Armita Nourmohammad

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Education

2008 - 2012	PhD in theoretical physics (**summa cum laude**) Thesis: *Evolution of regulatory complexes: a many-body system* Committee: Prof. Dr. Michael Lässig Prof. Dr. Joachim Krug Prof. Dr. Martin Kreitman
2006 - 2008	Master's degree in physics at University of Cologne, Grade 1.1 (**very good**) Thesis: *From microsatellite slippage to* cis*-regulatory module evolution* Advisor: Prof. Dr. Michael Lässig
2003 - 2006	Bachelor degree in physics at Sharif University of Technology, Tehran, Grade 16.44/20

Research activity & positions

2/2020 - present	Affiliate Investigator, Fred Hutchinson Cancer Research Center, Seattle
10/2019 - present	Faculty of "UW Computational Molecular Biology", Seattle
7/2019	Joliot Chair, ESPCI, Paris, France
9/2018 - present	Assistant professor of physics, University of Washington, Seattle (on leave: 9/2018-9/2019)
5/2018 - present	Faculty of the graduate school "Physics of biological and complex systems" (PBCS), University of Göttingen, Germany
1/2018 - present	Faculty of the GAUSS graduate school "Theoretical and computational neuroscience" (PTCN), University of Göttingen
9/2017 - present	Max Planck Research Group Leader, Max Planck Institute for Dynamics and Self-organization, Göttingen, Germany (non-tenure track position & 20% affiliation since 9/2019)
9/2015 - 8/2017	Part-time lecturer in physics and the Lewis-Sigler Institute for Integrative Genomics, Princeton University, Princeton, USA
10/2014 - 8/2017	Associate research scholar, Lewis-Sigler Institute for Integrative Genomics, Princeton University, Princeton, USA
10/2012 - 10/2014	James S. McDonnell postdoctoral fellow, Lewis-Sigler Institute for Integrative Genomics, Princeton University, Princeton, USA

Honors & Awards

2021	NSF CAREER award
2021	NIH Early Stage Investigator R35 MIRA award
2014	Postdoctoral travel award for the annual meeting of SMBE 2014
2012	Klaus-Liebrecht award for distinguished PhD dissertation (amount of 3,000 Euros)
2011	James S. McDonnell Foundation (JSMF) postdoctoral fellowship for studying complex systems (amount of $200,000)
2011	Finalist in Harvard Society of Fellows
2011	Student fellowship by Burroughs Wellcome Fund to attend the KITP program, *Microbial and viral evolution*, at UC Santa Barbara
2007	Scholarship from Bonn-Cologne excellency school of physics and astronomy
2003	Ranked 15^{th} nationwide in the Iranian university entrance exam among more than 300,000 participants

Research Grants

2021 - 2026	NSF CAREER award, *Emergence of functional organization in the adaptive immune system*, $900,000 ($612,535 direct cost)
2021 - 2026	NIH Early Stage Investigator R35 MIRA award, *Learning a molecular shape space for the adaptive immune system*, $1,838,760 ($1,250,000 direct cost)
2020 - 2021	Royalty Research Fund, *Learning the shape space of protein universe to predict function*, $ 38,000
2018 - 2021	Single PI project within SFB1310 *Predictability in Evolution*, EUR 207,000
2017 - 2021	Max Planck Research Group, EUR 1,851,000

Trainee Awards

Oskar Schnaack	Fulbright Fellowship (2021)
Assya Trofimov	Mahan postdoctoral fellowship (2021 - 2024)

Publications

Preprint

- Y. Wang, R. Lei, **A. Nourmohammad**, N. C. Wu (2021) Antigenic evolution of human influenza H3N2 neuraminidase is constrained by charge balancing. bioRxiv: 2021.07.10.451918
- **O. Schnaack**, L. Peliti, **A. Nourmohammad** (2021) Learning and organization of memory for evolving patterns. bioRxiv:2021.06.04.447135
- **G. Isacchini***, N. Spisak*, **A. Nourmohammad**†, T. Mora†, A. Walczak† (2021) MINIMALIST: Mutual INformatIon Maximization for Amortized Likelihood Inference from Sampled Trajectories. arXiv:2106.01808

Peer reviewed

1. **Z. Montague***, H. Lv*, J. Otwinowski, W. S. DeWitt, **G. Isacchini**, G. K. Yip, W. W. Ng, O. T. Tsang, M. Yuan, H. Liu, I. A. Wilson, M. Peiris, N. C. Wu†, **A. Nourmohammad**†, C. K. Mok† (2021) Dynamics of B-cell repertoires and emergence of cross-reactive responses in COVID-19 patients with different disease severity, Cell Rep. 35(8), 109173
   Press: The Physics of a Deadly Virus
2. **O.H. Schnaack, A. Nourmohammad** (2021) Optimal evolutionary decision-making to store immune memory. eLife 2021;10:e61346.
3. **G. Isacchini**, A. Walczak†, T. Mora†, **A. Nourmohammad**† (2021) Deep generative selection models of T and B cell receptor repertoires with soNNia, Proc. Natl. Acad. Sci. 118 (14) e2023141118
4. **A. Nourmohammad**† and C. Eksin (2021) Optimal evolutionary control for artificial selection on molecular phenotypes, Phys Rev. X 11, 011044.
5. J. Otwinowski, **C. LaMont**, **A. Nourmohammad** (2020) Information-geometric optimization with natural selection, Entropy, 22(9), 967
6. **G. Isacchini**, C. Olivares, **A. Nourmohammad**, A. Walczak and T. Mora (2020) SOS: Online probability estimation and generation of T and B cell receptors, Bioinformatics, btaa574
7. **G. Isacchini**, Z. Sethna, Y. Elhanati, **A. Nourmohammad**, A. Walczak and T. Mora (2020) Generative models of T-cell receptor sequences, Phys. Rev. E 101, 062414
8. N.C. Wu, J. Otwinowski, A.J. Thompson, C.M. Nycholat, J.C. Paulson, **A. Nourmohammad** and I. A. Wilson (2020) Major hemagglutinin antigenic site B of

human influenza H3N2 viruses has an evolving local fitness landscape, Nature Communications 11,1233

9. S. Bradde[†], **A. Nourmohammad**[†], S. Goyal[†], V. Balasubramanian[†] (2020) The size of the immune repertoire in bacteria, Proc. Nat. Acad. Sci. 117 (10) 5144-5151
   Commentary by M. Deem: 10.1073/pnas.2002746117
10. **A. Nourmohammad**[†], J. Otwinowski, M. Łuksza, T. Mora and A. M. Walczak (2019), Fierce Selection and Interference in B-Cell Repertoire Response to Chronic HIV-1, Mol Biol Evol, 36(10): 2184–2194
11. T. Hagai, X. Chen, R.J. Miragaia, R. Rostom ,T, Gomes, N. Kunowska, J. Henriksson, J. Park, V. Proserpio, G. Donati, L. Bossini-Castillo, F.A.V. Braga, G. Naamati, J. Fletcher, E. Stephenson, P. Vegh, G. Trynka, I. Kondova, M. Dennis, M. Haniffa, **A. Nourmohammad**, M. Lässig and S.A. Teichmann (2018), Gene expression variability across cells and species shapes innate immunity, Nature 563: 197–202
    F1000Prime Recommended
12. **A. Nourmohammad**[†], J. Rambeau, T. Held, V. Kovacova, J. Berg and M. Lässig (2017) Adaptive evolution of gene expression in Drosophila, Cell Reports 20, 1385-95
    F1000Prime Recommended
13. **A. Nourmohammad**[1†], J. Otwinowski[1] and J. Plotkin (2016) Host-pathogen coevolution and the emergence of broadly neutralizing antibodies in chronic infections, PLoS Genet. 12(7): e1006171
14. T. Held, **A. Nourmohammad** and M. Lässig (2014) Adaptive evolution of molecular phenotypes, J. Stat. Mech, P09029
15. **A. Nourmohammad**[1], T. Held[1], M. Lässig, (2013) Universality and predictability in molecular quantitative genetics, Curr Opin Genet Dev. 23(6):684-93
16. **A. Nourmohammad**[1], S. Schiffels[1] and M. Lässig (2013) Evolution of molecular phenotypes under stabilizing selection, J. Stat. Mech. P01012
17. **A. Nourmohammad** (2012) Evolution of regulatory complexes: a many-body system, PhD Thesis, University of Cologne
18. **A. Nourmohammad** and M. Lässig (2011) Formation of regulatory modules by local sequence duplication, PLoS Comput Biol 7(10): e1002167
19. RH. Abdolvahhab, F. Roshani, **A. Nourmohammad**, M. Sahimi and MR. Tabar (2008)Analytical and numerical studies of sequence dependence of passage times for translocation of heterobiopolymers through nanopores, J. Chem. Phys. 129(23):235102

[1]: equal contribution, [†]: equal contribution, corresponding author, **bold face**: group members

Invited Seminars & Conference talks

6/2021	Aspen Physics Center meeting "Biology, Biophysics and Epidemiology of COVID-19 and other Pandemics", Aspen (Co), USA
6/2021	"Predicting evolution" meeting, EMBL, Heidelberg, Germany (virtual)
6/2021	APS living histories (virtual: **online recording**)
5/2021	Biozentrum Computational Biology Seminar Series, Basel, Switzerland (virtual)
3/2021	Statistical Physics Seminar Series, the Institute for Theoretical Physics (IPhT), Saclay, France (virtual).
2/2021	Computational Biology Section, Fred Hutchinson Cancer Research Center, Seattle, USA

1/2021	"Quantitative evolution, phylogeny and ecology: from models to data and back", Institut Henri Poincaré, Paris (virtual meeting: **online recording**)
12/2020	AIRR Community Meeting V (virtual meeting: **online recording**)
11/2020	Research seminar at the Collaborative Research Center (SFB1310: *Predictability of Evolution*) Cologne, Germany (virtual)
10/2020	4^{th} Annual Symposium on Physical Concepts and Computational Models in Immunology, Cologne, Germany
8/2020	"Physical Biology of the Cell Course", Marine Biological Laboratory, Woods Hole (MA), USA (virtual seminar: **online recording**)
1/2020	Math Modeling Affinity Seminar Series, Fred Hutchinson Cancer Research Center, Seattle, USA
12/2019	Computational Biology Section, Fred Hutchinson Cancer Research Center, Seattle, USA
12/2019	"Adaptation symposium", Graduate Center, CUNY, NYC
8/2019	"Out-of-equilibrium processes in evolution and ecology", Oaxaca, Mexico
7/2019	"From Molecular Basis to Predictability and control of evolution" Nordita Institute, Stockholm, Sweden
6/2019	Gordon Research Conference "Molecular Mechanisms of Evolution", Stonehill College, USA
4/2019	Campus seminar at Max Planck Institute for Biological Cybernetics, Tübingen, Germany
3/2019	APS March meeting, invited session"Statistical physics of large populations of Cells: from microbes to tissues", Boston, USA
10/2018	"Stochasticity and control in the dynamics and diversity of immune repertoires", Paris, France
9/2018	"Physical concepts and computational models in immunology", ENS, Paris
9/2018	"Paths in Statistical Physics (in honor of Luca Peliti)", Paris, France
4/2018	"APS Physics-Next Meeting: Physics of Living Matter", Long Island, USA
4/2018	"Exploring the unreasonable ineffectiveness of mathematics in biology", University of Pennsylvania, Philadelphia, USA (panel speaker)
2/2018	Evolution of Diversity, Les Houches, France
1/2018	Regulation and inference in biological networks, Bardonecchia, Italy
1/2018	SFB 937 seminar, Göttingen, Germany
10/2017	EMBO conference "Quantitative Principles in Biology", Heidelberg, Germany
3/2017	Seminar at the physics department, Yale University, New Haven, USA
3/2017	Biophysics seminar, Department of physics, UCLA, USA
2/2017	Physics department seminar, Caltech, Pasadena, USA
2/2017	Physics Colloquium, University of Washington, Seattle, USA
1/2017	Seminar at the Max Planck Society, Berlin, Germany
1/2017	Physics department seminar, ICTP-SAIFR, São Paulo, Brazil
11/2016	Center for Studies in Physics and Biology seminar series, Rockefeller University, New York, USA
10/2016	Biophysics seminar, ENS & ESPCI, Paris, France
10/2016	CIRB seminar, Collège de France, Paris, France
10/2016	Séminaire de LPTMS, Orsay, France
9/2016	SFB 680 Evolution Colloquium, Cologne, Germany
9/2016	20^{th} evolutionary biology meeting, Marseilles, France
6/2016	Seminar at AMOLF, Amsterdam, the Netherlands
4/2016	Fred Hutchinson Cancer Research Center, Seattle, USA
3/2016	Quantitative Life Sciences seminar, ICTP, Trieste, Italy
3/2016	APS March meeting, "Quantitative Immunology" session, Baltimore, USA
2/2016	Quantitative immunology, KITP Program, UCSB, USA **Online Talk**: **effective theory of immune-pathogen interactions**
7/2015	Forecasting evolution?, Gulbenkian Institute, Portugal

	10/2014	Seminar at MPI for Cell Biology and Genetics, Dresden, Germany
	9/2014	Quantitative Systems Biology seminar, IST, Austria
	7/2014	Biophysics seminar, Rutgers University, USA
	3/2011	Natural History Seminars, University of Chicago, USA
	2/2011	Microbial and Viral Evolution, KITP Program, UCSB, USA **Online Talk**: **evolutionary modes of regulatory sequences in eukaryotes**
Contributed talks & group seminars	3/2021	American Physical Society (APS) meeting (virtual)
	7/2018	Annual meeting of the Society for Molecular Biology and Evolution (SMBE), Yokohama, Japan
	3/2016	Antibody viral co-evolution workshop, Los Alamos, USA
	1/2015	EvoGroup seminar, Princeton University, USA
	10/2014	Seminar at Isabel Gordo's group, Instituto Gulbenkian Ciencia, Portugal
	8/2014	Seminar at Daniel Fisher's group, Stanford, USA
	6/2014	Annual meeting of the Society for Molecular Biology and Evolution (SMBE), Puerto Rico
	12/2013	110^{th} Statistical Mechanics Conference, Rutgers University, USA
	4/2013	Seminar at Joshua Plotkin's group, University of Pennsylvania, USA
	3/2013	American Physical Society (APS) meeting, Baltimore, USA
	10/2011	RECOMB Conference on Regulatory Genomics & Systems Biology, Barcelona **Online Talk**: **formation and conservation of regulatory binding site complexes**
	10/2011	Workshop at the Bonn-Cologne graduate school of physics and astronomy, *Application of information theory in genomics*, Bonn, Germany.
	7/2011	Moscow Conference on Computational Molecular Biology, Moscow, Russia
	8/2009	15^{th} Annual European Meeting of PhD Students in Evolutionary Biology, Schoorl, the Netherlands
Lectures in summer schools & workshops	8/2020	Physical Biology of the Cell at Marine Biological Laboratory, Woods Hole, Massachusetts
	7/2019	Boulder summer school on theoretical biophysics, Boulder, CO, USA
	11/2018	International Curie course on biophysics, "Multiscale Integration in Biological Systems", Institut Curie, Paris
	1/2017	VI Southern-Summer School on Mathematical-Biology ICTP-SAIFR, São Paulo, Brazil (lecturer)
Undergrad & Graduate Teaching	Spring 2021	Special topics (PHYS 578 & PHYS 428): Statistical Physics of Living Systems, University of Washington, Seattle
	Fall 2020	Classical mechanics (PHYS 121), University of Washington, Seattle
	Spring 2020	
	Winter 2020	Biophysics (PHYS 429), University of Washington, Seattle
	Spring 2018	Statistical Physics in Biology, George-August University of Göttingen, Göttingen, Germany
	Spring 2018	Special topics (biophysics) graduate course (phys 578), University of Washington, Seattle, USA
	2015-2017	*Integrated science curriculum*, Lewis-Sigler Institute for Integrative Genomics, Princeton University, Princeton, USA

Service to Biophysics & Comp. Bio. communities

☐ **Journal Referee and Editorial Activities**

Reviewing editor: *eLife*

ad-hoc reviewer: *BMC Evolutionary Biology*, *eLife*, *Genetics*, *Interface Focus*, *Journal of Statistical Mechanics*, *Journal of Statistical Physics*, *Molecular Biology and Evolution*, *PNAS*, *Physical Review Letters*, *Physical Review E*, *PLoS computational biology*, *Virus Evolution*

recommandeuse: "Peer Community in"

Grant reviewer: QLife: Institut Curie, France
Vidi grant: NWO Domain Science (Dutch Research Council)
ANR: France National Research Agency

☐ **Meeting organizer**

2/2022	BIRS workshop: "Sensing and Signaling in Immune Systems", Banff Center, Canada
8/2019	"Out-of-equilibrium processes in evolution and ecology", Casa Matematica Oaxaca (CMO), Oaxaca, Mexico
7/2019	"From Molecular Basis to Predictability and control of evolution", Nordita program, Stockholm, Sweden
7/2018	"Predictability of rapid evolutionary processes", SMBE session, Yokohoma, Japan
3/2018	"Immune-pathogen interactions", CRC 1310 theory symposium, Cologne, Germany
4/2016	"Molecular coevolution: lessons from pathogen-immune system interactions" PCTS workshop, Princeton University, Princeton, USA
7/2015	"Beyond the equilibrium paradigm: the role of temporal processes in population genetics and evolution", SMBE session, Vienna, Austria
2011	'Statistical physics of biological systems", BCGS session, Workshop of Bonn-Cologne Graduate School (BCGS), Bonn, Germany

☐ **Other experiences and professional memberships:**

2019 - 2023	Scientific Committee Member, International Research Network (IRN), "Predictability, Adaptation, Navigation"
2018 -	Consultant on Burroughs Wellcome grant "Quantitative and Statistical Thinking in the Life Sciences"
2012 - present	Member, American Physical Society
2010	Member, Society for Molecular Biology and Evolution

August 2021