FRANK GLAW

The male Brookesia nana is only 0.53 inch long. It may be the smallest of all the roughly 11,500 known species of reptiles, the Bavarian State Collection of Zoology in Munich says. The female nano-chameleon is significantly larger, with an overall length of 1.14 inches,

Nano-chameleon may be smallest reptile on Earth

Scientists say they discovered a sunflower seed-sized subspecies of chameleon that may well be the smallest reptile on Earth.

Two of the miniature lizards, one male and one female, were discovered in northern Madagascar by a German-Madagascan expedition team.

The male *Brookesia nana*, or nano-chameleon, has a body that is only 0.53 inch long, making it the smallest of all the roughly 11,500 known species of reptiles, the Bavarian State Collection of Zoology in Munich said. Its total length from nose to tail is just under 0.87 inch.

The female nano-chameleon is significantly larger, with an overall length of 1.14 inches, the research institute said, adding that the scientists were unable to find further specimens of the new subspecies "despite great effort."

The species' closest relative is the slightly larger *Brookesia micra*, whose discovery was announced in 2012.

Scientists assume that the lizard's habitat is small, as is the case for similar subspecies.

"The nano-chameleon's habitat has unfortunately been subject to deforestation, but the area was placed under protection recently, so the species will survive," Oliver Hawlitschek, a scientist at the Center of Natural History in Hamburg, said in a statement.

— Reuters

Unearthing how brains make new cells

Neuroscientist talks about discovering the organ's regenerative abilities and the advantages of exercise

BY JAMIE TALAN

When Fred "Rusty" Gage began his career in neuroscience more than four decades ago, the general thinking was that adult human brain cells just don't reproduce and that their numbers are fixed. You lose them, they are gone forever. But Gage's studies on adult human brain cells in the 1990s surprised everyone, including himself, when he and his colleagues found that exercise — such as running — and enriched, complex and variable environments can give rise to new populations of cells that serve the brain well. He has been a serious runner most of his life, so this was good news on every level.

Now 70 and president of the Salk Institute for Biological Sciences in the La Jolla neighborhood in San Diego, Gage is still trying to figure out how adults can continue to make new brain cells and keep their brains healthier and resistant to disease. As head of the institute, he also supports his colleagues' broader work in novel approaches to treating cancer, how the properties in the food we eat shape our brains, the effect of isolation on brain functioning, and plant biology and climate change.

The Washington Post spoke with Gage on a video conference call recently to talk about growing up overseas, including in Frankfurt, Germany, and Rome; honing his interests in various labs; and giving mice a running wheel in their cages that sparked a key finding in understanding neuron growth in the brain

CHRIS KEENEY/SALK INSTITUTE

Now 70, Fred Gage of the Salk Institute for Biological Sciences continues to explore how adults can continue to make new brain cells and keep their brains healthier and resistant to disease.

Q: How did you first become interested in neuroscience?
A: It was a chance encounter [on a bus in Florida] with someone I had known in Frankfurt. He was working in the laboratory of Robert Isaacson, a psychologist laying the physiological groundwork of a brain structure called the hippocampus. [The hippocampus is important in moving short-term memories into long-term storage.] Isaacson was studying epilepsy. My friend urged me to apply for a summer job. I was 18, and I stayed in the lab for 3½ years. . . . .

[After studying science in college] I then applied to a graduate program at Johns Hopkins University to study with Dave Olton, who did PhD work with Bob Isaacson. In their lab, we made lesions [or cuts] in rodents' brains to study the anatomical basis of spatial memories. We'd make a cut in one area of the brain and see how it changed the animal's behavior. Then, we would follow the recovery process. It was an amazing place to learn neuroscience.

After I finished my doctorate, I headed to Texas Christian University as an associate director of a new neuroscience program. We were interested in sprouting — how nerve fibers can regrow — in the hippocampus after injury and determining if this was responsible for the behavioral recovery. We found a high level of zinc in the hippocampus, and we began following a trail that led us to growth factors that are involved in brain development. [Growth factors do just what their name implies: they regulate a number of cellular events.]

I wanted to discover more about growth factors and joined the lab of Anders Bjorklund at Lund University in Sweden. He discovered that sprouting, the growth of neural branches, took place when the brain is injured. . . . I learned about neural transplantation and techniques to deliver cells into the brains of animals. We were interested in nerve growth factors and wondered if these factors were the source of this new growth that we were observing in the brains of the animals we studied.

Q: How did you start testing your ideas?
A: I moved to the University of California in San Diego in 1985. My lab began working on engineering viruses to insert nerve growth factor in cells to transplant into the brain and subsequently contributed to building the first safe viral packages to deliver genes to the brain. We also took skin fibroblasts, which are known to divide and grow, and overexpressed nerve growth factors and then inserted them into the hippocampus. We found that when we put cells expressing a certain growth factor in a dish with neural progenitor cells, they grew like crazy. This led to a long effort to learn how progenitor cells divide and survive in the brain.

In 1994, DNA co-discoverer Francis Crick was heading up the Salk Institute, down the road from UCSD, and he invited me to join the Salk. The job description was simple: he said I could do anything I wanted. . . . My new lab experimented with a synthetic molecule called BrdU, which gets into a cell's DNA when it's dividing. It is used to tag dividing brain cells. We designed experiments to see whether BrdU was getting inside of neurons undergoing cell division. We found that the molecule did get inside of the neuron in the adult rodent brain, and this was a great tool for us and others to identify the birth of new neurons in older brains.

Meanwhile, my colleagues and I were busy studying the birth of new neurons, which is called neurogenesis, in adult mice. We first discovered increased neurogenesis with exposure to enriched environments that contained running wheels and we were amazed, but then we wondered whether the running wheels alone or the enriched environment without running wheels could increase neurogenesis. We took away the running wheel and added small playthings to the cages. We were further amazed that both conditions increased neurogenesis in different ways. Our lab and others have replicated these experiments with a variety of items: tunnels and tubes, blocks, balls, wire mesh, poles, really anything they can climb around and in.

The mice that spent time running and playing showed evidence of neurogenesis in an area of the brain called the dentate gyrus of the hippocampus. [The dentate gyrus is important in taking our experiences and turning them into memories.]

Q: How did these findings lead to your work in humans?
A: Our goal was to see if neurogenesis was also going on in humans. We used BrdU attached to a fluorescent antibody to tag any dividing neurons, if they were there. A colleague from Europe had access to fresh autopsied tissue from cancer patients who had been injected with BrdU to track brain tumors before they died. In early 1997, we conducted studies on the autopsy tissue and we could see cells tagged with BrdU. This proved there were dividing young cells in the dentate gyrus of the hippocampus that had become mature neurons. We continued to do other studies to prove that the human hippocampus retains its ability to generate neurons throughout life.

Last year, two studies were published showing that there is still neurogenesis in the hippocampus in older people and those who died with Alzheimer's disease.

Today, our findings and the work of many, many others have led pharmaceutical companies to develop drugs that target neurogenesis.

Q: You are also interested in the chemistry of food and behavior on life span?
A: Yes. We know that neurogenesis increases cognitive function and we wanted to find natural products in our diet that also increase the birth of new neurons in the adult brain. We have funding from the Mars Company's research arm — the Mars Edge Cocoa Flavanol Science Hub — to study the chemistry of food and the effects of our life choices and our behavior on our brains, and to look at various flavonoids that can have an effect on neurogenesis. We are also studying the effects of diet on inflammation, which appears to block vascular health and neurogenesis. We want to determine if the food we eat influences inflammatory processes.

Q: Have you found anything yet?
A: Yes, we found that specific elements in certain plants we eat contain flavones, which are small molecules that plants use to protect their outer cell layers from excess light; they can have remarkable anti-inflammatory effects on mammals, including humans.

Since our work with plants and food, my wife and I have modified our diet. We generally eat less, and choose more vegetables and fish over red meat, processed foods and sugar. I have always been a runner, but our findings on neurogenesis and exercise have continued to inspire my runs. In addition to my daily running, we also take long walks and stay active.

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SCIENCE NEWS

Pandemic lockdowns made the air cleaner. But better air added heat to warming planet.

Earth spiked a bit of a fever in 2020, partly because of cleaner air from the pandemic lockdown, a new study found.

For a short time, temperatures in some places in the eastern United States, Russia and China were as much as half to two-thirds of a degree (0.3 to 0.37 degrees Celsius) warmer. That's due to less soot and sulfate particles from car exhaust and burning coal, which normally cool the atmosphere temporarily by reflecting the sun's heat, last week's study in the journal Geophysical Research Letters reported.

Overall, the planet was about 0.05 degrees (0.03 degrees Celsius) warmer for the year because the air had fewer cooling aerosols, which unlike carbon dioxide is pollution you can see, the study found.

"Cleaning up the air can actually warm the planet because that (soot and sulfate) pollution results in cooling" which climate scientists have long known, said study lead author Andrew Gettelman, an atmospheric scientist at the National Center for Atmospheric Research. His calculations come from comparing 2020 weather to computer models that simulated a 2020 without the pollution reductions from pandemic lockdowns.

This temporary warming effect from fewer particles was stronger in 2020 than the effect of reduced heat-trapping carbon dioxide emissions, Gettelman said. That's because carbon stays in the atmosphere for more than a century with long-term effects, while aerosols remain in the air about a week.

Even without the reduction in cooling aerosols, global temperatures in 2020 already were flirting with breaking yearly heat records because of the burning of coal, oil and natural gas — and the aerosol effect may have been enough to help make this the hottest year in NASA's measuring system, said top NASA climate scientist Gavin Schmidt, who wasn't part of this study but said it confirms other research.

"Clean air warms the planet a tiny bit, but it kills a lot fewer people with air pollution," Gettelman said.

— Associated Press

ASSOCIATED PRESS

People take selfies in Shanghai. A study finds that cleaner air from the pandemic lockdown warmed Earth a bit in 2020, especially in places such as the eastern United States, Russia and China.

SCIENCE SCAN

ENTOMOLOGY

Free coloring book on arthropods is a fun, informative tool for your young naturalists

Arthropods! A Coloring/Learning Guide for Young Naturalists
Matt Bertone
bit.ly/ColorArthropods

Is your kid interested in creepy, crawly insects and other arthropods?

If the answer is yes, they'll want to check out a free coloring book created by the entomologist who directs North Carolina State University's Plant Disease and Insect Clinic.

Matt Bertone's "Arthropods! A Coloring/Learning Guide for Young Naturalists" is stuffed with information about arthropods — invertebrate animals with exoskeletons, jointed appendages and a segmented body.

Insects, spiders, crustaceans and many-footed critters such as millipedes are members of the phylum *Arthropoda*. Their ranks include everything from the Florida bark scorpion, a venomous scorpion that can grow up to six inches long, to the elephant mosquito, the largest mosquito in the world.

Scientists think there are at least 14 million species of arthropods, 80 percent of which have yet to be discovered.

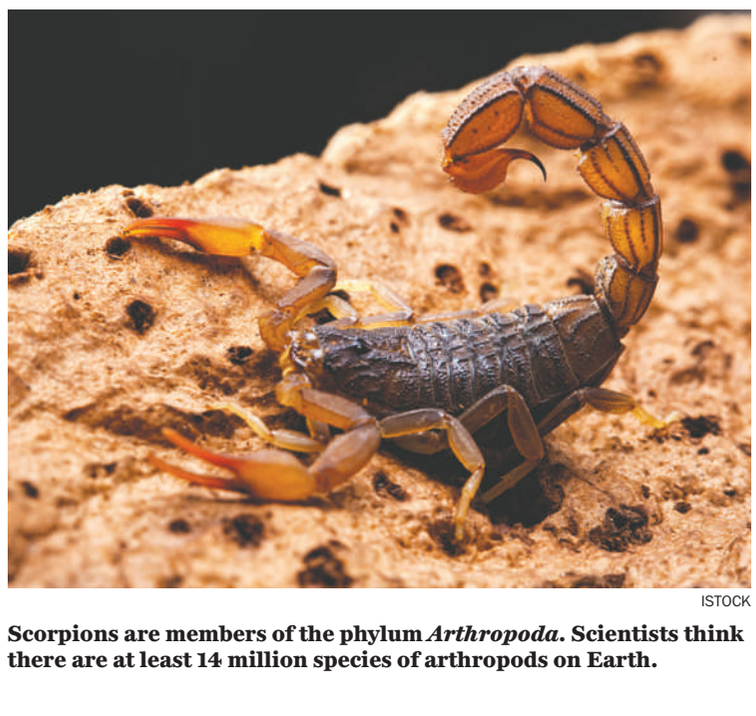
One of the more surprising additions to the book is the goose barnacle. Although it may look like a mollusk, it's actually an arthropod — and Bertone points out that none other than English naturalist Charles Darwin specialized in barnacles.

Each page includes an illustration and information on the arthropod's habits and habitats. The book also provides general information on arthropod distribution and how the animals eat and live.

The entomologist actually wrote the book in 2008 before he had found his professional path. He was inspired to finally post the work in response to a tweet asking people what they would have done if they hadn't followed their current career path.

When he realized he would have made coloring books for kids, he resurrected the project and posted it online. Download the free guide at *bit.ly/ColorArthropods*.

— Erin Blakemore



ISTOCK

Scorpions are members of the phylum *Arthropoda*. Scientists think there are at least 14 million species of arthropods on Earth.

HEALTH & SCIENCE

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