CURRICULUM VITAE – ARTO ANNILA

1. NAME:

Arto Jaakko Annila
5th November 1962, Helsinki, Finnish citizenship
Married, three children
Home address: Kirvuntie 27, FI-02140 Espoo, Finland

2. CURRENT POSITION

Prof. (biophysics), Dr.Tech. (physics), M.Sc. (biochemistry), Docent, lecturer (physical chemistry)

3. ADDRESS

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4. EDUCATION, DEGREES

1980 High School Diploma, Kettle Falls, Washington, USA
1982 Senior Secondary School Diploma, Helsingin Suomalainen Yhteiskoulu
1983 Military service, Reserve Officer School (currently premier lieutenant)
1988 Diploma in Engineer, Department of Technical Physics, Faculty of Information Sciences, Helsinki University of Technology
1991 Doctor of Technology, Department of Technical Physics, Faculty of Information Sciences, Helsinki University of Technology
1996 Master of Science, Department of Biochemistry, Faculty of Biosciences, University of Helsinki
1999 Docent, Physical Chemistry, University of Helsinki

5. PROFESSIONAL APPOINTMENTS

1986 Research Assistant, Low Temperature Laboratory, Helsinki University of Technology
1987 Researcher, Low Temperature Laboratory, Helsinki University of Technology
1988 Research Assistant, Academy of Finland at Low Temperature Laboratory, Helsinki University of Technology
1989 Research Fellow, Danish Research Academy at National Laboratory at Risø, Denmark
1990 Research Assistant, Helsinki University of Technology at Low Temperature Laboratory, Helsinki University of Technology
1991 Visiting Scientist at University of Lund, Department of Physical Chemistry 2
1992 Senior Scientist, VTT Chemical Technology, State Technical Research Centre of Finland
1993 Researcher, Academy of Finland
1996 Group Leader, Senior Scientist, VTT Chemical Technology, State Technical Research Centre of Finland
1998 Group Leader, Structural Biology and Biophysics Program at Viikki Biocenter (on-going)
2000 Group Leader, VTT Biotechnology, the State Technical Research Centre of Finland
2001 Senior Researcher, Academy of Finland
2001 Professor of Biophysics, University of Helsinki (on-going)
2008 Professor of Biophysics, University of Helsinki (permanent position)

RESEARCH INTERESTS: HOLISTIC WORLDVIEW

Nature is rich in diversity but not random. Also its complexity is astounding but not arbitrary. There are rules and regularities, that we call laws of physics, chemistry, more often as relations in biology, economics and social

sciences. Disciplines are not detached from each other. On the contrary, we find the same patterns all over nature. The most obvious ones are power laws that display on log-log plots sigmoid growth and decline curves that in turn accumulate from skewed distributions and logarithmic spirals. These ubiquitous patterns make no distinction between living and non-living or between microscopic and cosmic. This implies to us that there is a universal organizing principle and that everything comprises of universal elementary constituents in accordance with atomism. Hence, while an observation could be interpreted by some specific theory, all observations could be comprehended by the same general tenet.

The principle of least action was early on thought of as a powerful way to make sense out of complex phenomena as well as of simple matters. It says that a difference in energy of any kind will level off in the least time. This natural law is also known as the 2nd law of thermodynamics. When the corresponding equation of motion for natural processes is derived from statistical physics of open systems and analyzed, it will become apparent that evolution indeed yields the scale-free patterns and that the process is inherently intractable, path-dependent process. Yet evolution is not a random sequence of events. Flows of energy themselves will search and naturally select ways and mechanistic species that will consume free energy in the least time. Evolution steps from one state of symmetry to another by acquiring or expelling at least one quantum of action. A step down in free energy is an irreversible step forward in time. Eventually no more new properties will emerge and no old ones will vanish, as the system attains equilibrium with its surroundings. At the free-energy minimum stasis dynamics is on stable and computable trajectories. It turns out that many phenomena, puzzles and paradoxes can be comprehended by the supreme law of nature.

RESEARCH CONTRACTS

I have been in charge of finance for my research group since early 1990's. Primarily, our work is funded by the Academy of Finland and the Technology Agency of Finland (TEKES) as well as by the host institutions Department of Physics, Institute of Biotechnology and Department of Biosciences at the University of Helsinki. We are working in a highly competitive environment because the major part of resources stem from external sources and thus are subject to evaluation and competition. In addition to the group funding, graduate school positions, stipends and grants to individuals are important means to fund our activities.

OTHER ACADEMIC AND PROFESSIONAL ACTIVITIES

Reviewer duties 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., Physica A, Systems, Complexity, Chemical Physics Letters, Theory of Biosciences, Europhysics Letters.*

Graduate school supervisor, membership in the board of Informational and Structural Biology. Memberships in the advisory boards of Finnish Technology Agency projects, the organizing committee of Nordic NMR Meeting 2001, membership in Societas Biochemica, Biophysica et Microbiologica Fenniae, The Finnish Society for Natural Philosophy, Board of the Science Library of University of Helsinki, chairman of the research training program at the Department of Physics.

TALKS

Recognition of protein folds via dipolar couplings: International conference on magnetic resonance in biological systems, Aug. 23-28 (1998), Tokyo, Japan

Observation of conformational changes via dipolar couplings: Nordic NMR meeting, Aug. 24 (1999) Gothenburg, Sweden (invited)

Recognition of protein folds and observation of conformational changes via dipolar couplings: Bioscience days, Sept. 23 (1999) Oulu (invited)

Directional and distance information from NMR and SAXS combined to give structure of calmodulin in a complex: National NMR Symposium, May 24 (2000) Turku (invited)

Directional and distance information from NMR and SAXS combined in studies of large protein complexes. International conference on magnetic resonance in biological systems, upcoming Aug. 23-28 (2000) Florence, Italy (invited)

Building quaternary complexes on the basis of NMR and SAXS data. Experimental NMR Conference, March 11-13 (2001) Orlando, Florida U.S.A (invited)

Combining NMR and SAXS in studies of proteins: Second workshop on experimental methods in studies of proteins, July 23-26 (2001), Yokohama, Japan (invited)

Building quaternary complexes on the basis of NMR and SAXS data: Opening of 600 MHz NMR Facility at National Institute of Chemical Physics and Biophysics, Jan. 22 (2002) Tallinn, Estonia (invited)
Dilute liquid crystals – a new means to study biomolecules: Finnish Physics Days, March 14-16 (2002) Joensuu, Finland (invited)
Probing protein denaturation by residual dipolar couplings. International conference on magnetic resonance in biological systems, Aug. 25-31 (2002) Toronto, Canada (invited)
Residual dipolar coupling of denatured proteins. German NMR Meeting, Sept. 24-26 (2002) Bremen, Germany (invited)
Residual dipolar coupling of weakly structured proteins. NorFA summer school, June, 24-26 (2003) Skåne
Residual dipolar coupling of weakly structured proteins. Peptide symposium, May 13-14 (2004) Helsinki, (invited)
Residual dipolar coupling of weakly structured proteins. Japanese NMR Meeting, Nov, 18 (2004) Tokyo, Japan (invited)
Protein Dynamics by Residual Dipolar Couplings. NorFA summer school, June, 23 (2005) Copenhagen, Denmark
Examining polypeptide conformational ensembles by residue dipolar couplings. NMR in Molecular Biology, EuroConference on Structural Genomics, Structure, Dynamics and Interactions of Biomolecules NMR Meeting, August, 20-25 (2005) Höör, Sweden (invited)
Probing protein dynamics by residual dipolar couplings. International conference on magnetic resonance in biological systems, Aug. 25-31 (2006) Göttingen, Germany (invited)
Thermodynamic foundations of evolutionary theory. Joint European Thermodynamic Conference, Jun. (2009) Copenhagen, Denmark (invited)
Worldview guided by least action. Models in physics and cosmology, Conference 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. Aivot ja mieli, käsitteet ja kieli. Conference of the Finnish Society for Natural Philosophy, Sept. (2011) Helsinki, Finland
The meaning of mass: Finnish Physics Days, March 13-15 (2012) Joensuu, Finland
The Character of Natural Law, Feb. 2 (2013) ISMANS, Le Mans & Feb. 21 (2013) ENS, Paris
The energetic principle of nature: Systems ecological perspectives on sustainability Sept. 25 (2014), Helsinki
The Natural Law, Sept. 9 (2015) sDiV, Leipzig
Universal paradigm, March 23 (2016) Helsinki

TEACHING

The courses of biophysics for physicists and bioscientists involve both experimental techniques and theoretical concepts. The basic course of wave phenomena relate to the principles of spectroscopy and diffraction, the two main methods used in studies of biological macromolecules. The special courses on NMR spectroscopy as well as protein structure and folding are in the very heart of my research work in past, just is the course on the origin and evolution of diversity that matches my current research interest. Also the lecture course of statistics for bioscientists has acquired deeper meaning and connection to my research as I have become aware of the physical foundations of Bayesian and frequency statistics. In the recent years I have provided preliminaries of statistical physics of open systems for students to obtain more comprehensive understanding of nature. Indeed the students appear to get most motivated about these research aspects that are not all found in otherwise excellent textbooks. All in all the substantial amount of teaching is not a load for me rather an important source of inspiration.