

# Randal Halfmann, Ph.D.

1000 E. 50<sup>th</sup> Street  
Kansas City, MO 64110  
816-926-4441

## Assistant Investigator

Stowers Institute for Medical Research

[rhn@stowers.org](mailto:rhn@stowers.org)

[www.stowers.org/faculty/halfmann-lab](http://www.stowers.org/faculty/halfmann-lab)

## EDUCATION

---

### Massachusetts Institute of Technology, 2004 – 2010

Ph.D., Biology

Mentor: Susan Lindquist, Ph.D.

Thesis: *Discovery and Characterization of Prions in Saccharomyces cerevisiae*

### Texas A&M University, 2000-2004

B.S., Genetics, *summa cum laude*

## POSITIONS HELD

---

### Stowers Institute for Medical Research

Assistant Investigator, Aug. 2015-present

- Quantitative prion biology
- Contributions of nucleation-limited protein phase separations to cell identity
- Metabolic divisions of labor in *S. cerevisiae* communities

### University of Kansas Medical Center

Adjunct Assistant Professor, April 2016-present

Department of Molecular & Integrative Physiology

### UT Southwestern Medical Center, 2011-2015

Sara and Frank McKnight Fellow

Department of Biochemistry

- Protein polymerization as a paradigm for gene regulation

### Whitehead Institute for Biomedical Research, 2005-2010

Graduate Research Assistant

Laboratory of Susan Lindquist, Ph.D.

- Biochemistry of amyloidogenic proteins
- Biochemistry of protein chaperones
- Cell and evolutionary biology of prions and prion regulation in *S. cerevisiae*

### Texas A&M University, 2002-2004

Undergraduate Research Assistant

Laboratory of David Stelly, Ph.D.

- Plant cytogenetics
- Technology development for cell cycle manipulation

## FUNDING

---

1R01GM130927-01A1, National Institutes of Health NIGMS

\$192,500 annual direct support, 01/01/2020 – 11/30/2023

American Cancer Society, Research Scholar Grant

\$165,000 annual direct support, 01/01/2020 – 12/31/2023

Institutional Funding, Stowers Institute for Medical Research

\$368,388 annual direct support and \$95,000 annual core support, 08/01/2015 – 12/31/2021

Basil O'Connor Starter Scholar, March of Dimes

\$68,182 annual direct support, 04/01/2016 – 03/31/2019

Pilot Project Grant Program, University of Kansas Medical Center Alzheimer's Disease Center

\$28,000 annual direct support, 09/15/2016 – 06/30/2018

NIH Director's Early Independence Award (DP5), National Institutes of Health

\$200,000 annual direct support, 09/01/2011 - 08/30/2016

Sara and Frank McKnight Fellowship, UT Southwestern Medical Center

\$125,000 annual direct support, 01/03/2011 – 08/30/2015 (supplanted by DP5 on 09/01/2011)

## **OTHER HONORS**

---

EMBO/EMBL Symposium Fellowship travel grant, 2018

Endowed Scholar, UT Southwestern Medical Center, 2015 (declined)

CPRIT (Cancer Prevention Research Institute of Texas) Scholar, 2015 (declined)

Sara and Frank McKnight Fellow, UT Southwestern Medical Center, 2011-2015

## **PUBLICATIONS**

**(corresponding authorship; \*equal authorship)**

---

[ORCID ID 0000-0002-6592-1471](https://orcid.org/0000-0002-6592-1471)

## **RESEARCH PAPERS**

Nuckolls NL, Mok AC, Lange JJ, Yi K, Kandola TS, Hunn AM, McCroskey S, Snyder JL, Bravo Núñez MA, McClain ML, McKinney SA, Wood C, Halfmann R, Zanders SE. (2020) The wtf4 meiotic driver utilizes controlled protein aggregation to generate selective cell death. *bioRxiv* doi: 10.1101/2020.02.05.935874

Holliday M, Witt A, Gama AR, Walters B, Arthur C, **Halfmann R**, Rohou A, and Dueber E. (2019) Structures of autoinhibited and polymerized forms of CARD9 reveal mechanisms of CARD9 and CARD11 activation. *Nature Communications* 10, 3070.

Venkatesan S\*, Kandola TS\*, Gama AR, Box A, and **Halfmann R**. (2019) Detecting and Characterizing Protein Self-Assembly *in vivo* by Flow Cytometry. *Journal of Visualized Experiments* (149), e59577.

Khan T\*, Kandola TS\*, Wu J\*, Ketter E\*, Venkatesan S\*, Lange JL, Gama AR, Box A, Unruh JR, Cook M, and **Halfmann R**. (2018) Quantifying nucleation *in vivo* reveals the physical basis of prion-like phase behavior. *Molecular Cell* 7(1), 155-168.

Zhang XF, Sun R, Guo Q, Zhang S, Meulia T, **Halfmann R**, Li D, Qu F. (2017) A self-perpetuating repressive state of a viral replication protein blocks superinfection by the same virus. *PLoS Pathogens* 13(3): e1006253

Close DW, Don Paul C, Langan PS, Wilce MC, Traore DA, **Halfmann R**, Rocha R, Waldo GS, Payne RJ, Rucker JB, and Prescott M. (2015) TGP, an extremely stable, non-aggregating fluorescent protein created by structure-guided surface engineering. *Proteins: Structure, Function, and Bioinformatics* 83(7), 1225-1237.

Cai X, Chen J, Xu H, Liu S, Jiang Q, **Halfmann R**, and Chen ZJ. (2014) Prion-like polymerization underlies signal transduction in antiviral immune defense and inflammasome activation. *Cell* 156(6), 1207-1222.

Holmes DL, Lancaster AK, Lindquist S, and **Halfmann R**. (2013) Heritable remodeling of yeast multicellularity by an environmentally responsive prion. *Cell* 153(1), 153-165.

Wang G, Wang X, Yu H, Wei S, Williams N, Holmes DL, **Halfmann R**, Naidoo J, Wang L, Li L, Chen S, Harran P, Lei X, Wang X. (2013) Small-molecule activation of the TRAIL receptor DR5 in human cancer cells. *Nature Chemical Biology* 9, 84–89.

**Halfmann R\***, Wright J\*, Alberti S, Lindquist S, Rexach M. (2012). Prion formation by a yeast GLFG nucleoporin. *Prion* 6(4).

**Halfmann R\***, Jarosz DF\*, Jones SK, Chang A, Lancaster AK, Lindquist S. (2012). Prions are a common mechanism for phenotypic inheritance in wild yeasts. *Nature* 482(7385), 363-8.

**Halfmann R\***, Alberti S\*, Krishnan R, Lyle N, Pappu R, Lindquist S. (2011). Opposing effects of glutamine and asparagine govern prion formation by intrinsically disordered proteins. *Molecular Cell* 43(1), 72-84.

O'Donnell CW, Waldispühl J, Lis M, **Halfmann R**, Devadas S, Lindquist S, Berger B. (2011). A method for probing the mutational landscape of amyloid structure. *Bioinformatics* 27(13):i34-42

Alberti S\*, **Halfmann R\***, King O, Kapila A, and Lindquist S. (2009). S. A systematic survey identifies prions and illuminates sequence features of prionogenic proteins. *Cell* 137, 146-58.

**Halfmann R** and Lindquist S. (2008). Screening for Amyloid Aggregation by Semi-Denaturing Detergent-Agarose Gel Electrophoresis. *Journal of Visualized Experiments* 17.

Douglas P, Treusch S, Ren H, **Halfmann R**, Duennwald M, Lindquist S, and Cyr D. (2008). Chaperone-dependent amyloid assembly protects cells from prion toxicity. *Proc. Natl. Acad. Sci. USA* 105, 7206-7211.

**Halfmann R**, Stelly DM, and Young DH. (2007). Towards Improved Cell Cycle Synchronization and Chromosome Preparation Methods in Cotton. *Journal of Cotton Science* 11:60–67.

## **REVIEWS AND PERSPECTIVES**

**Halfmann R**. (2016). A glass menagerie of low complexity sequences. *Current Opinion in Structural Biology* 38, 9–16.

**Halfmann R**, Lindquist S. (2010). Epigenetics in the extreme: Prions and the inheritance of environmentally acquired traits. *Science* 330(6004), 629-32.

Alberti S, **Halfmann R**, and Lindquist S. (2010). Biochemical, cell biological and genetic assays to analyze amyloid and prion aggregation in yeast. For: *Guide to Yeast Genetics: Functional Genomics, Proteomics, and Other Systems Analysis, 2<sup>nd</sup> Ed. Methods in Enzymology* 470, 709-731.

**Halfmann R**, Alberti S, Lindquist S. (2010). Prions, protein homeostasis, and phenotypic diversity. *Trends in Cell Biology* 20, 125-33.

## **INVITED LECTURES**

---

*Title TBD.* Telluride Science Research Center Workshop: Plasticity in Biological Organization. Telluride, CO. 22 September 2020

*Kinetic control of proteins by ordered self-assembly.* Workshop on The Physical Basis of Cellular Memory and Adaptation. Bellairs Research Institute of McGill University. Holetown, Barbados. 17 April 2020

*Protein Self-Assembly Governs Cell Fate.* BioFrontiers Seminar Series. University of North Texas. Denton, TX. 17 January 2020

*Kinetic control of proteins by ordered self-assembly in vivo.* Midwest Regional Meeting of the American Chemical Society. Wichita, KS. 16 October 2019

*Quantifying nucleation in vivo reveals the physical basis of prion-like phase behavior.* Young Investigator Speaker. 32nd Annual Symposium of The Protein Society. Boston, MA. 09 July 2018

*Cell Fate Determination by Prions.* KU Cancer Center Cancer Biology Retreat. Olathe, KS. 8 June 2018

*Deconstructing nucleation barriers in living cells.* Workshop on The Physical Basis of Cellular Memory and Adaptation. Bellairs Research Institute of McGill University. Holetown, Barbados. 14 April 2018

*Rapid discovery and quantification of prion-like behavior in proteins.* Genetics and Genomics (G2) Seminar Series. Texas A&M University. 5 March 2018

*Deconstructing nucleation barriers to reveal the physical basis of prion behavior.* Jones Seminars on Science, Technology, and Society. Dartmouth College. 9 February 2018

*Rapid, Quantitative Discovery of Prion-like Protein Activity.* Neurology Seminar Series. University of Massachusetts Medical School. 28 November 2017

*Mapping the Quinary Protein Folding Landscape.* Biochemistry and Molecular Biophysics Seminar Series. Kansas State University. 31 August 2017

*Discovery and Biological Characterization of Prion-like Switches.* Neurology Grand Rounds. University of Kansas Medical Center. 4 August 2017

*Protein-based Self-Perpetuating Changes in Gene Expression.* ASBMB Special Symposium: Evolution and Core Processes in Gene Expression. Stowers Institute, Kansas City, MO. 14 July 2017

*Nucleation Barriers Govern Protein Function and Dysfunction.* Susan Lindquist Legacy Symposium. Whitehead Institute, Cambridge, MA. 8 July 2017

*Nucleation Landscapes Govern Protein Function and Dysfunction.* FASEB Protein Aggregation in Health and Disease Conference. Steamboat Springs, CO. 12 June 2017

*Prions Propagate Innate Immune Signaling.* Science Friday Talks. Kansas City University of Medicine and Biosciences. 5 May 2017

*Biological Consequences of Nucleation-Limited Protein Phase Behavior.* Workshop on The Physical Basis of Cellular Memory and Adaptation. Bellairs Research Institute of McGill University, Barbados. 20 April 2017

*Prions Propagate Innate Immune Signaling*. Microbiology, Molecular Genetics & Immunology Seminar Series. University of Kansas Medical Center. 26 Jan. 2017

*Quantitative Prion Biology*. Biochemistry and Molecular Biology Guest Seminar. University of Kansas Medical Center. 16 Dec. 2016

*Collective Behavior in a Unicellular Eukaryote*. Conflict and Cooperation in Cellular Populations. NCBS-Instem, Bangalore, India. 16 Oct. 2016

*Quantitative Prion Biology*. Student-invited Biochemistry Seminar Series. University of Pennsylvania. 29 Sep. 2016

*Quantitative Prion Biology*. Workshop on The Physical Basis of Cellular Memory and Adaptation. Bellairs Research Institute of McGill University, Barbados. 20 April 2016

*Quantitative Prion Biology*. School of Biological Sciences Seminar. University of Missouri-Kansas City. 17 March 2016

*Quantitative Prion Biology*. Physiology Seminar Series. University of Kansas Medical Center. 14 March 2016

*Functional cell fate determination by self-templated protein aggregation*. KU Cancer Center Seminar Series. University of Kansas Medical Center. 2 Feb. 2016

*The Social Lives of Prions*. FASEB Molecular Mechanisms and Physiological Consequences of Protein Aggregation. West Palm Beach, FL. 24 June 2015.

*The Social Lives of Prions*. Pathology Seminar Series. Case Western Reserve University. 18 May 2015

*Detection and Functional Characterization of Prion-Like Protein Self-Assembly*. NIH Common Fund High-Risk High-Reward Symposium. National Institutes of Health, Bethesda, MD. 17 Dec. 2014

*Prions functionally decide cell fate*. Biology Seminar Series. University of Texas at Arlington. 9 Oct. 2014

*Social behaviors driven by protein aggregation in budding yeast*. Harvard FAS Center for Systems Biology. Cambridge, MA. 25 Sep. 2013

*Prion-driven multicellularity in budding yeast*. Gordon Conference on Stress Proteins in Growth, Development and Disease. Mt. Snow, VT. 10 July 2013

*Prion-driven multicellularity in budding yeast*. Human Genetics Seminar Series. University of Michigan Medical School. 4 Dec. 2012

*Heritable remodeling of facultative multicellularity by an environmentally responsive prion*. 2012 Gordon Conference on Intrinsically Disordered Proteins. Mt. Snow, VT. 11 July 2012

*Environmentally regulated prion switching heritably remodels yeast social behaviors*. 39<sup>th</sup> Annual Meeting of the Texas Genetics Society. San Antonio, TX. 23 March 2012

## **TEACHING AND MENTORING**

---

**Co-Instructor, Graduate Cell Biology:** 2015 – present

- Design curriculum and deliver lectures on Protein Folding and Phase Transitions.

**Co-Instructor, Responsible Conduct in Research:** 2019 -- present

- One of three faculty delivering a lecture on Responsible authorship, publication, and peer review to SIMR scientific trainees and staff

#### **Trainees**

- Alejandro Rodriguez Gama, Stowers Institute PhD student (06/2017 – present)
- Tejbir Kandola, Open University PhD student (02/2017 – present)
- Jianzheng Wu, KU Medical Center PhD student (05/2016 – present)
- Shriram Venkatesan, Postdoc (03/2016 – present)
- Tarique Khan, Postdoc (09/2013 – 07/2017); now an Antibody Scientist at 23andMe

**Mentor** for high school students enrolled in the Center for Advanced Professional Studies (CAPS) Bioscience program: 2017, 2019

### **PROFESSIONAL INVOLVEMENT**

---

Leadership:	Programming Committee, 2021 FASEB Protein Aggregation conference
Service:	SIMR Institutional Biosafety Committee, Faculty Representative, 09/26/2019 – present Graduate School of SIMR Student Rotation Committee, 09/2017 – present
Memberships:	American Chemical Society, Protein Society, Genetics Society of America, American Society for Cell Biology, American Association for Cancer Research
Ad Hoc Reviewer:	NIH, Wellcome Trust, Science, PNAS, Journal of Biological Chemistry, Biophysical Journal, PLoS Genetics, Journal of Molecular Biology, PLoSOne, Prion, JoVE, FEMS Yeast Research, Proteomics, Semin Cell Dev Biol, Biology Open, Cell Reports, etc.