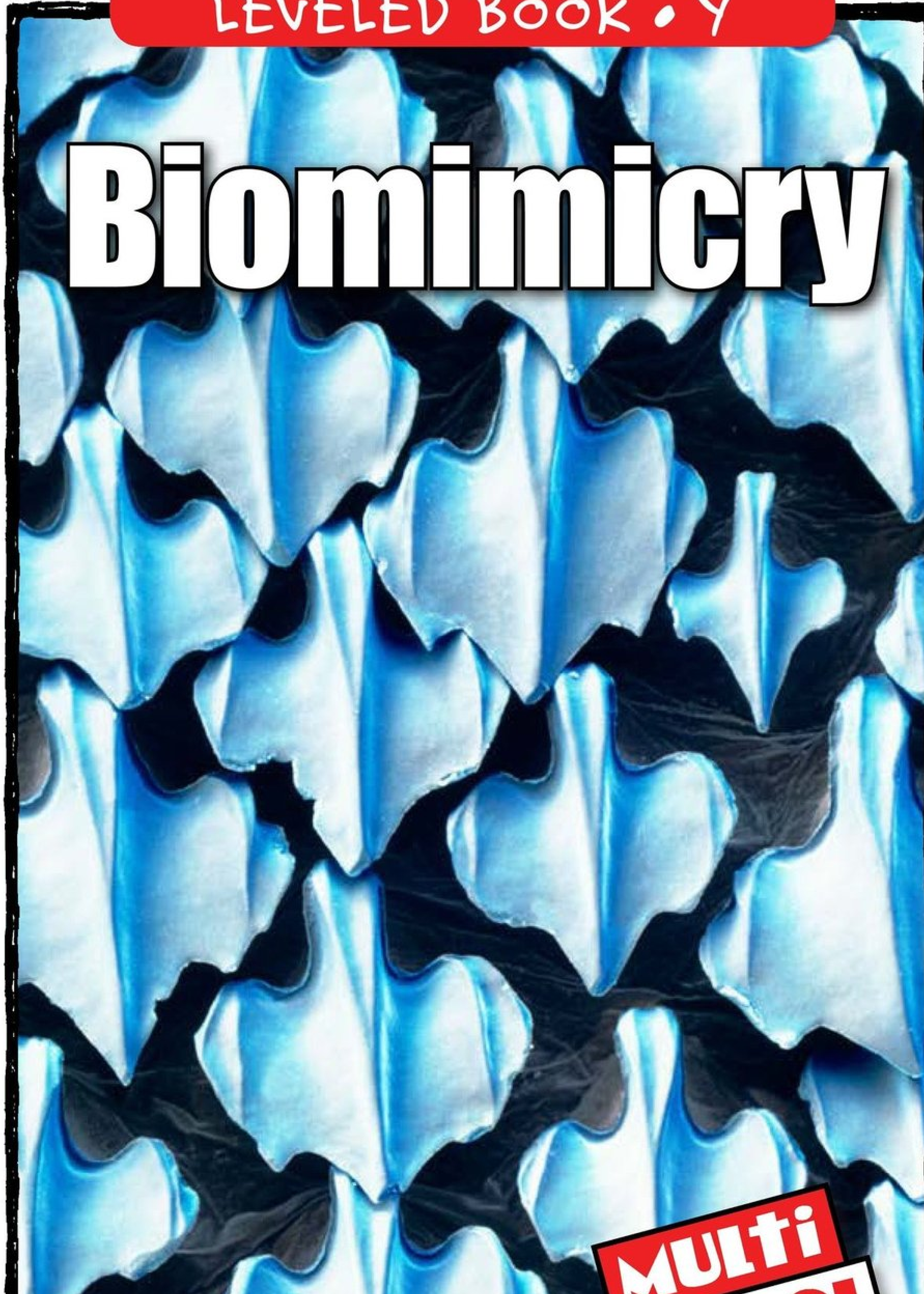
LEVELED BOOK • Y

Biomimicry



MULTI LEVEL Y•Z¹•Z²

Written by Rus Buyok

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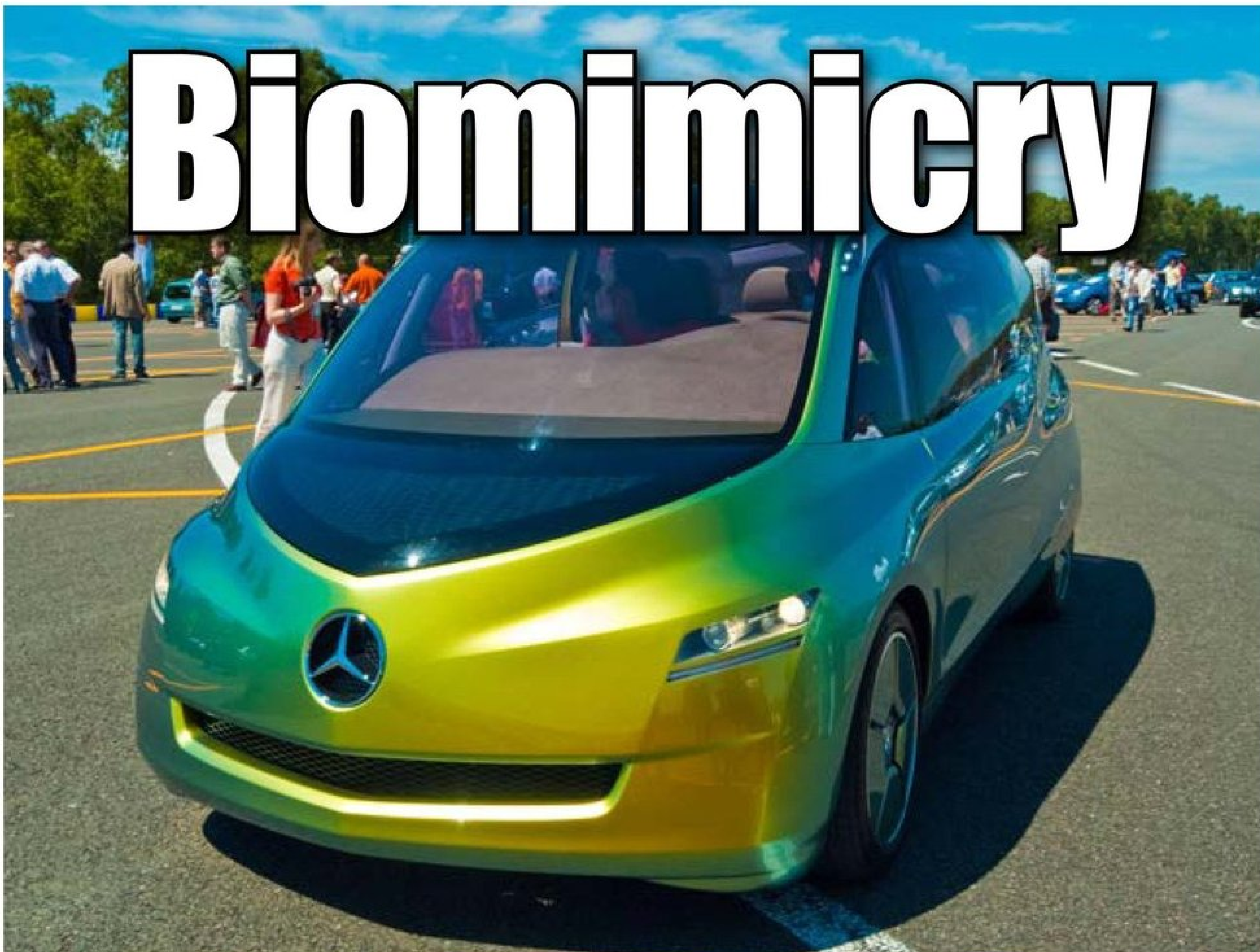
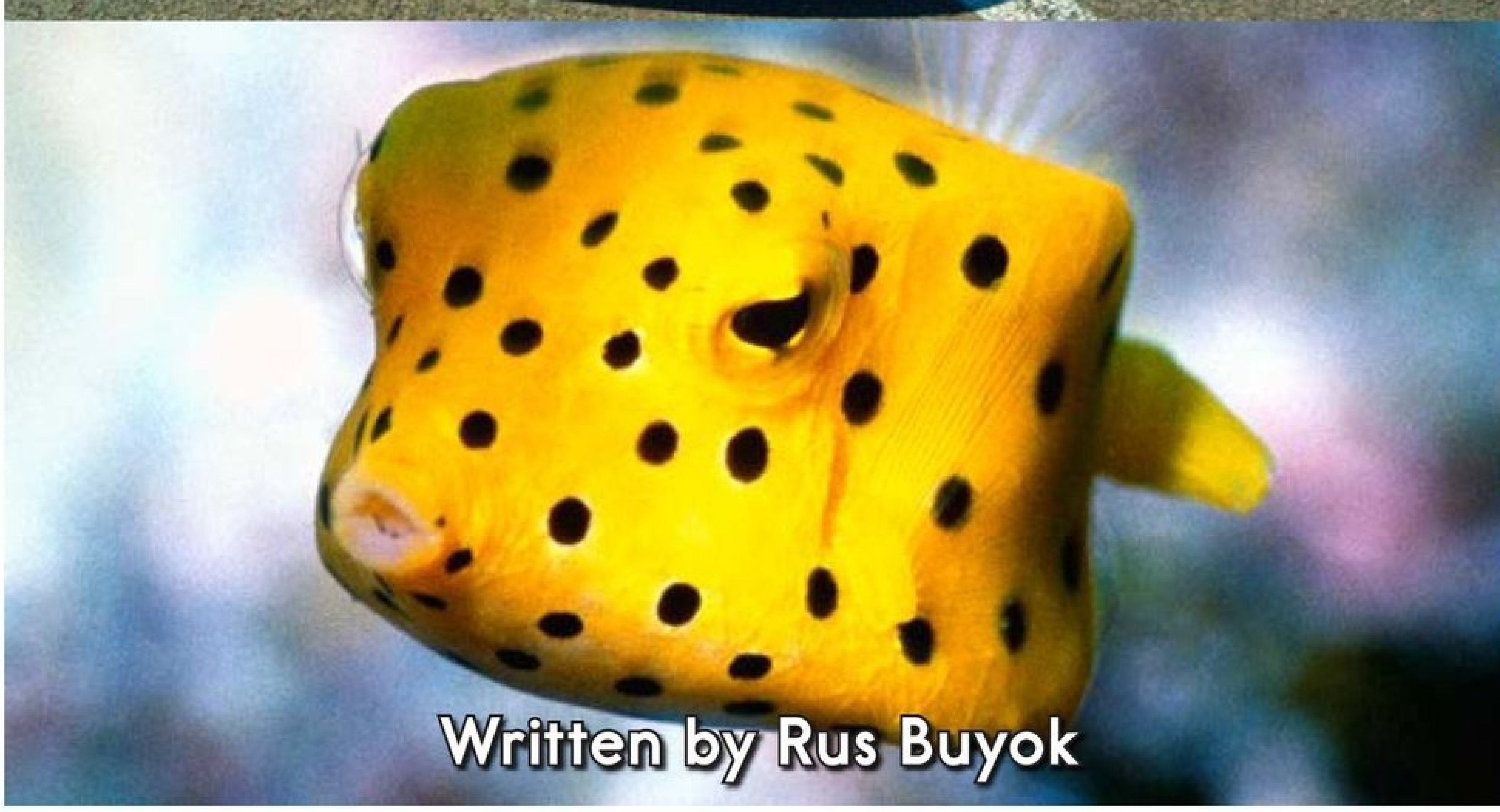
Biomimicry





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Focus Question

What important lessons have we learned from biomimicry?

Words to Know

adapted	ecosystem
antifreeze	fossil fuels
chlorophyll	glare
decompose	grooved
discarded	organism
durable	resource

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Correlation

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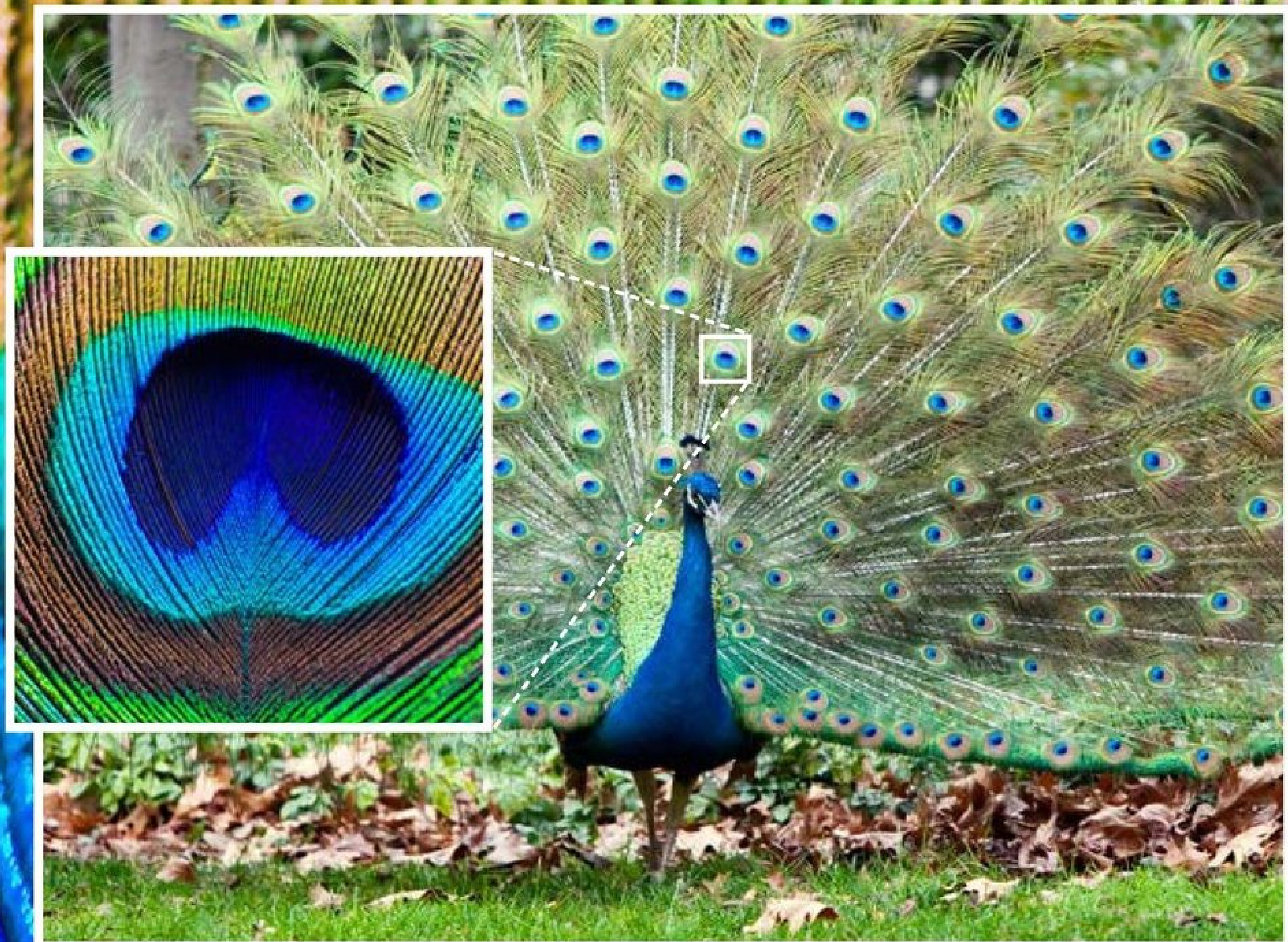
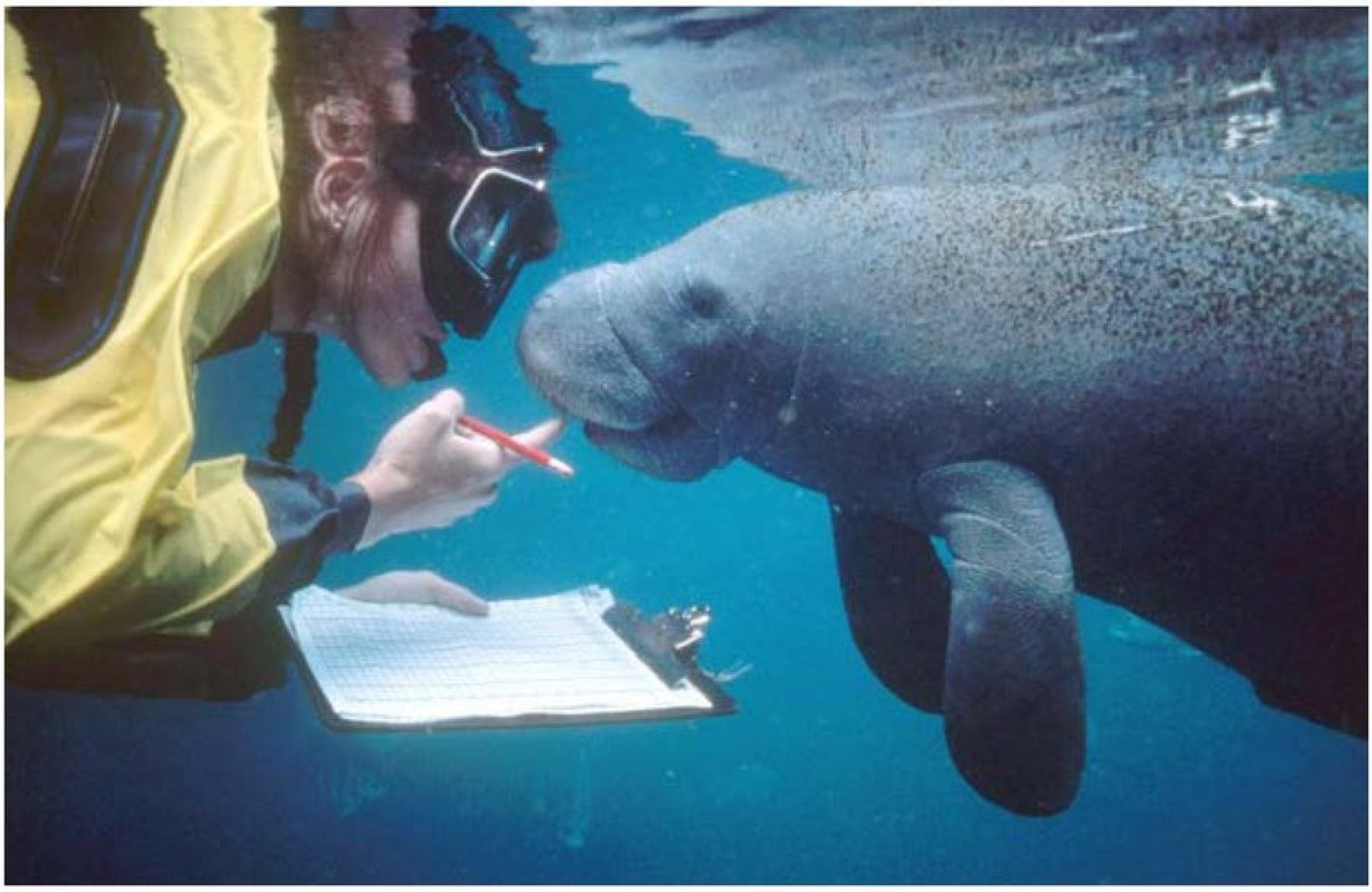


A peacock displays his feathers to attract mates.

Introduction

Did you know that a peacock's feathers have little color of their own? The colors we see come from the shape of the feathers, which causes light to bend so they look colorful. Have you ever noticed how flying locusts never seem to run into each other? One part of their tiny brains notices and reacts to things in front of them much faster than our brains can.

Nature is filled with many plants and animals that have developed special ways to live and survive. For years, humans have studied these ways to learn more about how they work. Now a science called *biomimicry* teaches us how to use what we learn from nature in our own lives.



A biologist studies a manatee in Florida.

What Is Biomimicry?

The word *biomimicry* comes from two words: *bio*, meaning "life," and *mimic*, meaning "to copy." This new field of study is also known as biomimetics. Both names mean the same thing: the science of copying life.

The idea behind this science is simple. Scientists, researchers, and engineers study how living creatures navigate the challenges of life. These experts then look at human challenges that are similar to see if people can adopt the same approaches in dealing with their problems.

Biomimicry doesn't involve using living things—it involves learning from them. And the idea of biomimicry is nothing new. People have been turning to nature to solve problems for hundreds of years.

Velcro under a microscope (left), a burr (inset), and a boy wearing a Velcro suit hanging from a Velcro wall (right)

That Comes from *What?*

Velcro

Have you ever gone running through a field and then found burrs stuck to your pants and socks? That's what happened to Swiss engineer Georges de Mestral and his dog one day in 1941. De Mestral wondered how the burrs managed to stick so well, so he looked at them under a microscope and saw that parts of each burr had little hooks that would catch onto cloth, fur, and hair.

After his discovery, de Mestral invented Velcro, a way to temporarily attach two things together using the same method as burrs. He designed two pieces of fabric, one with hooks and the other with loops. The hooks catch the loops and hold the pieces of fabric together. This system has been used by people at home, at work, and even in space!

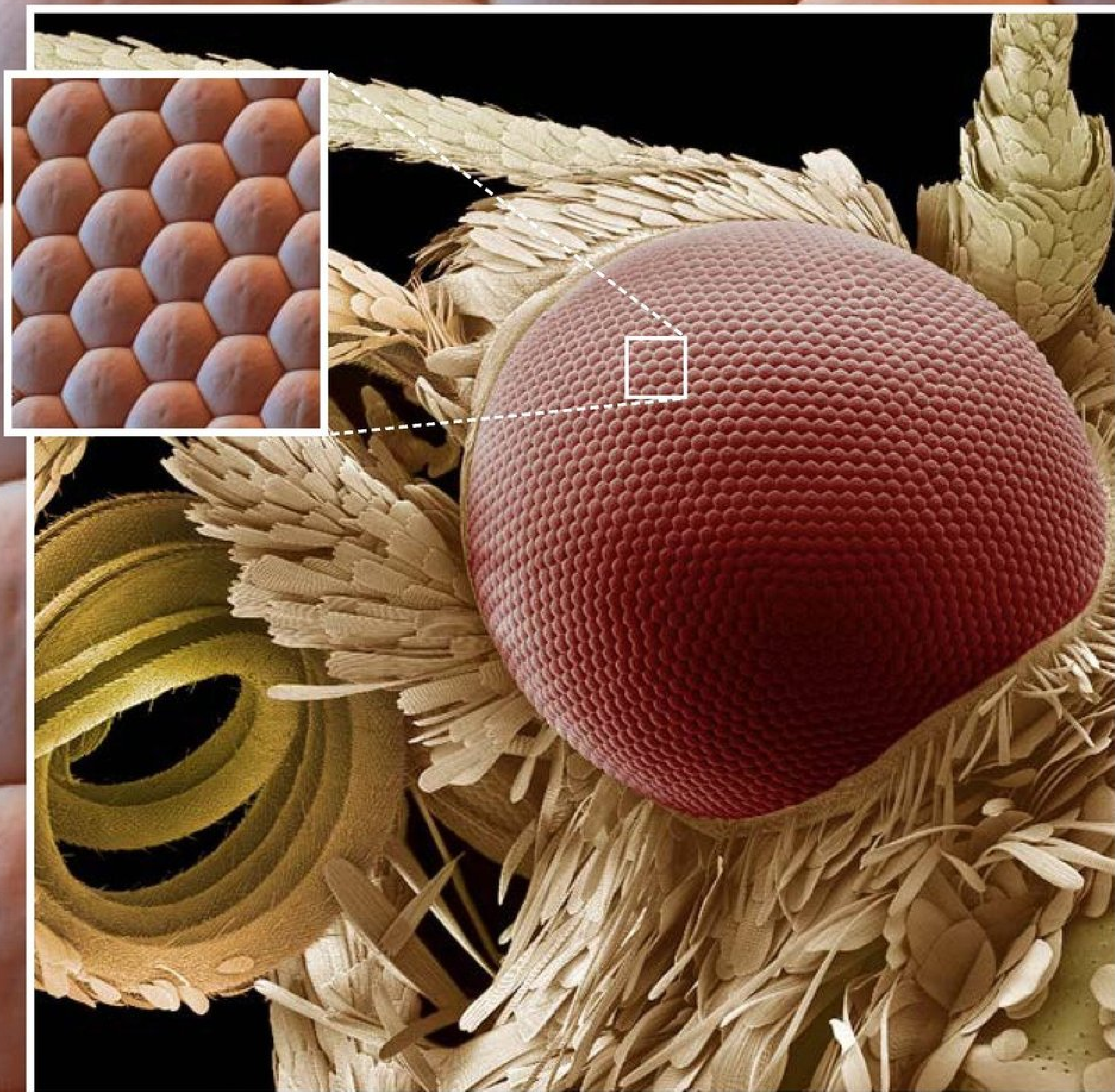
A cat's eyes reflecting light (main), and a Cat's Eye in Yorkshire, United Kingdom (inset)

Reflectors

Traveling in a car at night, you may have noticed light reflecting off small plastic bumps lining the road. These reflective bumps were invented in 1933 by a man named Percy Shaw.

While driving one foggy night, Shaw saw the eyes of a cat reflecting the beams from his headlights back at him through the mist. He thought if he could mimic the way a cat's eyes reflected light, he could make something to help car drivers keep safe on dark roads.

Shaw went on to invent the Cat's Eye—highly reflective spheres set into the center of roads. The design has changed over the years, but the idea remains the same—using reflected light to guide people safely home.

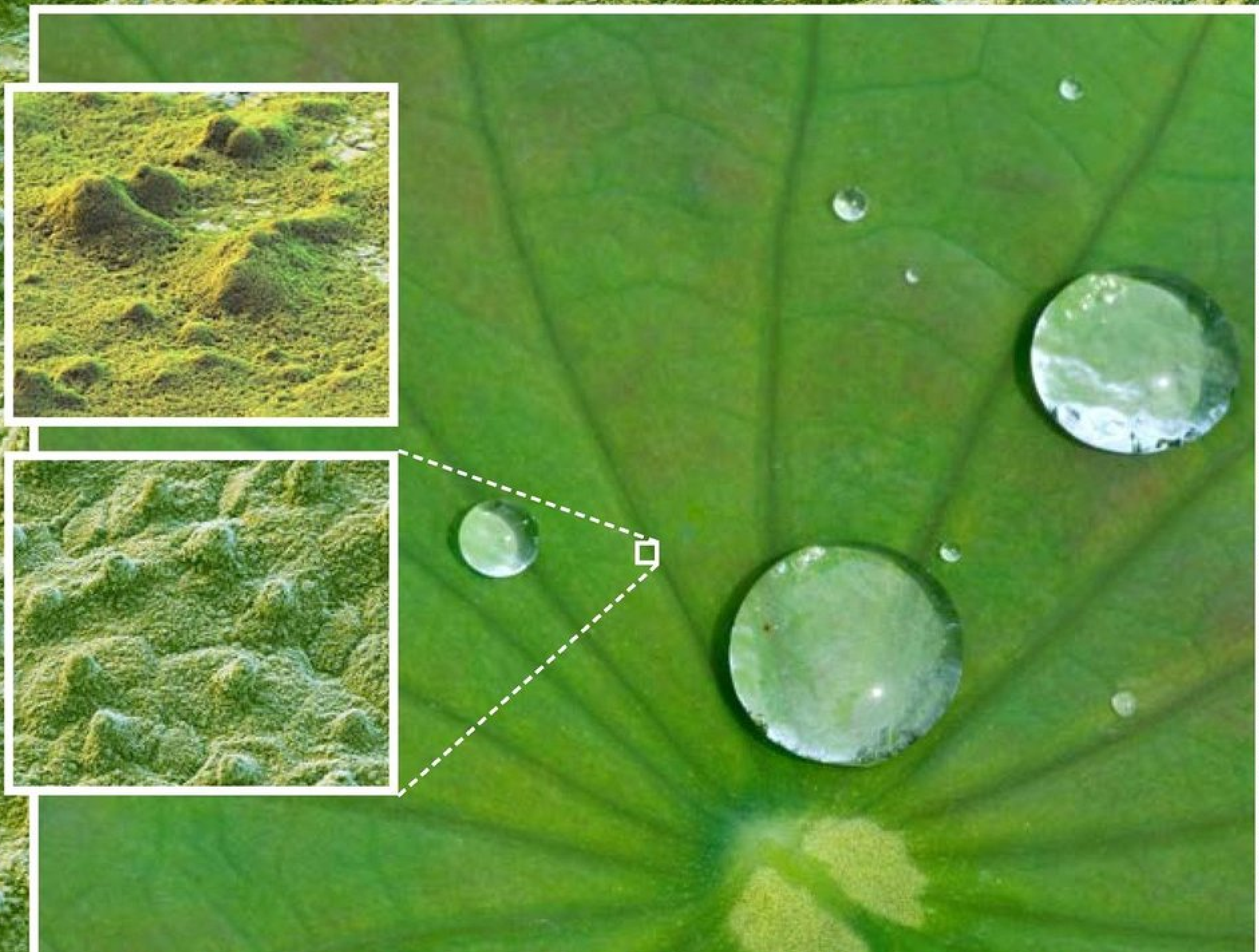


This microscopic view shows the antireflective surface of a moth's eye.

Antireflective Screens

While some animals have eyes that reflect light, other animals' eyes absorb light. A moth's eyes, for example, are designed to reduce reflection to keep them from shining and attracting the attention of predators.

Researchers copied this design to make computer screens that absorb light and reduce **glare**. This design helps prevent eyestrain in people who work or play on computers.



These microscopic views show how self-cleaning paint (top) mimics the surface of a lotus leaf (bottom) and causes water to bead and roll off (right).

Self-Cleaning Paint and Roof Tiles

Lotus plants grow in ponds and rivers. They are surrounded by mud, yet their leaves appear clean most of the time. The secret lies in the leaves' surface. Although it looks smooth, it actually has tiny bumps that cause water to bead up and roll off, carrying bits of dirt and dust with it.

Engineers studied lotus leaves and found a way to use this idea in house paint and roof tiles. The paint and tiles mimic the bumpy surface of the leaves. As a result, every time it rains, the outsides of houses with these paints and tiles are cleaned.

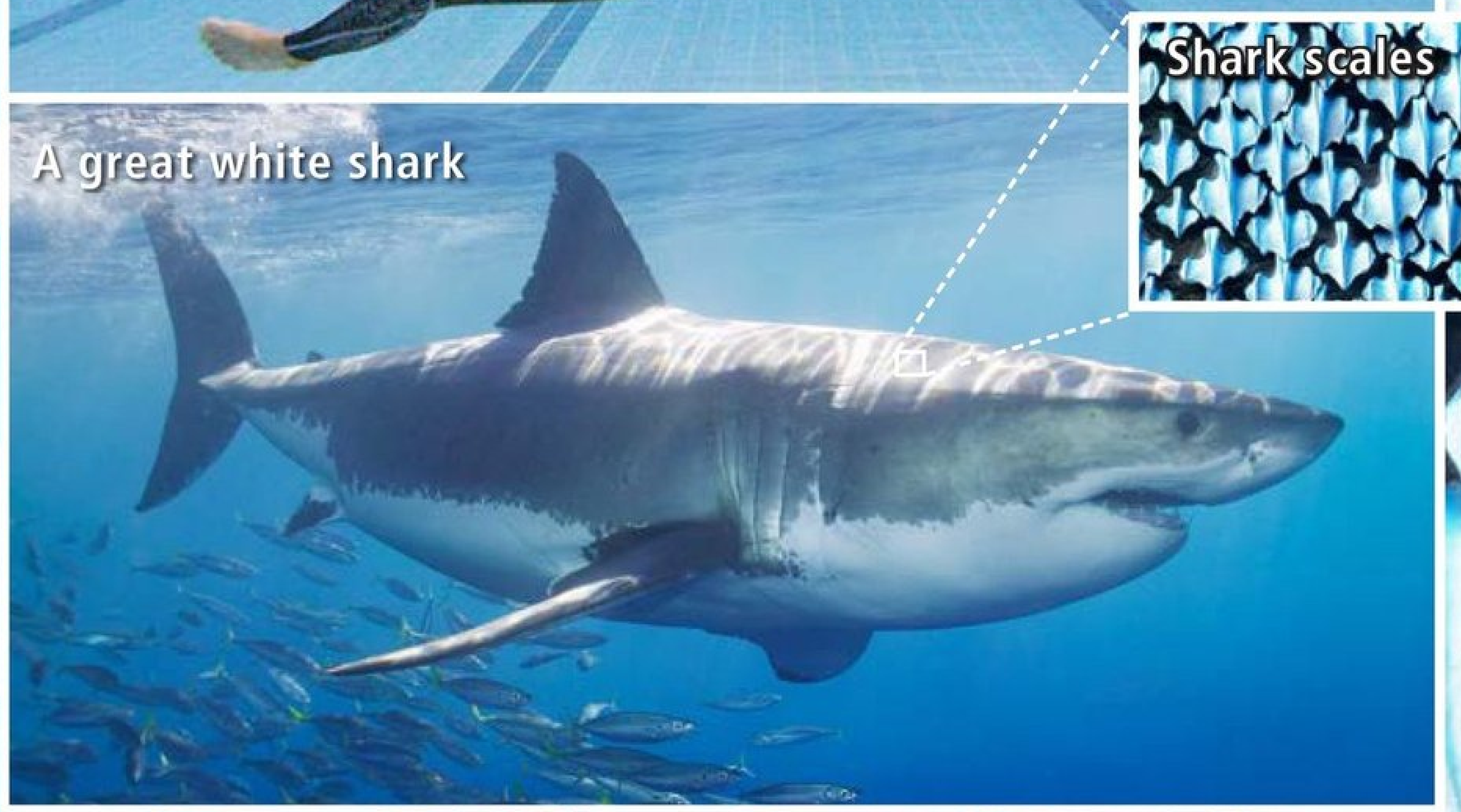
The newly designed Shinkansen train pulls into a Tokyo train station.

Shinkansen Train

Japan's Shinkansen train, known as the bullet train, is one of the world's fastest, zipping over the rails at speeds up to 210 kilometers per hour (130 mph). The train's rounded nose, however, created a problem in tunnels. Its shape caused air pressure to build up around the train. When the train left the tunnel, the pressure was released, making a very loud booming sound.

To fix this problem, the train designers looked to a small bird called a *kingfisher.* The shape of the kingfisher's beak lets it dive for fish without making a big splash as it enters the water. The designers thought that if the train's nose was the same shape, it would help the train move through tunnels more smoothly without any air pressure buildup. The redesigned nose not only solved the noise problem, but it also helped the train run even faster.

A swimmer models one of the swimsuits designed to work like a shark's skin.



A great white shark

Shark scales

Swimsuits

Sharks have been swimming in the ocean since before the time of the dinosaurs. Their bodies are well **adapted** to moving through the water. Sharkskin has tiny **grooved** scales that help these animals glide smoothly and quickly.

In order to swim faster, competitive swimmers tried swimsuits that mimicked the design of sharkskin. The new suits did seem to help, as 80 percent of the swimmers who wore those suits at the 2000 Sydney Olympics won medals.

The Eastgate Centre (left) releases hot air through vents along the sides and top of the building like a termite mound (right).

Cooling Systems

Termites are small insects with big appetites. Some kinds of termites build huge mounds in which to live. The mounds are climate controlled—no matter how hot it gets outside, the air inside the mounds stays cool. The mounds have a complex system of tunnels and vents that run from the bottom to the top. Hot air rises up out of the top of the mound while cooler air from the ground enters from below.

Engineers designing the Eastgate Centre in Harare, Zimbabwe, copied the termite mound system to help keep the building comfortable without using costly air conditioning. The building was made with heat-resistant materials and special vents at the top. Because of this design, the structure uses only 10 percent of the energy another building the same size would use.

The Moss Landing power plant in California (right) was one of the first to turn carbon dioxide into cement using a process similar to one that corals use (left).

Building Materials

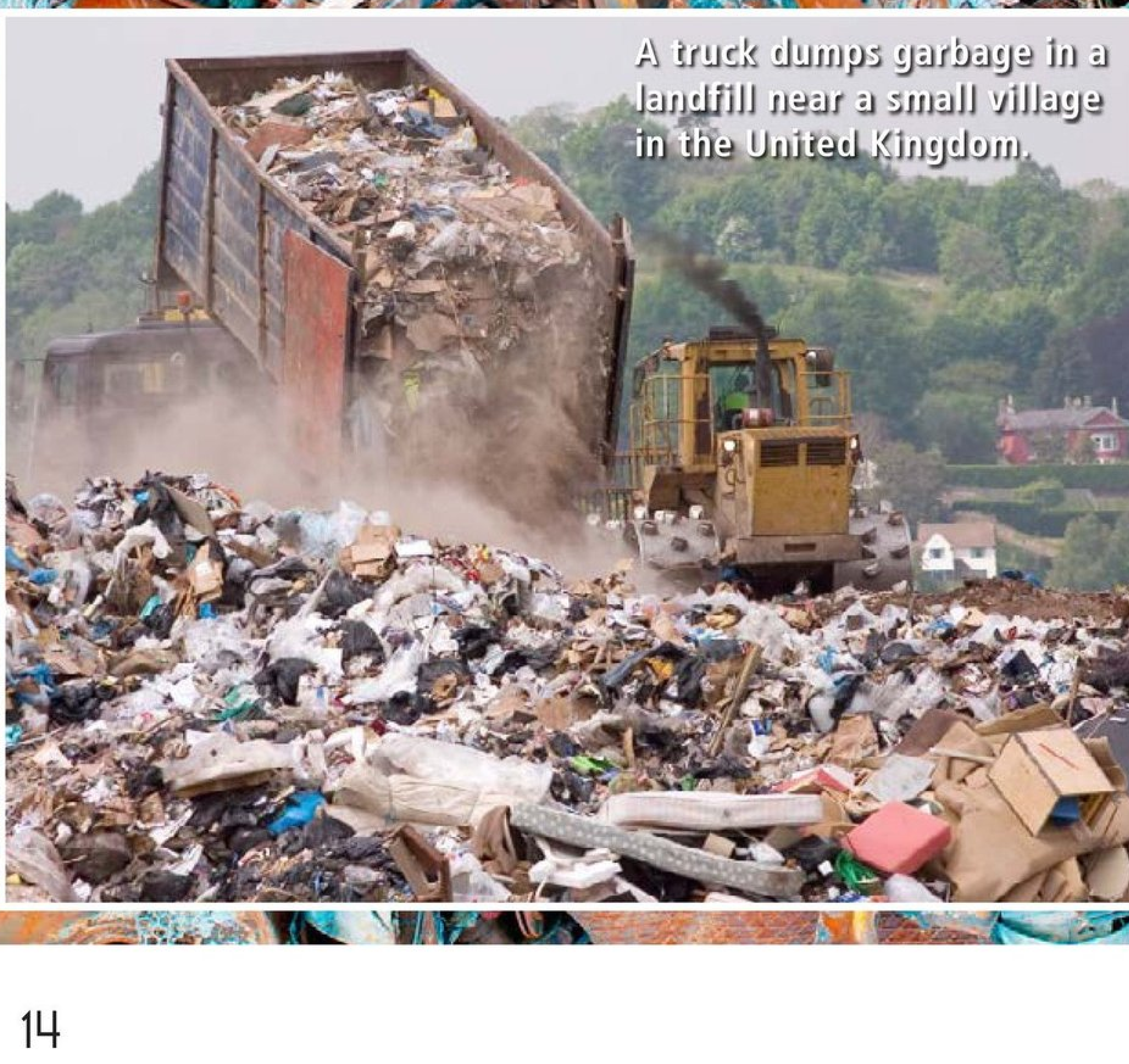
Some living things, such as coral, can recycle waste into something useful. Carbon dioxide is a waste gas that in small amounts is usually harmless, but in large quantities can hurt the environment. When carbon dioxide in the air mixes with ocean water, it becomes calcium carbonate. Corals use this mineral to make coral reefs.

Calcium carbonate is also an important ingredient in a building material humans use: cement. Scientists found a way to pump carbon dioxide through seawater to turn the gas into carbonate. Now people use it to make things, just as the coral does.

Why Is Biomimicry So Important?

Biomimicry is a great way to help people solve problems and make the things they need. Instead of trying to figure out how to do or fix something, people can look to nature to find ways that already work. Most of nature's designs are surprisingly simple and easy to imitate, such as the hooks on a burr or the bumps on a lotus leaf.

Natural designs are not just simple and effective, but are also good for the environment. People often forget the impact **discarded** materials have on other living things. Products that are made to last don't **decompose** quickly. Many are of little use to other living things and may in fact harm them.



A truck dumps garbage in a landfill near a small village in the United Kingdom.

Mushrooms and moss grow on a fallen tree.

In nature, however, nothing is wasted. Any waste becomes a **resource** for another **organism**. A dead tree, for example, becomes food, shelter, and energy for hundreds of living things. One species' trash is another species' treasure, as everything discarded contributes to the well-being of the **ecosystem**. People can take their cue from nature and do their part by being careful about what resources they use and considering what happens when they're finished with them.

Plastic bottles and trash litter a beach.

Solar Ivy (right) acts like artificial leaves, turning sunlight into energy as a tree does (left).

The Future of Biomimicry

Artificial Leaves

Solar panels turn sunlight into electricity and are considered a cleaner fuel source than **fossil fuels**. While the panels produce no harmful gasses, they are costly to manufacture. Making them creates waste products that are hard to dispose of safely.

Scientists have turned to green plants for a better way to convert sunlight to energy. Green plants use **chlorophyll** to absorb light, which they then turn into food. A new type of solar cell uses natural dyes that mimic how chlorophyll works. These new cells may perform just as well as the old cells, without the cost and waste.

An Antarctic ice fish

Fish Antifreeze

Freezing temperatures can be hard on machines and living things. Chemical **antifreeze** keeps engines and machines running in cold weather. Some kinds of ice fish use natural antifreeze to survive chilly temperatures in Antarctic waters. Unlike chemical antifreeze, fish antifreeze does not harm living tissue. Scientists are trying to learn more about how the fish make and use natural antifreeze. This information can help researchers create a safe way to keep living tissue warm and healthy.

A funnel spider and web

Spider Silk

Spiderwebs are made of sticky silk that is also quite strong. A thread of spider silk is about three times as strong as a steel thread of the same size. Scientists have analyzed spider silk so that they can create a similar material. The human-made silk could be used to create all sorts of **durable** materials, from bandages to fences.

Medicine

Animals that live in the wild sometimes get ill, just as people do. Unlike humans, they can't go to a doctor or clinic. Instead, they have found ways to treat themselves, either by eating certain plants or applying minerals. Observing animal behavior might provide people with clues about treatments for human sicknesses.

A chimpanzee and her baby eat medicinal plants.

Conclusion

Nature provides important lessons for humans, but there is still much to be learned. By studying the living things around us, scientists can find inspiration for solutions to important problems. The best answers may be right under our noses, waiting to be discovered through the science of biomimicry.

Glossary

adapted *(adj.)* changed to fit a new or specific situation or environment (p. 11)

antifreeze *(n.)* something added to lower the freezing point of a substance (p. 17)

chlorophyll *(n.)* a substance in green plants that can turn water, air, and sunlight into food (p. 16)

decompose *(v.)* to decay, rot, or break down into small parts (p. 14)

discarded *(adj.)* thrown away or rejected (p. 14)

durable *(adj.)* sturdy and able to last for a long time (p. 18)

ecosystem *(n.)* a community of living things together with their habitat (p. 15)

fossil fuels *(n.)* energy sources, such as coal, oil, and natural gas, that are taken from the ground (p. 16)

glare *(n.)* a bright light, usually reflected off something (p. 8)

grooved *(adj.)* having long, narrow cuts or channels (p. 11)

organism *(n.)* a living thing (p. 15)

resource *(n.)* a supply of something valuable or very useful (p. 15)

Biomimicry

A Reading A–Z Level Y Leveled Book
Word Count: 1,617

Connections

Writing

Which plant or animal adaptation do you think has provided the most important lesson for humans? Write a persuasive essay using information from the book, as well as outside resources, to support your answer.

Science

Research other examples of biomimicry not found in the book. Choose one and write an informational paragraph about it. Create a poster that includes your paragraph to share with your class.