

# Mr. Molecule

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A science newsletter for kids

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## A Massive Dinosaur Discovery

**Paleontologists uncover details about one of the world's largest land animals**

What's 30 feet tall, 85 feet long, and heavier than seven elephants? The answer is a massive dinosaur more than 75 million years old. Called Dreadnoughtus, meaning "fearing nothing," this newly discovered creature is believed to be one of the largest land animals that ever lived. And when it died, Dreadnoughtus was still growing.

### Prehistoric Puzzle

Dreadnoughtus was a leading beast in the titanosaur family, a group of dinosaurs with long necks, small heads, and tall, thick legs. A familiar member of this family is the brachiosaurus, which, at 75,000 pounds, seems like a peanut compared to its new family member.

Dr. Kenneth Lacovara, a paleontologist at Drexel University in Philadelphia, found the specimen in Argentina in 2005. His research was published on September 4, 2014, in the journal *Scientific Reports*. Though Dreadnoughtus was discovered in small pieces, Lacovara and his team put the puzzle together to find some big answers. From more than 200 uncovered bones, this fearless dino was revealed to have had a long neck and a powerful 29-foot tail. By calculating the weight of its upper arm and thigh muscles, the team determined Dreadnoughtus

to have weighed about 130,000 pounds. All the collected fossils make up 45 percent of the dinosaur's total skeleton, which is plenty of information for scientists to draw some exciting conclusions.

### A Growing Investigation

Lacovara and his team used their collections to create a computerized reconstruction to determine how Dreadnoughtus looked and moved. 3D printing technology is allowing researchers to produce replicas of bones for a more detailed analysis. "We're getting a more complete picture of this giant animal than we have for any of the other big titanosaurs that are out there," said paleontologist Kristi Curry Rogers of Macalester College in St. Paul, Minnesota. These discoveries can help scientists investigate other large, prehistoric beasts, and what allowed them to grow so large. From studying its bones, Lacovara found that Dreadnoughtus had more growing to do.

Scientists can apply what they have found from studying Dreadnoughtus

to learn more about the current animal population. Today, the largest living land animal is the African Elephant, which can weigh up to 15,000 pounds. At a frightening 400,000 pounds, the Blue Whale is the largest animal on the planet. But have no fear; this enormous creature shows no signs of leaving the ocean.



## Puppy Love

**A new study explains the bond between humans and dogs**

Here's a familiar story. You're sitting at the dinner table with a furry, four-legged friend scratching at your feet. You know you shouldn't give dogs human food, but when you look down, those cute puppy eyes are almost impossible to resist.

What is it about a dog's adoring gaze that makes it so charming? A new study by Japanese scientist Miho Nagasawa seems to have found the answer, and it has to do with something called the cuddle chemical.

The cuddle chemical has another, more scientific name: oxytocin. Oxytocin is a substance in the blood that encourages bonding. Levels of oxytocin increase, for example, when a mother feeds her newborn baby. According to Nagasawa's study, levels of oxytocin can also go up when we look deeply into the eyes of a dog.

### The Cuddle Chemical

In order to better understand how the cuddle chemical worked between dogs and humans, Nagasawa and his team conducted an experiment. They tested levels of oxytocin in dogs and

humans, and then put them in a room to interact with each other.

While in the room, the humans pet the dogs, spoke to the dogs, and looked into the dogs' eyes. Then the scientists tested their levels of oxytocin again.



The researchers found that levels of oxytocin were higher in both humans and dogs after they interacted. However, levels were the highest in the humans and dogs that simply looked into each other's eyes, without much petting or talking.

"The duration of the dog to owner gaze... significantly explained the oxytocin change ratio," the investigators wrote. Simply put, the longer the

humans stared into the eyes of the dogs, the more cuddle chemical was released. Nagasawa conducted the same experiment with humans and wolves, but it did not give the same results.

### From Wolves to Dogs

The results of this study can also tell us a lot about the history of the bond between humans and dogs. Have you ever wondered how man's best friend became so friendly?

It all started somewhere tens of thousands of years ago. Scientists believe that wolves used to follow humans who were hunting large animals, like the woolly mammoth. The wolves would eat the scraps of food left behind by the humans. Humans realized that they could use the wolves to help with the hunt, and eventually both species began to work together toward survival.

Over time, the wolves that interacted with the humans began to change. They became more loyal to their human partners. The wolves and humans started to depend on each other. And they started to bond with each other.

These changes are what caused some of the wolves to turn into what we now know as dogs, a new species evolved to better survive in their environment.

This process depended a great deal on the bond humans formed with them.



And according to Nagasawa's study, this bond was forged with the help of a hormone. Oxytocin, the cuddle chemical.

## Talking Plants

**A new study finds that plants communicate with one another to warn of danger**

We tend to think of plants as the furniture of the natural world. They don't move, they don't make sounds, they don't seem to respond to anything—at least not very quickly. Grass doesn't cry when you cut it, flowers don't scream when they're picked. But as is often the case, our human view of the world misses quite

a lot. Plants talk to each other all the time. And the language is chemical.

Over the years, scientists have reported that different types of plants, from trees to tomatoes, release compounds into the air to help neighboring plants. These chemical warnings all have the same purpose—to spread information about

one plant's disease or infestation so other plants can defend themselves. But exactly how plants receive and act on many of these signals is still mysterious.

In this week's *Proceedings of the National Academy of Sciences*, researchers in Japan offer some explanations. They have identified one chemical message and traced it all the way from release to action.

The scientists looked at tomato plants infested by a common pest, the cutworm

caterpillar. To start out, they grew plants in two plastic compartments connected by a tube. One plant was infested and placed upwind and the other was uninfested and placed downwind. The downwind plants were later exposed to the cutworm caterpillar. The results showed that plants that had previously been near sick neighbors were able to defend themselves better against the caterpillar.

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### Friendly Warnings

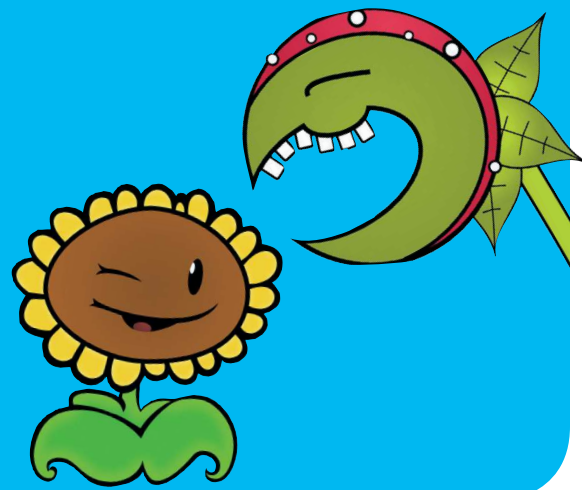
The researchers also studied leaves from exposed and unexposed plants. They found one compound showed up more often in the exposed plants. The substance is called HexVic. When the scientists fed HexVic to cutworms, it knocked down their survival rate by 17%.

The scientists identified the source of HexVic, and sprayed it lightly over

healthy plants. Those plants were then able to start producing the caterpillar-killing HexVic. Researchers confirmed that uninfested plants have to build their own weapon to fight off bugs and diseases. How do they know when to play defense?

They are warned first by their friendly plant neighbors. It is a complex tale, and

it may be happening in more plant species than tomatoes. It may also be happening with more chemical signals that are still unknown to us. For now though, we know that plants not only communicate, they look out for one another.



## Salad in Space Salad

**A portable garden aboard the International Space Station can help the astronauts' physical and mental health**

By Jeffrey Kluger for TIME

Three crewmembers on the International Space Station recently did something historic: they ate lettuce. Specifically red romaine lettuce. More specifically, red romaine lettuce that was grown onboard.

Space has never been a place known for good eating. Certainly, the food now is better than it was in the pureed, shrink-wrapped, sucked-from-packets days of earlier missions. The ISS has hot water, a food heater and even a cappuccino maker, for instance.

But fresh fruits and vegetables, which take up room and spoil fast, are another matter. While apples and carrots are sometimes sent up on cargo ships, those supply runs are infrequent, and when a ship fails to arrive—something that's happened three times in the past year—the veggie fast can go on and on.

During longer trips into deep space—particularly to Mars—NASA knows that fresh produce is not only good for the crew's physical health, but also for

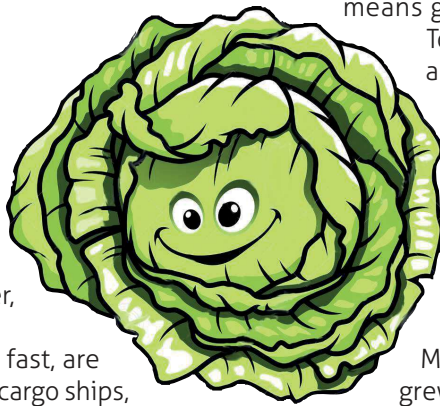
their mental well-being, giving them a comforting taste of home. That means growing the crops onboard.

To investigate how this could be done, NASA partnered with ORBITEC, a Madison, Wisconsin-based technology company, to develop a unit known straightforwardly as Veggie. The unit is collapsible, and includes a flat panel of red, blue and green LEDs.

"The farther and longer humans go away from Earth, the greater the need to be able to grow plants for food, atmosphere recycling and psychological benefits," said Gioia Massa, Veggie's payload scientist

Nothing, however, goes onto the astronauts' menu—or into their bodies—without being rigorously tested first. So in May of 2014, an earlier crew germinated the first plant pillows, grew them for 33 days, then plucked and froze them and shipped

them home on a returning spacecraft in October. Scientists on the ground certified them fit to eat, so Kelly germinated a new batch on July 7th and he and crewmates Kjell Lindgren and Kimiya Yui sampled them on August 10. They pronounced them fine.



## Testing the Five-Second Rule

**Researchers in Britain show that picking up dropped food in less than five seconds carries less risk**

You may have seen a friend drop food on the floor, pick it up, and eat it, while declaring, "Five-second rule!" The old adage says that food dropped on the floor for five seconds or less is still likely to be clean.

### But is that true?

Students at Britain's Ashton University, led by microbiology professor Anthony Hilton, tested the rule and found it to have some scientific basis. The study's results show that food dropped for five seconds is less likely to contain bacteria than if it sits there, according to Hilton. Some of the results were published in a news release on Ashton University's website.

The students also found that the type of flooring where the dropped food lands has an effect. Bacteria are least likely to transfer from carpeted surfaces. It's most likely to transfer from laminate or tiled surfaces when moist foods make contact with them for more than five seconds.

There is still a risk of infection if certain bacteria are present

on the dropped surface, so consumers should still be cautious. "However, the findings of this study will bring some light relief to those who have been employing the five-second rule for years, despite a general consensus that it is purely a myth," Professor Hilton said in a statement.

### Will You Eat That?

To test out the rule, the Ashton University students dropped toast, pasta, biscuits, and candy onto a variety of indoor floor types that had been exposed to two common bacteria, Escherichia coli (E. coli) and Staphylococcus aureus. They measured how much of the bacteria transferred to the food when it was left on the floor for durations that ranged from three to 30 seconds. The university has not yet released the complete study. The research team at Ashton also surveyed 500



people to find out who employs the five-second rule. Of the people surveyed, 87% said they would eat food dropped on the floor, or have done so in the past. Of those people, the majority were women. "Our study showed . . . [people] are also more likely to follow the five-second rule, which our research has shown to be much more than an old wives' tale," Hilton says.

Still, scientists say you should be careful about eating food

dropped on the floor, especially if you don't know the cleanliness of the surface. A video about the five-second rule embedded on npr.org from the Smithsonian's website features molecular biologist Eric Schulze, who points out that one in six Americans get sick from food poisoning every year. "Eating food off the floor is a bit like playing Russian roulette with your gut," Schulze says in the video.

## Bottled Egg

**First get permission to use kitchen equipment and eggs.**

### YOU WILL NEED

- One peeled, hard-boiled egg
- Plastic or glass bottle with an opening slightly smaller than the egg
- Large bowl of hot water
- Large bowl of ice water

### HERE'S HOW

1. Put the bottle in the bowl of hot water for about five minutes.
2. Move the bottle to the bowl of ice water. Wet the egg and place it pointed side down in the bottle opening.
3. As the air inside the bottle cools, the egg will slowly move into the bottle.
4. To remove the egg, hold the bottle upside down so the egg is near the opening. Blow hard into the bottle with your mouth tight against the opening.
5. Point the bottle away from you: The egg flies out!

### WHY?

Hot air expands. Cold air contracts. When the air inside the bottle is heated, the molecules, or tiny air particles, inside the bottle spread out, increasing air pressure.

As the air in the bottle cools, the air pressure decreases. The greater outside air pressure pushes the egg into the bottle. Blowing into the bottle raises the air pressure again.

The air and the egg rush out of the bottle.

