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A New Map of the Universe

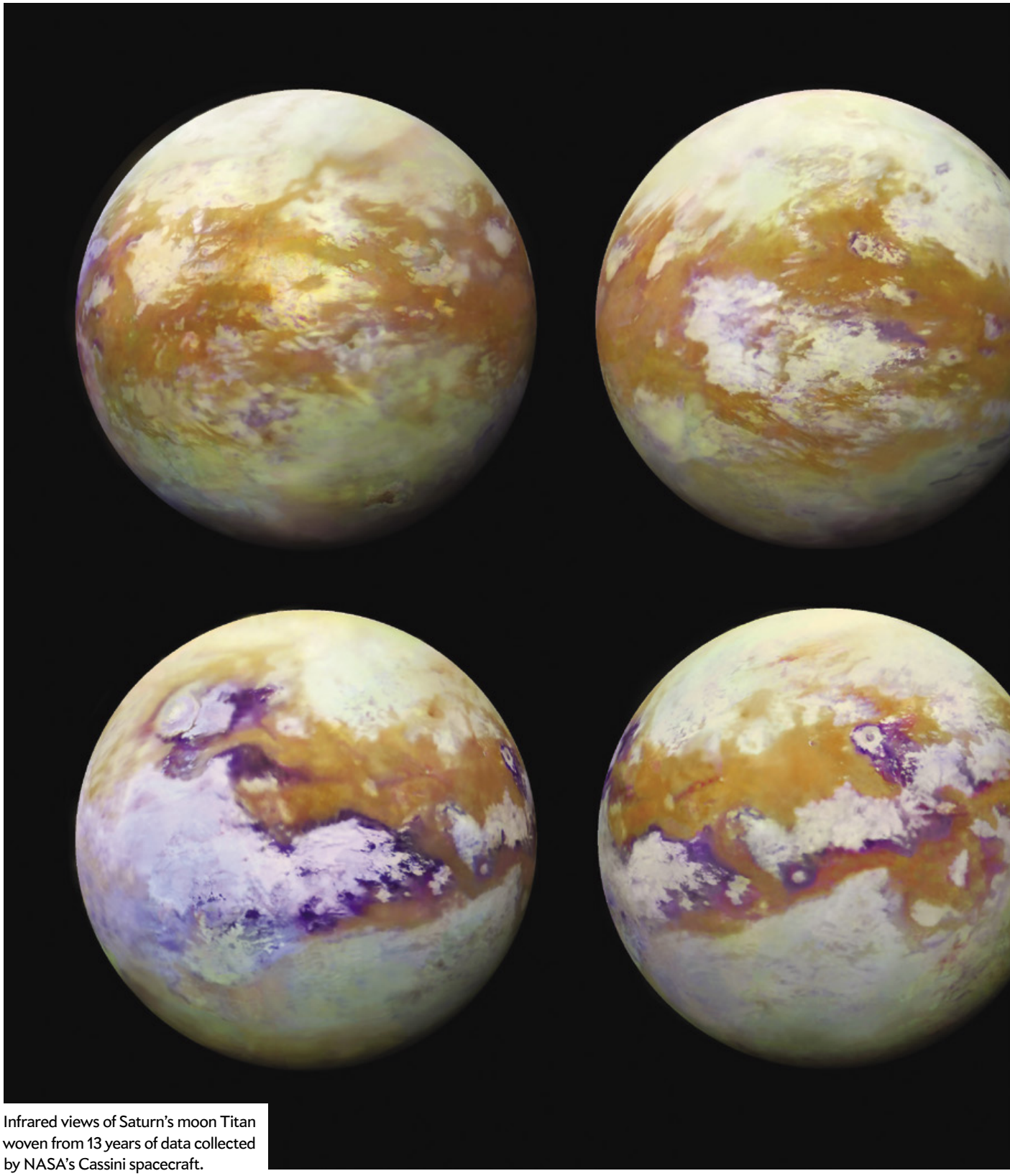
Alzheimer's and the Blood-Brain Barrier

How to Help Adolescents Flourish

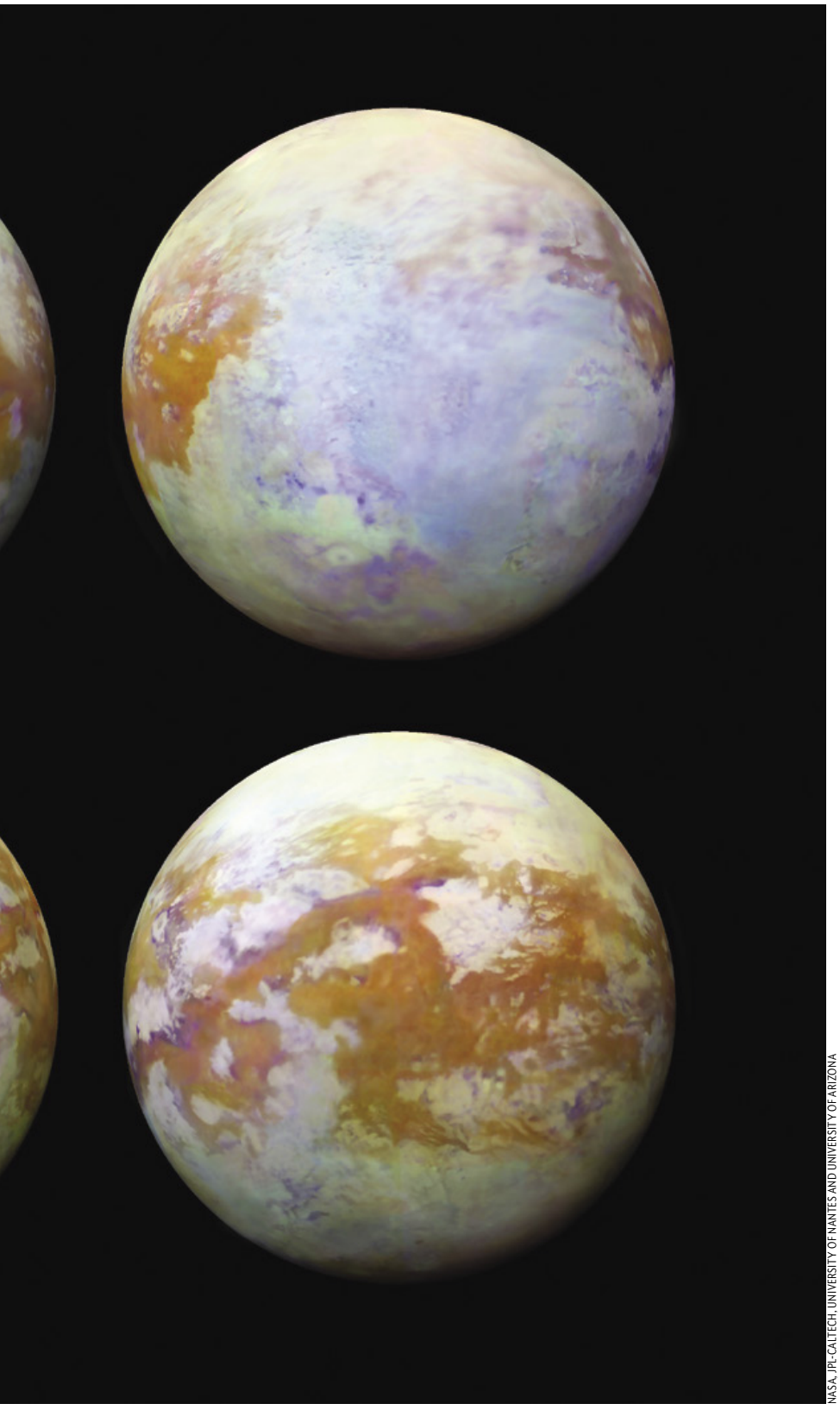
JOURNEY INTO THE AMERICAS

Genetic and archaeological discoveries tell a new story about how the continents were populated

ADVANCES



Infrared views of Saturn's moon Titan woven from 13 years of data collected by NASA's Cassini spacecraft.



NASA, JPL-CALTECH, UNIVERSITY OF NANTES AND UNIVERSITY OF ARIZONA

INSIDE

PLANETARY SCIENCE

Alien Depths

Titan's largest sea could be deep enough to swallow skyscrapers

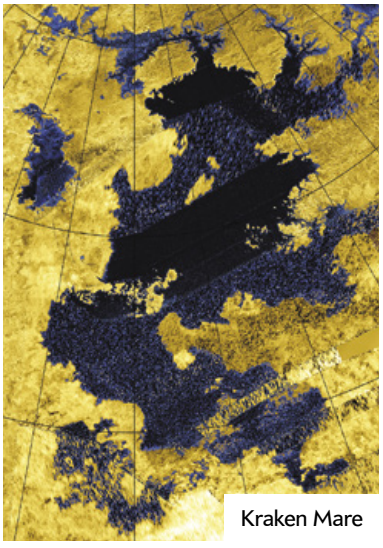
Saturn's moon Titan is the only known place in our solar system, other than Earth, where liquid lakes and seas persist on a world's surface. Scientists are fiercely curious about these features, and now new calculations plumb the impressive depths of Titan's largest sea, Kraken Mare—a frigid blend of methane, ethane and nitrogen.

The finding comes from a fresh analysis of radar scans performed by the Cassini probe as it passed haze-shrouded Titan in August 2014. Using the scans, researchers estimated the depth in a part of Kraken Mare where it was possible to detect a seafloor and in others where it was not. Where a bottom was found, in a large northern estuary, some signals bounced back from the surface while others penetrated the liquid and echoed off the seafloor, says planetary scientist Valerio Poggiali of Cornell University. The echoes indicated this part of the estuary is up to 85 meters deep, Poggiali and his colleagues report in the *Journal of Geophysical Research: Planets*. But the central and western parts of the sea produced no seafloor echoes, suggesting that central Kraken Mare could be at least 100 meters deep—or even 300 or more.

"The idea that you can do bathymetry [measure depth] on a moon in the outer solar system is exciting," says Elizabeth Turtle, a planetary scientist at Johns Hopkins University Applied Physics Laborato-

ry, who was not involved in the new study. The results "are so informative in terms of providing data to understand Titan and to help plan missions there."

The researchers caution that future work might indicate some signals failed to bounce back not because of great depth but because the liquid absorbed more radar energy than they calculated it would. That would suggest their working estimates about composition are off. Based on their calculations, the sea appears to comprise about 70 percent liquid methane, 16 percent liquid nitrogen and 14 percent liquid ethane at



Kraken Mare

a temperature of –182 degrees Celsius. When Cassini swept by, Kraken Mare's surface waves measured just a few millimeters high.

Depth and composition data are vital for engineers designing robotic submarines and other equipment to eventually journey through Titan's lakes and seas, says Steven Oleson, an astronautical engineer at NASA's Glenn Research Center in Ohio, who was also not involved in the study. He and other engineers have put together preliminary designs for such a craft, even though a robotic sub is not currently part of NASA's mission lineup. Understanding Kraken Mare is critical to understanding Titan overall: the sea holds about 80 percent of the moon's surface liquid and covers about 500,000 square kilometers—roughly twice the area of North America's Great Lakes combined. —*Sid Perkins*

NASA, JPL-CALTECH, AGENZIA SPAZIALE ITALIANA AND USGS

LANGUAGE

Signs of the Times

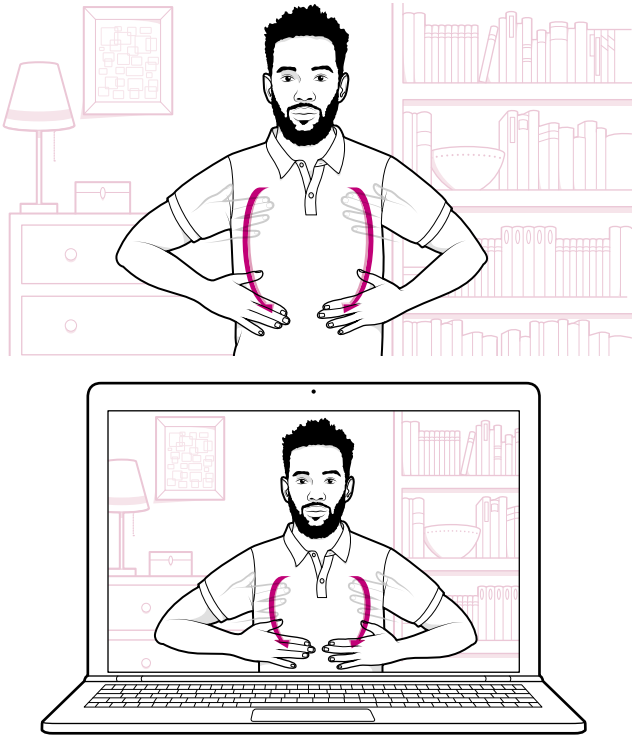
Pandemic videoconferencing is changing the way people use sign language to communicate

American Sign Language (ASL) users are no strangers to video chatting. The technology—which has been around since 1927, when AT&T experimented with the first rudimentary videophones—lets deaf and hard-of-hearing people sign via the airwaves. But after the coronavirus pandemic began confining people to their homes early last year, the use of platforms such as Zoom, Microsoft Teams and Google Meet exploded. This increased reliance on videoconferencing is altering some common elements of sign language.

Some adaptations arise as a result of a video meeting's limited window size. "The signing space is expansive," says Michael Skyer, a senior lecturer of deaf education at the Rochester Institute of Technology. "Even if many signs are produced easily or normally in the 'Zoom screen' dimensions, many are not." The sign for "body," for example, is usually produced by making a modified "B" hand shape and moving it from the shoulders to the hips. But to fit the reduced signing space demanded by videoconferencing, many signers have been ending it at the chest.

Signs that take up a lot of space may be harder to convey on video, but so are smaller ones with finer differences. Fingerspelled words, for example, as well as numbers and colors, all involve relatively small details formed with a single hand—which can make them harder to see clearly on a tiny conference screen. Skyer says signers must go slower and repeat themselves more often to fill in such gaps.

Signers communicating through video must also consider how they angle their bodies to convey meaning clearly. If two people face each other in person, each can easily see whether the other's hands are moving toward or away from them. This can be crucial for grammatical reasons; for example, signs representing future tense are usually made with a forward motion away from the signer's body, whereas past tense signs move the opposite way. Such nuances are sometimes difficult to detect on a video screen. Skyer is deaf and uses American Sign Language to teach in a bilingual ASL-English environment, in



In an in-person conversation, the sign for "body" involves moving the hands from the shoulders down toward the hips. But virtual communication tools often limit the field of view to the head and upper torso, so the signer may modify the movement to end higher up.

Illustrations by Brown Bird Design