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Python hearts reveal mechanisms relevant to human heart health and disease

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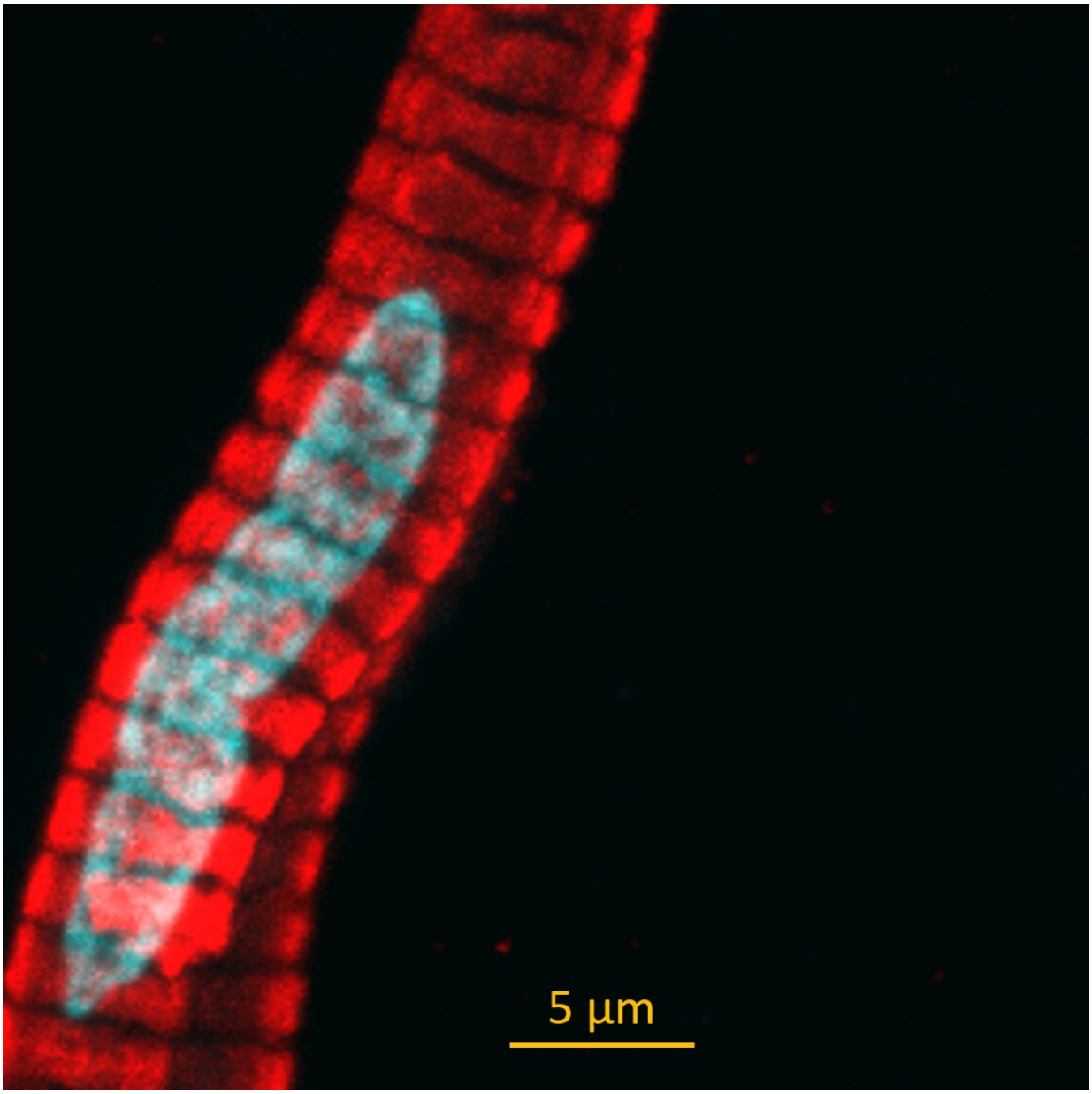

Python cardiomyocyte. Credit: Claudia Crocini

Burmese pythons have an amazing response to fasting and feeding. They can go without eating for months, and when they do eat, they can consume twice their body mass or more. Their hearts then nearly double in size in response to such a feeding, and after digestion most of that new tissue is broken down in a short amount of time. Leslie Leinwand's lab at the University of Colorado Boulder is working to better understand these dramatic changes in python hearts, which are relevant to enlargement of the human heart. Claudia Crocini, a postdoctoral fellow in the Leinwand lab, will present their latest research at the 63rd Biophysical Society Annual Meeting, to be held March 2—6, 2019 in Baltimore, Maryland.

Human hearts get larger in response to pregnancy or chronic exercise, both of which are normal, healthy processes. But the human heart also enlarges in response to chronic high blood pressure, or to certain genetic diseases, which presents health risks and can lead to heart failure. The processes involved in quickly growing and shrinking python hearts may provide insights that could help humans with these conditions.

"The Leinwand lab previously found that the increase in python cardiac size is triggered by a combination of fatty acids in python serum. That combination of fatty acids was able to induce hypertrophy in mice," Crocini said, and added, "now we want to understand the fundamental mechanisms of python cardiac growth at the cellular level, and how this healthy heart growth and regression could help redirect or regress a pathological heart growth in mammals."

But studying pythons isn't easy—there isn't much information about their genes, and it's difficult to isolate their cells because they're surrounded by a lot of tough collagen. "A python heart is 15-18 percent

collagen. In a healthy mouse, it's one percent," Crocini added. But in order to understand how python hearts function at the cellular and molecular levels, isolating their cells is crucial.

Crocini painstakingly developed a technique, involving an enzyme to break down the collagen, to isolate python heart cells (cardiomyocytes), while maintaining their normal structure. As compared to mammalian cardiac cells, python cardiomyocytes exhibit a long and thinner shape with one single nucleus. She and her colleagues were also able to isolate individual cardiac contractile units from python tissue, and measure the tension and rates of activation and relaxation of these units. Python contractile units are faster but generate less maximal force than those in humans.

"We now have the tools to study single python cardiomyocytes and understand the mechanics of python cardiac growth at the cellular level", Crocini explained.

Provided by Biophysical Society

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