

BIOMIMICRY

YOUTH DESIGN CHALLENGE

Biomimicry Case Studies

When introducing these examples, it is important to highlight the process of biomimicry: learning from nature, then applying the strategies learned to create more sustainable designs. Use the “Biomimicry Insight” sections to help highlight this crucial aspect of the Biomimicry Design Process.

Case Study	Organism as Inspiration	Biomimetic Design
#1	<p>Burdock seed pods have spines with tiny hooks that catch onto the fur of passing animals and help the plant to spread its seeds.</p> <p>More info: Hooked Spines Grab Onto Fibers</p>	<p>Velcro® is a system of two surfaces: one is covered in tiny hooks, and the other has loops which catch the hooks. It was invented by a Swiss engineer who got the idea after pulling burrs from his dog’s fur after a walk in the mountains.</p> <p>Biomimicry Insight: Velcro® is a biomimetic product that was created by studying the simple, structural strategy used by the Burdock plant (tiny hooks that attach to passing animals). This structure, and how it is used in the Burdock’s environmental context, was copied to create the two surfaces used in Velcro®.</p> <p>More Info: Versatile Fastener Inspired by Burrs</p>
#2	<p>The elephant’s trunk is an extremely agile “muscular hydrostat”, a muscular structure containing no bones.</p> <p>More info: Explore Trunks</p>	<p>The Bionic Handling Assistant is a robotic arm designed to operate safely in close proximity to people. It is lightweight, flexible, and uses a hydrostatic, compartmentalized structure inspired by nature.</p> <p>Biomimicry Insight: The development process involved more than simply exchanging biological structures for man-made materials and building a “robotic trunk”. Scientists studied many different facets of the trunk structure and function to learn what principles are at work to allow the elephant to have it range of motion, flexibility, and grip—they took what they had learned from the elephant and applied it to their own design.</p> <p>More info: Robotic Arm Inspired by the Elephant Trunk</p>



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#3	<p>The Kingfisher dives for its food, so its head and beak are very good at entering the water, without a splash, to catch fish by surprise.</p> <p>More info: The Beak That Inspired a Bullet Train</p>	<p>The Shinkansen train in Japan has streamlined fore-front (leading edge of the first train car) inspired by the Kingfisher's beak. This shape reduced noise that resulted from the aerodynamics of high-speed trains entering and exiting tunnels.</p> <p>Biomimicry Insight: Engineers examined the aerodynamic properties of the Kingfisher's beak to learn how it is able to enter the water without splashing. Instead of just copying and pasting the exact shape of the beak onto the front of the train, they built models and studies how air moves around the beak—applying the principles they learned to their design. The final result reduced energy use and increased the overall speed of the train, in addition to solving the noise problem.</p> <p>More Info: High Speed Train Inspired by the Kingfisher</p>
#4	<p>Wetland ecosystems remove nutrients and sediments from water as plants, bacteria, and physical processes interact.</p> <p>More Info: Interacting Organisms Filter Water</p>	<p>Eco-Machines (also "Living Machines") are custom-built wastewater treatment systems that purify water without chemicals by mimicking a natural ecosystem.</p> <p>Biomimicry Insight: This sustainable solution was developed after studying the complex interaction of organisms (plants, bacteria, etc) and abiotic factors in a wetland (i.e. what effect does temperature have on the system?). Instead of focusing on a single organism, the system as a whole needed to be understood in order to effectively apply the observed principles in their design.</p> <p>More Info: Refined Wastewater Treatment System Inspired by Aquatic Ecosystems</p>