



Emergent Mechanisms in Biology of  
Robustness, Integration & Organization

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

Issue 10: December 14, 2022

## **DIRECTORS' NOTE**

This is our last issue of the year – we hope your semester has been full of discovery, learning, and fruitful collaborations. Wishing good tidings to everyone in the EMBRIO community and a restful and regenerative winter break!

We've had a solid series of research and education talks this year, and we want to especially recognize the 20 graduate students and postdocs who have presented their research-in-progress to the Institute this past summer and fall. Speaking of our awesome trainees, the next session in our Grants Professional Development series is scheduled for January 23, 3pm ET: De-Mystifying the Craft of Creating an Aims Page.

A reminder for Spring semester 2023: we will maintain the Monday 3pm (ET) time continuing Weekly Updates split between research talks, DEI topics, professional development trainings, and a monthly meeting for Thrust and Site Leaders. A calendar invite with a new Zoom link was emailed on 11/18 and is available in the Upcoming Deadlines and Dates section of this issue.

And, speaking of future dates, we are very close to securing dates and venues for our annual summer trainee workshop and all-hands annual meeting. More on this is to come soon, but please hold July 10-12 for a training workshop at Notre Dame followed by our All-Hands Annual Meeting July 13-14 at Purdue.

The Member Spotlight introduces two affiliate members we are excited to welcome into the EMBRIO family: Dr. Priyanka Baloni, Health & Human Sciences, Purdue, and Dr. Greg Reeves, Chemical Engineering, TAMU. Please welcome them to our community. Dr. Reeves presented his research on December 5<sup>th</sup>, and Dr. Baloni will present on February 13<sup>th</sup>.

EMBRIO Purdue campus REU student nominations and project details are due January 13 for first consideration (and to enable students to meet the SURF program application deadlines). Please complete the [online survey](#) to submit your project details, and if you have a student already in mind, their contact information.

We want to hear about your news and announcements. Send them to Brent ([laddb@purdue.edu](mailto:laddb@purdue.edu)) by January 13 for inclusion in the next issue of *Emergence*.

**David, Chris, Stephanie, and Brent**

## **Quotable Quote:**

“As always in life, people want a simple answer... and it’s always wrong.” — Baroness [Susan Greenfield](#), Neuroscientist

## **QUICK LINKS**

[Schedule Your One-on-One Interview with Soumi](#)

[RAISING A RESILIENT SCIENTIST](#) NIH series

## **EMBRIO TRAINEE PROFESSIONAL DEVELOPMENT GRANTS SERIES**

For trainees that missed the Grants session panel discussion Nov. 28th, the video recording and chat file are available on our Box account > Weekly Meeting Recordings > 2022-11-28\_EMBRIO Weekly Update\_Grants-Series\_Prof-Dev\_Session 1.

Direct link: <https://app.box.com/s/3py70qibjqbbzywss3zc95y8qksav2ib>

Thank you to the panelists for sharing your insights and experience! Drs. Jason Cannon, Alejandra Magana, and Chris Staiger.

The next session in the series is scheduled for January 23, 3pm ET: De-Mystifying the Craft of Creating an Aims Page

November 28<sup>th</sup> : The Grants Process and Federal Granting Agencies – Faculty Panel

January 23<sup>rd</sup> : De-Mystifying the Craft of Creating an Aims Page

February 20<sup>th</sup> : Students present draft Aims page for Peer-Feedback (Jazzmin Owens and Peter Brumm share their aims pages)

March 27<sup>th</sup>: TBD

## **MEMBER SPOTLIGHT: Priyanka Baloni**



Dr. Priyanka Baloni is an Assistant Professor in the School of Health Sciences here at Purdue with expertise in computational biology, neuroscience, oncology, reproductive sciences, and

infectious diseases. She is joining EMBRIO as an affiliate member contributing to the CORE Thrust. We sat down with Priyanka recently to learn more about her research and teaching activities. She will present her research to EMBRIO on February 13<sup>th</sup> during our regular Weekly Update. You can read more about Dr. Baloni's scholarship at her [lab website](#).

**Hello Priyanka! You recently arrived at Purdue. Can you tell us more about your career up to this point?**

I received my Ph.D. from the Indian Institute of Science (IISc), India, working on the host-pathogen interactions in tuberculosis infection. In 2016, I began my postdoctoral position at the Institute for Systems Biology (ISB) and was mentored by Drs. Leroy Hood and Nathan Price. During my research experience at ISB, I collaborated and led computational efforts in various projects focusing on the metabolic signatures in neurodegenerative disorders, pregnancy, and cancer. As a tenure-track faculty in the School of Health Sciences at Purdue, my lab's research focus is in exploring mechanisms underlying adverse outcomes of environmental exposure on human health using high-throughput data and computational approaches. I think my broad expertise in computational biology, multi-omics analyses, and predictive modeling is a great fit to the research being done in the Core Thrust at EMBRIO, leading to potential collaborations across different labs and paving way for translational research.

**In your brief time at Purdue, you've hit the ground running. What are some of the collaborations you've been involved in and the investigations you have going now?**

I am a co-Investigator on four NIH-funded projects and was an MPI for an RO1 funded by the National Institute of Child Health and Human Development (NICHD). My funding from NIH RO1s has allowed me to collaborate with researchers from Johns Hopkins University, Duke University, Indiana University, University of Florida, Cincinnati Children's Hospital Medical Center, and Weill Cornell Medicine. I had collaborated on a project with Amgen Inc., in which I generated the genome-scale metabolic model of rat liver to explore the effects of diet restriction and chemical compounds and predict the metabolic outcome. I have used my expertise on metabolic networks for the COVID-19 research at ISB and investigated the metabolic reprogramming of immune cells in COVID-19 patients.

Going forward, I will perform systems-level analysis using genomics and multi-omics data, along with information available from various databases, and leverage the metabolic and transcriptional regulatory networks for rigorous dissection of molecular mechanisms, leading to new insights for improving public health using these data-driven models. This data-driven approach can lead to the generation of testable hypotheses and the development of personalized models predicting the effect of environmental exposure.

**You've also been active in teaching, mentoring others, and supporting diverse learners. Can you tell us more about those activities?**

In addition to research, I value and enjoy teaching and mentoring. I developed many of my

core teaching principles during the Science Teaching Experience for Postdocs (STEP) fellowship program, through the University of Washington, where I designed and taught a semester-long course on personalized medicine and wellness with two other postdocs. During this fellowship I learned skills in inquiry-based teaching approaches, curriculum and syllabus development, lesson planning, classroom management and student evaluations. This unique experience provided me with a platform to develop my teaching skills with weekly evaluations and discussions to improve my teaching effectiveness.

My interest in education also extends outside of the classroom, where I have placed a priority on mentoring undergraduate students from diverse economic, racial, ethnic and educational backgrounds. As a teacher and mentor for students, the best way I can contribute to supporting diversity is by supporting students who are at a disadvantage when starting their academic career as an undergraduate or have struggled with challenges throughout their careers. I will identify opportunities for funding and lead in the writing of grants to support equity and inclusion efforts within the Institute.

**Thank you for sharing your enthusiasm, research, and teaching experiences. We are excited to have you join EMBRIO as an affiliate member!**

Thank you! Being a part of EMBRIO, I foresee opportunities to collaborate with several groups at the Institute as the computational models can be used for studying infectious diseases, host-microbiome interactions, neurotoxins and other conditions. The collaborations can lead to potential funding opportunities and publications. I look forward to being a part of the Core Thrust at EMBRIO and bring in my expertise to complement the ongoing research at EMBRIO.

## **MEMBER SPOTLIGHT: Gregory Reeves**



Dr. Greg Reeves is an Associate Professor of Chemical Engineering at Texas A&M University and a member of the Faculty of the Interdisciplinary Graduate Program in Genetics. He is joining EMBRIO as an affiliate member, contributing to the Thrust 1 and 2 areas of the Institute. He

recently presented his research to the EMBRIO community (Dec. 5). You can learn more about Dr. Reeves' research at his [lab website](#). We asked Greg to tell us more about his background, research, and academic activities.

**Hi Greg! Thanks for your recent presentation to the Institute. We are excited for you to collaborate with us in EMBRIO. Not long ago you moved your lab to Texas A&M. Can you tell us more about your career up to this point?**

Yes, in the middle of the pandemic I moved my lab in the Fall of 2020 to Texas A&M. Prior to that, I worked at NC State University in the Chemical and Biomolecular Engineering Department for 10 years. I received my Ph.D. in Chemical Engineering from Princeton University – in the same lab that Jeremy Zartman got his Ph.D. Broadly, my research addresses the question of how cells make reliable decisions in a multicellular context, especially in the face of dynamic signals between cells. My goal is to synergistically use quantitative, *in vivo* imaging experiments and predictive, mechanistic modeling to deduce the rules of how signaling pathways dictate cellular decision making in tissue development and stem cell differentiation. Our systems biology approach is required to untangle the complexity and dynamics of development.

**What are some of the collaborations you've been involved in and the investigations you have going now?**

We specialize in quantitative imaging in live tissues, including raster image correlation spectroscopy (RICS), which allows us to measure the mobility, binding, and concentration of fluorescently tagged signaling proteins. Our imaging data constrain mechanistic models of these signaling pathways, which in turn allow us to design future experiments. Our primary model system is the 1-3 h old *Drosophila melanogaster* (fruit fly) embryo. We used modeling and experiment synergistically to make novel discoveries of the spreading and cellular interpretation of the Dorsal-mediated signal. These discoveries have revealed previously unknown mechanisms behind the robustness of NF- $\kappa$ B signaling.

Dorsal signaling also restricts the expression of the gene *dpp* to the dorsal half of the embryo, and *dpp* codes for the BMP ligand Dpp. We are also studying how the dynamics of Dpp signaling on the dorsal half of the embryo relates to Dpp target gene expression. Our initial work suggests that there are genes that are activated specifically by a transient exposure of Dpp signaling yet have sustained expression due to an unknown memory mechanism. Our work on Dpp signaling in the early embryo also translates to studying Dpp signaling in female germline stem cell specification, in which Dpp signaling from nearby cells to the germline stem cell represents self-renewal signal. We are studying how the dynamics of the intracellular portion of the Dpp pathway results in robust stem cell decisions.

My research aligns directly with Thrusts 1 and 2 of EMBRIO. My work on Dorsal is both intracellular and intercellular, and thus spans both Thrusts. Similarly, my work on Dpp signaling in the embryo aligns with Thrust 2, while my work in the germline stem cells aligns with Thrust 1.

I have been working on proposals with EMBRIO Institute members David Umulis and Jeremiah Zartman. The proposal focuses on engineering principles found in the BMP/Smad pathway in four model systems. As an outgrowth of the proposed ideas, we are working on a computational study to make predictions of these engineering principles.

**You've also been active in broadening participation in STEM and supporting diverse learners. Can you tell us more about those activities?**

At the high school level, I ran enrichment summer camps at NCSU titled “Bioengineering in the High School Classroom,” specifically targeting high schools from underprivileged areas. At TAMU, I’m integrating the material from the summer camp into STEM summer outreach programs in collaboration with the Spark! PK-12 Engineering Education Outreach and AggieSTEM programs.

At the undergraduate level, I’ve been partnering with TAMU's First-Generation Engineering Students (FGen) Mentoring Program. TAMU is a federally designated Hispanic Serving Institution (the general population of Texas is close to 40% Hispanic), and many Hispanics in the College of Engineering are first-gen. Data suggest that first-gen students have low retention rates, and that retention rate can be greatly improved by increasing motivation through undergraduate research.

At the grad student level, my group composition has always reflected a commitment to female representation (between 50 and 60% female) in a largely male-dominant field (chemical engineering is roughly 2/3<sup>rd</sup>s male). On the institutional side, the Core Facilities at TAMU are planning to offer pipeline facility workshops that target students at local HBCUs in which I will participate and teach RICS methods. URG students attending HBCUs have less access to state-of-the-art core facilities, and these facility workshops are an opportunity for training in cutting edge research methods.

**Thank you for sharing your motivations, research, and supporting diversity. We are excited to have you join EMBRIO as an affiliate member!**

Thanks – I am definitely looking forward to integrating into this exciting community of scientists and opening up more opportunities for collaboration.

### **Weekly Update Zoom Breakout Rooms:**

**Are you looking for a collaborator? Would you like to get conversation started about a specific research topic with other EMBRIO members?** Email me (Brent, [laddb@purdue.edu](mailto:laddb@purdue.edu)) with your breakout room topics for upcoming Weekly Update sessions.

### **INSTITUTE EVALUATION: SIGN UP FOR YOUR ONE-ON-ONE INTERVIEW (hint: it’s mandatory)**

“My name is Soumi Mukherjee, and I am a Graduate Student at the Department of Biological Sciences at Purdue. Along with my advisor Dr. Stephanie Gardner, I will be conducting an institute wide evaluation study as a part of Thrust 4 initiative. The process will help in capturing your experiences as a member of EMBRIO, which will be utilized to create a formative evaluation report for NSF at the end of each year. Your participation will not only aid in furthering the goals of the institute for providing an interdisciplinary collaborative environment essential for promoting knowledge integration across all the four thrusts, but also enable us to structure activities catered towards your own professional development.

**If you are a member of the EMBRIO institute currently doing a research project, we would like to invite you for participating in this study. Participation in the evaluation process is MANDATORY for all the members of the institute.**



As a part of the evaluation process, you will take part in an online session (via Zoom), which includes an interview and a brief survey, and the entire process should be completed in less than an hour. Interviews will be conducted annually for the total duration of your participation in the institute and the session would not exceed an hour and would be completed in a day.

**Please fill in all the times you may be available for our interviews using the link below with either your name or email address.** This information is requested so that we may contact you to set up an online session, but we will use a randomly generated 4-digit code in place of your name to identify all your information for the data collection and analysis.

<https://www.when2meet.com/?16968903-R8veS>

Your participation will not affect any aspect of your association with the EMBRIO institute. If you have any doubts regarding the evaluation process, please reach out to me at [mukher42@purdue.edu](mailto:mukher42@purdue.edu).”

With Regards  
Soumi

### NIH Raising a Resilient Scientist Series

The NIH OITE is pleased to offer the [RAISING A RESILIENT SCIENTIST](#) series for faculty, staff scientists, and administrators who mentor students and postdoctoral fellows in the biomedical, behavioral, and social sciences. The goal of the Raising a Resilient Scientist series is to promote the mental health and well-being of the academic research community by supporting faculty and administrators to develop self-management, relationship-management, and mentoring skills.

<b>Raising a Resilient Scientists Units</b>	<b>Workshop Date</b>	<b>Registration</b>
Communication Skills to Build Trainee Resilience	Nov 9, 2022 12:00-2:15 pm ET	<a href="https://nih.zoomgov.com/meeting/register/vJlsdeyhrjwsG3qSI89jFIF9zUdzoYlz4Vw">https://nih.zoomgov.com/meeting/register/vJlsdeyhrjwsG3qSI89jFIF9zUdzoYlz4Vw</a>
Promoting Trainee Resilience	Dec 14, 2022 12:00-2:15 pm ET	<a href="https://nih.zoomgov.com/meeting/register/vJlsc-uvpzovGbw2kGLBSbihRcERfN2raTc">https://nih.zoomgov.com/meeting/register/vJlsc-uvpzovGbw2kGLBSbihRcERfN2raTc</a>
Building a Welcoming and Inclusive Research Group	Jan 11, 2023 12:00-2:15 pm ET	<a href="https://nih.zoomgov.com/meeting/register/vJlscOurqjojGtH9Y_zDJPVHhg2Nm6zWNb0">https://nih.zoomgov.com/meeting/register/vJlscOurqjojGtH9Y_zDJPVHhg2Nm6zWNb0</a>
Difficult Conversations,	Feb 8, 2023 12:00-2:15 pm ET	<a href="https://nih.zoomgov.com/meeting/register/vJlsc-CgrTsiHfcOa91MnLLO-REQmdOO2I">https://nih.zoomgov.com/meeting/register/vJlsc-CgrTsiHfcOa91MnLLO-REQmdOO2I</a>

Conflict, and Feedback		
The Mental Health and Well-being of Your Trainees	Mar 8, 2023 12:00-2:15 pm ET	<a href="https://nih.zoomgov.com/meeting/register/vJlscuCpqT4pEzjHEmDI2E604ncYzhOrhm4">https://nih.zoomgov.com/meeting/register/vJlscuCpqT4pEzjHEmDI2E604ncYzhOrhm4</a>

There is no charge for participation, but advanced registration is required. For more information, and to register, please visit their [webpage](#). Participation in the entire series is recommended but is not required.

### **Resource: US Software Engineers Association**

New Community Resource via EMBRIO alumnus Matt Thompson:

*"A professional community known as [US Research Software Engineers Association](#) is worth joining. From the community call I sat in on last week and resources they have available online, I can tell it will be a big help with professional support, networking, and development. They welcome students, postdocs, faculty, and anyone engaged in any level of software development to do research."*

## **UPCOMING DEADLINES, IMPORTANT DATES, & INFO**

### **Weekly Research & Education Zoom Meetings Spring Semester, Monday's 3 – 4 pm.**

Spring Semester new Zoom link:

<https://purdue-edu.zoom.us/j/99819751005?pwd=UVlvWVpxRDB0cDVXbmxBU1NUTEZGZz09&from=addon>

- January 9 – Krishna Jayant, Asst. Prof., BME, Purdue
- January 16 – Martin Luther King, Jr. Day – No Meeting, please volunteer locally
- January 23 – Trainee Professional Development, Grants Series Session #2
- January 30 – Anjali Iyer-Pascuzzi, Assoc. Prof., BPP, Purdue, DEI Director, EMBRIO
- February 6 – Thrust & Site Leads Update Meeting
- February 13 – Priyanka Baloni, Asst. Prof, HHS, Purdue
- February 20 – Trainee Professional Development, Grants Series Session #3
- February 27 – Bakary Samasa, Mary Mullins Lab
- March 6 – Thrust & Site Leads Update Meeting
- March 13 – Spring break, no meeting
- March 20 – Open
- March 27 - Trainee Professional Development
- April – May TBD



**Nov. 9, 2022 – March 8, 2023.** NIH [RAISING A RESILIENT SCIENTIST](#) series.

**Jan. 2 – 6, 2023:** The BMES Cellular and Molecular Bioengineering Special Interest Group is seeking abstracts for the [BMES Conference \(CMBE\)](#) in Indian Wells, CA.

**Jan. 13, 2023:** EMBRIO REU Purdue campus student nominations and project details due for first consideration. Please complete the [online survey](#) to submit your project details, and student information if you have a student already in mind.

**July 10-12, 2023. Please hold for** EMBRIO Trainees Workshop, Notre Dame University. More information forthcoming.

**July 13-14, 2023. Please hold for** EMBRIO All-Hands Annual Meeting, Purdue University. More information forthcoming.

## **Hot Off the Press: New EMBRIO Journal and Conference Papers**

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

### **REMINDER: EMBRIO Acknowledgement for Scholarly Papers.**

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.”**

### **Conference Presentations:**

*Let us know about your conference presentations.*

### **Awards**

*Let us know about awards that you want to highlight.*

## **Open Positions**

### **Postdoctoral Fellow Position in Interdisciplinary Biomedical Research and Data Science, Purdue University**

A full-time postdoctoral fellow position is available immediately for interdisciplinary research in computational systems biology and collaborative data science at Purdue University. The postdoctoral position is associated with EMBRIO (Emergent Mechanisms in Biology of Robustness, Integration, and Organization), an NSF Biology Integration Institute with six university partners. The postdoctoral fellow will be broadly involved in the EMBRIO Institute, with efforts engaged in computational systems modeling and simulation research, as well as building expertise, guidance, and collaboration support and research in data management and data analysis for EMBRIO teams. The postdoctoral fellow will conduct research under the guidance of Dr. Elsje Pienaar (<https://engineering.purdue.edu/PienaarLab>) and be co-advised by Dr. Adrian Buganza Tepole (<https://engineering.purdue.edu/tepolelab/>).

As part of the work with the Pienaar lab the fellow would build and calibrate computational models of Calcium signaling in multicellular environments and its diverse downstream effects. Together with the Tepole lab the fellow would work to leverage machine learning (ML) tools to speed up and automate model evaluation, and to complement closed-form models with multi-modality ML metamodels for improved accuracy. The work is highly interdisciplinary and highly integrative across multiple systems. The fellow will work closely with experimental experts in zebrafish, plant and tissue culture biology within the EMBRIO Institute to build and parameterize the models. The fellow will also have opportunities to work closely with other computational faculty, staff and students on innovating new ways to integrate and analyze models and data across biological scales and systems.

As these specific projects progress, the postdoctoral fellow will have the opportunity to collaborate with investigators and interdisciplinary teams to research and deliver secure systems of data collection, storage, sharing, and analysis to produce new and actionable knowledge. This work will research and provide regular guidance and training in data science best practices and serve as a point of contact for all things data related. The postdoctoral fellow will have the opportunity to co-write proposals and to develop research components around the data-rich interdisciplinary modeling and simulation environment of EMBRIO.

A Ph.D. degree in Data Science, Computer Science, Biomedical Engineering, Chemical Engineering, Mechanical Engineering, Mathematics, Physics or related fields is required. Previous experience in computational modeling, systems biology, stochastic modeling, numerical methods, and associated statistical analysis, data science, or research data management is desired. Successful applicants will be detail oriented, eager to learn new methods, and enthusiastic about computationally rigorous modeling, collaborating across disciplines, working with experimental biologists and chemists, and advancing and supporting the research data realm of EMBRIO Institute. Salary to be negotiated.

To apply for this position, please submit to Dr. Pienaar ([epienaar@purdue.edu](mailto:epienaar@purdue.edu)) and Dr. Buganza Tepole ([abuganza@purdue.edu](mailto:abuganza@purdue.edu)): (1) your CV, (2) a cover letter explaining your background, interest and qualifications for the position, and (3) contact information for three references, including your relationship to the reference, their phone number, email address, and mailing address. Please contact Dr. Pienaar ([epienaar@purdue.edu](mailto:epienaar@purdue.edu)) for formal inquiries.

### **Postdoctoral Fellow Position in Interdisciplinary Biochemical Cancer Research, University of Notre Dame**

A full-time postdoctoral fellow position is available immediately for Multidisciplinary Cancer Research at the University of Notre Dame, affiliated with the Harper Cancer Research Institute, the Notre Dame Warren Drug Delivery Center and Notre Dame Institute for Precision Health. The perspective candidate will conduct an interdisciplinary research on projects studying the basic molecular mechanisms of multiple birth defects, cancer progression and neurodegeneration and developing novel therapies to combat them. The postdoctoral fellow will receive crossdisciplinary training in biochemistry, cell biology, synthetic organic chemistry, and drug discovery utilizing a broad range of biochemical assays related to phenotypic screening and protein-protein interactions. The postdoctoral fellow will conduct research under the guidance of a mentoring team, including Dr. Jeremiah Zartman (<http://sites.nd.edu/zartmanlab/>) and Dr. Brandon Ashfeld (<https://ashfeldlab.nd.edu/>).

A Ph.D. or M.D. degree in cell or molecular biology, genetics, biochemistry, chemistry or a related discipline, is required. Previous experience in genetics, screening technologies and associated statistical analysis, synthetic chemistry, imaging or mouse modeling is desired. Successful applicants will be detail oriented, eager to learn new techniques, and enthusiastic about biology, exploring the interface between chemistry and biology, and working in an academic lab environment. Salary is commensurate with experience.

To apply this position, please submit: (1) your CV, (2) a cover letter explaining your background, interest and qualifications for the position, and (3) contact information for three references, including your relationship to the reference, their phone number, email address, and mailing address. Please contact Dr. Jeremiah Zartman (jzartman@nd.edu) or Dr. Brandon Ashfeld (bashfeld@nd.edu) for formal inquiries.

### **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/frd9275xc069gmtbe3y1osoz1j7ssk7> ), or they have graduated, let Brent know their names and email contacts ([laddb@purdue.edu](mailto:laddb@purdue.edu) )

**Submit your items for the next newsletter by Jan.13 to Brent ([laddb@purdue.edu](mailto:laddb@purdue.edu))**