CV of Prof Ilpo Vattulainen

ERC Advanced Grant Recipient (2012-2017)

Department of Physics, University of Helsinki
Member of Centre of Excellence in Biomembrane Research (Academy of Finland) (2014-2019)
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BASIC FACTS & EDUCATION

- **Name, Birth, Nationality:** Ilpo Tapio Vattulainen, 1968 (age 50), Finnish
- **Researcher Identifier:** ORCID ID 0000-0001-7408-3214
- **Most Recent Degree:** DrTech, Helsinki Univ of Tech (Aalto Univ), Finland (1998). PhD supervisor: Tapio Ala-Nissilä

RESEARCH INTERESTS

- **Computational and theoretical biological physics.** Research topics including, e.g. membrane biophysics & lipid-protein interactions, signaling, protein dynamics, lipoproteins, transfer proteins & trafficking, drug-membrane & drug-receptor interactions, algorithm development, machine learning, development of computational technologies.

CURRENT POSITION

- **Professor** of Biological Physics (Tenure), Dept Physics, Univ Helsinki (primary post)
- **Visiting Professor** (Mercator Fellow), Heidelberg Univ & TU Dresden (DFG/TRR 83 network) (2018-2022)
- **Professor** of Physics (Biophysics, Tenure) at the Dept of Physics, Tampere Univ of Tech (secondary post)
- **Vice-Chair** of the Center of Excellence in Biomembrane Research (Academy of Finland)
- **Director** of the Biological Physics group (about 25 scientists)
- **Vice-Chair** of the Helsinki Eye Lab merging clinical, experimental, and computational science in ophthalmology
- **Associate Member** of MEMPHYS – Center for Biomembrane Physics, Odense, Denmark

MOST IMPORTANT SCIENTIFIC ACKNOWLEDGMENTS AND AWARDS

- **Center of Excellence t**ogether with Academyprof. Elina Ikonen and Prof. Pekka Lappalainen (Univ Helsinki): the Academy of Finland *Center of Excellence in Biomembrane Research* for 2014-2019
- **Award by the Magnus Ehrnrooth Foundation 2013** – the Award in Physics; **Award by the Alfred Kordelin Foundation 2007**. The Incentive Award 2007; **Academy of Finland Incentive Award 2005**
- **Scientific Evaluation**. ***ERC Advanced Grant*** (2012-2017) – European Research Council
- **Center of Excellence.** Together with other theory/modeling groups at the Laboratory of Physics (HUT (Aalto Univ)), we were chosen as a *Center of Excellence by the Academy of Finland* for 2006–2011.
- **Young Center of Excellence 2004.** The Biophysics & Soft Matter Team (my group at the Lab of Physics & Dr. Mikko Karttunen's group at the Lab of Comput Engineering selected as the *Young Center of Excellence* (Aalto Univ)

RECENT RESEARCH FUNDING (EXAMPLES) ALTOGETHER > 10 MILLION EUR IN 2006-2018

- **Sigrid Juselius Foundation**. Dry eye syndrome (2018-2020) ~170,000 EUR.
- **HiLIFE (Helsinki Institute of Life Science) Fellow project** (2017-2020) ~180,000 EUR
- **Academy of Finland – Centre of Excellence** (2014-2019): my team ~1,800,000 EUR/6 years + matching funds
- **Academy of Finland** – Research Infrastructure (high-performance computing) (2015-2016) ~289,000 EUR
- **European Research Council – ERC Advanced Grant** (2012-2017) ~1,920,000 EUR + matching funds
- **EU FP7** – Spider network (2012-2016) ~32,000 EUR
- **COST network** TD1104 on electroporation (2012-2016) many EUR with many partners
- **Academy of Finland** – Programmable materials (2012-2015) ~210,000 EUR
- **Academy of Finland** – Computational science (LASTU call) (2012-2016) ~272,000 EUR
- **Sigrid Juselius Foundation** (biomedicine). Lipid-protein interactions (2012-2015; 2015-2017) ~300,000 EUR each
- **Academy of Finland – FiDiPro project:** Prof Pavel Jungwirth (2013-2017) ~838,000 EUR + matching funds
- **Academy of Finland – FiDiPro project:** Prof Ralf Metzler (2011-2015) ~912,000 EUR + matching funds

SUPERVISION OF DOCTORAL STUDENTS & POST-DOCTORAL SCIENTISTS & THEIR EMPLOYMENT

- **Employment.** I have considerable and successful experience in researcher training. I have supervised 19 PhD theses and ~20 postdocs. ***All of my previous PhD students have found their place in the job market*** (e.g., Emma Falck (Partner & Director, Boston Consulting Group, Stockholm Office), Emma Terämä (Director, Finnish Environment Inst), Olli Punkkinen (Head of Risk Analysis, Eläke-Fennia), Teemu Murtola (Research Scientist, Varian Medical Systems), Jelena Telenius (Bioinformatician, Univ Oxford), etc.). ***Also, all of my previous postdocs have found their place in the job market*** (A Gurtovenko (Senior Scientist, St Petersburg), Luca Monticelli (Tenure, CNRS/INSERM Lyon), Giulia Rossi (ERC StG & Senior Scientist, Univ Genova), etc.). Currently, Vattulainen is supervising and mentoring 10 PhD students and > 10 postdocs.

LEADERSHIP, BREAKTHROUGHS

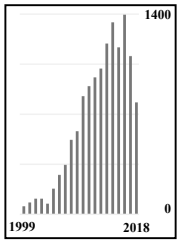
- **Leadership.** After my post-doc, I started from scratch and founded the Biological Physics group of ~15 people (Helsinki Univ of Tech (2001 – 2005)). After moving to TUT (professorship), I again started from scratch & founded a new group which I raised to a level of ~50 people (2006 – 2015). In Jan 2016, I moved my team to Univ Helsinki, where we now have a focused

team (~10 postdocs, ~10 PhD students, ~10 MSc students).

- **Leadership.** Together with Elina Ikonen, I direct the Center of Excellence of ~60 people; As the Director of Tampere Center for Scientific Computing (2009-2015), I increased its computing infrastructure by a factor of 50 and it's personnel by a factor of 2; I lead the doctoral school at Univ Helsinki; etc.
- **Ability for Breakthrough Science.** I have driven the group to reach multi-disciplinary excellence in methodology, talent, and experience for attacking challenging high risk/high gain research questions. Here are some examples. 1) Diffusion in membranes. My group predicted (*J Am Chem Soc* **130**, 44 (2008)) that diffusion of lipids occurs via concerted motions of tens of lipids in unison. QENS experiments later verified (*J Am Chem Soc* **132**, 3232 (2010)) that the prediction was correct. 2) Membrane protein structures are known to contain a few lipids. My group showed (*J Am Chem Soc* **132**, 7574 (2010)) that this is just the tip of an iceberg: proteins move with ~100 lipids as dynamical protein-lipid complexes, with implications for the formation/lifetime of nanosized lipid rafts. 3) We changed the paradigm that membrane potential arises solely from a salt ion concentration gradient across a membrane: the asymmetric lipid distribution plays an equally important role (*J Am Chem Soc* **129**, 5358 (2007)). 4) Lipoproteins (HDL, LDL) are largely responsible for the trafficking of cholesterol and its esters. Their concentrations determine the exposure to atherosclerosis. My team resolved their nanoscale structures (*PLoS Comput Biol* **6**, e1000964 (2010); Soft Matter **7**, 8135 (2011)) and showed how drugs are able to interfere with the trafficking (*PLoS Comput Biol* **10**, e1003987 (2014)), leading to increasing HDL (for better health). 5) Cholesterol is known to modulate membrane receptor function. For GM1, we showed how cholesterol does it (*Nature Chem Biol* **7**, 260 (2011)). 6) We showed for cytochrome c oxidase that the proton transfer pathway involved in ATP synthesis is controlled by a water-gate (*PNAS* **112**, 2040 (2015)). 7) Until now membrane protein simulations have disregarded glycosylation. We showed that glycosylation changes the protein conformation and hence visibility to ligands, affecting function (*PNAS* **112**, 4334 (2015)). Experiments confirmed these predictions (*PNAS* **112**, 4334 (2015); *Mol Biol Cell* **26**, 4087 (2015)). 8) Experiments have suggested that lipids could modulate membrane receptor conformation and activation but direct evidence has been lacking. We showed in a pioneering study through extensive atomistic 100-microsecond simulations that cholesterol modulates G protein-coupled receptors in an allosteric fashion through specific lipid-protein interactions (*eLife* **5**, e18432 (2016)).

OTHER SCIENTIFIC EXPERT POSITIONS AND SCIENTIFIC ACHIEVEMENTS (EXAMPLES)

- **Board Member.** European Biophysical Societies Association (EBSA) (2011-); Chair, Customer Panel of CSC (www.csc.fi, 2013-); BioBio Society–*Societas biochemica, biophysica et microbiologica Fenniae* (2012-); COST (TD1104) action for electroporation (2012-); Nordic network in Soft Matter Physics, NordForsk (2010-); Board of Advisors, Finnish Grad School in Comput Sciences (2009-); Finnish Physical Society (2008-2010); SIGHT2009 Eval Panel in Physics, Acad Finland (2008); Glycoscience Grad School (2007-); NORDITA committee for condensed matter physics (2007-2013); ESF-SiMBIOMA network (2006-2012); ESF-FuncDyn network (2006-2012); etc.
- **Positions of Trust.** Chair, Doctoral Programme in Materials Research and Nanosciences, Univ Helsinki (2018-); Chair, Customer Panel of CSC – IT Center for Science (supercomputing) (www.csc.fi, 2013-); Chair, Doctoral Programme of the Faculty of Natural Sciences, Tampere Univ Tech (2013-); Board Member, BioBio Society – *Societas biochemica, biophysica et microbiologica Fenniae* (2012-); Director, TCSC – Tampere Centre for Scientific Computing (2009 – 2014); Vice-Chair, Center of Excellence in Biomembrane Research (Academy of Finland) (2014 –); Director, Division of Computational Physics, Department of Physics, TUT (2011–); etc.
- **Evaluator**. Member of ERC Starting Grant Evaluation Panel PE3 (2014-); The Wellcome Trust (2015, 2013); EU FP7 (2006-2014); Evaluation panel member for the impact of completed ERC projects (2015); EU Horizon 2020 (2015-2018, >6 evaluations); Czech Natl Res Academy (2014); Qatar Natl Research Fund (3 evaluations); US-Israel Binational Science Foundation (2013); Research Council of Lithuania (2013; 2012 twice); ERC proposals (2011-); EU FP7 (14 evaluations in 2006-2014); Member of the COST Expert Eval Panel in Materials, Physics, and Nanosciences (MPNS), 4 evaluations/year (2010-2013); PRACE evaluations (2010-); Member of the scientific evaluation panel in HPC-EUROPA2, 4 evaluations/year (2010-2013); FNRS (2011-); etc.
- **Evaluator.** Acted as reviewer for ~70 different scientific journals (typically ~30-40 manuscripts/year).
- **Editorial Board Member.** *Chemistry and Physics of Lipids* (2017-); Review Editor, *Frontiers in Mathematics of Biomolecules* (2014-); Guest Editor for BBA Biomembranes, Special Issue on *Biosimulations of Lipid Membranes* (2016); etc.
- **Invited Talks in Major Intl Conferences.** ~1000 invited talks, typically 6-8 invited talks/year, e.g., in ***EBSA Biophysics Course***, Montpellier 2018; Key Symposium **Metabolic Complications of Obesity**, Cambridge, UK, 2017; ***Biomembrane Days***, Berlin 2016; ***Keystone Symposium*** on Systems Biology of Lipids, Breckenridge 2015; ***CECAM Workshop*** Protein Assemblies at the Interface of Functionalized Materials, Lausanne 2014; ***EMBO Meeting***, Amsterdam 2013; ***Faraday Discussions***: Lipids and Membrane Biophysics, London 2012;
- **Organization of Conferences.** Many, such as: *Physics Days* (500-600 participants), March 2019, Helsinki (**Chair**); *Venice Meeting on Fluctuations in Small Complex Systems*, Venice, Oct 2018; *ICBL (Intl Conf Bioscience Lipids) Conference*, Helsinki, Sept 2018; *Intl Workshop on Biological Membranes: Tiny Lipids with Grand Functions* (~200 participants), Aug 2018, Helsinki (**Chair**); *Computational Chemistry Days*, Helsinki, May 2018 (**Chair**); *EMBO Practical Course*, Helsinki, July 2017 (**Co-chair**); *etc.*



PUBLICATIONS, DISSEMINATION & IMPACT

- About 250 peer-reviewed articles. Recently ~15-20 articles/year. ***H-index 69 with ~14,000 citations*** (Google Scholar) as demonstrated in the figure on the right.