KAS BULLETIN

NEWSLETTER OF THE KANSAS ACADEMY OF SCIENCE

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148th ANNUAL MEETING OF THE KANSAS ACADEMY OF SCIENCE

April 1st & 2nd, 2016
Melhorn Hall, McPherson College
McPherson, Kansas

The early registration deadline is Friday, March 11th, 2016. Online registration is open through March 25th, 2016. Conference details and the online registration form can be found at:

http://www.kansasacademyscience.org/meeting.html

All three of this year's field trips will be leaving from the west entry of Melhorn Hall on Friday afternoon:

- Maxwell Wildlife Refuge Tour and Nature Hike, $8 at 1:30pm
- CHS Oil Refinery Plant and Chemistry Lab Tour, Free at 2:30pm
- Pfizer Lab Tours, Free at 2:15pm

This year there will be two keynote speakers:

- **Dr. Devin Schrader** from the Center of Meteorite Studies at Arizona State University will give a public talk on meteorites on Friday evening.
- **Dr. Jonathan Pruitt** from the University of Pittsburg will talk about behavioral syndromes and their impacts on social systems in colonial spiders on Saturday afternoon.

Mail Annual Meeting Registration Form to:

Dustin Wilgers,
McPherson College, 1600 E. Euclid Ave.,
McPherson, KS 67460

(Make checks payable to McPherson College)

THE STARFISH ASSAISSIN

By John R. Platt, From Scientific American Vol. 314, No. 1, January 2016

The Great Barrier Reef will have a robotic protector beginning this winter. The underwater autonomous vehicle is programmed to patrol the massive living structure in search of destructive crown-of-thorns starfish (COTS), which it then kills by lethal injection. These starfish prey on coral polyps, and although they are native to the reef, their population has exploded in the past few years, possibly because of overfishing of their natural predators. The latest report from Australia's Great Barrier Reef Marine Park Authority places the venomous invertebrates alongside climate change and human activity as a significant threat to the reef, which lost half its coral cover between 1985 and 2012.

COTSbot, developed by robotics researchers at Queensland University of Technology in Australia, could help slow the starfish's invasion. Artificially intelligent, it correctly identified its target 99.4 percent of the time in laboratory tests. “It's now so good it even ignores our 3-D-printed decoys and targets only live starfish,” Queensland's Matthew Dunbabin says. A fleet of COTSbots could supplement the efforts of human divers who currently remove or poison the sea stars by hand and could operate during bad weather or high currents. They could also be useful at night when starfish are more active but swimming is prohibited.

HOW IT WORKS

1. The COTSbot follows a preprogrammed path, moving up and down the Great Barrier Reef with the help of five thrusters. It stays close to the reef—and avoids bumping into the delicate structure—with the aid of sonar and multiple cameras.

2. The cameras scan for starfish, distinguished by their purplish colors, arm and thorn shapes, and creeping motion. Starfish often wrap around and hide under coral outcroppings, but the robot's software has been programmed to recognize those positions.

3. When the robot spots a crown-of-thorns starfish, its needle-capped pneumatic arm lowers and injects 10 milliliters of poisonous bile salts into the echinoderm. The compounds effectively digest the animal from the inside.

4. A poisoned starfish will die within 24 hours, leaving no opportunity for separation and regeneration—a survival tactic that is a boon for the starfish population but maddening to those trying to reduce its numbers.

5. The vehicle's tanks carry enough poison to kill more than 200 starfish in one four- to eight-hour mission. The rapid pace is key because even one starfish can spawn millions of young.

PHOBOS IS CRACKING UP

By Kory Haynes, From Astronomy Vol. 44, No. 3, March 2016

Mars may have a moon only for another 30 million to 50 million years – the blink of an eye, in astronomical terms. For many years, astronomers thought Phobos' grooves, first seen in images sent by the Viking Spacecraft, were signs of asteroid impacts. But recent modeling, presented November 10 at the American Astronomical Society's Division for Planetary Sciences meeting, shows that instead they are "stretch marks" from Mars' persistent gravitational tug, and signs of the world's eventual destruction.

Mars and Phobos orbit closer than any other planet and moon in the solar system, at 3,700 miles (6,000 kilometers) apart, and they grow closer by 7 feet (2 meters) every century. Further, Phobos is unlikely to be a solid body, and is instead more likely a pile of rubble held together only loosely by its own gravity, surrounded by a powdery material a few hundred feet thick. As Mars pulls on Phobos' bulk innards, the outer layers adjust, flexing but still building stress. The grooves are the first signs of the surface fracturing, which will eventually break up the moon into many moonlets and perhaps a Saturn-like ring.

Phobos, a tiny moon orbiting Mars

SHARK VIRGIN BIRTHS CONTINUE FOR GENERATIONS

By Andy Coghlan, from New Scientist January 16, 2016

It wasn't a one-off. Virgin births are far more common than we thought, and can continue for multiple generations. These two surprising findings are overturning everything we knew about parthenogenesis.

Some animals, including Komodo dragons and domestic chickens, can sometimes produce offspring without copulating with a male. Females do this by using one of two methods to add an extra set of chromosomes to their eggs, producing either full- or half-clones of themselves. It had only been seen in captivity – until two virgin births were recently recorded in a wild sawfish and pit viper.

The process was also thought to be a dead end, producing infertile offspring. Now, for the first time, researchers have seen an individual born through parthenogenesis go on to have its own virgin birth.

The finding was made by following a captive female whitespotted bamboo shark. Genetic testing revealed her offspring had no father, and one of these then went on to have her own pups by parthenogenesis (*Journal of Fish Biology*, doi.org/bbsj).

The finding shows that an animal conceived by parthenogenesis can be fertile and isn't an evolutionary dead end, says Nicolas Straube of the Bavarian State Collection for Zoology in Munich, who led the study. "It implies that parthenogenesis may be an alternative to sexual reproduction."

A second study has found that parthenogenesis happens frequently in 20 snake species, adding evidence to the idea that virgin births aren't just a rare trick (*Biological Journal of the Linnean Society*, doi.org/bbsh).

"Both papers show that parthenogenesis occurs in more vertebrates than previously thought," says Jim Bogart of the University of Guelph in Canada.

PARASITE GIVES MAN CANCER

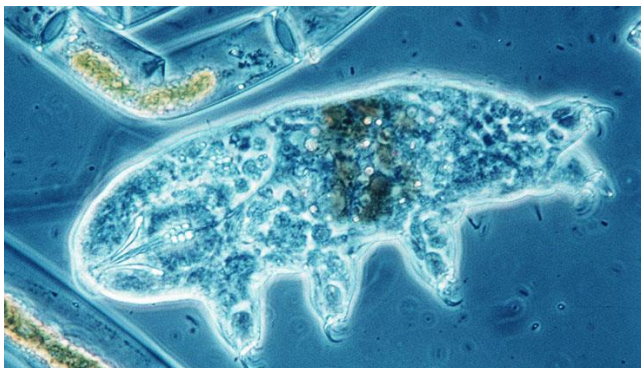
By Tina Hesman Saey, from Science News
Vol. 188, No. 12, December 12, 2015

Tapeworms can kick parasitism up a notch to become cancer, a case in Colombia shows.

A 41-year-old man in Medellín went to the doctor complaining of fever, cough, fatigue and weight loss that had lasted several months. Scans revealed tumors in his lungs, liver, adrenal glands, lymph nodes and other spots in his body. The disease looked like cancer, but it puzzled doctors: the small cells in the growths weren't human cancer cells.

DNA analysis revealed a shock: The cancer cells came from dwarf tapeworms (*Hymenolepis nana)*, pathologist Atis Muehlenbachs of the U.S. Centers for Disease Control and Prevention and colleagues report in the Nov. 5 *New England Journal of Medicine*. Contagious cancers affect dogs, Tasmanian devils and clams, but this is the first time researchers have found a parasite giving a person cancer.

HIV infection had weakened the man's immune system so that tapeworm stem cells could grow unchecked, the researchers speculate. Mutations then turned the stem cells into cancer. The case raises concerns that people with weakened immune systems may be in danger of contracting similar tapeworm cancers. "This is a rare disease," Muehlenbachs says, but "we don't know how rare."



Water bears, or tardigrades, make proteins that turn into glass when the microscopic animals dry out. The glass preserves other proteins.

FOR WATERBEARS, THE GLASS IS ALL FULL

By Tina Hesman Saey, from Science News
Vol. 189, No. 1, January 9, 2016

Water bears turn into glass when they dry out.

That glazing enables the hardy microscopic creatures, also known as tardigrades, to withstand extreme desiccation, biologist Thomas Boothby of the University of North Carolina at Chapel Hill reported December 15 at the annual meeting of the American Society for Cell Biology.

Boothby and colleagues discovered that water bears make a lot of certain proteins in dry conditions. Those proteins are floppy and unformed when tardigrades are hydrated. As the animals dry, the proteins fold into a glasslike solid that encases and protects other proteins and molecules that would normally fall apart when dried. Adding water melts the glass and the tardigrade recovers. Yeast engineered to produce the tardigrade glass proteins survive desiccation better than they normally do, Boothby's collaborators discovered.

Reducing levels of the glass proteins hampers the water bears' desiccation resistance, but doesn't harm their remarkable ability to withstand extreme cold. That suggests that other proteins offer cold protection, Boothby said.

Tardigrade glass may have practical uses, such as preserving useful proteins in a dry state, experiments with an enzyme called lactate dehydrogenase suggest. The enzyme loses its activity when dried out. But when the researchers mixed the enzyme with the glass proteins before drying, the enzyme bounced back to normal activity when rehydrated. Mixing in water bear proteins after drying didn't help, indicating that the glass proteins need to encase other molecules to protect them.

Glass proteins may one day help preserve vaccines in parts of the world where keeping them cold is impractical, Boothby suggested.

PACIFIC PLATE SLIDES OVER SLICK LAYER

By Thomas Sumner, from Science News
Vol. 188, No. 13, December 26, 2015

With 6,000 kilograms of dynamite and an ear to the ground, a team of geologists shook the understanding of plate tectonics this year.

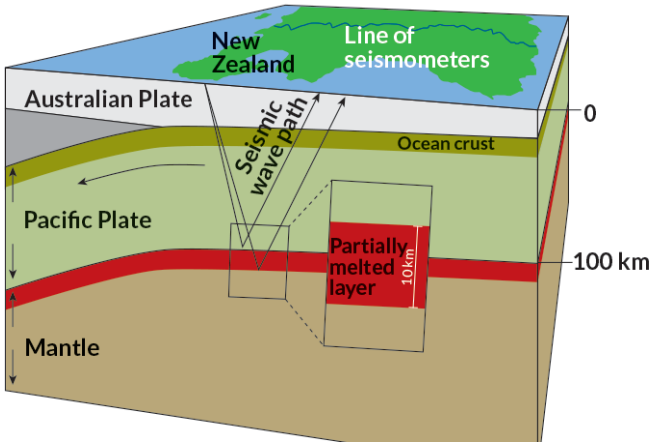
Ricocheting vibrations from the dynamite blasts, intentionally set off over two nights in New Zealand, gave geologists their first clear glimpse of the underside of a tectonic plate. The work revealed an underlying layer of partially melted rock, 100 kilometers belowground and 10 kilometers thick, that lubricates the motion of the Pacific Plate (*SN: 3/7/15, p. 6*).

The finding is "remarkable," says geophysicist Simon Klemperer of Stanford University. "Explaining how these plates move is one of the things that held back the identification of plate tectonics for 50 years."

The layer contains an estimated 2 percent molten rock, enough to drastically reduce the strength of the rock and essentially grease the overlying plate, like a layer of melted water beneath an ice skater's blades. Because it is sandwiched between the plate and the mantle, the layer also forms a barrier between the two. That separation challenges the prevailing view that flowing material in the mantle drives plate tectonics, says the geophysicist who led the study, Tim Stern of Victoria University of Wellington in New Zealand. Instead, forces at the edges of tectonic plates, such as the pull of a sinking plate, probably move the rocky slabs across Earth's surface.

Such a sideways yank is what broke apart the Pangaea supercontinent around 200 million years ago, earth scientist Fraser Keppie of Nova Scotia's Department of Energy in Halifax proposed in February (*SN: 4/4/15, p. 13*). Previous explanations held that a rising plume of magma from the mantle wedged the supercontinent apart. Instead, Keppie contends, as the ancient forerunner to the Indian Ocean shrank, Pangaea was pulled from two sides, ripping the continent apart between Africa and North America.

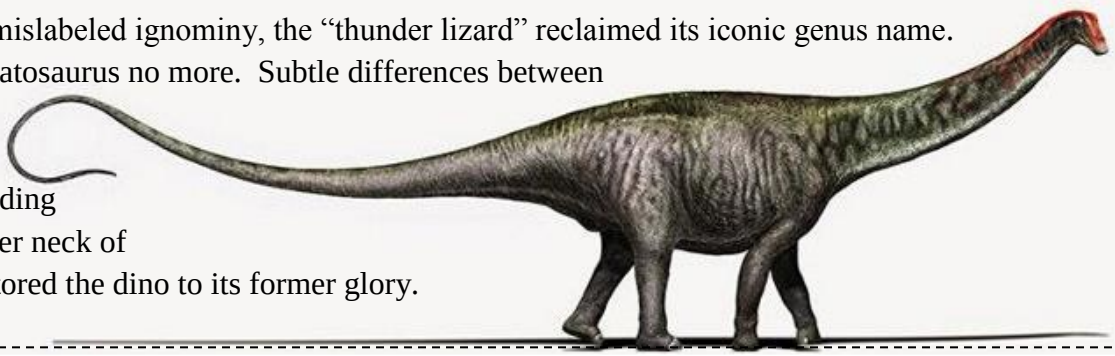
A separate team cruising across the Atlantic Ocean in March and April fired air guns that sent vibrations downward through the seawater and into the ocean crust. That work should reveal whether slick layers are ubiquitous beneath tectonic plates, and further explain how the Earth moves under our feet.



Partially melted rock (red) appears to separate the Pacific Plate from the mantle below, reducing the force required for the massive plate to slide.

WELCOME BACK, BRONTOSAURUS

After a century of mislabeled ignominy, the "thunder lizard" reclaimed its iconic genus name. Brontosaurus is Apatosaurus no more. Subtle differences between skeletons of the massive diplodocids – Including the narrower, weaker neck of Brontosaurus – restored the dino to its former glory.



KANSAS ACADEMY OF SCIENCE
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MAIL TO:

The 148th Annual Meeting of the Kansas Academy of Science
Keynote Speakers

Dr. Devin Schrader

Dr. Schrader will be speaking on meteorites! He works for the National Museum of Natural History at the Smithsonian.

Dr. Jonathan Pruitt

Dr. Pruitt is an Assistant Professor in the Ecology, Evolution and Marine Biology department at UCSB and will be giving a colonial spider talk.