EYE RESEARCH INSTITUTE

ERI research team probes molecular basis for healthy vision

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If you're reading this, thank your rods and cones – the millions of nerve cells that absorb light and allow you to see. These photoreceptors live in your retina, at the back of your eye, and they have a very distinct shape – without which healthy vision is impossible.

Andrew Goldberg, Reddy Professor of Biomedical Sciences in OU's Eye Research Institute, has devoted much of his career to studying the molecular basis for how this unique shape is achieved. He and a team of researchers published an article in the Proceedings of the National Academy of Sciences confirming the role of a specific protein in giving rods and cones their shape.

From left, Breyanna Cavanaugh, Andrew Goldberg and Michelle Milstein pictured in the Eye Research Institute.

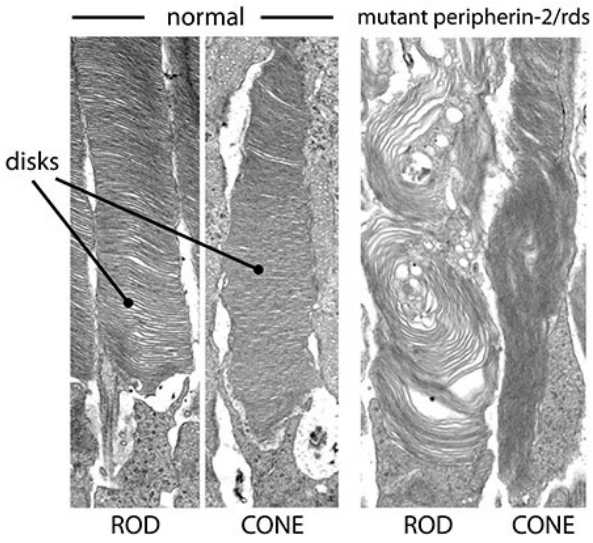
"The light-sensitive parts of rods and cones look sort of like stacks of pita breads," Goldberg said, describing healthy photoreceptor structure. "Individual pita breads (disks) are held in shape by a protein called peripherin-2/rds."

Scientists have discovered that gene mutations can impair the protein's normal function, leading to malformed rod and cone disks, and ultimately, to sight-robbing diseases such as retinitis pigmentosa and macular dystrophy.

One of the biggest challenges to treating diseases involving rods and cones has been a lack of understanding about their fundamental structure when healthy. That's why currently available therapies are designed to treat disease complications, instead of root causes.

"When you start losing vision, typically that means you've had the disease for a very long time," said Goldberg. "People usually start to notice problems in

their 40s or 50s, and by the time intervention takes place, you're treating the long-term effects of the disease, such as leaky blood vessels, rather than the rods and cones, which are the root cause."

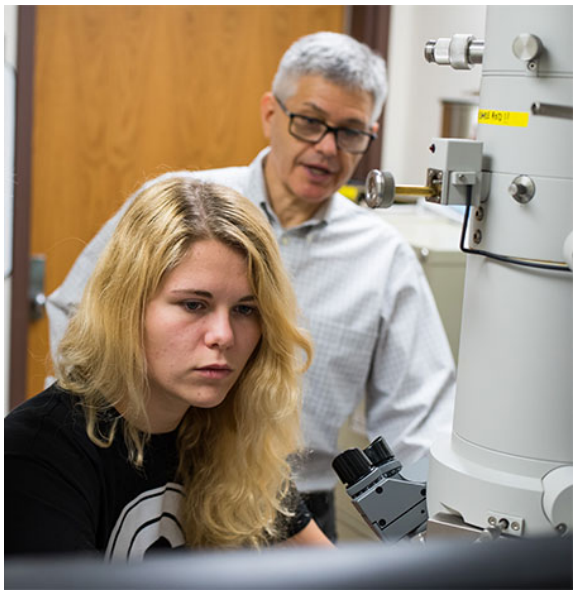


By discovering how normal rod and cone structures are achieved, Goldberg and colleagues are laying the groundwork for development of treatments that could be deployed much earlier in disease progression. Goldberg describes the published article as the "culmination of nearly two decades of work and national and international collaborations."

"This truly was a team effort," he added, noting that, besides himself, three other co-authors have OU ties: Michelle Milstein and Breyanna Cavanaugh are research scientists in Goldberg's lab, and Nicole Roussey trained in his lab as an undergraduate and is now in a biomedical Ph.D. program at Michigan State. Christian Rizza, who completed the 2018 Summer Undergraduate Program in Eye Research in Goldberg's lab, also contributed to the effort.

In addition, Goldberg credits institutional support for advancing OU's research mission as a whole.

"The need for efficiency within a research lab seems obvious, but the broader institutional culture is just as important," he said. "This research achievement was enabled by the hard work of many unsung heroes in areas like Facilities, University Technology Services, Legal, Purchasing and the Biomedical Research Support Facility."



Nicole Roussey and Andrew Goldberg pictured in the Eye Research Institute.

Now that researchers have answered the general question of how mutations in peripherin-2/rds cause eye disease, they can pursue more detailed inquiries into the causes and potential cures for specific pathologies affecting rods and cones.

"Because mutations in this protein can affect mainly rods or mainly cones, that suggests that the protein is keeping rods and cones in shape in different ways," Goldberg said. "No one knows how that works, so the next stage of our research is to look into these

questions and try to find answers that could further the development of more and better treatment options."

Learn more about the Goldberg Lab's research here.