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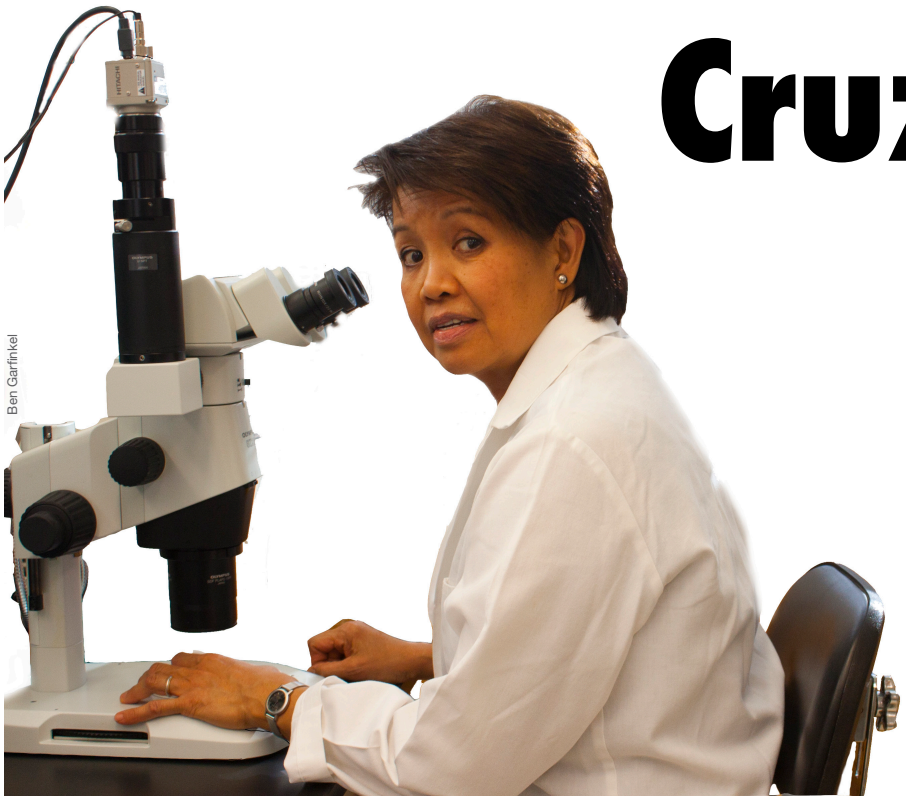
Cruzin' with Yolanda: The Life and Research of the Biology 100 Icon


Ben Garfinkel

Cruzin' With Yolanda

The Life and Research of the Biology 100 Icon

Since joining Oberlin College in 1986, Professor Yolanda Cruz has taught a number of biology and health related courses. Her current teaching assignments include a first year seminar, a health careers practicum, Intro Biology, Developmental Biology, and Epigenetics. Her main area of research focuses on marsupial reproduction and development.

I would like to know more about your research and how you got into it. I understand you work with marsupial development?

I do. … I'm a closet evolutionary biologist. … My particular favorite topic is how we can understand the common origin of animals, in particular mammals. I started studying mouse embryos, and expanded into marsupial development because, at my job at Oberlin, there is no way to compete with all the … bigger [mouse] labs.

How does the embryonic development of marsupials differ from that of other mammals? I know kangaroos give birth to underdeveloped young who crawl into the pouch to fully develop.

That is correct. I'm going to call the two major groups of mammals the marsupials and the placentals. You and I are placentals, whereas kangaroos, wombats, and possums are all marsupials. Marsupial babies are born immature — most of their development occurs outside the uterus. … The animal I study is a Brazilian marsupial called the gray short-tailed opossum. … It doesn't have a pouch; none of the New World [modern-day Latin and South America] marsupials have pouches. But, yes, their babies are born immature and they cling to their mothers' teats until they are ready to jump off. So the fundamental difference is that although the basic embryonic development scheme is about the same between marsupials and placentals, the marsupials are born much earlier.

So it's easier to study the embryonic development?

Exactly. … As you might guess, at the genetic level, we have a high degree of similarity, if not identity. So if I wanted to study the development of, say, the liver or the heart, I would be better off studying it in a marsupial. The embryos do not implant in the maternal uterus, so you can literally flush them out. My animal, for example, is pregnant for about only fourteen days. … The first six days are spent making the embryo become a beach-ball like entity called the blastocyst. There's nothing there really…maybe 128 cells. Then some cell divisions occur, the cells rearrange themselves into layers, and between days 12 and 13…you can practically see this thing become a baby in front of your eyes. ... All the organs, blood, and muscles will form, and then whoosh, they're born.

Do humans have a longer gestation period because we're larger and more complex?

No, I don't really think that. That's not the reason for it; it actually has to do with … the physiological requirements of the embryo. Placental embryos take longer to develop in utero. They are highly dependent on the mother. But … the shortest gestation period known is the Australian marsupial, the dunnart — eleven and a half days. You could probably take out the embryos on day nine and grow them in the right broth in a sterile dish and they wouldn't be much different from uterus-grown pups.

So, the way to understand this is to understand the origin of mammals. Mammals originated from an ancestral reptilian group. … Platypuses and Echidnas are members of a third group [of mammals], which lay eggs instead of bearing babies. It's a very obscure group because they're not found anywhere but Australia. If … you did not label their embryos and asked me to look at them, I would tell you they were reptiles. They do not look at all mammalian, not in the way we think of mammals.

Is the marsupial sort of in between the platypus and the placentals?

Not quite. You can't really say 'in between' because 'in between' would indicate that you are arranging them in a hierarchy.

Continued on **24**

Continued from **24**

So, it's more of an evolutionary tree.

It's more like a branch. Suppose you and I were to imagine that there were all these reptiles a long time ago. There was one branch of reptiles that spun off and somehow became different from the rest. That branch eventually diverged into three smaller branches. The first to spin off was the ancestral group of today's egg-laying mammals. The second branch stayed with the third for a while and then split off. One of these more recent branches was the marsupial, the other was us [placentals]. We [placentals] have more in common with marsupials than marsupials and placentals do with egg-laying mammals. But fundamentally we share some characteristics that define us all as mammals — the hair, the mammary glands.

You know, the platypus actually makes milk and the babies, when they hatch out of the eggs, start lapping up the milk from mom's belly skin. It's the most bizarre thing. The milk dribbles out like sweat from glands — modified sweat glands. …

I love these forms of organisms because … they are essentially extant fossils. What interests me is how related these animals are. I like the fact we can now access genes. That's the most exciting thing in my entire life as a biologist.

What research techniques do you use in your lab?

Several groups. You could say molecular — we do a lot of looking for marker genes. We also do cell biology techniques: immunochemistry, we can look at where genes are being expressed in an embryo. Molecular approaches, PCR, and things. We are still very visual, so we do a lot of imaging, confocal and light microscopy. A lot of staining. That's why I like developmental biology, because it straddles all of those levels of organization. I like to see molecules and how they change organisms in a visual way. ... That's why I'm a biologist. I think organic chemistry is really great, but I want to see things move, and wake up, and have babies and do weird things, like make pee or poop or eat. That's just me.

What would your advice be to students interested in going to graduate school and pursuing a career in research?

I would be remiss if I did not point out it is hard to get jobs these days. ... But let's forget for a minute that that is the reality. My advice would be … to actually fall in love with the discipline you want to immerse yourself in. Keep in mind how long you are going to live. Eighty-seven, eighty-four? How old are you? Nineteen? ... So if you go into a field of study because it will give you money or get you a job or something else, but doesn't really hold your interest, you will not be a happy camper. You want to find a … discipline that you are excited to get into every single day. In the worst day of the year, when it's snowing, but you want to go to work, that's when you know you've got the right job.

What made you choose to go into biology and research?

A series of total accidents. I was always interested in science, but I didn't know what kind of science until I was a junior [in college]. I was thinking about becoming a chem major, but then I became fascinated by biological systems. My undergraduate degree is a Bachelor of Science in Agriculture. … I studied livestock, sugar cane, all kinds of crops, … and for me, the biological aspect of everything was the most enticing, so I stayed in biology. I just happened to have really fantastic teachers in a field you might laugh at — entomology. So I became an entomology major. When I was doing my Master's, I moved into genetics. And when I did my Ph.D. I moved back to entomology because I found a professor I fell in love with intellectually, and I wanted him to be my mentor for my Ph.D. I ended up doing embryonic development in an obscure parasitic wasp about which essentially nothing was known.

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>
> Yolanda Cruz, Professor of Biology

Anyway, this is how I became interested in developmental biology. When I did my dissertation, no one understood anything about these [wasps], so I thought, "I have to understand embryonic development'. That was 1982, Ronald Reagan was President, there wasn't a lot of money to support postdocs and there happened to be an available postdoc [position] in California … [involving] mouse embryonic development. I knew nothing about mice. I signed up for it, and I guess I never looked back.

How did you end up at Oberlin?

Well, after four years of being a post-doc, you have to find a real job. Oberlin was one of the acceptances I had that year. … It is much less expensive to live in Ohio than in the other cities where I found jobs. And I am really not a party girl, so I didn't mind living in a small town. Also, at the time I had been divorced from my first husband, and I had a seven-year-old to care for, so I needed to be in a place where I could not only build a career but also raise my kid. There's a lot of personal stuff that goes into choosing where you end up. It was a whole series of little events.

I guess you love it, because you're willing to come out in the snow and the cold.

I do! I guess I love teaching in equal measure.

One more question: What are your interests and hobbies outside of academia?

I … travel a lot. I have one more continent to go: Antarctica. I'm saving for it. … [Traveling] is my one remaining vice. I like seeing places, I like doing things that challenge me. For example, last summer I climbed Kilimanjaro. I've paraglided in New Zealand, I've hiked in Australia. I think it's the coolest thing ever, and I'm very happy I can still do that. …

I took the train once from Adelaide to Perth, nearly three days' ride, and there was nothing out there except for desert and sky. That really taught me a lot about sustainability — I was told that that part of Australia has been continuously occupied for 40,000 years by Australian aborigines, but you never see them because there are so few. The land is so stark. These people don't build cities, they don't farm, they don't have houses. They go where the rains go. And perhaps that's the way to keep life on the planet sustainable. Sitting in the train for two days taught me something; I was saying to myself, "I don't believe there's nothing here."

Thank you so much for letting me interview you.

My pleasure.