asknature

BIOLOGICAL STRATEGIES

How do other living beings solve problems?

Learn more:
asknature.org/strategycards

Termites

The internal structure of above-ground termite mounds facilitates gas exchange in the below-ground nest by harnessing external wind energy.

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Black-tailed prairie dog

Differences in position and shape of burrow openings of black-tailed prairie dogs create passive ventilation from wind energy by altering air pressure.

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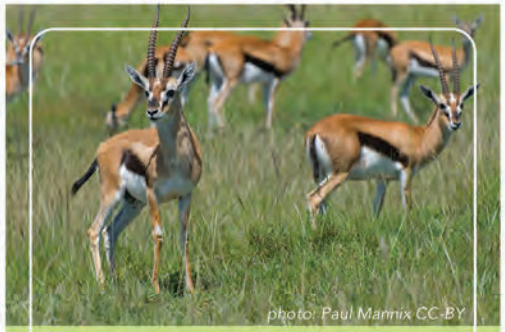

Thompson's gazelle

A network of blood vessels called the carotid rete cools the brain of the Thomson's gazelle via counter-current heat exchange.

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Reindeer

The coat of a reindeer insulates against polar cold with the help of dense underfur that traps air.

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Alaskan darkling beetle

A sugar polymer produced by an Alaskan darkling beetle keeps cells from freezing in extreme cold by preventing ice formation.

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Oriental hornet

Pigments in the oriental hornet's exoskeleton absorb solar energy that is turned into electrical energy.

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Olive tree

Leaves of olive trees optimize sunlight harvesting by differing in shape and being flexible to changing conditions.

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BIOMIMICRY INSTITUTE

photo: DiverDave CC-BY-SA

Tammar wallaby

The tendons of tammar wallaby hindlimbs help reduce the energetic cost of hopping by storing and returning elastic energy.

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photo: Jon Nelson CC-BY

Rainbow trout

The body of rainbow trout decreases energy required for swimming by interacting with swirling flows in its fluid environment.

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Social insects

Colonies of social insects effciently coordinate complex group tasks without a leader through many simple individual interactions.

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Wetland

Wetlands remove nutrients and sediments from water as plants, bacteria, and physical processes interact.

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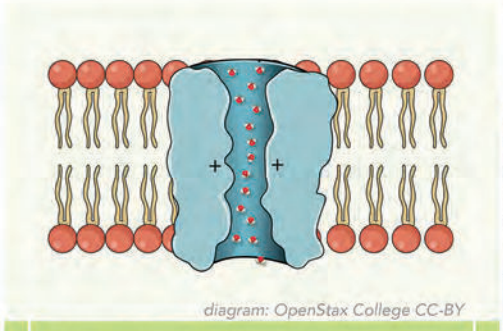

diagram: OpenStax College CC-BY

Aquaporin

Aquaporin protein channels in cell membranes selectively allow water molecules to flow easily through them because they're lined with specific, charged chemical groups.

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Dromedary camel

The inner nasal surfaces of camels help conserve water by absorbing water vapor from exhaled air.

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Chameleon

The skin of the chameleon rapidly changes color by actively adjusting nano-sized crystal structures beneath pigment cells.

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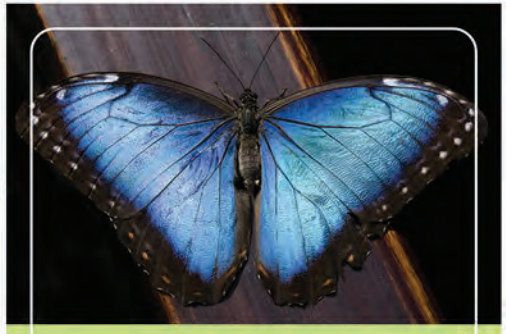

Morpho butterfly

Tiny structures on the wings of Morpho butterflies create color by causing light waves to diffract and interfere.

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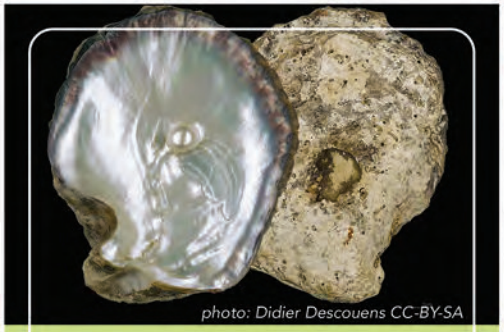

Nacre

Layers of weak and stretchy organic material between brittle mineral layers in shell nacre (mother of pearl) make the whole composite tough by managing cracks.

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Striped bass

Scales on striped bass provide high resistance to penetration due to their double-layer structure.

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Golden-scale snail

The shell of the golden-scale snail protects from attack with a specialized tri-layered composition.

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Photosynthesis

Photosynthesis in plants makes useful organic compounds out of carbon dioxide in the air through carbon-fixing reactions.

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Bacteria

Bacteria produce polyester grains in water at ambient temperature and pressure using enzymes and self-assembly.

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White rock shell snail

The eggs of the white rock shell snail ward off microbial attack with a series of physical, mechanical, and potentially chemical defenses.

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Lotus leaf

Leaves of the sacred lotus are self-cleaning thanks to hydrophobic microscale bumps.

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Harbor seal

The sensitive whiskers of harbor seals reduce vibrations caused by swirling flows during swimming due to their wavy surface structure.

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Owl

Specialized feathers of the owl enable near-silent flight by altering air turbulence and absorbing noise.

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photo: Forest and Kim Starr CC-BY

Water fern

The leaf structure of the Salvinia water fern retains a drag-reducing layer of air when submerged in water due to water-resistant hairs that possess water-attracting tips.

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photo: Didier Descouens CC-BY-SA

Namib darkling beetle

Surfaces of wing covers on some darkling beetles in the Namib desert gather water from the air using nanoscale bumps and body position.

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photo: Schokraie E, et al. CC-BY

Tardigrade

The tardigrade survives extreme heat, cold, and dehydration by entering a reversible suspended metabolic state known as cryptobiosis.

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Tallgrass prairie

Diverse plant species in prairie grasslands support a long-term, stable ecosystem because they exhibit complementary functionality.

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Blue mussels

Byssal threads of the blue mussel attach to a wet, solid surface using adhesive proteins that overcome the surface's attraction to water molecules.

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photo: NOAA

Venus flower basket

The silica skeleton of the Venus' flower basket sea sponge resists bending and twisting because multiple levels of organization each help to manage forces.

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Choose a strategy

Describe a unique ability or trait of an organism that enables it to perform a specific life function. Include as much information as you can about how the strategy works.

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HUMAN CHALLENGES

What problems could we solve using biomimicry?

Radon

Radon is a hazardous gas that can accumulate in buildings, especially in low areas such as basements.

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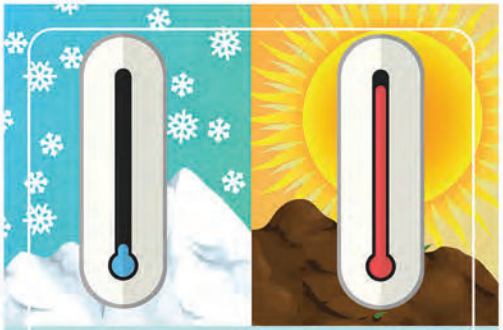

Weather extremes

Climate scientists predict that global warming will increase the frequency of extreme weather conditions, including very hot summers and very cold winters.

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Off-grid home

An architect is designing an "off-grid" home that must generate its own energy as well as store and use it efficiently for many household purposes.

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Water treatment

Global demand for freshwater is rising rapidly at the same time that much of it is being polluted by the activities of industry and agriculture.

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Digital displays

The screens on smartphones and other digital devices consume more energy than any other component.

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Durable materials

Sporting equipment companies want to make protective gear that's stronger while using fewer non-renewable petroleum-based plastics and foams.

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Polymers

With global petroleum feedstocks on the decline, we need alternative ways to produce useful materials from locally abundant resources.

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Clean surfaces

Lots of water and harsh cleaning compounds are used every day to keep surfaces clean in busy public buildings, such as schools and shopping centers.

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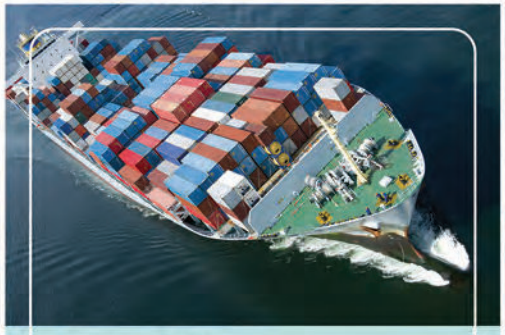
Wind power

The power-generating efficiency and longevity of wind turbines can be compromised by swirling flows in turbulent air around large objects such as buildings and trees.

CHALLENGE CARD



Cargo ships

Roughly 70% of the world's goods are transported in transoceanic cargo ships, which burn highly polluting "bunker fuel" oil to propel themselves through the water.

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Water supply

Communities in dry regions of the world often struggle to maintain a reliable supply of clean drinking water.

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Sample storage

Science and medical labs worldwide spend billions on energy for refrigeration to preserve biological samples.

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Agriculture

Conventional agriculture that focuses on growing a single crop makes farms vulnerable to pests and disease and depletes soil nutrients.

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Surgical glues

Doctors who perform joint replacements and repair broken bones need a surgical glue that can be used safely and effectively inside the body.

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Earthquakes

The structure of buildings in earthquake-prone regions must be both strong and stable to remain standing when a quake hits.

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