LUNCHTIME: Reindeer graze in Alaska.

CHEMISTRY: TOXINS

REINDEER DROOL

Drooling on your food usually isn't a good idea—unless you're a reindeer or a moose. New research indicates that their saliva helps make grass that's usually dangerous to them safe to eat.

Both animals like to munch on a grass called red fescue that's found throughout the Northern Hemisphere. The grass carries a species of fungus that is toxic to most grazing animals. Biologists wondered if reindeer and moose saliva somehow helped them eat the grass without getting sick. So they smeared moose and reindeer slobber on cut grass that contained the fungus to simulate what happens when the animals graze.

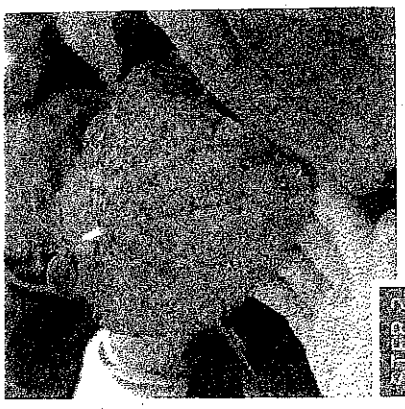
"The saliva slowed fungus growth and helped detoxify the grass," says Dawn Bazely, a biology professor at York University in Toronto, Canada.

The findings suggest that some plant-eating animals, called *herbivores*, have developed the ability to fight back against the plant's natural defenses.

—Sara B. McPherson

MAKING THE ZMAPP DRUG

Dr. Lance Plyler made the decision to give ZMapp to Kent Brantly. The drug may have saved Brantly's life. ZMapp hasn't been tested enough to know if it's safe and effective in humans, but it has shown enough promise that scientists are racing to produce more doses. How scientists develop the drug may surprise

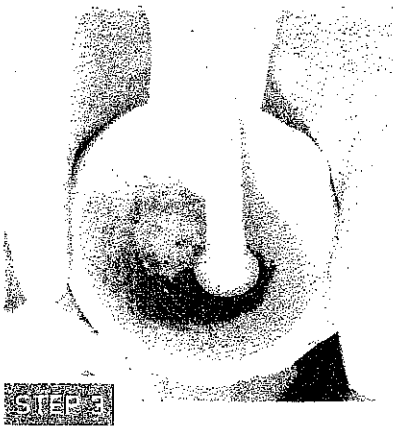


STEP 2

The plant's leaves turn yellow as it becomes sick from the virus. The plant produces Ebola *antibodies* to fight off the virus.

STEP 1

Scientists inject the leaves of a tobacco plant with a virus that's altered to fight Ebola. Tobacco plants were chosen because they're known to be vulnerable to viral infection. Once inside the plant, the

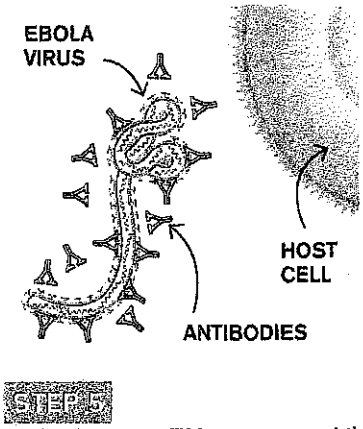


STEP 3

The antibodies are extracted from the plant and purified.

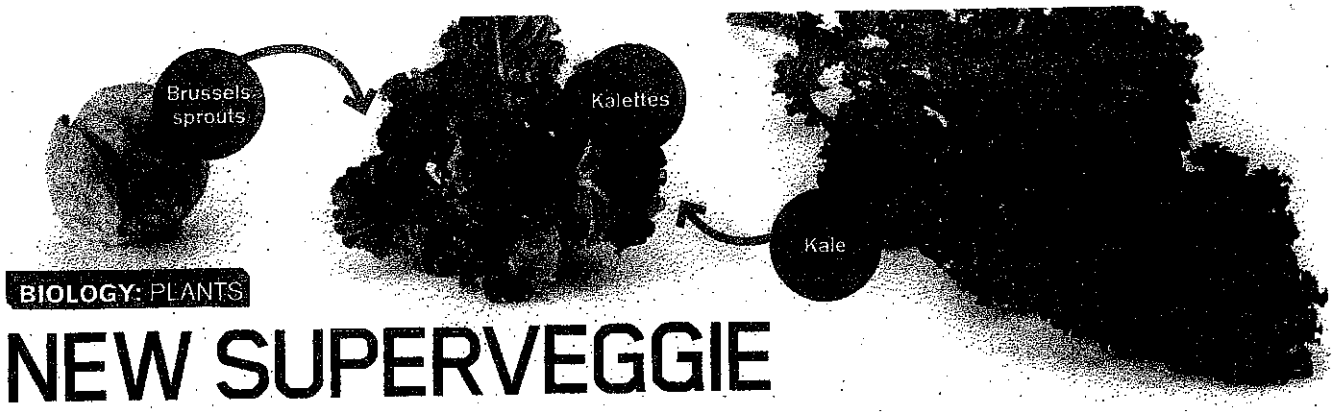
STEP 4

The purified solution is measured out into the correct dosage of ZMapp for humans. Then an IV can deliver the drug into the Ebola patient's veins.



STEP 5

Antibodies from ZMapp surround th Ebola virus, stopping it from invadir the patient's cells. If the drug works as intended, the patient is protected from Ebola.



BIOLOGY: PLANTS

NEW SUPERVEGGIE

This fall, kale and brussels sprouts are teaming up to form a new superveggie: "kalettes."

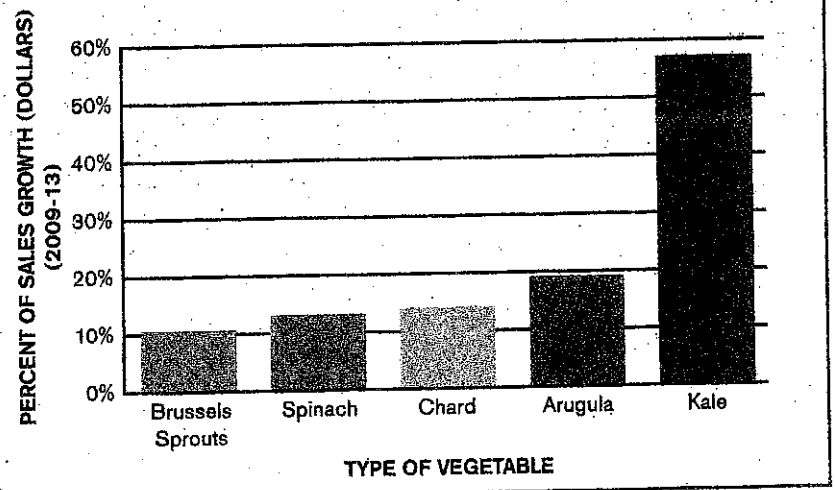
The vegetable is a *hybrid*, or cross between two types of plants. To breed kalettes, biologists combined the healthiest and tastiest *traits*, or characteristics, from kale and brussels sprouts. "Finding the perfect combination of traits took 15 years," says Lisa Friedrich of Tozer Seeds, the British company that created kalettes.

Other veggie hybrids have had success. Broccolini—a mix of broccoli and Japanese kale—is a big hit. Fruit hybrids have also caught on, including the plumcot (plum and apricot) and tangelo (tangerine and grapefruit).

—Charles Hofer

KALE ON SALE

Kale is known as a "superfood" because it has high levels of vitamins, minerals, and *antioxidants*, substances that help prevent disease. How does kale's sales growth compare with that of other superfoods?



SOURCE: NIELSEN, BUSINESSWEEK.COM

THIRSTY BUG: Once enough water collects on the back of a Namib Desert beetle, it will drink it.

WATER CATCHER

The Namib Desert on Africa's southwest coast is one of the driest places on Earth. Parts of it get only 2 millimeters (0.08 inches) of rain each year. Still, the Namib Desert beetle manages to get all the water it needs by catching ocean fog that rolls over the desert each morning.

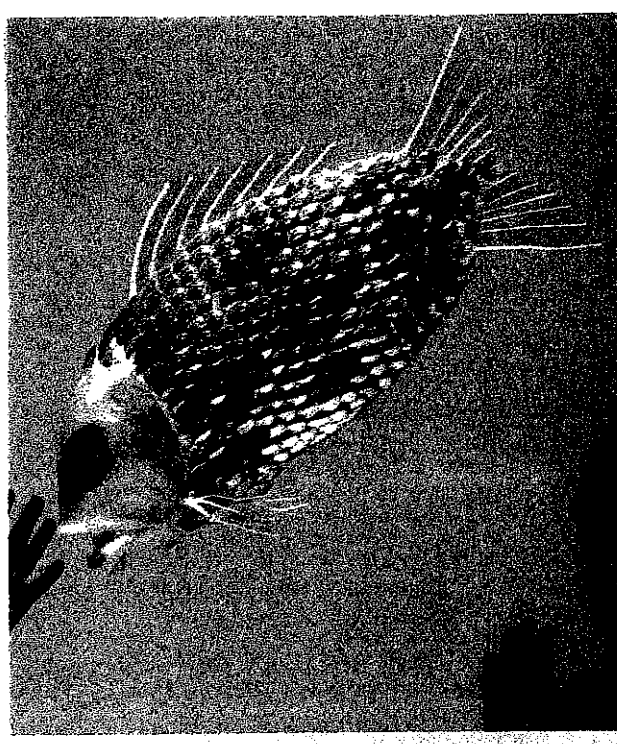
The beetle's back is rough and covered in ridges. Microscopic water droplets from the fog gather on its textured back. Once the droplets grow large enough, they roll down the thirsty beetle's back and into its mouth.

Constantine Megaridis, an engineer at the University of Illinois at Chicago, is working on creating textured surfaces that mimic the beetle's back—and could revolutionize the way people gather water.

Some people already use fog nets (*pictured at left*) to collect water droplets from the air in places where water is scarce. Megaridis's textured coatings could be applied to inexpensive fabrics to create a more efficient netting. That could help the world's 780 million people who lack drinking water. Megaridis says, "We try to figure out what nature has done over millions of years, and then use that to improve technology."

DRIP, DROP: Megaridis's work could revolutionize how fog nets, below, capture water.

SOLVIN ZANKL/NATURE PICTURE LIBRARY/CORBIS (BEETLE); FOGQUEST (WATER NET, NET CONSTRUCTION)



ROBO-FISH

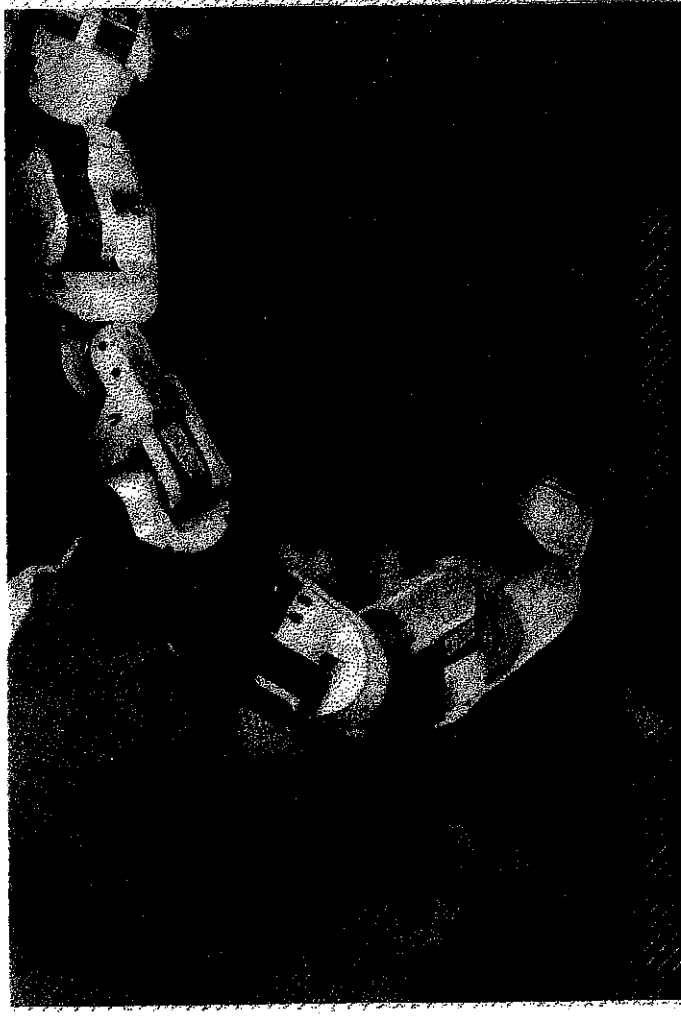
It looks like a fish and moves like a fish, but don't be fooled. The swimming machine at left was created to patrol the seas for pollution.

Luke Speller manages the European research team that created the 1.5-meter (5-foot)-long Robo-fish. "Let's say someone is dumping chemicals or there's a toxic leak," he says. "We can get to it straightaway, find out what is causing the problem, and put a stop to it."

The swimming robot uses sensors to analyze the surrounding water. If it finds pollutants, it instantly reports the information to a base station. This cuts the time it takes to locate and test for pollution "from weeks to just a few seconds," says Speller.

CORE QUESTION

How can understanding animal biology help engineers solve technological problems?



SNAKEBOT

Robots with legs or wheels can get stuck in rough terrain. But a snake-shaped bot could slither through bushes, swim in rivers, climb trees, and cross deserts—just like live snakes do.

Howie Choset, a roboticist at Carnegie Mellon University in Pittsburgh, Pennsylvania, spent years working on a snake-inspired robot. But his design had a problem: it couldn't climb sandy hills.

Many real-life snakes have trouble with sandy slopes too. But not the sidewinder, a snake found in desert regions. Sidewinders scale sand dunes with ease.

To find out how sidewinders do it, Daniel Goldman, a physicist at the Georgia Institute of Technology in Atlanta, used high-speed cameras to watch the snakes climb sandy inclines. He found that on a slope, they adjust their motion to maximize how much of their body touches the ground. The extra *surface area* making contact with the sand helps the snake scale the dune without sliding.

Choset used Goldman's findings to update his robot. It now mimics the sidewinder's motion. His snakebot could someday use its improved slithering skills to squeeze inside collapsed buildings and find trapped victims, or to explore pyramids and other tombs.

Biotechnology Activity

Directions: Complete the following worksheet while working with your cooperative groups. Do not jump ahead until directed to do so.

ARTICLE

1. What is biotechnology?

2. How does each article relate to biotechnology? List the title of each article before answering each question.

A)

B)

C)

D)

E)

F)

G)

3. How can these technologies be used to help improve our lives?

Discussion Questions:

4. Why is it necessary for agricultural practices to continue changing?

5. What agricultural engineering technologies do today's farmers use to increase food production and quality?

6. What social and environmental problems do bioengineering technologies in agriculture pose?

7. What factors do people consider when designing and using bioengineered products that come from agriculture and food industries?

8. Identify the benefits that biological bio engineering systems provide individuals and society.

9. Describe various products and processes that are applied in biological bio engineering.

10. List 5 examples of biotechnology that you have learned about this year in Science.