

ALEX HOLEHOUSE - RESUME

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SUMMARY

Postdoctoral fellow working on understanding emergent complexity in biological systems

EDUCATION

- 2012 - 2017 **Washington University in St. Louis**, Computational Biophysics (PhD)
Thesis title: Sequence Determinants of the Individual and Collective Behaviour of Intrinsically Disordered Proteins (with Prof. Rohit V. Pappu)
- 2010 - 2011 **Imperial College London**, Computer Science (MSc)
Thesis title: System Modelling of Cell Signalling Pathways (with Prof. Yike Guo)
- 2006 - 2010 **University of Oxford, Lincoln College**, Molecular & Cellular Biochemistry (MBioch)
Thesis title: Peptide Carbon Nanotube Interactions in Bilayers (with Prof. Mark Sansom)

PROFESSIONAL & RESEARCH EXPERIENCE

- 2017 - Present **Postdoctoral Fellow**, Washington University in St. Louis
Working on the physics, function, and evolution of biological self-assembly
- 2012 **Bioinformatician**, Mount Sinai School of Medicine, NYC, NY, USA
Building high performance data analysis tools to operate in a massively parallel manner
- 2009 - 2012 **Ad hoc Due Diligence Analyst**, MENAS Consulting, London, UK
- 2008 & 2009 **Summer Research (Experimental Biophysics)**, University of Oxford, UK

SKILLS & SERVICE

- Engineering Expertise in C, C++, Fortran, Python/Cython, Bash, MATLAB, R, SQL, HTML, CSS, TCL, LaTeX. Sysadmin for multiple HPC clusters. Responsible for all hardware, software, networking, and user support (~15 users). Developed various software packages ([CIDER](#), [localCIDER](#), [geeneus](#), [PIMMS](#), [CTraj](#), [ProteomeScoutAPI](#)).
- Teaching TA for Chemistry and Physics of Biomolecules. Developed widely cited machine learning notes (www.holehouse.org/mlclass). Mentoring of graduate, undergraduate and high school students, various access-to-science initiative projects at many levels.
- Reviewer Biochemistry, Biophysical Journal, Current Opinions in Structural Biology, Journal of Lipid Research, Soft Matter

HONOURS / LEADERSHIP

- 2018 Protein Folding Dynamics Gordon Research Conference Travel Awardee
- 2017 Spencer T. and Ann W. Olin Fellowship (Washington University in St. Louis)
- 2017 Co-chair of the IDPs & Aggregates I Platform session, Biophysical Society 61st Meeting
- 2016 - 2018 Chair of the 2018 Intrinsically Disordered Proteins Gordon Research Seminar
- 2016 Best Talk - 23rd Annual Biophysics and Biochemistry Retreat
- 2016 IDP Gordon Research Seminar Travel Awardee
- 2016 Bonnie & Kent Lattig Scholarship (Washington University in St. Louis)
- 2015 Student Research Achievement Award (IDPs), Biophysical Society 59th Meeting
- 2015 Co-chair of the 2015 Protein Folding Consortium conference
- 2014 Student Research Achievement Award (IDPs), Biophysical Society 58th Meeting
- 2014-2015 Graduate student representative on the IDP subgroup council, Biophysical Society
- 2011 Distinguished Thesis, Imperial College London
- 2008-2010 Various awards for sportsmanship, University of Oxford (Half blue, college colors)
- 2007 Nuffield Foundation Summer Research Scholarship

PUBLICATIONS

- - Denotes first or co-first author
 - - Denotes corresponding or co-corresponding author
- 1 ● ■ [2018] Functional implications of intracellular phase transitions
Holehouse, AS & Pappu, RV. *Biochemistry* [*In Press*]
 - 2 [2018] Design principles of an acidic activation domain
Staller, MV., Holehouse, AS., Swain-Lenz, D., Das, RK., Pappu, RV., Cohen, BC. *Cell Systems* [*In press*]
 - 3 ● ■ [2018] Collapse transitions of proteins and the interplay amongst backbone, sidechain, and solvent interactions
Holehouse, AS, Pappu, RV. *Annual Reviews in Biophysics* 47:1 [*In press*]
 - 4 [2018] Protein phase separation by a yeast prion protein promotes cellular fitness
Franzmann, TM., Jahnel, M., Mahamid, J. Holehouse, AS., Poznakowski, P., Richter, D., Nuske, E., Baumeister, W., Grill, S., RK. Pappu, RV., Hyman, AT., Alberti, S. *Science* 359: 6371
 - 5 [2017] Protein and RNA molecules drive multi-layer organization of nuclear speckles
Fei, J., Jadhaliha, M., Harmon, TS., Li, ITS., Hua, B., Freier, SM., Holehouse, AS., Pappu, RV. Prasanth, KV., Ha, T. *Journal of Cell Science* 130: 4180-4192
 - 6 [2017] Intrinsically disordered linkers determine the interplay between phase separation and gelation in multivalent proteins
Harmon, TS., Holehouse, AS, Rosen, MK., Pappu, RV. *eLife* 6: 30294
 - 7 ● [2017] FUS zigzags its way to cross beta
Holehouse, AS., Pappu, RV. *Cell* 171: 499-500
 - 8 [2017] SAXS vs. FRET: A matter of heterogeneity?
Ruff, KM., Holehouse, AS. *Biophysical Journal* 113: 971-973
 - 9 ● [2017] Phase separation of intrinsically disordered proteins yield low-density semidilute liquids
Wei, SMT., Elbaum-Garfinkle, S., Holehouse, AS., Chen, C., Feric, M., Arnold CB., Priestley RD., Pappu RV., Brangwynne CP. *Nature Chemistry*
 - 10 [2017] To mix, or to demix, that is the question
Harmon, TS., Holehouse, AS., Pappu RV. *Biophysical Journal* 112: 565-567
 - 11 ● ■ [2017] CIDER: Resources to analyze sequence-ensemble relationships of intrinsically disordered proteins
Holehouse, AS., Das, RK., Ahad, J., Richardson, MOG., Pappu RV. *Biophysical Journal*, 112: 16-21
[Recommended by F1000]
 - 12 [2017] Allosteric control and evolutionary fine-tuning of conformational ensembles in FimH during host-pathogen interactions
Kalas, V. Pinker, JS., Hannan, TJ., Hibbing, ME., Dodson, KW., Holehouse, AS., Zhang, H. Tolia, NH., Gross, ML., Pappu, RV., Jenetka, J., Hultgren, SJ., *Sciences Advances*, 3: e1601944
 - 13 ● [2016] Sequence determinants of the conformational properties of an intrinsically disordered protein prior to and upon multisite phosphorylation
Martin, EW. Holehouse, AS, Grace, CR., Hughes, A., Pappu RV., Mittag, T. *Journal of the American Chemical Society*, 138: 15323-15335
 - 14 [2016] Sequence determinants of intracellular phase separation by complex coacervation of a disordered protein
Pak, CW., Kosno, M., Holehouse, AS., Padrick, SB., Mittal, A., Ali, M., Yunus, A., Pappu, RV., Rosen, MK. *Molecular Cell*, 63: 72-85
 - 15 ● [2015] Reproducible analysis of proteomes: The relationship between disease-related mutations and post-translational modifications
Holehouse, AS., Naegle, KM. *PLoS One*, 10: e0144692
 - 16 ● [2015] Protein polymers: encoding phase transitions
Holehouse, AS., Pappu, RV. *Nature Materials*, 14: 1083-1084
 - 17 ● [2015] Quantitative assessments of the distinct contributions of polypeptide backbone amides versus sidechain groups to chain expansion via chemical denaturation

- Holehouse, AS.**, Lyle, N., Garai, K. Vitalis, A., and Pappu, RV. **Journal of the American Chemical Society** 137: 2984-2995
- 18 [2015] **OSCAR is a receptor for Surfactant Protein D that activates TNF- α release from human CCR2+ inflammatory monocytes**
Barrow, A., Skjodt, K., **Holehouse, AS.**, Crouch, E., and Colonna, M. **Journal of Immunology** 194:7 3317-3326
- 19 [2015] **ProteomeScout: an integrated repository and analysis resource for post-translational modifications and proteins**
Matlock, M, **Holehouse, A.S.** and Naegle, K. **Nucleic Acids Research**, Vol. 43 D521-D530
- 20 ● [2012] **Developing a novel integrated model of p38 MAPK and glucocorticoid signalling pathways**
Holehouse, A., Yang, X., Adcock, I., Guo, Y. **IEEE Computational Intelligence in Bioinformatics and Computational Biology** 2012, p69.

INVITED PRESENTATIONS: TALKS

- 2018 **Determinants of Sequence-Encoded Coupling Between Single-Chain Properties and Phase Separation in an Archetypal Low Complexity Domain**, Protein Folding Dynamics GRC, January 2017, Galveston, TX
- 2017 **A General Framework for Describing Sequence-Specific Phase Behaviour of Intrinsically Disordered Proteins**, CECAM Intrinsically Disordered Protein Segments Conference, CECAM-FR-MOSER - Institut Henri Poincar, October 2017, Paris, France.
- 2017 **From Sequence to Assembly: How Disordered Proteins Influence Biological Phase Separation and Gelation**, Invited Seminar, University of Oxford, Dept. of Biochemistry, August 2017, Oxford, UK
- 2017 **The Phase Behaviour of Disordered Proteins Underlying Liquid Organelles**, Physical Basis of Cellular Memory & Adaptation Workshop, April 2017, Barbados
- 2017 **Simulations And Experiments Provide A Convergent View Of Protein Unfolded States Under Folding Conditions**, Biophysical Society 61st Meeting, Feb 2017, New Orleans, LA
- 2016 **Phase separation of intrinsically disordered proteins yields low-density “empty” liquids**, CMB Retreat, October 2016, New Haven, MO
- 2016 **Sequence Determinants of Phase Separation in Strong Biological Polyampholytes**, IDP GRS, June 2016, Les Diablerets, Switzerland
- 2016 **Sequence Determinants of the Conformational Properties of an Intrinsically Disordered Protein Prior to and Upon Multi-site Phosphorylation**, Protein Folding Consortium Workshop, June 2016, St. Louis, MO
- 2016 **Physical Principles that Govern the Sequence-encoded Phase Behaviour of Intrinsically Disordered Block-Copolymeric Proteins**, Biophysical Society 60th Meeting, Feb 2016, Los Angeles, CA
- 2014 **Biophysics of Chemical Denaturation**, Gibbs conference on Biothermodynamics, September 2014, Carbondale, IL
- 2014 **Resolving Between Conflicting Models of Protein Denaturation**, Protein Folding Consortium Workshop, May 2014, Ann Arbor, MI

INVITED PRESENTATIONS: POSTERS

- 2018 **Determinants of Sequence-Encoded Coupling Between Single-Chain Properties and Phase Separation in an Archetypal Low Complexity Domain**, Protein Folding Dynamics GRC/GRS, January 2017, Galveston, TX
- 2017 **Inferring emergent evolutionary features from alignments of intrinsically disordered regions despite poor sequence conservation**, ASCB/EMBO 2017, Dec. 2017, Philadelphia, USA
- 2016 **Sequence determinants of phase separation via complex coacervation in IDPs**, IDP GRS/GRC, June 2016, Les Diableret, Switzerland
- 2015 **Decoding the driving forces for the complex phase behavior of polyampholytes**, Gibbs conference on Biothermodynamics, October 2015, Carbondale, IL

- 2015 **CIDER: Classification of Intrinsically Disordered Ensemble Regions**, Protein Folding Consortium Workshop, May 2015, Berkeley, CA
- 2015 **Decoding the driving forces for the complex phase behavior of polyampholytic septal pore proteins**, Intracellular Phase Transitions Conference, May 2015, Princeton, NJ
- 2015 **CIDER: Classification of Intrinsically Disordered Ensemble Regions**, 59th Annual Biophysical Society Meeting, Feb. 2015, Baltimore, MD
- 2014 **Resolving between conflicting models of protein denaturation**, Intrinsically disordered proteins GRC and GRS, Jul. 2014, Stonehill, MA
- 2014 **Parsing the Contributions of Polypeptide Backbones and Sidechains to Denaturation in Concentrated Aqueous Solutions of Urea and Guanidinium Chloride**, 58th Annual Biophysical Society Meeting, Feb. 2014, San Francisco, CA
- 2012 **Developing a novel integrated model of p38 MAPK and glucocorticoid signalling pathways**, CIBCB 2012, San Diego, CA