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Biomimicry throughout History: Transcript

Project link: https://umassengwri112.github.io/biomimicry/

[The video goes through the site. No words are spoken. All text not in brackets is directly from the website. The site has a green background and white text. Yellow is used as an accent color. The first image is of a cheetah.]

Biomimicry throughout History: Since when and Why copying nature become so effective?

Timeline.

Silk.

4000BC - Silk is one of the first examples of biomimicry. Humans learned to produce silk by observing silkworms and mimicking their ability to spin silk cocoons.

Scarecrows.

2500BC - Farmers have been using scare crows for centuries to protect their crops from birds and other pests. Scare crows are inspired by the appearance of humans, and they are effective because birds and other animals are naturally wary of humans.

DaVinci Plane.

14th Century - Leonardo Da Vinci's work on biomimicry is a testament to his genius and his ability to think outside the box. He was one of the first people to realize that nature could be a source of inspiration for human innovation. His work on flying machines has had a profound impact on the world, and it continues to inspire engineers and designers today.

Bullet Train.

1990s - The engineers designed the train's nose to resemble the kingfisher's beak, which helps to reduce drag and noise. The train's body is also streamlined, which helps it to move through the air more efficiently.

UMass! Gecko Skin.

2010s - The development of Geckskin by scientists at UMass Amherst is a great example of biomimicry, which is the use of nature to inspire the design of new products and technologies. By studying the natural world, scientists can learn how to create materials and systems that are strong, durable, and efficient.

[Image of silkworms.]

Silk's Enduring Legacy.

The biomimicry of silk in the past 400 BCE was not limited to the production of textiles. Silk was also used to create a variety of other products, including fishing lines, musical instruments, and medical devices. The Chinese were particularly skilled at using silk to create intricate and beautiful works of art.

The biomimicry of silk continued to flourish in the centuries after 400 BCE. As new civilizations discovered the secrets of silk production, they began to develop their own unique silk-making traditions. For example, the Persians were known for their vibrant silk brocades, while the Byzantines were known for their shimmering silk mosaics.

Today, silk remains a popular and versatile material. It is used in a wide variety of products, from clothing and textiles to medical implants and tissue engineering scaffolds. The biomimicry of silk continues to inspire scientists and engineers, who are constantly developing new ways to use this remarkable material to improve our lives.

[Image of a scarecrow.]

Using Predetor to Help Algriculture.

Humans have long looked to nature for inspiration, and scarecrows are a prime example of biomimicry. The traditional scarecrow, with its human-like form and clothing, is designed to mimic a predator, such as a hawk or an owl. This is because birds are natural enemies of many pests that damage crops. By creating a scarecrow that resembles a predator, farmers can effectively scare away birds and protect their crops.

In addition to their predator-like appearance, scarecrows can be further enhanced by incorporating other biomimetic features. For example, reflective surfaces, such as mirrors or aluminum foil, can be used to mimic the eyes of a predator, which can further startle birds. Additionally, scarecrows can be made to move in the wind, which will make them appear even more lifelike and threatening to pests.

By using biomimicry, farmers can create effective and environmentally friendly pest control methods. Scarecrows are a simple and inexpensive way to protect crops from damage, and they can be easily adapted to different types of pests and growing conditions.

[Image of a flying machine drawing.]

The Plane that Flaps.

Leonardo da Vinci was one of the first people to apply biomimicry to the design of flying machines. He studied the flight of birds and bats, and used their anatomy and physiology as inspiration for his own designs. For example, he observed that birds' wings are curved, which helps them to generate lift. He also noticed that bats' wings are flexible, which allows them to change their shape during flight. Da Vinci incorporated these observations into his own designs,

creating flying machines that were more aerodynamic and efficient than anything that had been seen before.

One of da Vinci's most famous flying machine designs is the Ornithopter. The Ornithopter is a flapping-wing aircraft that was inspired by the way birds fly. It has a large, bat-like wingspan and is powered by a system of cranks and levers that would have been operated by the pilot. Although the Ornithopter was never successfully flown, it was a groundbreaking design that helped to pave the way for the development of modern airplanes.

Da Vinci's work on biomimicry is a testament to his genius and his ability to think outside the box. He was one of the first people to realize that nature could be a source of inspiration for human innovation. His work on flying machines has had a profound impact on the world, and it continues to inspire engineers and designers today.

[Image of a kingfisher bird.]

Bullet Train and the Kingfisher.

This is perhaps my personal favorite example of biomimicry. The Japanese shinkansen bullet train was inspired by the kingfisher, a bird that can dive into water at high speeds without creating much splash. The engineers designed the train's nose to resemble the kingfisher's beak, which helps to reduce drag and noise. The train's body is also streamlined, which helps it to move through the air more efficiently.

In addition, the shinkansen's wheels are covered in a special material that helps to reduce friction and noise. The train also has a suspension system that helps to absorb vibrations, making for a smoother ride.

As a result of these biomimetic design features, the shinkansen is able to travel at speeds of up to 320 km/h (200 mph) with very little noise or vibration. This makes it one of the fastest and most efficient trains in the world.

Some of the specific ways in which the kingfisher inspired the design of the shinkansen bullet train:

i. The kingfisher's beak is long and slender, which helps it to pierce the water with minimal resistance. The shinkansen's nose is similarly shaped, which helps to reduce drag and noise as the train travels through the air.

ii. The kingfisher's feathers are covered in a thin layer of oil, which helps to reduce the amount of water that sticks to its body. The shinkansen's body is also covered in a special coating that helps to reduce drag and noise.

iii. The kingfisher's wings are designed to generate lift without creating much drag. The shinkansen's pantograph (the device that collects electricity from the overhead power lines) is also designed to generate lift and reduce drag.

[Graphic of a kingfisher with a body length of 0.17 m and beak length of 0.09 m. Beak and nose of train have a long and narrow shape. Train nose has a car length of 27.35 m, width of 3.36 m, and height of m.6 m.]

Biomimetic scaling of noise reduction. Kingfisher's beak was transferred into the design of high-speed trains. These trains became quieter and more efficient requiring 15% less energy while traveling even faster than before. Train image adapted from Source.

Video: The world is poorly designed. But copying nature helps.

One of my favorite video about biomimicry made by Vox.

[Image of a gecko.]

Super Sticky thanks to Gecko.

It just happened coincidentally that I came across an UMass 🎓🏫breakthrough studies while doing topic research and decided it to be a must-have example!

Geckos are amazing climbers, and their ability to stick to walls has inspired scientists at the University of Massachusetts Amherst to develop a new adhesive material called Geckskin. Geckskin is made of tiny fibers that are similar to the hairs on gecko feet, and it can stick to a variety of surfaces, including glass, metal, and plastic.

Geckskin is a strong adhesive, but it is also easy to remove. This is because the fibers are very thin and flexible, so they can conform to the surface of an object without getting stuck. Geckskin is also reusable, so it can be used over and over again.

Geckskin has a variety of potential applications, including robotics, medical devices, and consumer products. For example, Geckskin could be used to make robots that can climb walls, or to develop medical devices that can stick to skin without causing irritation. Geckskin could also be used to make consumer products that are easier to clean, such as shower doors and windows.

The development of Geckskin is a great example of biomimicry, which is the use of nature to inspire the design of new products and technologies. By studying the natural world, scientists can learn how to create materials and systems that are strong, durable, and efficient.

Video: Geckskin Does Some Heavy Lifting!

Video of the device that can hold 700 pounds on a smooth wall. Learn more at geckskin.umass.edu

Take Away: Anyone can be inspired.

The natural world is a treasure trove of inspiration for innovative solutions. From the gecko's ability to cling to walls to the spider's silken thread production, animals have evolved remarkable

adaptations that can inform human design. Biomimicry, the practice of emulating nature's designs, offers a promising approach to addressing global challenges in areas such as sustainability, energy, and healthcare.

Consider these mind-blowing facts about animals:

- A single hummingbird's heart beats up to 1,300 times per minute, which is equivalent to 150 beats per second.
- A sloth's digestive system takes about a month to process a single meal.
- A dragonfly's compound eyes are made up of up to 30,000 individual lenses, giving them exceptional vision.
- An elephant's trumpeting call can travel up to 12 miles.
- A shark's teeth are constantly being replaced, with a new row forming behind the existing ones.

What I want to say is the source of inspiration are endless! You just need to observe and look at the world anew. You can look at my work: Looking At Problems From A Different Perspective ↗ written in UMass English Writing 112.

Thank you!

Figures & Credits

[A bar chart showing “Number of publications” and “Year.”]

Graph showing that Biomimicry is a growing trend Source.

Citation for images, information, researches, etc... that I used on this website.

Cheetah image

Photo by Saifuddin Ratlamwala from Pexels:

https://www.pexels.com/photo/photo-of-cheetah-on-green-grass-field-3849686/

Silkworm Feeding Mulberry Leaves image

https://ehistory.osu.edu/exhibitions/biomimicry-history

Scarecrow image

Photo by Ariful Haque from Pexels:

https://www.pexels.com/photo/man-planting-on-field-3560020/

Leonardo da Vinci: ornithopter image

Britannica, The Editors of Encyclopaedia. "ornithopter". Encyclopedia Britannica, 1 May. 2013,

https://www.britannica.com/technology/ornithopter. Accessed 28 November 2023.

Kingfisher image

https://www.childhoodbynature.com/decoding-birds/

Biomimetic scaling of noise reduction inforgraphic

Organismal Design and Biomimetics: A Problem of Scale - Scientific Figure on ResearchGate.

Available from:

https://www.researchgate.net/figure/Biomimetic-scaling-of-noise-reduction-Kingfishers-beak-was-transferred-into-the-design_fig4_354909240 [accessed 28 Nov, 2023]

Vox: The world is poorly designed. But copying nature helps.

https://youtu.be/iMtXqTmfta0?si=ST88u8a_NVk2ttI7

Gecko paw image

https://commons.wikimedia.org/wiki/File:Green_gecko_paw.jpg

UMass Amherst: Geckskin Does Some Heavy Lifting!

https://www.youtube.com/watch?v=9ZJYbcG0Ts0&ab_channel=UMassAmherst

Biomimicry publications figure

https://www.researchgate.net/figure/Number-of-publications-containing-the-words-biomimetics-and-biomimicry-associated-with_fig2_327534798

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