Research highlights

BRAIN TRACKERS REVEAL NAVIGATION SECRETS OF GOLDFISH

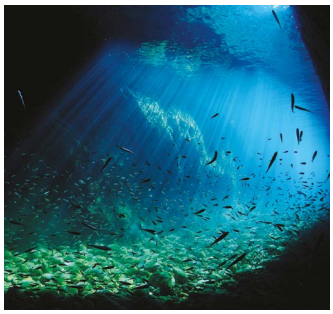
Recording devices implanted in the brains of goldfish have revealed how the animals navigate as they swim.

Scientists have long understood how land mammals use specialized neurons and brain-wave patterns to navigate on solid ground. To understand how fish determine their location in 3D space, Lear Cohen at Ben-Gurion University of the Negev in Beer-Sheva, Israel, and his colleagues equipped 15 goldfish (*Carassius auratus*) with a waterproof device that can measure an animal's brain activity as it swims.

The recordings revealed that fish, like mammals, have 'boundary' neurons, each of which detects a fish's distance from a boundary in a specific direction and fires more quickly as the animal approaches this boundary. In goldfish, these neurons create a type of brain-wave pattern that has never been seen in another animal during spatial navigation.

The authors suspect that the fishes' brains can also sense changes in water pressure as they move up and down. Comparing the navigation systems of fish and mammals, the authors add, could reveal how navigational abilities evolved and were adapted for different environments.

PLoS Biol. **21**, e3001747 (2023)



AIRBORNE SONAR SPIES ON WHAT LIES BENEATH THE WAVES

An imaging system can reveal underwater objects even when the water's surface is moving.

Underwater imaging is challenging. A laser-based technique called lidar can scan underwater objects from the air, but lidar's blue–green lasers do not penetrate turbid waters. The sound waves emitted by sonar systems can reach depths that lidar cannot, but sonars must usually be mounted on a vehicle, severely limiting their spatial coverage.

Aidan Fitzpatrick at Stanford University in California and his colleagues proposed a compromise. In their system, airborne infrared lasers scan the water's surface, generating ultrasound waves that propagate underwater and bounce off objects. The reflected sound waves are detectable in the air above the water, but are warped if the water is choppy. To compensate, the authors' design includes a scanner that maps the water's surface in 3D from above, allowing the system to take the water's motion into account.

The system successfully imaged simple objects submerged in a table-sized indoor water tank, in both still and moving water. Next, the authors will test their set-up in outdoor environments with more-complex wave conditions.

Commun. Eng. **2**, 16 (2023)

A FISH OUT OF WATER OFFERS CLUES TO WHY WE BLINK

Nearly all four-limbed vertebrates, or tetrapods, have evolved some way of blinking — but why and how?

Brett Aiello at Seton Hill University in Greensburg, Pennsylvania, and his colleagues studied mudskippers (subfamily Oxudercinae, pictured), which evolved blinking independently. These fish spend a lot of time on land and can breathe air, offering a parallel to the fish that crawled onto dry ground some 375 million years ago and gave rise to tetrapods.

Mudskippers blink not by shutting eyelids but by retracting their eyes into their heads. The authors found that the fish blink for similar reasons to tetrapods: in particular, they blink more often when the air gets drier, suggesting that this helps to keep their corneas moist. However, the fish do not seem to have tear glands or muscles that evolved specifically for retracting the eyes.

Tetrapod fossils from shortly after the creatures moved onto land show evidence of retractable eyes, which suggests that they were capable of blinking. This, along with the latest findings, implies that blinking arose in both lineages as an adaptation to life on land.

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HOPES FIZZLE THAT TB VACCINE ALSO FIGHTS OFF COVID

A widely used tuberculosis vaccine failed to prevent COVID-19 in health-care workers who were enrolled in a large trial at the height of the pandemic.

Laure Pittet at the Murdoch Children's Research Institute in Melbourne, Australia, and her colleagues enrolled nearly 4,000 health-care workers in Brazil, Australia and Europe in a trial of BCG, a tuberculosis vaccine given to 130 million babies each year. None of the workers had received a COVID-19 vaccine. Between May 2020 and April 2021, half of the participants were randomly chosen to receive BCG; the other half got a placebo.

Rates of COVID-19 were similar in both groups after six months, as were the very small numbers of people hospitalized (five in each group, with one death in the placebo group). An earlier study had found that participants in the randomized trial who received the BCG vaccine had immune markers consistent with protection against severe COVID-19.

The trial stopped enrolling participants when COVID-19 vaccines became available, and its smaller-than-planned size meant that it was not possible to determine conclusively whether BCG vaccine gave any protection against severe disease and death.

N. Engl. J. Med. **388**, 1582–1596 (2023)

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