Biomimicry

The imitation game

Evolution has the advantage of millions of years of trial and error to refine nature's designs; biomimetics uses nature as the source of inspiration for innovative design solutions to complex problems. The scope of opportunity offered by biomimicry is breathtaking – and the results are often beautiful. Here, we take a closer look at brilliant examples of biomimicry and the incredible ways we are cracking nature's secrets to unlock beautiful designs.

BIOMIMICRY: INSPIRED BY NATURE

We are constantly looking for ways to improve our designs and solve problems. But does nature know best? The ancient Chinese were the first to unearth the silkworm's secret, weaving the fine soft threads into luxurious cloth. Producing silk from silkworms, which only eat mulberry leaves, can be expensive and labour-intensive, so many have tried to find a synthetic alternative. Although humans learned to spin silk as early as 3,500 BC, we have yet to successfully master a way to replicate its prized properties; research efforts continue to mimic silk's unique combination of strength and elasticity.

Let's explore some more successful examples of how we have emulated nature to develop life-changing materials.

VELCRO? I'M HOOKED

Materials science researchers look to nature to help develop new materials. Take Velcro, for example. A serendipitous discovery by Swiss George de Mestral in 1948, Velcro has become the textbook example of biomimicry. Developed while de Mestral walked his dog in the countryside, the inventor noticed burrs stuck to his dog's fur, which led to his creation of the hook-and-loop fastening material we all use today.

Evolution has the advantage of millions of years of trial and error to refine its designs in nature.

BIOMIMETICS: THE LOTUS EFFECT

Known as superhydrophobicity, the lotus effect is seen on the leaves of the lotus flower. Water spilt on the leaf does not wet its surface. It simply beads and rolls off, and by doing so, the water cleans accumulated dust and muck from its surface. This highly repellent ability is down to the leaves' microstructure: tiny protrusions coated in waxy hydrophobic substances repel water. It's a very useful quality. Researchers have mimicked superhydrophobicity to create water-repellent (and fat- and oil-repellent) self-cleaning materials with many applications – including for tackling marine corrosion.

QUIET PROGRESS OF BIOMIMICRY A HOOT

Constant noise exposure is an increasing problem in developed countries, impacting not only industry but also our health. Key noise-polluting culprits can be airports and wind farms. Part of the noisy problem is from the aeroplanes' and wind turbines' aerofoils; large wings or propellors make noise when (loudly) swooshing through the air. Fortunately, researchers have developed a new aerofoil design – adding a feather to their cap with their remarkable advancement in noise-reduction technology. Taking inspiration from nature for a new generation of quiet aerofoils, the team from a consortium of four universities (with industrial support from Airbus and Vestas) have achieved noticeable noise reductions of about 10 dB – far surpassing previous designs. What was the source of inspiration? Owls! The researchers looked at the feathers in their wings to draw inspiration for their innovative design.

NATURE-INSPIRED BIOMIMETIC ARCHITECTURE

The last entry of our list is an example of biomimetic architecture that innovatively uses designs found in nature to create beautiful (and practical) structures. Antoni Gaudí I Cornet, often referred to simply as Gaudí, designed buildings using principles and shapes he spotted in nature. Spiral staircases, columns in the shape of tree trunks, and nature-inspired waves and curvy lines are practical structural elements that give Gaudí's architecture its sublimity, attracting hundreds of thousands of awestruck tourists a year. Like the Honeycombe gates, nature-based decorative details symbolise humanity's close relationship with the natural world in La Sagrada Familia. Gaudí's pioneering use of biomimicry imbues a sense of wonder in worshippers and visitors alike.

Experts predict that biomimicry will have many future applications in medicine and biomedical engineering.

THE FUTURE OF BIOMIMICRY

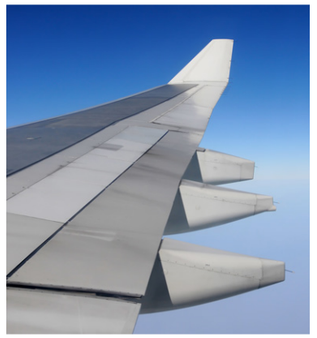
Researchers worldwide are looking to biomimetics for future solutions to complex conundrums. Experts predict that biomimicry will have many future applications in medicine and biomedical engineering, helping us treat diseases and heal wounds faster. New advances in biomimetic nanoparticles already bring hope to cancer patients worldwide. Biomimicry can even be used to tackle environmental issues, completing the full circle from inspiration to resolution in nature-based problem-solving approaches.

Biomimetics' impact on science is set only to increase. For robotics, biomimicry of the human form has already resulted in human-like androids, with the world's most advanced called Ameca. Ameca uses artificial intelligence and speech recognition software to talk meaningfully with humans and learn. Humans (and likely humanoids) will keep playing the imitation game with nature, looking to unlock new innovations and solve currently unbreakable problems – like finally creating that elusive artificial silk.

SILK IS THE STRONGEST NATURAL FIBRE – BUT HARDEST TO REPLICATE

- Silk is the strongest natural fibre in the world.
- It's the thread produced by the spinning glands of the silkworm (but technically it's a moth pupa, not a worm).
- Silk lacks the rigidity of steel, yet (relative to its weight) is just as strong!
- Silk has a massive warmth-to-weight/thickness ratio: tightly woven silk fabrics keep us cosy as their tiny fibres trap warm air close to our bodies.
- Scientists have for years tried to exploit these properties of silk – but have not yet been able to recreate it.
- This approach of replicating nature to develop new technology and materials is called biomimetic design.

The highly repellent quality of lotus leaves is known as superhydrophobicity.



Taking inspiration from nature:
A new generation of quiet aerofoils were modelled on the owl.

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