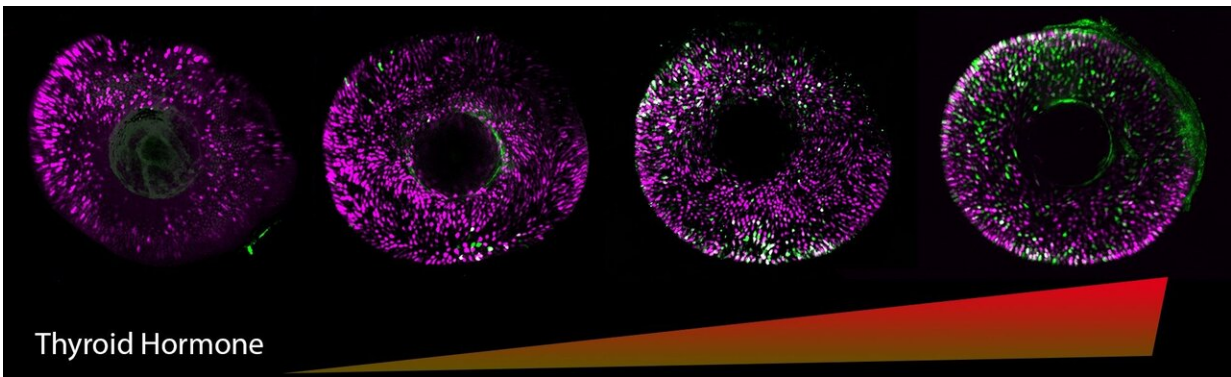


# Thyroid hormone can alter color vision in zebrafish, potentially in humans

August 6 2019, by Leigh Cooper

---



Thyroid hormone changes the color sensitivity of cones. Increasing concentrations of an active form of thyroid hormone (from left to right) cause a switch from “orange-sensitive” cones, indicated by magenta fluorescence, to “red-sensitive” cones, indicated by green fluorescence, in whole eyes obtained from larval zebrafish. The cones that appear white are caught in the act of switching. Credit: Robert Mackin and Deborah Stenkamp/University of Idaho

Exposure to thyroid hormone can alter eye function in zebrafish, a result with implications for curing color blindness and retinal degeneration in humans.

The University of Idaho study found the dosage of [thyroid hormone](#) in zebrafish could switch the type of [opsin](#)—proteins that support color vision—produced in individual eye cells called cones, likely influencing

the animals' color vision. Zebrafish and humans have similar genetics when it comes to color vision.

The researchers' findings were published today in *Proceedings of the National Academy of Sciences* and could lead to new therapies for visual disorders.

Cones distinguish color in vertebrates. Individual cones are sensitive to different colors of light depending on the type of opsin protein the cone produces. A cone that produces red-sensitive opsin is mainly responsive to red light. In humans and other primates, the genes that determine if a cone produces red- or green-sensitive opsin sit next to each other on the X chromosome.

Whether a cone became red- or green-sensitive was thought to be a random process due to this configuration. Recent research has suggested otherwise, said Robert Mackin, a doctoral student in U of I's College of Science and lead author of the study.

"Red and green are the most important colors we see," Mackin said. "They allow for our high-acuity vision, which we use for driving and reading. The red and the green cones that allow us to see these colors can die through diseases like macular degeneration, which affects many of the elderly."

The team tested whether thyroid hormone, which is pivotal in the development of the retina, could control which of the two opsin genes are turned on in zebrafish. Similar to the genetic arrangement in humans, zebrafish have neighboring opsin genes that produce red- and orange-sensitive opsin instead of red and green.

The study exposed [zebrafish embryos](#) and larvae to greater levels of an active form of thyroid hormone (T3). In those zebrafish, the number of

cones that expressed the red-sensitive opsin gene increased with the dosage of T3. Alternatively, if the thyroid gland was removed, the number of cones expressing orange-sensitive opsin increased compared to normal zebrafish. The findings indicate thyroid hormone can control whether red- or orange-sensitive opsin genes are turned on in zebrafish, Mackin said, a process that's not random.

Although individual cones usually produce only one type of opsin, the team found larvae exposed to T3 had individual cones that switched from triggering the orange-sensitive to the red-sensitive opsin gene. This finding suggests cones can change the type of opsins they produce. The authors suggest [zebrafish](#) may use [thyroid hormone](#) to tweak their eyesight as they grow and change their swimming and feeding behaviors.

"Our primary goal is to figure out the basic science and understand how opsin expression is controlled," Mackin said. "We hope that we and other researchers may be able to test this process in humans and then develop new treatments or therapies for preventing visual disorders from occurring or cure [color blindness](#) and vision loss diseases."

**More information:** Robert D. Mackin et al., "Endocrine regulation of multichromatic color vision," *PNAS* (2019).

[www.pnas.org/cgi/doi/10.1073/pnas.1904783116](http://www.pnas.org/cgi/doi/10.1073/pnas.1904783116)

Provided by University of Idaho

Citation: Thyroid hormone can alter color vision in zebrafish, potentially in humans (2019, August 6) retrieved 28 April 2024 from <https://phys.org/news/2019-08-thyroid-hormone-vision-zebrafish-potentially.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private

study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.