



SPARC WEEKLY



THE MOST REMARKABLE SCIENTIFIC DISCOVERIES OF 2024

COMPLETED MAP OF FRUIT FLY BRAIN



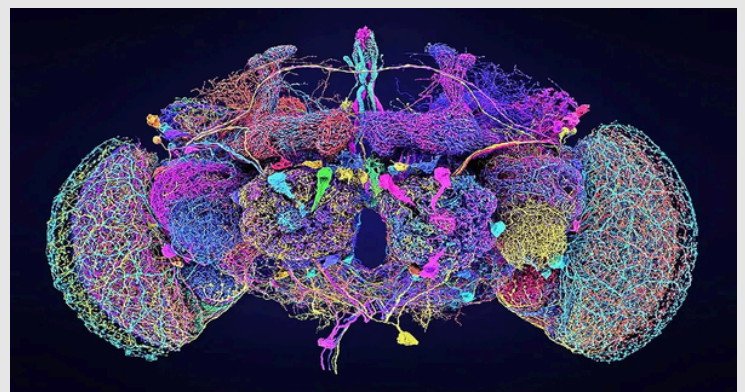
In October 2024, researchers released a completed map of nearly 140,000 neurons in a fruit fly (*Drosophila melanogaster*) brain. This wiring diagram, or connectome, could help experts understand how human minds process thoughts, make decisions, and store memories. The mapping process took an international research team 10 years to complete. Along with counting neurons, the team also looked at and mapped millions of synaptic connections.

To map the fruit fly brain fully, the research team removed the fly's brain - which was about the size of a poppy seed - covered it in resin and let it harden into a block. Then, the team shaved off ultra-thin pieces of the block - thinner than human hair - and photographed each piece with an extremely high-resolution microscope.

With over a million images, the team identified neurons and synapses before using a computer program to create a three-dimensional model of the brain.

Key Stats From the Fly Brain Study

- 76 laboratories and 287 individuals
- 7,050 brain slices
- 21 million microscope images
- 139,255 neurons
- 50 million chemical synapses
- 8,453 cell types (there are now only 3,300 identified neuron cell types in the human brain)
- 490 feet of neuronal "wiring"



Researchers mapped all 139,255 neurons in the brain of an adult fruit fly, which are linked by more than 50 million synapses.

<https://www.discovermagazine.com/the-sciences/scientists-share-mind-boggling-insights-about-human-memory-by-mapping-fly>
<https://www.nature.com/articles/s41586-024-07686-5>
<https://www.discovermagazine.com/the-sciences/9-of-the-most-remarkable-scientific-discoveries-of-2024>

NEW SUPER-EARTH FOUND IN A HABITABLE ZONE



Super-Earth discovered in the "optimal habitable zone" of its star

In January 2024, NASA **announced** the discovery of a “super-Earth” about 137 light-years away from us. The planet — TOI-715 b — may be habitable.

According to NASA, TOI-715 b is about one and a half times as wide as Earth and resides in a “conservative habitable zone” while it orbits its small, reddish star. The habitable zone describes a planet that is the perfect distance from its star so that water can remain in liquid form on its surface instead of freezing or vaporizing. This star may also have a smaller Earth-like planet in its orbit. Though not yet confirmed, the smaller planet, TIC 271971130.02, would be the smallest known exoplanet in a habitable zone. Researchers located both of these planets using the Transiting Exoplanet Survey Satellite (TESS).

<https://www.earth.com/news/super-earth-discovered-in-the-habitable-zone-of-its-star/>

CRISPR AND AI TEAM UP

Clustered Regularly Interspaced Short Palindromic Repeats (CRISPR) technology allows for geneticists to cut and edit specific parts of DNA strands. This could help treat people with genetic disorders. Emmanuelle Charpentier and Jennifer Doudna won the Nobel Prize in 2020 for creating the CRISPR/Cas9 genetic scissors, a tool that could help change countless lives. Now, this technology may be getting an artificial boost.

Researchers are hoping to implement large language models (LLMs) similar to the artificial intelligence (AI) behind ChatGPT. The team at Profluent is calling the new technology OpenCRISPR-1 and has made the gene editor open-source so that other research teams worldwide can access it. They also emphasize that their creation is for ethical use only. AI could help make gene editing more accurate and safer.



CREME can provide interpretations across multiple scales of genomic organization

<https://www.sciencedirect.com/science/article/abs/pii/S277304412400041X>
<https://www.genengnews.com/news/crispr-creme-an-ai-treat-to-enable-virtual-genomic-experiments/>

PLASTIC POLLUTION PANIC

There are now an estimated eight gigatons of accumulated plastic on Earth — twice as much as the weight of all animal life.



Plastics hit the spotlight this year as delegates to the United Nations tried to thrash out an international treaty to end plastic pollution. Although they failed to come to an agreement by December as originally planned, their work will continue next year.

There are now an estimated eight gigatons of accumulated plastic on Earth — twice as much as the weight of all animal life. Plastic has leached into every corner of our lives, including our oceans, air, food, blood and mothers' milk. To support the treaty process, researchers modeled various plastic control policies and cataloged more than 16,000 plastic chemicals. More than 4,200 of these were found to be of concern because they were “persistent, bioaccumulative, mobile and/or toxic.”

“I would far rather we take the time needed to agree upon a strong treaty rather than settle for something of little substance,” says Richard Thompson, a marine biologist at the University of Plymouth in England who studies plastics and is coleader of the

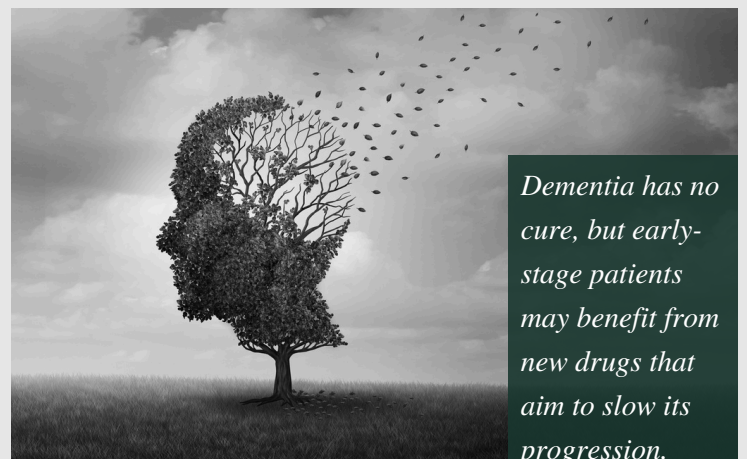
Scientists' Coalition for an Effective Plastics Treaty. “Personally, I remain hopeful; there are answers to this problem.” The key, he says, is to dramatically reduce overall production, and make the remaining essential plastics “better by design” — with more recycled content, for example, and fewer toxic additives.

Researchers also continue to seek out better ways to recycle or dispose of plastics (including finding fungi or bacteria to do the job), or to create more biodegradable versions.

<https://knowablemagazine.org/content/article/society/2024/top-scientific-news-and-breakthroughs-of-2024>

DEALING WITH DEMENTIA

Alzheimer's is a cruel disease for all involved. Watching a loved one slowly lose their memories, identity, and independence is painful. On top of that, testing for the disease requires a sample of cerebrospinal fluid or a PET scan (brain imaging), according to the NIH. These tests are usually not offered at a primary care office, and inconvenient hurdles can prevent patients from discovering the diagnosis and finding the right medication to slow the disease's progression.



Dementia has no cure, but early-stage patients may benefit from new drugs that aim to slow its progression.

However, in 2024, a study partially funded by the NIH revealed that a simple blood test could accurately detect if a patient had Alzheimer's. Researchers tested blood samples from over 1,200 older adults, some in memory care and some in primary care. The team analyzed the blood through a PrecivityAD2 test that measured amyloid beta and p-tau217. Amyloid beta accumulates in your brain due to Alzheimer's.

The team compared the blood to the cerebral fluid and PET results and found there was an 88 percent to 92 percent accuracy. While more fine-tuning needs to be done to the blood test, this could drastically change patients' lives in the long run.

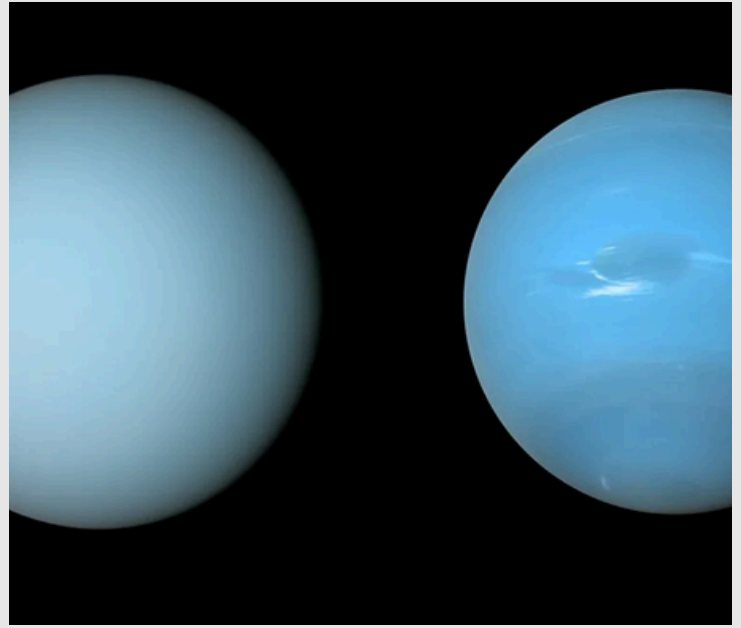
<https://www.discovermagazine.com/the-sciences/9-of-the-most-remarkable-scientific-discoveries-of-2024>

<https://www.nih.gov/news-events/nih-research-matters/accurate-blood-test-alzheimer-s-disease>

THE NEW MOONS OF NEPTUNE AND URANUS

Like Earth, Uranus and Neptune have their own moons. Unlike our one moon, however, these ice giants have multiple. Up until 2024, astronomers were only aware of Uranus having 27 moons and Neptune having 14. According to the International Astronomical Union's Minor Planet Center, however, three new moons are in orbit around these two planets.

Using powerful land-based telescopes — Magellan in Chile and Subaru in Hawaii — astronomers spotted two of the moons orbiting



NASA's Voyager 2 spacecraft captured these views of Uranus (left) and Neptune (right) during its flybys of the planets in the 1980s.

Neptune and one orbiting Uranus. The new moon in Uranus' orbit is only about 5 miles across, likely the smallest of the now 28 moons. Astronomers also say it takes 680 days for the moon to travel around Uranus.

The new moons around Neptune are a bit larger. One is about 14 miles across and takes 9 years to complete a turn around Neptune, while the other is about 8 miles across and takes 27 years to complete orbit.

Astronomers say that these are the faintest moons ever spotted with land-based telescopes, and a special image process was used to identify them.

<https://www.discovermagazine.com/the-sciences/9-of-the-most-remarkable-scientific-discoveries-of-2024>

<https://carnegiescience.edu/new-moons-uranus-and-neptune-announced>
<https://earthsky.org/space/new-moons-uranus-neptune-solar-system/>

WHO ARE WE?

SPARC Robotics Team's mission and vision is to make our environment the best it can be. On a volunteer basis, we look at the problems that are happening around us and make them our problems, both as SPARC and individually, and help as much as we can with appropriate projects. NASA ACCP (Astro Camp Community Partners) was only in the US until four years ago. This year they came to Turkey with us after four years of traveling to many countries. ACCP educates school-age children from kindergarten to high school on science-related topics of interest with practical knowledge and application, while also supporting children's craft development, general culture and questioning skills. As SPARC, we have brought this training provided by NASA to our country in the most comprehensive way and our continuous communication with NASA not only enables us to improve our trainings day by day, but also gives us the opportunity to learn about the innovations in the field of STEM instantly, from the most accurate source and to spread the knowledge we have around us.



EDITOR

Dear reader,

On behalf of SPARC, wishing you a New Year filled with groundbreaking ideas, seamless collaborations, and inspiring achievements.

Happy 2025!

Defne Şehidoğlu

