**Matthew Ryan King**

Ruth L. Kirschstein NRSA Post-Doctoral Fellow

Department of Biomedical Engineering

Washington University in St. Louis

matthewking@wustl.edu

**Education and training**

**Post-Doctoral Research Associate Washington University**

Advisor:Rohit V. Pappu, Ph.D. – Biomedical Engineering 2019-Present

**Ph.D., Molecular Biology**  **Princeton University**

Advisor: Sabine Petry, Ph.D. – Department of Molecular Biology 2013 – 2019

Thesis: Regulation of Branching Microtubule Nucleation

**Post-Baccalaureate Fellow** - Intramural Research Training Award **NIH/NIDDK**

Advisor: Elissa P Lei, Ph.D. 2011-2013

**B.S., Biological Sciences** and **Neuroscience -** Honors with Distinction **University of Delaware**

Advisor: Melinda K. Duncan, Ph.D. - Department of Biological Sciences 2007-2011

Thesis: The Distribution and Role of Fibronectin in the Ocular Lens

**International Baccalaureate Diploma** **South Africa**

American International School of Johannesburg 2006-2007

**Publications** **Matthew R. King**, Kiersten M. Ruff, Andrew Z. Lin, Avnika Pant, Mina Farag, Tingting Wu, Wei Ouyang, Matin Fossat, Matthew D. Lew, Michael D. Vahey, Emma Lundberg, Rohit V. Pappu. Macromolecular condensation organizes nucleolar sub-phases to set up a pH gradient. *Cell*, 2024

**Matthew R. King**, Kiersten M. Ruff, Rohit V. Pappu. Emergent microenvironments of nucleoli. *Nucleus*

Andrew Z. Lin\*, Kiersten M. Ruff\*, Furqan Dar\*, Ameya Jalihal, **Matthew R. King**, Jared M. Lalmansingh, Ammon E. Posey, Ian Seim, Amy S. Gladfelter, and Rohit V. Pappu. Dynamical Control Enables the Formation of Demixed Biomolecular Condensates. *Nature Communications.* 2023.\*Co-first Authors

Aidan J. Flynn, Kari Miller, Jennette M. Codjoe, **Matthew R. King**, Elizabeth S. Haswell. Mechanosensitive Ion Channels MSL8, MSL9, and MSL10 Have Environmentally Sensitive Intrinsically Disordered Regions with Distinct Biophysical Characteristics in Vitro. *Plant Direct* 2023

Sagar U. Setru\*, Bernardo Gouveia\*, **Matthew R. King**, Aaron Hamlin, Joshua W. Shaevitz, Howard A. Stone, and Sabine Petry. Acentrosomal spindles assemble from branching microtubule nucleation near chromosomes. *Nature Communications*. 2023. \*Co-first Authors

Jodi Kraus\*, Sophie M. Travis\*, **Matthew R. King,** and Sabine Petry. Augmin is a Ran-regulated spindle assembly factor. *Journal of Biological Chemistry*. 2023. \*co-first authors

Renu Maan\*, Louis Reese\*, Vladimir A. Volkov\*, **Matthew R. King**, Eli van der Sluis, Nemo Andrea, Wiel Evers, Arjen J. Jakobi, and Marileen Dogterom. “Multivalent Interactions Facilitate Motor-Dependent Protein Accumulation at Growing Microtubule plus Ends,” *Nature Cell Biology*. 2022 \*co-first authors

Mohammad S. Safari\*, **Matthew R. King\***, Clifford P. Brangwynne, and Sabine Petry. “Branching Microtubule Nucleation Is Controlled by Importin-Mediated Inhibition of TPX2 Phase Separation.” *Journal of Biological Chemistry*. 2021. \*Co-first Authors

**Matthew R. King**, and Sabine Petry. Phase separation of TPX2 enhances and spatially coordinates microtubule nucleation. *Nature Communications.* 2020

Jae-Geun Song, **Matthew R. King**, Rui Zhang, Rachel Kadzik, Akanksha Thawani, and Sabine Perty. Mechanism of how Augmin directly targets the γ-tubulin ring complex to microtubules. *Journal of Cell Biology.* 2018.

**Matthew King** and Sabine Perty. Visualization and analysis of branching microtubule nucleation using meiotic *Xenopus* Egg extracts and TIRF microscopy. *Methods in Molecular Biology “The Mitotic Spindle.”*2016.

**Matthew R. King**, Leah Matzat, Ryan P. Dale, Su Jun Lim, and Elissa P Lei. The RNA-binding protein Rumpelstiltskin antagonizes gypsy chromatin insulator function in a tissue-specific manner. *Journal of Cell Science*. 2014.

**Publications in revision:**Tingting Wu, **Matthew R. King**, Mina Farag, Rohit V. Pappu, and Matthew D. Lew. Single Fluorogen Imaging Reveals Spatial Inhomogeneities within Biomolecular Condensates. *bioRxiv*. 2023. *In revision* at *Nature Physics*

Sean Wang\*, Rohit Gupta, Ananya Benegal, Anushree Seth, Michael Vahey, Rajan Chakrabarty, Rohit Pappu, and Srikanth Singamaneni**,** Joseph Puthussery, **Matthew King** A High-Avidity, Thermostable, and Low-Cost Synthetic Capture for Ultrasensitive Detection and Quantification of Viral Antigens and Aerosols. \*co-corresponding authors. *In revision at* *ACS Sensors*

**Meeting abstracts**

**Talks:**

**Matthew R. King**, Nikita Gupta, Martin J. Fossat, and Rohit V. Pappu. Dissecting the contributions of D/E tracts to setting up nucleolar pH gradients and complexities of complex coacervation. EMBO | EMBL Symposium: Cellular mechanisms driven by phase separation. Heidelberg, Germany. May 2024

**Matthew R. King**, Kiersten M. Ruff, Andrew Z. Lin, Avnika Pant, Mina Farag, Tingting Wu, Wei Ouyang, Matthew D. Lew, Michael D. Vahey, Emma Lundberg, Rohit V. Pappu. Macromolecular condensation organizes nucleolar sub-phases to set up a pH gradient. EMBO Workshop: Epigenetics and condensates in lineage decisions. Dresden, Germany. October 2023 **Matthew R. King**, Andrew Z. Lin, Kiersten M. Ruff, Mina Farag, Wei Ouyang, Michael D. Vahey, Emma Lundberg, Rohit V. Pappu. Bottom-up biochemical reconstitutions of nucleolar substructures. FASEB SRC: Nuclear Bodies. Nova Scotia, Canada. July 2022

**Matthew R. King**, Andrew Z. Lin, Kiersten M. Ruff, Wei Ouyang, Michael D. Vahey, Emma Lundberg, Rohit V. Pappu. Distinct features of nucleolar proteins contribute to driving forces for assembly and ribosomal RNA flux. EMBO | EMBL Symposium: Cellular mechanisms driven by phase separation. Heidelberg, Germany. May 2022

**Matthew R King** and Rohit V. Pappu Toward in vitro reconstitutions and functional characterizations of the fibrillar centers of nucleoli. Biophysical Society Annual Meeting: Intrinsically Disordered Proteins and Protein Assemblies subsections (two talks). Held virtually. February 2021

**Matthew R. King**, and Sabine Petry. Biomolecular condensation of the microtubule nucleation effector TPX2 enhances reaction kinetics *in vivo*. Cytoskeletal Motors from Structure to Mechanism to Disease, Gordon Research Conference, Mt. Snow, Vermont. July 2018

**Matthew R. King**, and Sabine Petry. Biomolecular condensation of the microtubule nucleation effector TPX2 enhances reaction kinetics *in vivo*. EMBL/EMBO Symposium: Cellular Mechanisms Driven by Liquid Phase Separation, Heidelberg, Germany. May 2018

**Posters** (selected)**:**

**Matthew R. King**, Andrew Z. Lin, Kiersten M. Ruff, Mina Farag, Wei Ouyang, Michael D. Vahey, Emma Lundberg, Rohit V. Pappu. Uncovering molecular grammars of intrinsically disordered regions that organize nucleolar fibrillar centers. Keystone Symposia - Biomolecular Condensates: Emerging Cellular and Biophysical Roles, Vancouver, Canada. January 2023

**Matthew R. King**, and Sabine Petry. Phase separation of TPX2 enhances and spatially coordinates microtubule nucleation. Biomolecular Condensates: Phase-Separated Organizers of Cellular Biochemistry, Snowbird, Utah, USA. April 2019

Louis Reese, **Matthew King**, Renu Maan, Vladimir Volkov, Eli van der Sluis, Roland Dries, Marileen Dogterom. Liquid-liquid phase separation of microtubule end-binding proteins. EMBL/EBMO Symposium: Cellular Mechanisms Driven by Liquid Phase Separation,, Heidelberg, Germany. May 2018

**Matthew R. King**, and Sabine Petry. The Branching Microtubule Nucleation factor Augmin is RanGTP regulated. Microtubules: From atoms to complex systems, EMBL/EBMO Symposium: Microtubules, Heidelberg, Germany. May 2016

**Matthew R. King**, Ryan P. Dale, Leah Matzat, and Elissa P Lei. A ubiquitously expressed RNA-binding protein antagonizes chromatin insulator activity in a tissue-specific manner, Gordon Research Conference: Epignetics, Smithfield, Rhode Island. August 2013

**Matthew R. King**, Ryan P. Dale, Leah Matzat, and Elissa P Lei. Identification of an RNA Binding Protein Involved in Chromatin Insulation, 54th Drosophila Research Conference, Washington DC. April 2013

**Matthew R. King**, and Elissa P Lei. Identification of an RNA Binding Protein Involved in Chromatin Insulation, Genetics Society of America Meeting: Model Organisms to Human Biology, Washington DC, June 2012

**Matthew R. King** and Melinda K. Duncan. Fibronectin in the Ocular Lens, American Society of Biochemistry and Molecular Biology meeting, Experimental Biology, Washington DC. April 2011

**Research activities**

Physiology post-course research fellowship Spring 2018 (2mo)

Laboratory of Marileen Dogterom Delft, Netherlands

Department of Bionanosciences, Technical University of Delft

Student in 124th Physiology Course Summer 2017

PIs: Stephan Grill, Ibrahim Cisse, and Marileen Dogterom Woods Hole, MA

Marine Biological Laboratory

Whitman scholars graduate student researcher Summer 2016

PIs: Sabine Petry and Simone Reber Woods Hole, MA

Marine Biological Laboratory

**Invited Talks**

Max Plank Institute for Molecular Genetics (Host: Matt Kraushar) October 2023

Radboud University (Host: Evan Spruijt) May 2022

Allen Institute for Cell Science (Virtual; Host: Susanne Rafelski) April 2022

**Courses taught**

**Summary:** I have taught or co-taught 20 credit-bearing college courses and one noncredit-bearing seminar.

**Prison Education Project at Washington University in St. Louis**

BIO101 (U29 – 101P) – General Biology I Spring 2023

Lead Instructor, Missouri Eastern Correctional Center

BIO4391 (U29 – 4391) – Modern Genetics Fall 2021

Co-Lead Instructor, Missouri Eastern Correctional Center

BIO101 (U29 – 101P) – General Biology I Spring 2020

Lead Instructor, Missouri Eastern Correctional Center

**Prison Teaching Initiative at Princeton University** in partnership with Raritan Valley Community College (RVCC) and Mercer Country Community College (MCCC)

BIOL142 - Human Nutrition Fall 2020

Lead Instructor - RVCC, Multiple correctional facilities (correspondence course)

CHEM101 - Introductory Chemistry for non-majors Fall 2018

Assistant Instructor - MCCC, Ft. Dix Federal Corrections Institution

BIO113 - Introductory Biology with Lab for non-majors Spring 2018

Lead Instructor - MCCC, Ft. Dix Federal Corrections Institution

BIOL111 - Introductory Biology with Lab for non-majors Fall 2017

Instructor - RVCC, Edna Mahan Correctional Facility for Women

BIOL111 - Introductory Biology with Lab for non-majors Fall 2017

Lead Instructor - RVCC, Garden State Correctional Facility

How to be a scientist – weekly seminar (not for credit) Fall 2017

Co-Lead Instructor - Ft. Dix Federal Corrections Institution

BIOL111 - Introductory Biology with Lab for non-majors Spring 2017

Co-Lead Instructor - RVCC, Albert C Wagner Correctional Facility

BIO113 - Introductory Biology with Lab for non-majors Spring 2017

Lead Instructor - MCCC, Ft. Dix Federal Corrections Institution

BIOL120 – Human Biology with Lab for non-majors Fall 2016

Co-Lead Instructor - RVCC, Albert C Wagner Correctional Facility

BIO113 – Introductory Biology with Lab for non-majors Spring 2016

Co-Lead Instructor - MCCC, East Jersey State Penitentiary

BIO114 – Environmental Science Fall 2015

Co-Lead Instructor - MCCC, Mountain View Correctional Facility

MAT125 – Statistics I Spring 2015

Instructor - MCCC, East Jersey State Penitentiary

BIO114 - Environmental Science Spring 2014

Assistant Instructor - MCCC, Garden State Correctional Facility

**Princeton University – Department of Molecular Biology**

MOL345 – Biochemistry - Advanced lecture-based course Spring 2016

Assistant Instructor to Professors Petry and Cristea – independent lead of precept section

MOL214 - Introductory Biology with Lab for Molecular Biology majors Fall 2016

Assistant Instructor to Professors Theiringer, Gitai, and Nottermen - independent lead of lab section

**University of Delaware – Department of Biology**

BISC208 - Introductory Biology II with Lab for science majors Spring 2011

Assistant Instructor to Professor Nauen - independent lead of a lab section

BISC207 - Introductory Biology I with Lab for science majors Fall 2010

Assistant Instructor to Professor Nauen - independent lead of a lab section

BISC104 - Introductory Biology with Lab for non-science majors Spring 2010

Assistant Instructor to Professor Walsh – assistant to the lead of a lab section

**Awards and fellowships**

Ruth L. Kirschstein NRSA Postdoctoral Fellowship (F32) 2022-2024

1F32GM146418-01A1 - NIH/NIGMS

Travel Grant – FASEB SRC: Nuclear Bodies 2022

Post-doctoral award – Biophysical Society, Intrinsically Disordered Proteins 2021

Best Presentation – Department of Molecular Biology annual retreat 2018

Travel Grant - EMBL/EMBO Symposium on Phase Separation 2018

Physiology Post-Course Research Fellowship - Dogterom Lab at TU Delft 2018

Physiology Course Scholarship - Marine Biological Laboratory 2017

Graduate Fellowship Honorable Mention - National Science Foundation 2015

Graduate Molecular Biology Training Grant (5T32GM007388-39) - NIH 2014-2017

Most outstanding undergraduate researcher in biology - University of Delaware 2011

Summer Research Scholarships – University of Delaware 2009 and 2010

Merit Scholarship - University of Delaware 2007-2011

**Leadership and service**

**Leadership roles in prison education**:

* Member of curriculum and advising committee, Prison Education Project at Washington University in St. Louis (2019-2022 - committee disbanded)
* Presenter at the National Conference in Higher Education in Prison – “How to Implement a Rich STEAM Curriculum inside Correctional Facilities” (2019)
* Member of the leadership team, Prison Teaching Initiative at Princeton University (2016-2019)
	+ Science Committee Chair - Prison Teaching Initiative at Princeton University and the McGraw Center for Teaching and Learning; funded by Liechtenstein initiative on self-determination (2018-2019)
	+ Assistant Administrator for Federal Prison Initiatives, Prison Teaching Initiative at Princeton University; funded by Liechtenstein initiative on self-determination (2017-2018)
	+ University Administrative Fellow for coordinating tutoring, Prison Teaching Initiative at Princeton University; funded by the Office of the Dean of the Graduate School (2016-2017)

**Leadership roles in the Molecular Biology Department at Princeton University**:

* Chair of Community and Adult Outreach - Graduate Molecular Biology Outreach Program Department of Molecular Biology (2014-2018)
* Lead organizer – Weekly departmental Symposium Series (2015-16)
* Lead organizer – Incoming Graduate Class Hike (2016)
* Co-organizer - Graduate Student Recruitment (2016)
* Lead organizer – Departmental Holiday Party (2015)

**Other leadership Roles**:

* Q’nections Family Leader – LGBT+ center, Princeton University (2016-17)
* Volunteer Tour guide and Docent – Human Genome Exhibit, Smithsonian National Museum of Natural History, Washington DC. (2013-15)
* Vice president – Amnesty International University of Delaware Chapter (2009-2011)
* Tutor – University of Delaware (2008-2011)

**Refereed Manuscripts for**: PNAS, Molecular Cell, Genetics, Molecular and Cellular Biology (MCB), Public Library of Science ONE (PLOS ONE), Biochimica et Biophysica Acta (BBA), and Bioessays

**Students Mentored**:

*Washington University in St. Louis*:

* Undergraduate researcher mentees: Olivia Lazorik (2021-2024) and Kaitlyn Hardesy (2020-2022)
* Graduate student mentees (rotations and on-boarding): Avnika Pant (2023) and Nikita Gupta (2022)

*Princeton University*:

* Career development mentor to former PTI (Prison Teaching Initiative) student Steven Contraras. Carried out in partnership with the Princeton Class of ’94 service project and PTI (2023)
* Graduate student mentees (rotations and on-boarding): Bahar Javdan (2016), Sagar Setru (2016), Michael Rale (2016), and Akanksha Thawani (2015)
* Undergraduate researcher mentee (senior thesis supervisor): Aparna Ragu (2017-2018)
* Undergraduate student mentees (biophysics summer REU program): Edger B Mejia (2015) and Rebecca Berg (2014)

**Interviewed and quoted in**:

Tanaka, Kurtis, and Danielle Cooper. Forthcoming report following up "Advancing Technological Equity for Incarcerated College Students: Examining the Opportunities and Risks." Ithaka S+R. (pending)

Feder, Toni. “Teaching Science in Prisons Brings Rewards.” *Physics Today* 73, no. 5 (May 1, 2020)

**Intellectual property and patents**

“Rapid, high sensitivity, digital assays for antigen detection” (co-inventor; chief inventors - Anushree Seth and Srikanth Sinamaneni). Intellectual property publicly disclosed (03/2021), patent application filed (09/2022)