6 percent per decade. Because there are now fewer nighttime clouds to keep the region's warmth from radiating back into space, Arctic temperatures for December, January, and February have dropped accordingly, about 0.34°C per decade on average, says Key.

During the same 18-year period, spring and summer cloudiness has risen about 3 percent and 1.5 percent per decade, respectively. Daytime clouds block incoming sunlight and thus tend to cool Earth's surface. Currently in the Arctic, however, other factors associated with global warming mask that effect, the researchers say. For instance, snow melts earlier in the spring than it used to, so the ground absorbs more warming sunlight. Overall, satellites show that surface temperatures in the Arctic during summer have risen about 0.7°C per decade.

If cloud coverage in June, July, and August hadn't increased in recent years, Arctic temperatures might have risen even further. Key and his colleague Xuanji Wang of the University of Wisconsin–Madison present their findings in the March 14 *Science*. —S.P.

PHYSICS

Squirming through space-time

Just as a bicyclist can summon gravity's help by turning onto a descending street, it might be possible to use the topography of space itself for a propulsion assist, albeit a tiny one, says a relativity theorist.

The scheme starts with Einstein's general theory of relativity, which says that space-time curves near massive objects (*SN: 12/21&28/02, p. 394*). In such a universe, certain idealized machines, such as one made of balls attached to long, adjustable struts, can propel themselves through curved space-time by shifting the relative positions of their parts, suggests Jack Wisdom of the Massachusetts Institute of Technology in the March 21 *Science*.

By means of mathematical and physical analyses, Wisdom argues that such machines can "swim" through space-time without thrust from an engine or other external forces. In effect, the contortions of such machines and probably more complex bodies would be like the acrobatics of a cat held feet up and then dropped to the ground, Wisdom says. The cat reorients itself and lands on its feet.

Wherever space-time isn't curved—as is effectively true in the weak gravitational field of Earth—such rotations only produce changes in an object's orientation. However, in strongly curved space, the same gyrations cause a simultaneous shift in location, Wisdom shows. For example, a contorting cat might actually move sideways even if it weren't falling. Unfortunately, it would take forever to move anywhere.

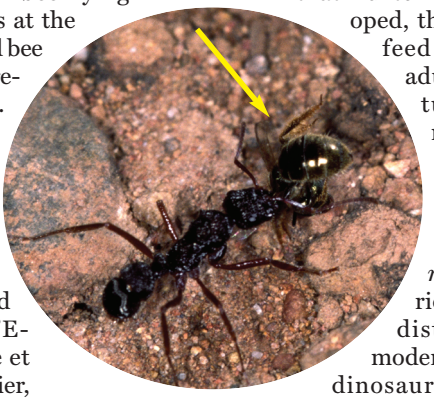
"When I started this, I hoped it would be a practical way of moving around," Wisdom confesses. However, a swimmer would travel only as far as the diameter of a proton after even 100 million strokes, he calculates. Nonetheless, Wisdom's proposal might point to new ways of testing general relativity. —P.W.

ZOOLOGY

Ants lurk for bees, but bees see ambush

A tropical ant hunts bees by setting ambushes. However, the bees have developed a trick or two of their own.

The New World ant *Ectatomma ruidum* waits outside the tiny holes in the ground that lead to nests of the sweat bee *Lasioglossum umbripenne*, explains William T. Wcislo of the Smithsonian Tropical Research Institute headquartered in Balboa, Panama. A bee flying home typically pauses at the entrance while a guard bee checks her chemical credentials as a nest mate. During this brief delay, the ant lunges, grabs the bee in her mouthparts, and then stings the captive to death.



CARRY OUT After an ambush, an ant carries home a dead bee (arrow).

Wcislo and Bertrand Schatz of Centre d'Ecologie Fonctionnelle et Evolutive in Montpellier, France, described such ambushes in 1999. Now, in the February *Behavioral Ecology and Sociobiology*, the researchers report bee countermeasures.

When an ant is hanging around the nest, 97 percent of returning bees interrupt their first swoop to the nest and veer away. Nearly half make a second approach, trying to slip in from the far side. Others land at a distance and walk home. This can save the bee if the ant keeps scanning the sky or moves on.

The warning for bees seems to be visual, say the researchers. Bees shied away from a dead ant beside the nest, even a dead ant that researchers had washed in solvent to remove body odors. A little black square or rectangle, however, didn't alarm the bees.

Once a bee falls into an ant's fatal grasp, it doesn't get a chance to learn from its mistake. So just how bees have come to recognize the ant dangers remains a puzzle, says Wcislo. —S.M.

PALEOBIOLOGY

Was *T. rex* just a big freeloader?

Paleontologists have long debated whether *Tyrannosaurus rex* was a predator or a scavenger. In most previous analyses, scientists have scrutinized the creature's teeth and jaws. Now, Graeme D. Ruxton and David C. Houston at the University of Glasgow in Scotland weigh in on the issue from another angle: whether a *T. rex*–size scavenger could have found enough dead meat to survive.

Ecosystems like the savannas of Africa could have provided sufficient carrion to nourish a scavenging *T. rex*, the researchers report in an upcoming issue of *Proceedings of the Royal Society of London B*.

On Tanzania's Serengeti grasslands, enough herbivores die each day to provide about 4.4 kilograms of carrion per square kilometer. According to equations that Ruxton and Houston developed, that's enough meat to feed a typical 6,000-kg adult *T. rex* if the creature had a reptilian metabolism, spent 12 hours daily foraging, and could detect carrion as much as 80 meters away. If *T. rex* could sense carrion at four times that distance, which some modern reptiles can do, the dinosaur could have missed out on three of every four corpses and still made a scavenger's living, Ruxton says.

Even if *T. rex* had a high-energy metabolism more typical of mammals, the savanna probably still could have provided enough dead meat to support a scavenging lifestyle. Although the dinosaur would need much more food in that case, it also could travel faster and thus cover more ground to find its required calories.

Ruxton notes that the new research doesn't prove *T. rex* was a scavenger; it only suggests that the meat eater didn't have to be a predator. —S.P.

M. GUERRA/STRI