

Leigh's team mixed together building blocks containing carbon, hydrogen, oxygen and nitrogen atoms with iron ions and chloride ions. "You dump them all in, heat them all up and they self-assemble," he says.

Sticky metal ions hold the building blocks in the correct position, and a single chloride ion sitting in the middle of the structure anchors it all together. Then, a chemical catalyst links the building blocks, forming the completed knot. The new knot is the tightest ever created, Leigh says, with just 24 atoms between each crossing point.

It's beautiful, Sanders says. "It's a string of atoms rolled up in a spherical shape, with an astonishing amount of symmetry." Sanders is reluctant to speculate how such a knot might be used, but it's round and very dense, he says. That could give it some interesting material properties.

Leigh suspects that different molecular knots might behave differently, like the various knots used by fishermen and sailors. "We want to make specific knots, see what they do and then figure out how to best exploit that," he says. ^s

another controlled biting. Together, those neurons helped the mice grab dinner.

"Over the years we've become progressively more surprised by the behavioral specificity of these particular pathways," says Anthony Leonardo, a neuroscientist at the Howard Hughes Medical Institute's Janelia Research Campus in Ashburn, Va. "Certainly the evidence is mounting for a very strongly specific role for neurons." Leonardo has found similarly specialized neurons in the dragonfly brain, with groups of neurons that run in parallel to each other controlling different types of movements.

Next, de Araujo says, his lab hopes to figure out what flips the neural switches in a mouse's brain — how seeing or smelling potential prey triggers the amygdala to send the critter after a meal. ^s

EARTH & ENVIRONMENT

2016 shattered Earth's heat record

Climate change, El Niño drove high global temperatures

BY THOMAS SUMNER

For the third year running, Earth's thermometer broke a new record: 2016 was the warmest year since record-keeping began in 1880.

Spurred by climate change and heat from a monster El Niño, the global average surface temperature last year was 0.94 degrees Celsius (1.69 degrees Fahrenheit) higher than the 20th century average of 13.9° C (57° F). That figure slightly edges out the previous titleholder, 2015, by 0.04 degrees C (SN: 2/20/16, p. 13). Eight months during 2016 set new all-time highs. July and August tied as Earth's warmest months on record, scientists from the National Oceanic and Atmospheric Administration and NASA reported January 18.

This is only the second time that the annual temperature record has been broken three years in a row, Deke Arndt, chief of the monitoring branch of NOAA's National Centers for Environmental Information in Asheville, N.C., said in a news conference. The previous trio — 1939 through 1941 — don't rank within the top 30 warmest years on record, he noted.

Last year's heat has helped set other records as well. On January 17, for instance, global sea ice extent was at its paltriest in potentially thousands of

years, according to observational data from the National Snow and Ice Data Center and sea ice reconstructions.

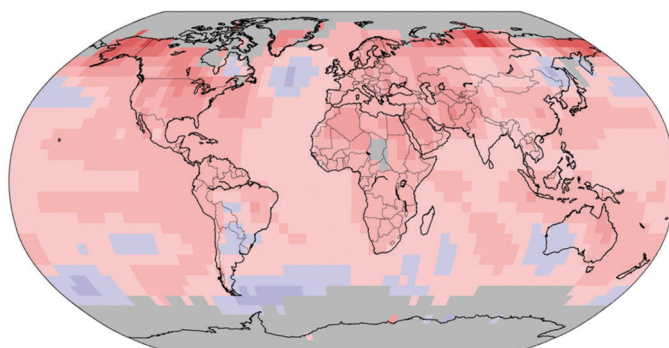
Greenhouse gases released by human activities such as fossil fuel burning have cranked Earth's thermostat over the last few decades by trapping heat that would otherwise escape into space. All 16 years of the 21st century are among the 17 warmest on record. (1998 ranks as the eighth warmest year.)

Humankind's fossil fuel habit isn't solely to blame for 2016's sweltering heat, says Kevin Trenberth, a climate scientist at the National Center for Atmospheric Research in Boulder, Colo. El Niño, the pile up of warm water in the eastern Pacific, also contributed. The 2015–2016 El Niño, among the three strongest on record, raised global temperatures by releasing pent-up heat from the ocean into the atmosphere (SN Online: 6/9/16).

Within a decade or so, as global warming continues, 2016's heat will be par for the course even during non-El Niño years, Trenberth predicts. "The temperature record is like going up a staircase, and now with 2015 and 2016, we've seemed to go up another step," he says. "We'll maybe oscillate around this higher level for a few years, but I don't think we'll ever go back to the values we've seen in previous years." ^s

Record breaker

Climate change and remnant warming from the 2015–2016 El Niño helped make 2016 the hottest year on record. Red areas were warmer than their long-term average temperature; blue areas were cooler. Gray represents areas with insufficient long-term data.



Temperature difference in 2016 compared with 1891–2010 average

