Sustainable Design

WITH

BIOMIMICRY

When designing safer chemicals and products, you can look to nature for inspiration. This is called **biomimicry**. Many products, like **glues and Velcro**, can be inspired by nature. However, some of these innovations might use harmful chemicals to create the final product. In those cases, nature inspired the "form" but not the materials. Designing products that are better for human health and the environment is not easy, but by using biomimicry plus the **Design Principles for Green Chemistry and Engineering**, you can create safer, innovative products.

Adaptations

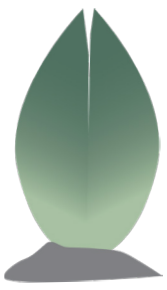
Mussels secrete byssus threads through their "foot"

Mighty Sticky Mussels

Mussels live in harsh intertidal zones where they are battered by heavy waves, yet they remain firmly attached to the rocks. The fact the rocks are wet poses no problem for these critters.

How do they do it?

Mussels produce sticky threads, called **byssus**, made of mussel adhesive proteins (MAPS), to keep them attached to wet rocks. These threads remain on the rocks as hardened plaque even after mussels leave.



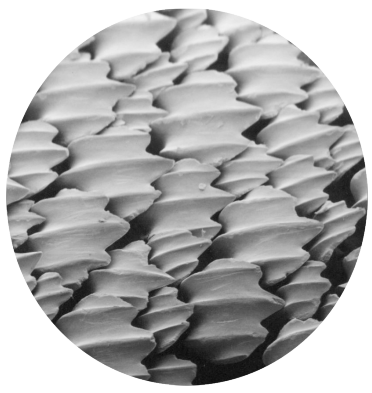
Very Hairy Geckos

Have you ever touched a gecko foot? You'd find that it's not sticky at all. Yet geckos can climb walls!

How do they do it?

Geckos have millions of tiny hairs, called **setae**, on their feet. These hairs have nano-scaled "split ends" called spatulae that increase the contact area of a gecko's foot using weak molecular bonds called **van der Waals forces** to "stick" to surfaces.

Setae give geckos their "sticky" power



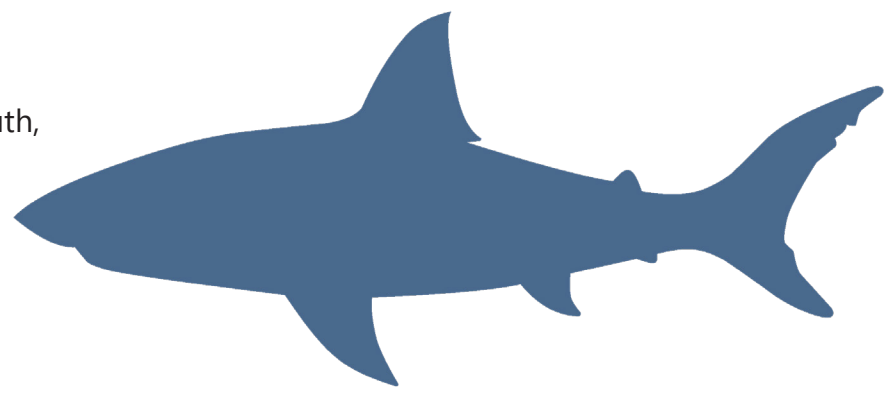
Dermal denticles make shark skin antimicrobial[1]

Sharp Skin Sharks

Have you ever noticed barnacles growing on boats, even whales, but not sharks?

How do they do it?

Sharks have a lot of teeth in their mouth, but they also have "teeth" all over them called **dermal denticles**—ridged, tooth-like scales that help them move silently through the water AND prevent algae and other micro-organisms from sticking to them.



What have scientists designed?

Scientists have been researching these animals and their adaptations to develop new kinds of adhesives, such as surgical tape and glues, and antimicrobial surfaces. One new product designed in the Pacific Northwest, a wood glue made from soy, won a Presidential Green Chemistry Award in 2007.

What can YOU design from nature?

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References

1 Deynat, P. (2020). Dermal denticles of a lemon shark viewed through a scanning electron microscope. Creative Commons Attribution-Share Alike 3.0 Unported. creativecommons.org/licenses/by-sa/3.0/deed.en