Design and Nature

Many design problems have been solved by copying nature. This is called "biomimicry." For example, Velcro was invented by copying the tiny hooks on burrs.

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In exercise 1, you are going to speculate with a partner about which items borrowed design elements from which animals. A common grammatical structure in a situation like this is past tense modal verbs, such as (*might have* + *past participle*) or (*could have* + *past participle*).

E.g *"I guess Velcro might have come from burrs, because they both have tiny hooks"*

or

"They could have copied burrs to invent Velcro, they both have tiny hooks"

1. Look at the items below and try to guess with a partner which were improved by borrowing design elements from which animals.

Item/product	Natural phenomenon
a) Bird-safe glass *3.*	1. Termites
b) Less painful needles (Syringes) *4.*	2. Geckos
c) Faster Olympic swimsuits *6.*	3. Spiders
d) More efficient air conditioning in office buildings *1.*	4. Mosquitoes
e) Stickier adhesives (glue etc) *2.*	5. Woodpeckers
f) Better Shock absorbers (in cars etc) *5.*	6. Sharks

2. In pairs read about 3 of the examples of biomimicry from exercise 1 and explain what you learned to your partner in your own words.

Student A

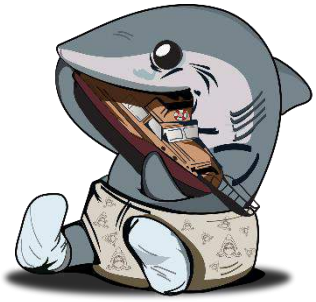
Woodpeckers

A woodpecker bangs its head into a tree 22 times per second, hitting it with a force that would cause severe concussion or brain damage to a human being. Researchers have studied the beaks and skulls of woodpeckers and found one of the secrets to their durability is the combination of a very hard beak and a soft area in their skull. They have copied this to make everything from better shock absorbers in cars to more shock-resistant flight recorders.

Termites

Termites build impressively high nests, many of which can top 10 meters. Not only that but they often build them in very hot countries, and yet somehow keep the interior cool (with no A/C!). Architect Mick Pearce studied the complex system of pipes and chimneys in these structures and copied them to create buildings which are far more energy efficient.

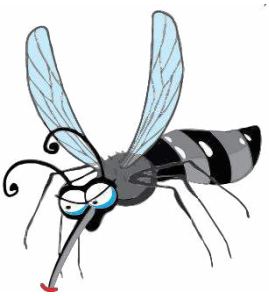
Sharks



Shark skin is made up of countless microscopic overlapping scales. These scales are shaped in such a way that they reduce the turbulence in the water around them when they move. This reduces drag, allowing sharks to move smoothly and quickly through the water, and is also used in high-end, Olympic level swimsuits.

Student B

Mosquitoes

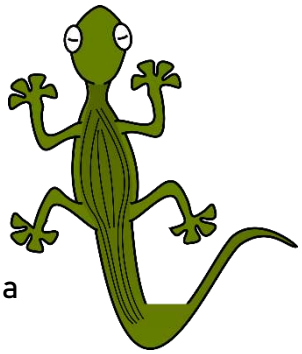


Have you ever been covered in mosquito bites, but never actually felt them bite you? Well science has copied mosquito's proboscises (that's the pointy, sucky part) to be used for good instead of evil. The tip of the proboscis is actually quite soft, hardening further up, and is serrated in such a way that means a mosquito needs 1/3 of the pressure a standard syringe needs to penetrate human skin. Less pressure means less pain, and both of these design elements have been copied to achieve less painful needles. So mosquitos are not completely useless after all.

Spiders

Spider webs are famously resilient, but did you know that they are also specifically designed to reflect UV (ultra-violet) rays? Spider webs are hard to see with human eyes, but to birds they stand out as clear as day, a clear warning to stay away. This idea has been used all over the world to prevent birds flying into windows, with many windows now laced with UV reflectors, making the windows highly visible to our feathered friends.

Geckos



Geckos are able to climb up any surface with ease, seemingly defying the laws of gravity. Their secret? Their large toes are covered with thousands of sticky hairs which stick and unstick simply by applying and removing pressure. This has allowed researchers to develop masking tape 4 times as strong as normal masking tape, and has even been used to develop special gloves and shoes that allow a human being to climb up a glass wall.

Which of these examples of biomimicry surprised you the most? Can you think of any other elements we could take from nature to help us make a better designed world?

3. You are going to watch a video about copying nature to improve design. The video contains the phrases in the box. Use the phrases to complete the sentences.

sonic boom	flock	novice	coined the term
by-product	buzzword	decibels	consultant

a) He worked as a *consultant* for several years before they hired him full-time.

b) If you eat chips at the beach you'll attract a *flock* of seagulls.

c) Charles Dickens *coined the term* "butter-fingers." He used it in a book to describe a very clumsy person.

d) The train goes so fast, it makes a loud *sonic boom* every time it exits a tunnel.

e) "Fat-free" has been a *buzz-word* in advertising for decades.

f) Glycerin is a *by-product* of the soap-making process.

g) The loudest alarm clocks are 110 *decibels* loud.

h) There are five different levels, ranging from *novice* to expert.

4. Watch "The World is Poorly Designed" [1] and answer the questions.

a) What was the problem with Japan's Shinkansen train? *It created loud sonic booms every time it left a tunnel*

b) What was Eiji Nakatsu's hobby? *He was a bird watcher*

c) What part of the train did they copy from the kingfisher bird and why? *They copied the nose from the kingfisher bird, because the kingfisher's beak is designed to enter water without making a splash.*

d) Who invented the term "biomimicry"? *Janine Benyus*

e) What material was created by mimicking shark skin (apart from swimsuits)? *Antibacterial surfaces for hospitals*

f) Janine Benyus says there are 3 main ways we can mimic nature in design. What are these 3 ways, and what are the examples she gives for each?

Way 1 and example: *Form/Shape: mimicking lotus leaves to make self-cleaning paint.*

Way 2 and example: Process: *Mimicking ants to make software, specifically software for autonomous cars.*

Way 3 and example: *Ecosystem: Material from a log moving into a fungus, which moves into a mouse, which moves into a hawk, mimicking that to improve cities.*

g) What is a circular economy? *A system which has no waste, no by-products, everything is used for something else.*

[1] https://www.youtube.com/watch?v=iMtXqTmfta0&t=16s&ab_channel=Vox