Curriculum Vitae – Andrew Rutenberg

Present position	AC Fales Professor of Theoretical Physics		
Organisation/Employer	Dalhousie University		
Contact Address	Department of Physics and Atmospheric Science		
	Halifax, Nova Scotia		
	Canada	**Post code**	B3H 4R2
Work telephone	1-902-494-2952		
Email	adr@dal.ca		

Academic qualifications

1993, Physics PhD, Princeton University (USA)
1987, Math/Physics BSc, University of Toronto (Canada)

Professional positions held

2014-present	AC Fales Professor of Theoretical Physics, Dalhousie University
2005-2014	Associate Professor, Dalhousie University, Canada
2000-2005	Assistant Professor, Dalhousie University, Canada
1997-1999	Research Associate, McGill University, Canada
1995-1997	Postdoc, Oxford University, UK
1993-1995	Postdoc, University of Manchester, UK

Current research

I work in the broad areas of statistical, soft-matter, and biological physics, using theoretical and computational models to study biological systems. Two particular areas of focus are elastic models of collagen fibrils (in collaboration with Laurent Kreplak) and models of organismal aging and mortality (often in collaboration with Ken Rockwood).

Collagen fibrils: Coarse-grained model of the structure of collagen fibrils, including radial, axial, and elastomeric structure, can be directly compared with experimental observations of single fibril structure, mechanics, and damage. We have developed equilibrium and non-equilibrium structural models of fibrillar collagen. Mechanical contributions of cross-linking are treated with methods developed for liquid-crystalline rubbers (elastomers), or with molecular dynamics approaches.

Organismal aging: We use computational approaches to model, characterize, and predict organismal aging and mortality of both humans and model organisms such as mice and worms. Aging is multidimensional, so a complex systems or network approach is often appropriate. We use a variety of top-down (data-first, e.g. machine learning), middle-out (phenomenology-informed statistical modelling), and bottom up (network simulation) approaches. Some current interests are on modelling the effects of medicine and disease (bottom-up), on capturing natural dynamics (middle-out), and on predicting disease onset (top-down).

Selected Publications (see also https://rutengroup.ca/publications.html)

1. **Dynamical modelling of the frailty index indicates that health reaches a tipping point at age 75,** G Pridham, K Rockwood, A Rutenberg, https://arxiv.org/abs/2412.07795
2. **Systems-level health of patients living with end-stage kidney disease using standard lab values,** Glen Pridham, Karthik Tennankore, Kenneth Rockwood, George Worthen, and Andrew Rutenberg**,** https://arxiv.org/abs/2405.20523
3. **Using deep-learning to obtain calibrated individual disease and ADL damage transition probabilities between successive ELSA waves**, Emre Dil and A Rutenberg, https://www.biorxiv.org/content/10.1101/2023.10.24.563857v1
4. **Anisotropic swelling due to hydration in fibrous biomaterials,** Xander Gouws, Ana Mastnak, Laurent Kreplak, and A Rutenberg, *JMBBM* **160** 106749 (2024).
5. **Dynamical network stability analysis of multiple biological ages provides a framework for understanding the aging process,** G Pridham and A Rutenberg, *Journals of Gerontology A* **79** glae21 (2024).
6. **Network dynamical stability analysis of homeostasis reveals "mallostasis": biological equilibria drifting towards worsening health with age**, G Pridham and A Rutenberg, *Scientific Reports* **13** 22140 (2023).
7. **Modelling disease impact: lifespan reduction is greatest for young adults in an exogenous damage model of disease**, R Tobin, G Pridham, and A Rutenberg, *Scientific Reports* **13** 16304 (2023).
8. **Torsion and Bistability of Double-twist Elastomers**, M Leighton, L Kreplak, and A Rutenberg, *Soft Matter* **19** 6376-6386 (2023).
9. **A complex systems approach to aging biology**, AA Cohen et al, *Nature Aging* **2**, 580-591 (2022)
10. **Interpretable machine learning for high-dimensional trajectories of aging health** Spencer Farrell, Arnold Mitnitski, Kenneth Rockwood, and AD Rutenberg, *PLoS Computational Biology* **18** e1009746 (2022)
11. **Measurements of damage and repair of binary health attributes in aging mice and humans reveal that robustness and resilience decrease with age, operate over broad timescales, and are affected differently by interventions**, Spencer Farrell, Alice Kane, Elise Bissett, Susan Howlett, and AD Rutenberg, *eLife* **11** e77632 (2022).
12. **Non-equilibrium growth and twist of cross-linked collagen fibrils** Matthew P Leighton, Laurent Kreplak, and AD Rutenberg, *Soft Matter* **17** 1415 (2021)
13. **The potential for complex computational models of aging** Spencer Farrell, Garrett Stubbings, Kenneth Rockwood, Arnold Mitnitski, and AD Rutenberg, *Mechanisms of Ageing and Development* **193** 111403 (2021)
14. **The degree of frailty as a translational measure of health in aging**, Susan E Howlett, AD Rutenberg, and Kenneth Rockwood, *Nature Aging* **1** 651 (2021).
15. **Chiral phase-coexistence in compressed double-twist elastomers**, Matthew P Leighton, Laurent Kreplak, and AD Rutenberg, *Soft Matter* **17** 5018 (2021).
16. **Non-equilibrium growth and twist of cross-linked collagen fibrils**, Matthew P Leighton, Laurent Kreplak, and AD Rutenberg, *Soft Matter* **17** 1415 (2021).
17. **Polymorphism of Stable Collagen Fibrils**, Sam Cameron, Laurent Kreplak, and AD Rutenberg, *Soft Matter* **14** 4772-4783 (2018)
18. **Network model of human aging: Frailty limits and information measures**, SG Farrell, AB Mitnitski, K Rockwood, AD Rutenberg, *Physical Review E* **94**, 052409 (2016)