evolve from one state to another by consuming free energy.
9. Annila A. Natural thermodynamics. *Physica A* 2016 444, 843–852. doi:10.1016/j.physa.2015.10.105
   The principle of increasing entropy is derived from the axiom that quanta embody everything by statistical physics.
10. Annila A. The matter of time. *Entropy* 2021 23, 943–956. doi: 10.3390/e23080943
    Causality is understood in terms of physics to embody flows of quanta.

8. RESEARCH SUPERVISION AND LEADERSHIP EXPERIENCE

I have supervised following Ph.D. students: Kimmo Pääkkönen (2003), Maija-Liisa Mattinen (1998), Kai Fredriksson (2007), Martti Louhivuori (2007), Perttu Permi (2000), Helena Aitio (2003, co-tutoring), Tia Sorsa (2003, co-tutoring), Maarit Hellman (2007, co-tutoring) and about dozen M.Sc. students. I have examined B.Sc. 2 – 5 theses per year.

9. TEACHING MERITS

I have taught as a university professor for 15 years, and I have docent (lecturer/associate professor) status for 20 years. Thereby, I am familiar with lecturing bachelor's and a good part of master's courses in physics.
Pedagogical training and competence: Pedagogical studies for subject teachers (mathematics and physics) completed 2016 – 2017, 60 ETCS.
In charge of Biophysics and Medical Physics curriculum planning and implementation of courses (Finnish: Opetusresurssityöryhmän jäsen 2015). I have acted as the leader of the researcher training group (Finnish: Tutkijalinja) at the Department of Physics, the University of Helsinki, until 2016.
Teaching at the Faculty of Biosciences and the Faculty of Science, 6 – 8 interdisciplinary courses per year. For further activities, please see https://tuhat.helsinki.fi/portal/en/ for Arto Annila

Biophysics 1 (5 ETCS) 2002-2015
Biophysics 2 (5 ETCS) 2002-2015
Origin of biodiversity (3 ETCS) 2009-2016
Molecular biophysics for bioscientists (3 ETCS) 2002-2015
Statistics for bioscientists (3 ETCS) 2008-2015
Biomolecular NMR spectroscopy (5 ETCS) 2002-2015 (every second year)
Protein folding (5 ETCS) 2002-2012 (every second year)
Pro gradu seminar (3 ETCS) 2008-2016
Wave mechanics (5 ETCS) 2002-2008

As a teacher, I generate and recruit motive forces to power motion toward a consistent and comprehensive worldview. Conversely, inconsistencies in rationales and exceptions to rules comprise students' ability to solve problems and track down causes and effects. I engage students in exploring, experimenting, visualizing, simulating, building, tearing apart, and explaining in their own words rather than wearing them out by mere lecturing.

10. AWARDS AND HONOURS

Science Aphorism award 2016.
Entropy Journals award for the paper "Economies evolve by energy dispersal" with Stanley Salthe, 2010.

11. OTHER ACADEMIC MERITS

Opponent a doctoral dissertation of TongLing Lin, a student of Prof. Q. Alexander Wang, Le Mans 2011.
Pre-examiner of Harri Koskela's thesis, a student of Prof. Ilkka Kilpeläinen, Helsinki.

Reviewer for *Biochemistry, EMBO J., FEBS Letters, J. Am. Chem. Soc., J. Biomol. NMR, J. Mol. Biol., Protein Sci., Entropy, Math.Biosci., App. Math. Model., J. Non-Eq. Thermod., Int. J. Mol. Sci., Ecol. Mod., Int. J. Astrobio., Information, Physica A, Systems, Complexity, Chem. Phys. Letters, J. Phys. Chem., Theor. Biosci., Europhys. Letters, J. Roc. Soc. Interface., Front. Systems Neurosci.*

Graduate school supervisor & membership in ISB and MATERNA. Memberships in the advisory boards of Finnish Technology Agency projects, the organizing committee of Nordic NMR Meeting 2001. Member of Societas Biochemica, Biophysica & Microbiologica Fenniae, The Finnish Society for Natural Philosophy, The Finnish Physical Society. Board member of the Science Library of the University of Helsinki, Publication center of The Federation of Finnish Learned Societies (TSV). Chairman of the researcher training program at the Department of Physics.

12. SCIENTIFIC AND SOCIETAL IMPACT

CITED BY

Phys.Org. https://phys.org/search/?search=annila
Evolution as Described by the Second Law of Thermodynamics, 2008 Why Life Originated (And Why it Continues), 2008.
Second Law of Thermodynamics May Explain Economic Evolution, 2009
A second look at supernovae light: Universe's expansion may be understood without dark energy, 2011. A challenge to the genetic interpretation of biology, 2014.
Science Alert: *New paper claims that the EM Drive doesn't defy Newton's 2nd law, 2016.*
Finding Genius Podcast: *Everything is light, January 20, 2020.*

TALKS

Thermodynamic foundations of evolutionary theory. Joint Eur. Therm. Conf., Jun. 2009 Copenhagen, Denmark (invited)
Worldview guided by the least action. Conf. of the Finnish Society for Natural Philosophy, Sept. 2010 Helsinki, Finland

Natural emergence. Finnish Physics Days, March 29-31, 2011 Helsinki, Finland
Ajatuksia ajattelusta yleisen luonnonlain mukaan. Conf. Finnish Society for Natural Philosophy, Sept. 2011 Helsinki
The meaning of mass. Finnish Physics Days, March 13-15, 2012 Joensuu, Finland
The Character of Natural Law, February 2, 2013 ISMANS, Le Mans & February 21, 2013 ENS, Paris
The energetic principle of nature. Systems ecological perspectives on sustainability Sept. 25, 2014, Helsinki
Selittävätkö luonnonlait kaiken? Jan. 14, 2015 Jyväskylän ikääntyvien yliopisto, Jyväskylä
The Natural Law. Sept. 9, 2015 sDiV, Leipzig
Universal paradigm. March 23, 2016 Helsinki
Efficiency in Complex Systems: Satellite Session at Conference on Complex Systems, 2017, Cancun
Revival of Realism, Physics beneath Modeling: Physics Beyond Relativity, October 18-21, 2019, Prague
Kaiken maailman kvantit: Society for Natural Philosophy, September 29, 2020, Helsinki
Thermodynamics of universal patterns The International Conference on Thermodynamics 2.0 July 18-20, 2022, Boone, North Carolina

13. OTHER MERITS

Finnish military rank: Captain