



Emergent Mechanisms in Biology of
Robustness, Integration & Organization

Emergence: A biweekly newsletter of discovery, education, and outreach from the EMBRIO Institute

Issue 21: September 7, 2023

DIRECTORS' NOTE

We hope you all had an enjoyable Labor Day holiday weekend. Thank you to all who led, organized, taught, and participated in summer EMBRIO events. A total of 41 trainees and faculty participated in the summer workshop hosted at Notre Dame that focused on image acquisition, processing, and analysis. [Slides, handouts, and video recordings](#) from this workshop are available on our shared Box account.

The annual retreat, hosted again this year at Purdue in July, brought together the large majority of EMBRIO members in one physical place, with more than 60 of us engaging in research talks, poster presentations, programmatic discussions, and informal gatherings. [Slide decks and posters from the annual retreat](#) can be accessed on Box.

If you haven't yet weighed in with your evaluation of either the summer workshop or the annual retreat, please do so in the next week at these links: [workshop survey](#), and [annual retreat survey](#).

As we are now officially starting year three of our NSF Biology Integration Institute activity, the leadership team (which has expanded to include Dr. Janice Evans and Dr. Jeremy Zartman, both Co-PIs on the NSF grant award) shares our excitement for progress and discovery with all EMBRIO investigators in integrated research, education, and diversity activity. On this note, we have several opportunities lined up for Institute-wide learning and ongoing exchange highlighted in this issue. If you haven't yet reviewed the [draft EMBRIO products and achievement tracking checklist](#) helpful for documenting your progress, please check it out, along with [Institute competencies](#) currently being developed with your input that solidly point to 'what makes an EMBRIO trainee special'.

Be sure to check out this issue's member spotlight of Morehouse College Site Lead and Core Imaging Co-Lead, Dr. Juana Mendenhall. Also, be sure to check out the recent journal publications cited in this issue. Mark your calendar for upcoming mini-workshops exclusively for EMBRIO by Dr. Linlin Li (Solving ODE's & PDE's – Sept. 11th and 18th), Dr. Adrian Buganza Tepole (Physics Informed Machine Learning, Sept. 25th and Oct. 2nd) and an in-person mentoring workshop 3-4pm on October 23rd led by Dr. Anjali Iyer-Pascuzzi, followed by an EMBRIO Open House, 4 – 5pm in the Hall for Discovery Learning and Research on the Purdue campus. Details will be shared in a future announcement.

We want to hear about your news and announcements. Send them to Brent (laddb@purdue.edu) by September 15th for inclusion in the next issue of *Emergence*.

David, Chris, Stephanie, Anjali, Janice, Jeremy, and Brent

Notable Quote

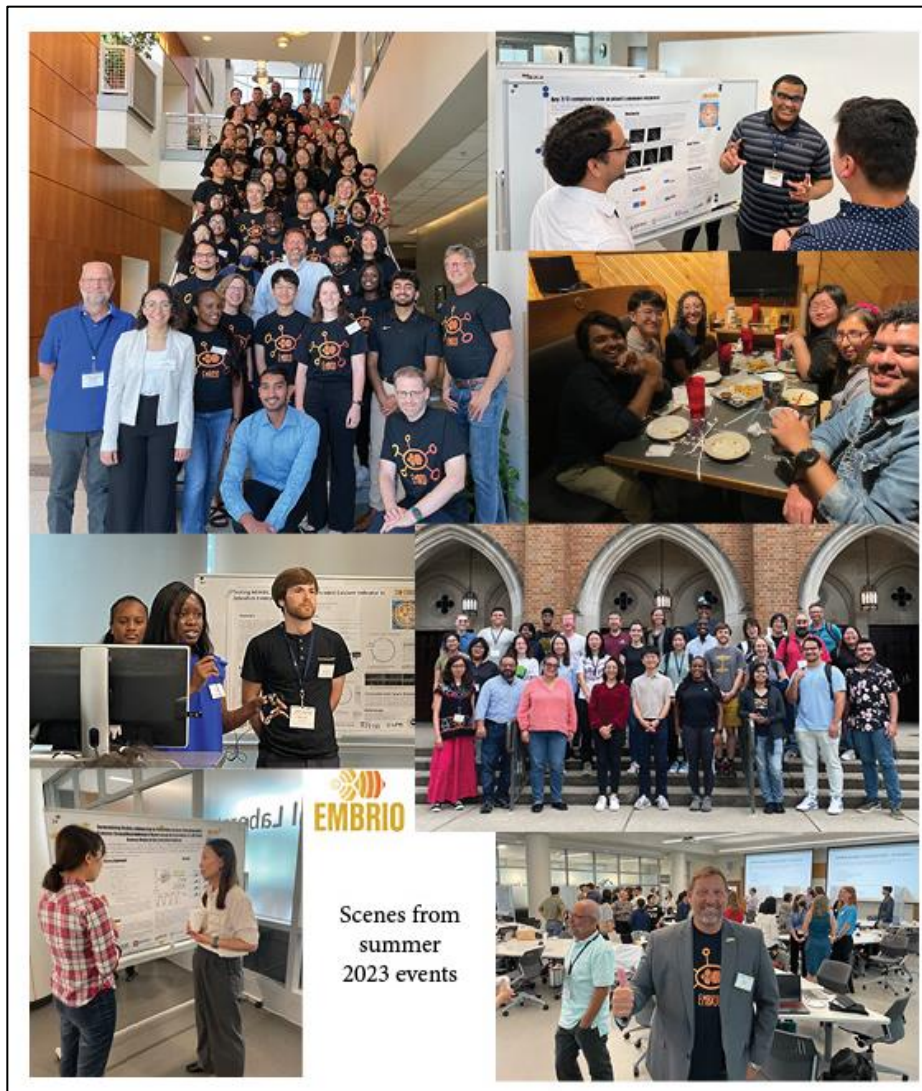
"In questions of science, the authority of a thousand is not worth the humble reasoning of a single individual."
~Galileo Galilei

QUICK LINKS

[Summer workshop materials](#)

[Annual Retreat slides and posters](#)

[Weekly Update Meeting Recordings](#)



EMBRIO SUMMER WORKSHOP RESOURCES

EMBRIO Institute's 2nd Annual Summer Training Workshop took place July 10-12. [Workshop Schedule of Sessions](#). Hosted by Dr. Jeremiah Zartman at the University of Notre Dame with a theme of *Image Acquisition, Processing, and Analysis*, tutorials and hands-on sessions were specifically aimed at benefiting trainees from both computational and experimental domains. Slides, handouts, and video recordings from this workshop are available on our shared Box account: <https://app.box.com/s/mzo5ihlqiq4tfeig2psx2l6rmmdxto0c>

EMBRIO ALL-HANDS ANNUAL RETREAT MATERIALS

EMBRIO Institute's Annual Retreat was hosted in the Weldon School of Biomedical Engineering on the Purdue University West Lafayette Campus, July 13-14, 2023. The annual retreat brought together the large majority of EMBRIO members in one physical place, with more than 60 of us engaging in research talks, poster presentations, programmatic discussions, and informal gatherings. Slide decks and posters from the annual retreat can be accessed here: <https://app.box.com/s/rmsiuvydlsccezhugyjp2b5v72xl9l>

EMBRIO ABIDES (Access, Belonging, Inclusion, Diversity, Equity, Support)

Dr. Anjali Iyer-Pascuzzi, EMBRIO ABIDES Director and Professor at Purdue, leads activities for Institute members. A series of mentoring topics will be presented at the beginning of Weekly meetings, and a continuation of the Mentoring Panel topics from the annual retreat will be presented October 23rd during the EMBRIO Weekly time.

JOURNAL CLUBS

Journal club on Calcium Imaging Techniques meets Monday's 11am ET

Due to the need within our EMBRIO community to process and analyze Ca²⁺ Images, Dr. Norma Perez Rosas (nperezro@purdue.edu) is helping lead this club in discussing papers regarding methods and tools for analyzing calcium imaging. **The goal, beyond integrating these techniques, is to write a review paper.** The Club is meeting weekly on Mondays at 11am. Please contact Norma about participating.

Journal Club on Multimodal Functions of Calcium in Tuning and Regulating Cytoskeleton Networks

Please contact Dr. Linlin Li (li2212@purdue.edu) for information. The club is in the writing stage for organizing and publishing a review paper on the topic. It isn't too late to join. Here is the link to the current working documents:

https://docs.google.com/document/d/1Cpg77yjtioWiluRmiDMCcAiAd4jNNX_J7s64RQk8xOU/edit?usp=sharing

STUDENT LEADERSHIP COUNCIL CORNER

The SLC is recruiting new officers to represent your university and your perspective for EMBRIO. Reach out to David Gazzo (dgazzo@nd.edu), Feyisayo Akande (fakande@purdue.edu), and Jazzmin Owens (jazzmin.owens@morehouse.edu) for more information, and [log your ideas for future topics or events](#) that the SLC could organize. [Access SLC slides and documents](#), and consider [signing up to give or receive mentoring](#) for/from EMBRIO trainees in helping support and orient to the EMBRIO mission and interdisciplinary framework.

R CAFÉ SERIES – FALL SEMESTER

Dr. Priyanka Baloni & Dr. Anke Tukker are hosting a bi-weekly session for those in EMBRIO interested in learning R and solving their research related questions. Participants only need to bring their laptop with [R and R studio installed](#). We will have an interactive session where we try to solve coding related

questions and learn new things related to data analysis and visualization using R. We invite everyone to work on their own R projects, ask questions and learn from each other.

The first session was held Sept. 6th. Those interested in learning or brushing up on using R for data analysis, sessions of R Café will be on Thursdays 9/21, 10/12, 10/26, 11/9, 11/30, 12/14, 4-5 pm in DLR 323 or virtual link <https://purdue-edu.zoom.us/j/3998037199> (please note this day and time change compared to previous announcements).

EMBRIO MINI-WORKSHOP @ WEEKLY MEETING: SOLVING ODE'S & PDE'S

Dr. Linlin Li in the Umulis Lab will lead a two-part mini-workshop series during the EMBRIO Weekly on September 11th and 18th for **Solving Ordinary Differential Equations (ODEs) and Partial Differential Equations (PDEs) using Google Colab.**

The two-session workshop will primarily focus on introducing participants to basic numerical methods for solving Ordinary Differential Equations (ODEs) and Partial Differential Equations (PDEs) using Google Colab. During the first section, we will provide an overview of fundamental concepts related to ODEs and PDEs, followed by a practical demonstration of ODE solvers in Python, including a specific example involving the modeling of Ca²⁺ oscillations.

In the second section of the workshop, we will focus on solving simple PDE models within a regular domain, using the finite difference method. The primary goal of this workshop is to facilitate the understanding of mathematical modeling techniques among entry-level students and those who may not have prior modeling experience. Hopefully, by the end of the workshop, participants will be equipped with the skills necessary to tackle basic mathematical modeling challenges using Python and Google Colab.

Purdue BME/EMBRIO Seminar "Imaging Genetics: Dynamic Gene Control in Space and Time" by Dr. Bomyi Lim

Dr. Bomyi Lim from the University of Pennsylvania will be on the Purdue campus Wednesday 9/13, presenting a seminar 9:30 - 10:30 am. in BME Department, rm MJIS 1001. BME students should attend in person. Those further away or off-campus can join via [Zoom](#). Faculty interested in meeting with Dr. Lim, please contact Lee Hua Chiang chiang47@purdue.edu or 765-496-1339.

Abstract: Proper gene control across space and time is crucial for the seamless execution of various cellular functions, as too much or too little gene expression in the wrong place or time leads to developmental defects and disease phenotypes. While the importance of gene regulation is well acknowledged, systematic characterization of dynamic gene control is lacking. What is the "normal" range of gene expression, and how does transcriptional kinetics play a role? We employ quantitative live imaging to examine the structure-function relationships of genome topology and gene activity and ultimately relate it to phenotypes. We first systematically varied the distance and orientation between an enhancer and the target promoter and analyzed the changes in transcriptional dynamics. To gain further insights into the kinetics of E-P interactions, we employed the trans-activation (transvection) assay and utilized the DNA and RNA labeling to measure the long-range E-P interaction kinetics and its relationship with transcription. Our study provides a comprehensive characterization of the E-P interaction dynamics required for transcription and normal development.

MEMBER SPOTLIGHT



Juana Mendenhall, Ph.D., Morehouse College, EMBRIO Co-Lead for CORE Imaging

Dr. Juana Mendenhall is Chair of the Chemistry Department and the Walter E. Massey Professor of Physical Sciences at Morehouse College. She is president and founder of TheraVisc™, LLC, a company specializing in developing viscosupplement injectable gels to help with knee injuries. Dr. Mendenhall's ground-breaking medical technology is one of the first to show potential in treating osteoarthritis. As a result, Dr. Mendenhall filed a patent on her innovative hydrogels. She was recently selected to serve as a 2023 Committee of Visitors (COV) member for the National Science Foundation's Division of Materials Research (DMR). The 2023 DMR COV is charged with addressing and preparing a report on the integrity and efficacy of NSF's programs processes, management, quality, and significance of the results of DMR's programmatic investments.

Dr. Mendenhall, tell us a bit about your research:

My research lab, [SMART Therapeutic Biomaterials Research Lab](#), has created polymeric solutions using tissue engineering strategies to treat diseased and defective cartilage. Currently, my lab focuses on developing novel materials for tissue engineering and regenerative medicine by inhibiting inflammatory pathways. This work has been funded by the National Science Foundation and the American Society of Cell Biologists (ASCB).

You've been heavily involved in student training and diversity efforts.

My primary objective as a researcher is to educate, train, and mentor students on interdisciplinary topics by showing the synergy between polymer chemistry, materials science, and biomedical engineering. I am passionate about introducing underrepresented minorities to science, technology, engineering, and mathematics (STEM) while setting a tangible example of leadership for minorities to inspire their interest and encourage them to pursue degrees and careers in STEM. This work is about cultivating the next generation of scientific innovators and change makers from the Atlanta University Center (AUC): Morehouse College, Spelman College, and Clark Atlanta University.

What was the pathway that brought you to become a research scientist and educator?

I first received my Bachelor of Science degree from North Carolina A&T State University, and after graduating from NC A&T, I worked in the polymer industry. With this industry experience, I decided to pursue a doctorate in polymer chemistry at Clark Atlanta University and completed the program in 2006. This graduate experience positioned me to receive several awards in polymer chemistry from

organizations such as the American Chemical Society (ACS) and the National Science Foundation (NSF). As a result, I was selected as a Diversity Postdoctoral Fellow at Cornell University, where I continued my research in nanobiotechnology and tissue engineering. Following my Cornell postdoc, I was accepted into Emory University's Fellowships in Research and Science Teaching (FIRST). The FIRST fellowship teaches scientists how to become better science teachers while doing research.

You are passionate about educating the public about your research as well.

I'm more than passionate! I also teach elementary school students how to print 3D objects for math classes. Further, my [TEDx talk on the Future of Knee Repair](#) was a wonderful experience, enabling me to introduce my work to a larger community. This TEDx talk has helped change the narrative around treating patients with knee problems, such as osteoarthritis.

Can you share your social media and research publication links?

[Juana Mendenhall Research Gate](#)

[Mendenhall Lab](#)

[Juana's LinkedIn](#)

UPCOMING DEADLINES, IMPORTANT DATES, & INFO

EMBRIO Weekly Meeting, Monday's 3-4pm ET. [Zoom link](#).

Aug	14	Benchling Workshop - SLC (Feyisayo)
Aug	21	Student Leadership Council - Grads and Postdocs Only Session
Aug	28	Faculty Investigators Only
Sept	4	Labor Day no meeting
Sept	11	Dr. Linlin Li: Part I: Solving mathematical modeling with ODE or PDE in MatLab or Python (Google Colab)
Sept	18	Dr. Linlin: Part II: Solving mathematical modeling with ODE or PDE in MatLab or Python (Google Colab)
Sept	25	Dr. Adrian Buganza Tepole: Part I: Physics informed machine learning
Oct	2	Dr. Adrian Buganza Tepole: Part II: Physics informed machine learning
Oct	9	Fall Break - no meeting
Oct	16	TBD
Oct	23	ABIDES: Mentoring Workshop (in person, DLR 221) followed by EMBRIO Open House DLR 203

The EMBRIO Weekly will adapt to a new format the second half of the semester. The intention is to focus more time for research thrust projects to meet with cross talk between the thrusts, while dedicating one week a month to a trainee topic, and periodic research talks. Twice a month, the ABIDES program will feature a "10-minute mentoring snack" at the beginning of the Weekly.

September 13, 2023. Purdue BME/EMBRIO Seminar "Imaging Genetics: Dynamic Gene Control in Space and Time" by Bomyi Lim, Ph.D.

Dr. Bomyi Lim from the University of Pennsylvania will be on the Purdue campus Wednesday 9/13, presenting a seminar 9:30 - 10:30 am. in BME Department, rm MJIS 1001. BME students should attend in

person. Those further away or off-campus can join via [Zoom](#). Faculty interested in meeting with Dr. Lim, please contact Lee Hua Chiang chiang47@purdue.edu or 765-496-1339.

September 15, 2023. Chicago Cytoskeleton Meeting, Feinberg School of Medicine, Northwestern University. Five talks will be delivered in person only 3pm – 6pm, followed by a social hour with refreshments. <https://chicagocytoskeleton.net>

October 11-14, 2023. The 2023 BMES Annual Meeting will be held in Seattle, WA. Thousands of biomedical engineers will attend this year's meeting to learn, collaborate, and network. As a BMES member, you can save more than 10% with reduced early bird rates, so if you're not already a member, now would be a good time to join! Click here for details: <https://mailchi.mp/e3958bb463f2/o8cvhb9q5x-9335625?e=ea10e317a2> **NOTE:** BME Dept. recommends booking your room at the Hyatt Regency Seattle because it's *closer* to the convention center AND it's where university receptions will be held (in addition to some being held *inside* the convention center). Here's the link to reserve with the \$259 discount rate. **This rate only lasts until the allotted number of rooms have been sold.** <https://www.hyatt.com/en-US/group-booking/SEARS/G-BMES>

October 27 – [2024 Hertz Fellowship](#) Application deadline for doctoral students.

January 2 – 6, 2024. BMES – CMBE Conference. San Juan, Puerto Rico. Accepting abstracts – deadline September 12. Conference details: <https://www.bmes.org/cmbe2024>

Fri., Sept. 15: **Deadline to register as an NSF Graduate Research Fellowship Program Reviewer.** Serving as a National Science Foundation (NSF) [Graduate Research Fellowship Program](#) (GRFP) reviewer is a real opportunity to help shape the future of science. The **deadline to register interest in serving as a reviewer is September 15, 2023.** We know that reviewing for GRFP is a significant commitment and are extremely grateful to all of our STEM colleagues who are able to serve as reviewers! If you are available, please complete your registration at <https://nsfgrfpreviewers.org>.

Hot Off the Press: New EMBRIO Journal and Conference Papers

Mayesha Sahir Mim, Caroline Knight, **Jeremiah J. Zartman**. "Quantitative Insights in Tissue Growth and Morphogenesis with Optogenetics." (accepted, *Physical Biology*, 2023).

Kumar, Nilay, Alexander Dowling, and Jeremiah J. Zartman. "Reverse engineering morphogenesis through Bayesian optimization of physics-based models." *bioRxiv* (2023): 2023-08. doi: <https://doi.org/10.1101/2023.08.21.553928>

Kumar, Nilay, Mayesha Sahir Mim, Megan Levis, Maria Unger, Gabriel Miranda, Trent Robinett, and Jeremiah J. Zartman. "Piezo regulates epithelial topology and promotes precision in organ size control." *bioRxiv* (2023): 2023-08. doi: <https://doi.org/10.1101/2023.08.16.553584>

Let us know about new papers you want to highlight for the EMBRIO community!

REMINDER: EMBRIO Acknowledgement for Scholarly Papers and Posters.

For EMBRIO related research publications, NSF requires acknowledgement of EMBRIO NSF funding for our Institute to claim the work in our reporting back to NSF. Please include the following

acknowledgement in your journal and conference papers and posters: “This work is based upon efforts supported by EMBRIO Institute, contract #2120200, a National Science Foundation (NSF) Biology Integration Institute.”

Awards

Open Positions

New Lab Members?

Did you recently have new students or staff members join your EMBRIO projects? We want to add them to the listserv, Box account, demographics survey, and Personnel List for ensuring their inclusion in communications and participation. If they are not already on our Personnel spreadsheet (<https://app.box.com/s/frd9275xc069gmgmtbe3y1osoz1j7ssk7>), or they have graduated, let Brent know their names and email contacts (laddb@purdue.edu)

Submit your items for the next newsletter by **Sept. 15th** to Brent (laddb@purdue.edu)