

In the Spotlight—Established researcher

Cassandra G. Extavour 

Professor in the Department of Organismic & Evolutionary Biology and the Department of Molecular & Cellular Biology at Harvard University.



Cassandra Extavour has been the recipient of an Ellison Medical Foundation Inspiration New Scholar in Aging Award, a Harvard College Professorship, and the Inspiration Award of the African American Female Professor Award Association. She is a General Member of the Kavli Institute for Theoretical Physics and a Distinguished Visiting Scholar at Chan-Zuckerberg BioHub. Cassandra was nominated for Harvard Graduate Women in Science and Engineering Mentor of the Year Awards and a Joseph R. Levenson Memorial Teaching Prize.

Cassandra is also a *Journal of Experimental Zoology Part B: Molecular and Developmental Evolution* Editorial Board Member, and an Academic Editor at *Development*.

Website: www.extavourlab.com

Google scholar page: <https://scholar.google.com/citations?user=ChHokKEAAAAJ>

With whom and where did you study?

My first exposure to laboratory research was as an undergraduate summer intern in the lab of Joseph Culotti at the Samuel Lunenfeld Research Institute (now called the Lunenfeld-Tanenbaum Research Institute) at the University of Toronto, Canada. My research project was to help map a series of mutations that had been isolated in a forward genetics screen conducted to find new genes involved in axon guidance in *Caenorhabditis elegans*. I then moved on to do a senior undergraduate thesis with Marc Perry, also at the University of Toronto, working on genetic mechanisms of sex determination in *C. elegans*. After graduating from the University of

advisor Antonio García Bellido, I learned that bringing 110% of one's Toronto with a degree in molecular genetics, mathematics, and Spanish, I had the experience of learning more molecular biology and biochemistry during a brief research assistantship on transcriptional regulation in Alberto Kornblihtt's lab at the INGEBI research institute (now at the University of Buenos Aires) in Buenos Aires, Argentina. I then moved to Madrid, Spain to pursue my PhD in *Drosophila* developmental genetics with Antonio García Bellido. I began to learn about how to work with nonmodel organisms during a brief postdoc with Michalis Averof (now at the Institut de Génétique Fonctionnelle de Lyon, France) at the IMBB in Crete, Greece. I then continued to develop my evo-devo research during a second postdoc with Michael Akam at the University of Cambridge, UK.

What got you interested in biology?

I initially became interested in biology towards the end of high school, because I thought it might be relevant to understanding how the human brain directs behavior. However, this interest was quite vague, and my first couple of years of life science study as an undergraduate didn't convince me that biology used rigorous tools to answer this question. I, therefore, didn't become seriously interested in biological research until a third-year biochemistry class, where our laboratory exercises showed me the power of controlled experiments to decipher how genes controlled cell traits, one nucleotide at a time.

When did you know EvoDevo was for you?

When I started my PhD, my goal was to understand how genes regulated cell fates and behaviors during development in any single organism amenable to genetic manipulation. Learning how to do experiments to figure this out on my own, was absorbing enough. By the end of my PhD, however, obtaining answers to these questions in a single organism was no longer satisfying. I wanted to know if what I was learning about how genes directed development in one organism was to be expected or not, based on what these genes did in other organisms. Although I'd never taken a course in evolutionary biology as an undergraduate, I grew to understand that what I needed was the context that only an evolutionary perspective on the genetic control of development could provide. That understanding drove me to seek out labs doing evo-devo work for my postdoc.

Who was your most influential mentor?

Different people have provided me with invaluable mentorship in distinct ways, all of which have been essential. From my PhD

absolute best efforts to one's work, and following one's own intellectual path even in the face of skepticism, is not only its own reward but the only truly lasting reward in this profession. From my postdoctoral advisor Michael Akam, I learned that it is possible to juggle multiple demanding scientific, organizational, management, and leadership tasks, while still treating everyone with respect, grace, and dignity. And most importantly, from my parents, I learned the importance of setting one's own internal standards for the work and life we aspire to, rather than looking to others for approval or permission.

What was your biggest challenge getting to your position?

The biggest challenge has been just continuing to show up to work every day, despite having my abilities and interests questioned on a regular basis since high school. For every teacher, mentor, and peer that was encouraging along the way, there have been five more who have taken the time to tell or show me the various ways in which they thought I couldn't, shouldn't, or wouldn't be able to do what I wanted to do. Year after year, these things take a toll. Every day requires more energy to push these accumulated discouragements aside, keep my eye on my scientific passions, and tighten my grip on my belief that what I know I can do is more important than what others believe I should be satisfied with or am capable of.

Did you have to cross disciplines or engage in interdisciplinary collaborations to be able to conduct your characteristic kind of EvoDevo work?

Yes. For some of our work, we have collaborated with other researchers who have distinct technical or intellectual expertise. For example, we collaborated with applied mathematician Chris Rycroft from Harvard's School of Engineering and Applied Sciences, on a recent project that combined quantitative imaging of transgenic insect embryos with mathematical modeling (<https://www.biorxiv.org/content/10.1101/2021.04.26.441395v1>). Much more often, however, my lab's interdisciplinary approach is a result of my own wide range of interests and experiences, and of my deliberate recruitment of postdocs and graduate students who will bring distinct viewpoints,

interests, and skillsets to the existing lab team, to contribute new lenses of inquiry to the biological and evolutionary questions that we study.

In light of the transformation of EvoDevo and the institutional landscape you have seen, what is your advice for junior EvoDevo researchers?

I would advise that junior EvoDevo researchers stay true to themselves and their interests and that they check in with themselves regularly to make sure that they are really doing work that they love and believe in. This job is very hard work, and in my experience, it is only possible or worth it if you are genuinely passionate about what you are doing, and would rather be working on that problem than on almost anything else you can think of. Changing your research program in an attempt to match the perceived priorities of funding agencies or senior influencers, for example, is unlikely to be worth it if you end up working on something you don't genuinely care about. It is of course a reality that senior colleagues often have useful advice born from hard-earned experience, and that funding agencies need to be convinced that you have something useful to offer, to support your work. Nevertheless, if you don't truly believe in your work, in the potential importance of its contributions to our understanding of the natural world, and that you are doing it to the absolute best of your abilities, it will be hard to convince funding agencies, colleagues, or potential trainees to join you.

ORCID

Cassandra G. Extavour  <http://orcid.org/0000-0003-2922-5855>

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