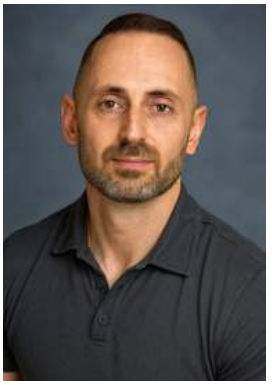
PANS
Pan American Neuroendocrine Society

Welcome message from **Victor Navarro, PhD President of PANS**



Dear PANS friends and colleagues,

I'm happy to share a few updates and highlights from the past few months as well as what's ahead for our society. This issue features an interview with Dan Bernard discussing his recent Science paper—an excellent read that we hope you'll enjoy! We also want to spotlight the MAPS program: our current mentees are making great progress, and we're preparing to launch a new cohort soon!

We recently held the second PANS Pioneers Lecture, honoring Mary Dallman's career and contributions. Both this and the inaugural lecture are available on our website! You can access it here.

The recent ECR symposium on multiomic techniques was also a success—thanks to all who joined! Our Career Development Committee is now working with BSN to organize our next Career Development webinar, which will take place later this year.

I want to highlight that at this year's Endocrine Society meeting, Carol Elias (a PANS member!) received the 2025 Clark T. Sawin Memorial History of Endocrinology Lecture Award (Congratulations, Carol!) Her talk on the metabolic control of reproductive function was outstanding! And we're pleased to announce that she has kindly offered to present this lecture again as a special seminar for PANS members this fall, on November 5th.

Finally, registration is open for the PANS Neuroendocrinology Workshop in Buenos Aires, Argentina, on December 6th. You can register and submit abstracts through our website. The deadline for abstracts is September 15th—we hope to see many of you there!

Warm regards.

Victor Navarro

Join now BECOME A MEMBER

Welcome to "The Neuroendocrinology Quiz!"

Neuroendo Quiz!

Think you've got your neuroendocrine circuits firing?

Time to put that brain to the test! Throughout this issue, you'll find science-packed questions popping up like surprise hormone surges. Dive into the content, take your best shot at the answers, and scroll to the end to see how you did. No pressure, just good nerdy fun. Let's quiz those hypothalami!

Read in detail about Society's updates, activities, members and relevant topics in our quarterly Newsletter, distributed by email.

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PANS
Pan American Neuroendocrine Society

Membership Drive

BECOME A MEMBER

MEMBERSHIP BENEFITS

Access the latest *neuroendocrinology research* (and researchers) spanning the Americas.

Reduced registration rates to the upcoming PANS meetings and to the ICN 2026 meeting in Japan.

Eligibility for student, postdoc, and faculty *travel awards* to attend the neuroendocrine meeting in Japan.

Access *career development resources*, including mentoring programs and workshops.

PANS members receive a *10% discount on all Stoelting products*, with highly discounted items (40–75% off list price) available for members outside of the US and Canada.

Opportunities to serve on committees and help define the *future direction* of neuroendocrinology research.

FREE registration rate to the upcoming PANS Satellite meeting in Buenos Aires, 6th December 2025. (Event details)

AND MORE!

Discounted membership rates for Early Career Researchers and members from Latin America

Current members: renew now and get the **second year for free**

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Award-Winning Insights REPRODUCTION METABOLISM

The presenter of the Clark T. Sawin Memorial History of Endocrinology Lecture and also the recipient of the 2025 Delbert A. Fisher Research Scholar Award, Dr. Carol Elias takes the spotlight to talk about the history of metabolic control of reproductive function.

Neuroendo Quiz!

1 Who received the Nobel Prize of Physiology/Medicine for the development of the radioimmunoassay?

At the most recent Endocrine Society meeting, I was deeply honored to receive the 2025 Clark T. Sawin Memorial History of Endocrinology Lecture Award. This prestigious award recognizes a significant historical topic in endocrinology. My lecture, titled "Metabolic Control of the Neuroendocrine Reproductive Function," explored the history and groundbreaking discoveries in this field, highlighting both the major milestones and contributions from fellow researchers and my own work.

The inspiration for this award stemmed from organizing and publishing a comprehensive review article on this topic in Nature Reviews Endocrinology. Experts from around the globe con In our review, we acknowledged the pioneering research of Kennedy and Mitra from 1963, which experimentally demonstrated the critical role of body size (weight) in the onset of puberty through manipulation of litter size in rats. Remarkably, sixty years later, their model is still widely used to model childhood undernutrition and obesity.tributed their knowledge, helping to create a thorough overview o the field.

Nutritional status has a profound impact on reproductive physiology. When food is scarce or energy demands increase, both males and females redirect energy away from processes like reproduction. Conversely, excess energy such as obesity also impairs fertility. Increased adiposity exacerbates ovulatory dysfunction and polycystic ovary syndrome and can lead to infertility in both sexes. Even when conception is achieved, women with obesity are at higher risk for poor pregnancy outcomes and increased maternal and fetal morbidity and mortality.

Metabolic dysregulation also affects sexual maturation. Leanness can delay puberty onset, whereas childhood obesity is linked to earlier puberty, a trend increasingly observed over the past three decades, particularly in girls. This early onset is associated with greater risk of adult obesity, diabetes, cardiovascular diseases, and cancer, presenting serious public health challenges for coming generations. The metabolic effect upon reproductive health has been observed throughout history and across cultures. Examples include prehistoric female figurines such as the Venus of Hohle Fels (Germany, ~ 40,000 BCE) and Venus of Willendorf (Austria, ~25,000 BCE), which depict corpulent female forms, an unexpected trait for hunter-gatherer societies. An interpretation for these female figurines is the attempt to represent the hope for survival and longevity within well-nourished and reproductively successful communities (Dixson, 2011). Aristotle (~350 BCE), in The Generation of Animals, recognized the importance of nutrition in fertility, noting that both underfeeding and overfeeding can reduce a woman's ability to conceive and carry to term. Later, Darwin (1868) added to this insight when observing domesticated animals. In his words, "nothing so much affects the powers of reproduction as deficient or excessive nourishment…many animals do not breed even on moderately poor food."

Scientific studies from 1970 to 1990 provided experimental evidence for these observations, demonstrating that negative energy balance disrupts reproductive hormones, estrous cycles, and sexual behavior. The discovery of key metabolic signal and neuroendocrine peptide (i.e., leptin in the mid-1990s and a kisspeptin in 2003) opened new doors to understanding the mechanisms behind these effects. Recent advances in mouse genetics, viral vector technology, omics, and population genetics have further transformed the field. It has been a privilege to contribute to this evolving field, and I am deeply grateful for the opportunity to spotlight its rich history and ongoing significance through the Clark T. Sawin Memorial Lecture.

Dr. Carol Elias
University of Michigan

Dr. Carol Elias will honour our PANS community with a presentation of her award-winning lecture!

PANS SPECIAL LECTURE

From Scarcity to Abundance: Historical Insights into Metabolic Control of Reproduction

BY DR. CAROL ELIAS

Nov. 5th, 2025

1PM EST
VIA ZOOM

PANS Pan American Neuroendocrine Society

REGISTER HERE!

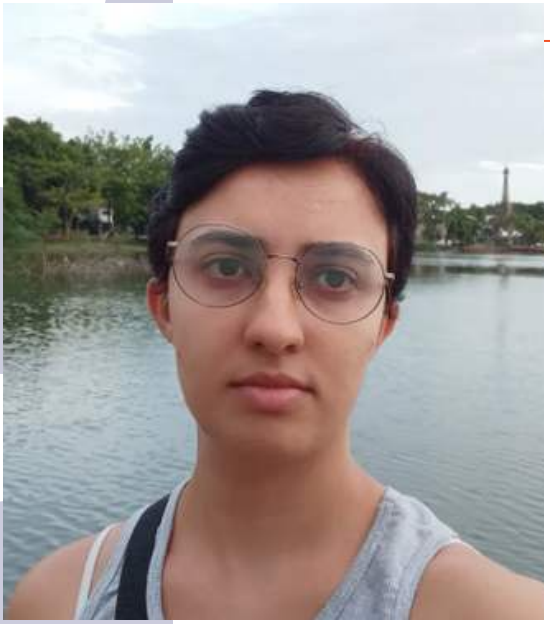
Neuroendo Quiz!

Which hormone was discovered in 1921 at the University of Toronto and resulted in a Nobel Prize in Physiology or Medicine to Dr. Frederick G Banting and Dr. J.J.R. Macleod in 1923?

2

The MAPS Program MEET THE MENTEES

*The inaugural **Mentoring Access for Pre- and Post-Doctoral Scientists (MAPS) Program** that occured from September 2024 to June 2025 was supervised by Dr. Nico West (University of Tennessee Health Science Center, TN, USA) and Dr. Shannon Stephens (Albany Medical College, NY, USA). Mentees in the program were able to expand their professional network and receive individual mentorship from a PANS faculty member, engaging in mentee-led workshops and discussion forums. Meet two of the latest mentees!*



DR. ANA CLARA CAMPIDELI SANTANA

Postdoctoral Fellow
Federal University of Minas Gerais, Minas Gerais, Brazil
MAPS Program Mentor: Dr. Renata Frazão

My primary goal is to become a research assistant at a research-intensive institution. During MAPS, I successfully secured a postdoctoral scholarship. My favorite activity was to develop a 5-year career plan using SMART goals, and hear about other PIs, mentors, and mentees experiences. I learned that when applying for research positions, a strong publication record can outweigh limited teaching experience. My mentor offered insightful advice on where to search for funding in Brazil. The Program helped me structure my career plan in a systematic and practical way, giving me a clearer understanding of the steps needed to achieve my goals. Additionally, listening to the experiences of other PIs was both insightful and motivating.

DR. JULIETTA SHENG

Postdoctoral Fellow
Engineering Biology Research Consortium, California, USA
MAPS Program Mentor: Dr. John Wu

My long-term career goal is to become a prominent voice for advocating for policies that improve women's health. One of the goals I have accomplished during the MAPS Program was to write a policy brief on Women's Health policy. Throughout the Program, my favorite activity were the Mentee-Led workshops and the resume/CV and career searching tips that I learned from my mentor. The MAPS Program helped me with my career goals by gaining a new mentor with new insights and perspectives.

Interested in applying to the MAPS program for 2025-2026?

Applications will be available September 2025 so ***check back*** for more information! Worldwide member welcome, although programming will be focused on the Americas.

PANS Pioneers in Neuroendocrinology lecture HONORING DR. MARY DALLMAN

"Glucocorticoids, adaptation and pathology"

Dr. James Herman lecture is available on our YouTube channel.

Watch it NOW!

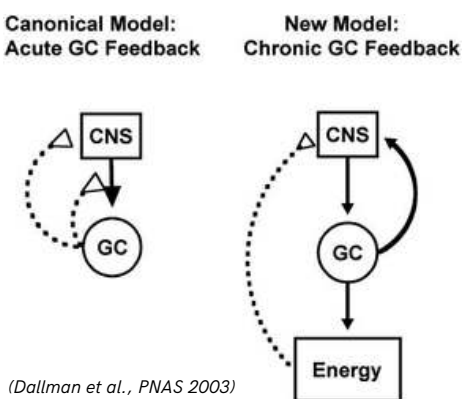
Mary Dallman was a pioneer in neuroendocrinology and neuroscience making seminal discoveries in negative feedback control of the hypothalamic-pituitary adrenal axis and in regulation of adrenal function and in identifying the relationship between metabolic functions and the stress response.

As mentioned by **Dr. Seema Bhatnagar** who gave a biographical introduction, Mary Dallman received her BS in Chemistry from Smith College, her PhD in Physiology from Stanford University, and her postdoctoral fellowship from the University of California at San Francisco (UCSF). These accomplishments occurred in an era when few women were expected or encouraged to become faculty members and independent scientists. Mary Dallman became the first female faculty member in the basic sciences at UCSF and stayed there until her retirement in 2007. She trained generations of scientists active today and influenced countless others.

Mary Dallman's research career, encompassing more than 240 publications, can be roughly divided into three phases. She established unique time domains through which glucocorticoids exerted negative feedback effects upon the HPA axis. A second phase examined the neural substrates of facilitation of stress responses that can be seen in repeated and chronic stress conditions and this was the topic of the lecture given by **Dr. James Herman**, who worked closely with Mary Dallman and established the neurocircuitry affected by chronic stress. In her late scientific years, her focus was on the interplay of glucocorticoids and metabolism. More specifically, she discovered the central role of glucocorticoids to mediate the action of "comfort food" on the stress response. Below is a figure conceptualizing a major shift in our thinking of the feedback systems on the CNS, adding the contribution of metabolic stores to modulate brain function.

Dr. Claire-Dominque Walker
McGill University
PANS Communications Committee

*Left to right: **Dr. Neena Schwartz**, **Dr. Janet Hall**, president of the Endocrine Society and **Dr. Dallman**. Picture taken at the "Women in Endocrinology" event during an Endocrine Society meeting. Dr. Schwartz and Dallman were long time friends and mentored many young women scientists. Dr. Schwartz was honored during the first PANS Pioneers in Neuroendocrinology lecture.*



(Dallman et al., PNAS 2003)

Neuroendo Quiz!

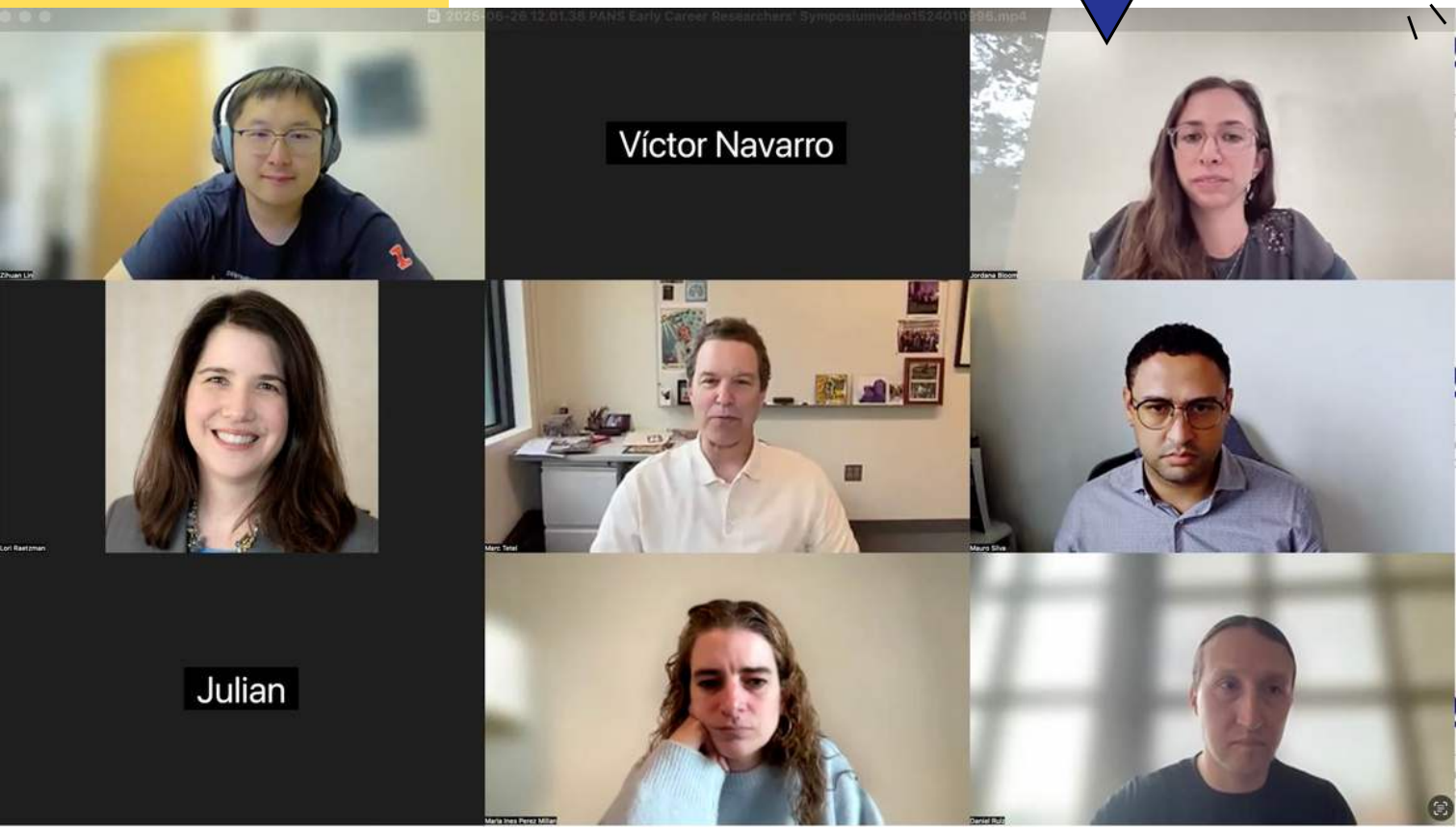
3 **Which technique, developed simultaneously by Dr. Pfaff and Dr. Stumpf, provided for the first time a precise localization of steroid binding sites in the brain?**

ECR Symposium

MULTI-OMICS APPROACHES TO CELL DIVERSITY IN NEUROENDOCRINOLOGY

Neuroendo Quiz!

4 In 1977, Dr. Numan and collegues described that a hormonal implant in a specific hypothalamic region facilitated the onset of maternal behavior in pregnant rats. Which hormone was it and in which region was it administered?



On June 26th, the Career Development Committee organized the PANS Early Career Researcher's Symposium on Multi-omics Approaches to Cell Diversity in Neuroendocrinology. Chaired by Sihuan Lin, PhD Candidate at the University of Illinois Urbana-Champaign, USA, the Symposium brought together three early-career researchers from across the Americas to discuss new methods they are using to investigate different hypothalamic populations.

In the talk "Assessing single-cell gene expression in the mouse mediobasal hypothalamus and preoptic area from birth to puberty", Dr. Daniel Ruiz, postdoctoral fellow in Victor Corces' lab in the Department of Human Genetics at Emory University School of Medicine, USA, discussed how he is exploring the identity and roles of hypothalamic neuronal populations involved in metabolism and reproduction, especially during the postnatal development.

Dr. Jordana Bloom, postdoctoral fellow at Dr. David Page's lab at Whitehead Institute for Biomedical Research – MIT, USA, shared her work on transcriptomic analysis of the hypothalamus during menopause. Studying both human and animal models, Dr. Bloom seeks to understand how well mouse models can recapitulate the changes in hypothalamic gene expression seen in humans.

Lastly, Dr. María Inés Pérez Millán, an Assistant Professor at Instituto de Biociencia, Biotecnología y Biología Traslacional (iB3), Universidad de Buenos Aires, Argentina, highlighted how her laboratory is investigating early pituitary development and its related pathologies. Using different animal models, Dr. Pérez Millán is interested in discovering novel genes involved in pituitary development while also performing genetic analyses in pediatric patients.

Dr. Marina Martins
University of São Paulo
PANS Communications Committee

PANS

Sociedad Argentina de Biología

Connecting Neuroendocrinology Across the AMERICAS WORKSHOP

Buenos Aires, Argentina December 6th, 2025

Abstract submission deadline:
September 15th

Travel grants available!

Register HERE!

(Free registration for PANS member)

Hear from the organizers as they share the symposium importance and key highlights:

DR. MARIO PERELLO

IMBICE, Argentine Research Council (CONICET)

From my own experience, meetings like the PANS symposium are incredibly valuable—not just for the science presented, but for the informal conversations they spark. Having international speakers in a relaxed, friendly setting creates a unique atmosphere that encourages open discussions, the exchange of ideas, and the development of meaningful collaborations. Some of my most enduring scientific partnerships actually began at poster sessions or over coffee breaks. I met Edith Sánchez-Jaramillo at the Endocrine Society meeting in 2006 in Boston—we were presenting posters side by side, started chatting, and ended up collaborating and even receiving a grant together. Years later, at ICN 2014, I met Vincent Prévot, Jacques Epelbaum, Virginie Tolle, Zane Andrews, and Suzanne Dickson, among others. Those encounters led to fruitful collaborations, scientific support, and publications. These kinds of meetings offer a rare chance to connect with potential mentors, advisors, or future postdoc hosts, and to grow as part of an international community. I'm truly looking forward to the December symposium in Buenos Aires and hope it will be just as inspiring for others.

SPONSORS: FUNDACIÓN WILLIAMS | JNE Journal of Neuroendocrinology

The power of connection: How international meetings propel our science forward?

DR. CLAUDIO ESTEBAN P. LEIGHTON

PONTIFICIA UNIVERSIDAD CATÓLICA DE CHILE

The more I do science, the more I learn to value the benefit of having excellent collaborations. More often than not, collaborations are born out of random encounters at meetings. I can think of two examples in my career. First, I can think of my collaboration with Dr. Bredford Kerr (Chile). As I recall, we met because Bred happened to be around at a coffee break while I was talking to one of his students, and we got talking about neuroscience and just sharing ideas. We kept in touch, and over the years, this encounter grew into a shared collaborative grant about neuroendocrine regulation of food intake, co-mentoring of students, and my involvement in PANS. Second, I remember meeting Dr. Harry Kissileff after a presentation I gave at the Obesity Society Meeting in 2017. I remember that after my talk, Harry walked up to me to ask me a question about a graph that was in one of my slides. And from that question, we managed to keep in touch, and I was introduced to the world of human feeding behavior, leading to several publications, grant submissions, and getting to know other scientists in that field. These two are just examples of a story I often hear: scientific meetings are a chance to meet other scientists and where collaborations are born, often over coffee or in social events. As such, I've come to value meetings that offer opportunities for close interaction with other scientists, where we can exchange experiences, geek over data, and learn from one another. Thus, I am really excited to participate in the PANS Symposium in Buenos Aires this December to connect with neuroendocrinologists all over the Americas.

DR. GRACIELA DÍAZ

INSTITUTO DE BIOLOGÍA Y MEDICINA EXPERIMENTAL CONICET

International collaborations have been key to our progress. I've had the immense pleasure of connecting with leading researchers at international conferences. These vital partnerships are often born in the dynamic environments of scientific meetings—unique platforms for discussion, networking, and the exchange of ideas. Our experience stands as a testament to this: collaborations initiated at these meetings have resulted in nearly 15 publications in highly cited neuroendocrinology journals. For instance, a 2010 international meeting led to a productive collaboration with Professor Daniel Rifkin at the NYU School of Medicine, supported by two consecutive CONICET-NSF International Cooperation Grants. Together, we demonstrated that a deficient TGFβ1 system could be a key factor in the initiation and progression of prolactinomas. This partnership also enabled us to evaluate the preclinical therapeutic potential of novel peptides in collaboration with Abbott Laboratories. Years later, an informal conversation during a coffee break at ENDO 2017 sparked a collaboration with the distinguished pathologist Dr. Alfredo Molinolo at UCSD. Our joint work uncovered key sex-specific differences that may protect male pituitaries from prolactinoma development. Similarly, a 2016 meeting initiated a collaboration with Professor Peter Thomas at the University of Texas at Austin, the discoverer of the membrane progesterone receptor (mPR). Together, we characterized the expression of all five mPR subtypes in normal and tumorous pituitary tissue. This led to the discovery of a novel inhibitory mechanism in which progesterone, acting through mPRα, suppresses prolactin secretion—positioning mPR agonists as a highly promising therapeutic strategy for pathological hyperprolactinemia. These international collaborations have been true milestones for our lab's scientific journey. International meetings are not only a platform to share our findings with a global audience, but also fertile ground where transformative networks are built, ideas are challenged, and the future of our field is shaped. I hope that the upcoming PANS International Workshop on Neuroendocrinology in Buenos Aires will offer colleagues and students a similarly inspiring environment for idea exchange and the creation of long-lasting scientific collaborations.

INSIDE THE DISCOVERY:

Dr. Dan Bernard sheds light on myostatin's role in FSH synthesis

Dr. Daniel Bernard
McGill University, Canada

Ashley Herdman
(Interviewer)
University of Arkansas, USA

A recent paper from the lab of Dr. Daniel Bernard at McGill University described a tour de force effort to discover a major regulator of follicle-stimulating hormone synthesis. Ashley Herdman, PhD student in Angela Odle's lab at the University of Arkansas for Medical Sciences, talked with Dan about the career that led him to this discovery and some of the triumphs and hurdles of the research.

The beginning!

Your work defining FSH regulation is well recognized. How did you initially come to study reproductive neuroendocrine pathways? The short version is that it wasn't my intention at the beginning. As an undergraduate, I was actually a psychology major, and I started working on visual perception in pigeons. For grad school I joined a lab at Johns Hopkins studying auditory perception in birds. In my first year, I took a class called, "Neurobiology and Behavior". One of the units was on the neurobiology of birdsong and it just clicked for me. I loved that system - neurogenesis, sex differences, neural circuits underlying learning and behavior - it was just so interesting for so many reasons. I was very interested in plasticity in the song control system, and the main driver of plasticity was testosterone. That's when I first started to work on hormones. In my first postdoc, I studied how steroid feedback was modulated on a seasonal basis. I started to work on GnRH and how it was regulated and became interested in differential regulation of LH and FSH. I then went to Teresa Woodruff's lab to work on what we thought was the new inhibin receptor, and the rest is kind of history.

What has been your philosophy in training and mentoring young scientists? My goal is to have my students leave the lab as highly skilled and careful scientists. I ask my students to read a paper called "Strong Interference" by JR Platt which was published in Science in 1964. It's about setting up experiments in a way that also helps visualize what the outcomes may be. In the paper, we used this strong interference approach to hone in on myostatin and GDF11 and eliminate other possibilities. I'm really vigorous in teaching the scientific method and the nature of hypothesis testing. I try to eliminate words from their vocabulary like 'believe', 'hope', and 'want' because I think that's where biases creep into science. The data are what they are - you get what you get, and you don't get upset. We change the hypothesis to fit the data, not the other way around. I also talk about the importance of converging evidence and addressing a given question in at least two ways. At the end of the day, the goal is for students to take ownership of their project and drive it intellectually.

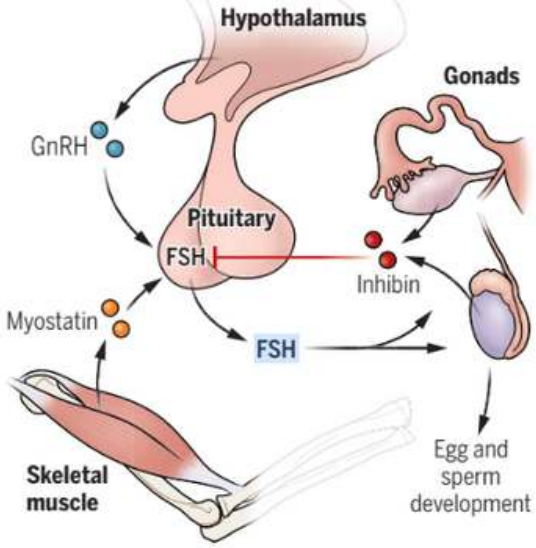
How did you get involved in the Pan American Neuroendocrine Society (PANS), and how has participation in scientific societies contributed to your work and career development? It's contributed substantially. Around 2016-2017, I was asked to join the PANS executive committee. My other "home" societies are the Society for the Study of Reproduction (SSR) and the Endocrine Society. I've been involved in both for many years, including being on the boards, so I've really benefited in a variety of ways. One is you see how professional societies operate, but the main benefit is networking. I've been able to meet a lot of people that I may never have met, for example, clinicians through the Endocrine Society. I've developed friendships and collaborations through these societies and come to know people much better than I would have otherwise. I would definitely recommend it to others.

The Research

How does your discovery of the skeletal muscle-pituitary axis change our current understanding of reproductive endocrinology? I definitely think it changes our perspective on reproductive endocrinology in the mouse, and to some extent in rats. I don't know yet about other species, but what it does tell us is that there is endocrine communication between the muscle and the pituitary. It turns out, there was this 2019 paper, and they actually showed that myostatin also regulates growth hormone. But for us, it's the opposite - we show that myostatin stimulates FSH and they show that myostatin inhibits growth hormone. We also saw this growth hormone inhibition in our KOs. So, I don't think the relationship between the pituitary and muscle is unique to the reproductive axis. I think that there's going to end up being this crosstalk between muscle and the pituitary regulating at least two endocrine axes. There's clearly a link between adipose tissue and reproduction, with leptin being the best example. This might be a corollary to that - another peripheral tissue that maybe we didn't think of as an endocrine organ, may actually be able to function that way to regulate diverse aspects of physiology, not just reproduction.

You showed that global, but not gonadotrope-specific, loss of activin B resulted in elevated levels of FSH in mice. How does this redefine our understanding of the role of activins in FSH regulation? Locally produced activin B was thought to be the main driver of FSH production, based on studies in rats. Interestingly, in Vassalli's 1994 paper, FSH was elevated in male Inhbb KO mice (which cannot make activin B). That bugged me. I thought that the dogma around FSH production had to be wrong and we don't need activin B in order to make FSH. There was the idea that activin A could be compensating, but there is really no activin A made in the pituitary, so it must come from somewhere else. This idea of endocrine activin A acting in a compensatory manner would also be a change to the dogma. That was always in the back of my mind. What our results tell us is that if you're a mouse, you don't need activin B in the gonadotropes in order to make FSH. The dogma, to the extent it applies to all species, is wrong, because it clearly doesn't apply to the mouse. The extent to which our results apply to other species, we don't know. We did have one experiment in the paper in rats where we treated them with the myostatin/GDF11 neutralizing antibody and we also saw an effect on FSH there. So, we know that those ligands also contribute to FSH production in rats, but we don't know about other species.

You note that myostatin inhibitors are being explored to combat muscle loss, especially alongside GLP-1R agonist use. How might your findings impact the development or potential side effects of such therapies? Regeneron recently published a Nature Communications paper in a primate model where they showed they were actually able to preserve muscle mass, and in fact, drive even more fat loss in monkeys that were treated with a myostatin antibody in combination with the GLP-1R agonist semaglutide. They did cite our paper and discuss FSH, but they didn't actually say whether they measured FSH levels in the monkeys. For side effects, I'd be more concerned in women than men. It's already the case that if you are taking a GLP-1R agonist and you intend to try to have a child, that you're recommended to stop taking the drug for a month before you try to have a baby. If you're someone who's taking these drugs, you want to preserve your lean mass, maybe even drive more fat loss. For women, if FSH levels are impacted then it will impact estrogen production which won't be good for the skeleton. That's where I would be looking for potential side effects.



What are the next steps in this line of research? In the paper we show that the activin A neutralizing antibody does have an effect on FSH. It's about a 25% decrease, at least at the concentrations that we use. And so, the question is - where does that activin A come from? In the stem cell population in the pituitary, there is the inhibin βA subunit, so it's possible that it's locally derived, but we're wondering whether it's also coming from the muscles. We're knocking out the inhibin βA subunit in muscle, in particular in the myostatin KOs. We think we may have to get rid of the myostatin to see if by doing this additionally we'll decrease FSH levels more. This brings up a second question about whether the tissue of origin of the ligand makes a difference. We measure hormones in circulation, but does it matter where they come from? You might simplistically think, 'Why wouldn't it, it's the same hormone in circulation', but in the TGFβ family, that's not strictly true. TGFβ family member proteins are made as preproproteins and the processing of the prodomains does seem to differ across cell types and tissues. While they may look like the same molecules in circulation based on the assays we use, they may not be. It may actually make a difference where it was made.

The challenges

How many weeks out were you planning on looking when you did the injections? Oh, one. We thought one week was going to be enough. We had never worked with an AAV before and so we thought it would start expressing right away. It's very interesting, and I don't have a good explanation. The myostatin KO mice are hyper-muscular, but at the site where Luisina injected the myostatin, the muscles were smaller. This is interesting, because all the muscles were exposed to this circulating myostatin, but she was only seeing the local action. The only systemic action we could show was in the pituitary. So, it comes back to this issue about where myostatin is getting activated.

Were there any unexpected challenges during these studies? The biggest technical and practical challenge for the paper was the hormone replacement experiment. One of the reviewers asked us to do classic endocrinology ablation replacement. We calculated the cost, and it was going to be cost-prohibitive to buy the myostatin that we needed in order to inject it and see what happened acutely to FSH. Myostatin is difficult to make, but we reached out to a group in Australia who developed an AAV that expresses myostatin from the muscle. Luisina (Ongaro, first author of the paper) injected it into the muscle in the myostatin KO mice and collected blood samples every week so she could measure FSH. We were within weeks of our deadline, really running up against the clock, and at Week 1, nothing happened. Then Week 2, nothing happened. Again, Week 3, nothing happened. We thought 'Oh, this isn't going to work, the paper isn't going to get accepted', but then in Week 4 FSH was up. Then she measured myostatin in the same samples and Week 1, nothing. Week 2, nothing, Week 3, nothing. But in Week 4 myostatin was finally elevated in circulation, and actually by Week 5 the circulating levels of both myostatin and FSH had already started to come down.

How do you deal with setbacks in research? I think that the people who stay in science are just the resilient ones. There's something in all of us where we can just get up off the mat. We all have setbacks and even though we don't want anything or hope for anything, we're human beings, so we do get disappointed. I think you just have to persevere. You know there's a question you want to answer, and come hell or high water, you're just going to figure out a way to answer it.

The researcher!

When you're not in the lab, how do you like to spend your time? Other than my family, my passion is cycling. I'm an avid cyclist. I don't ride as much as I used to, but in the summer, I ride probably 6 days a week. I love being out and riding my bike, that's when I do some of my best thinking.

Do you have any advice you would like to share with early career scientists?

One is beware of dogma. I think that was a big one that came out of this myostatin story. If you are convinced from a thorough reading of the literature and your own experience that something out there is not right, incomplete, or just completely unknown, then just go for it. I would say be stubborn, be persistent, but don't be inflexible. In the last couple of years, we published one paper on the discovery of a new inhibin receptor and now we have this myostatin story, and neither were initially funded. In the initial grant that I submitted in 2013, where one aim was to discover this new receptor, and the other was to figure out the ligand, the reviewers didn't like it. So, I wrote a different grant, but then we did it anyway because I was convinced that we were on to something. Another thing we talk about a lot in the lab is that we want to work on the "need to know" and not the "nice to know" questions. It can be highly subjective of course, but I try to get people to focus on the big gaps in knowledge that we want to address. I would also say, don't be afraid of new technologies. I wouldn't say just use them for the sake of using them, but if something new comes up and you think it's a tool that you've needed all along, go for it. Finally, be collaborative. We had these quotes on the lab door and one of them was from Harry Truman, which is 'It's amazing what you can accomplish if you don't care who gets the credit'. I have found that to be absolutely true. Collaboration is a win-win situation and getting the science out there is more important than getting the credit.

You can access Dr. Bernard's paper, published in the January issue of Science, by clicking *here*.

Muscle-derived myostatin is a major endocrine driver of follicle-stimulating hormone synthesis

LUISINA ONGARO, XIANG ZHOU, YING WANG, HAILEY SCHULTZ, [...], AND DANIEL J. BERNARD +17 authors Authors Info & Affiliations Science

Neuroendo Quiz!

The final question from our quiz is...

5 **In which year were published the 2 seminal papers identifying the critical role of kisspeptin and its receptor on the control of puberty and fertility?**

Submit your answers *HERE* and see which ones you got right!
We hope you enjoyed this adventure through neuroendocrinology!

How did you do?

- **5/5** You're our neuroendocrine hero!
- **4/5** You're a pituitary pro!
- **3/5** Let's work that hypothalamus
- **2/5** Almost got it, buddy!
- **1/5** Good luck next time!