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APPLICATION OF BIOMIMICRY

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Abstract

Biomimitics is the development that gives affordable resolution to the issues faced by humans by imitating the character thereby explanation most edges of nature and improved property. We have a tendency to the character galvanized techniques used as natural ventilation, harnessing nonconventional energy, lighting, climate management and information optimisation exploitation soft computing techniques like artificial neural networks and genetic programming. are endeavour for inexperienced buildings and use of inexperienced materials for constant. This paper makes an attempt to gift a review of its applications in technology normally in addition as in numerous kinds of constructions to create the structures eco-friendly, as well as repetition the character for planning the shapes in addition for actual constructions. a lot of and a lot of ideas ought to be explored and derived from the character for the advantage of humans in addition as natural surroundings.

Index Terms: *Biomimicry(intro.), History of Biomemetics, Popular inventions, Applications in civil engineering, Building's designs inspired by Nature.*

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1. Biomimicry

Biometics or biomimicry is the imitation of the models, systems, and parts of nature for the aim of finding complicated human issues. Biomimicry originates from 2 Greek words : Bios=Life , Mimesis=Imitate.

Living organisms have evolved well-adapted structures and materials over time through survival of the fittest. Biomimetics has given rise to new technologies impressed by biological solutions at macro and nanoscales. Humans have checked out nature for answers to issues throughout our existence. Nature has resolved engineering issues like self-healing skills, environmental exposure tolerance and resistance, property, self-assembly, and harnessing alternative energy.

1.1 History

Otto Schmitt

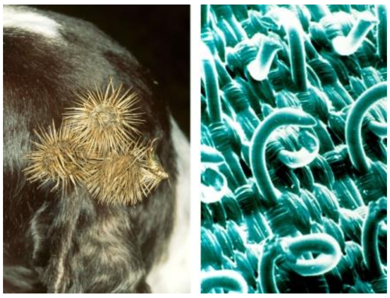
In 1969 Schmitt used the term "biomimetic" within the title one in all his papers, and by 1974 it had found its means intoWebster's lexicon, technology entered const ant lexicon earlier in 1960 as "a science involved with the applying of knowledge regarding the functioning of biological systems to the answer of engineering problems".

Janine Benyus

The term *biomimicry* appeared in 1982. Biomimicry was popularized by researcher and author Janine Benyus in her 1997 book *Biomimicry: Innovation Inspired by Nature*. Biomimicry is defined in the book as a "new science that studies nature's models and then imitates or takes inspiration from these designs and processes to solve human problems". Benyus suggests looking to Nature as a "Model, Measure, and Mentor" and emphasizes sustainability as an objective of biomimicry. In addition to the advantges of sustainability, using biomimicry to make innovative materials, systems and architecture also results in businesses being able to do more at a cheap cost, making more production and profits.

2. Popular Inventions inspired by Biomimcry

2.1. Velcro



During a hunting trip in the Alps in 1941, Swiss engineer George de Mestral's dog was covered in burdock burrs. Mestral observed one under his microscope and discovered a basic design of hooks that nimbly attached to fur and socks. After months of experimentation, he invented Velcro — and earned U.S. Patent 2,717,437 in September 1955. Benyus said it is the best-known and most economically successful instance of biomimicry.

2.2. Shinkansen Bullet Train

High-velocity trains can really cause headaches. So Japan reduced their acceptable noise-pollution level, which can be very high when the trains emerge from tunnels. As they drive through, air pressure converts to waves and, when the nose emerges, can produce a shotgun-like thunderclap audible from a quarter mile. Eiji Nakatsu, a bird-watching engineer at the Japanese railway company JR-West, in the 1990s inspired from the kingfisher, a fish-eating fowl that creates barely a ripple when it dives into water in search of a food. The train's redesigned nose — a 50-foot-long steel kingfisher beak — didn't just solve the noise problem; it decreased power use and enabled increased velocity.

2.3. Harvesting Desert Fog

The Namibian Beetle raises its back into the atmosphere as fog flows into its desert habitat. Bumps on its shell capture water droplets, which then run down chutes toward its mouth. "The design of this fog-collecting structure can be regenerate cheaply on a economical scale and may find application in water-trapping tent and building coverings," wrote the authors of a 2001 paper that revealed how the water collection works. Inventors and designers have taken note. A "Dew Bank Bottle," designed by Pak Kitae of the Seoul National University of Technology, mimics the beetle's water-collection system. Morning dew precipitates on it and conveys it to a bottle, which has a drinking spout.

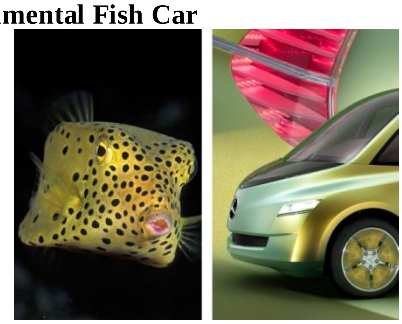
2.4. Nature's Water Filter

The 2003 Nobel Prize was awarded in part to Peter Agre of Johns Hopkins for his discovery, around 1990, of a membrane protein that allows water to penitrate through cell walls. The discovery of aquaporin solved a common problem in biochemistry. The Danish company Aquaporin has produced a new approach to seawater desalination that eschews the polymer-layering of traditional industrial films for the elegant complexity — and energy efficiency — of biological membranes.

2.5. 'Candy-Coated Vaccines'

Nature cannot make the deceased come back to life, but it can re-animate the seemingly dead. Tardigrades, which are millimeter-long brother of arthropods, can dry out for up to 120 years. A process known as anhydrobiosis protects the critter's chemical machinery — DNA, RNA and proteins — until water re-animate them. Biomatrica, a San Diego company, adapted that process into a product that protects live vaccines so that they no longer need to be freezed — half of vaccines are lost to breaks in refrigeration during transportation or treatment. Biomatrica's chemical barrier "shrink-wraps" the vaccine until it can be revived with water .Nova Laboratories, in Leicester, England, produce technology that secures vaccines "in a glassy film made of sugars," according to a 2010 journal article about the company's "candy-coated vaccines." The coating keeps the virus useful for 6 months at temperatures up to 113 degrees Fahrenheit — helpful for vaccinating vulnerable populations in tropical countries.

2.6.Experimental Fish Car



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"Rediscovering the wheel" is imprecise, even as a metaphor, in the biomimetic context. That's because nature doesn't actually do wheels; there's nothing for engineers to rediscover. The rough-and-humble tumbleweed is one of the some works of evolution that roll to get where they're going. Mercedes-Benz instead found inspiration for a car body (less its wheels) in the boxfish, a tropical species shaped sort of like, well, a 2-door compact. The fish's body turned out to be aerodynamically superb, and the resulting concept car has one of the most relevant shapes for a car of its size.

2.7. Fin to the Wind

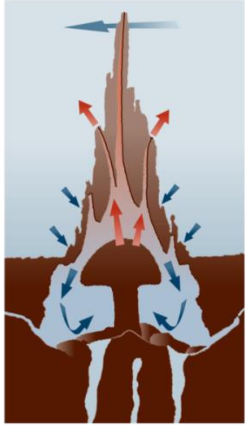

Humpback whales are surprisingly agile swimmers considering each mammal weighs in at about 80,000 pounds. Part of their swimming prowess may come from a row of warty ridges, called tubercles, on the front edge of their fins. Frank Fish, biology professor at West Chester University in Pennsylvania, discovered that by adding rows of similar bumps to turbine blades he could reduce drag and noise, increase speed to changing wind direction and increase the power harnessed by 20%.Fish developed the idea after he noticed bumps on a whale statue in a Boston present shop. He assumed, incorrectly, that the artist got it wrong and that the bumps shouldn't go on the front edge of fins, which typically are straight and sharp.The bumps are now being sell on industrial fans made by Envira-North Systems and on surfboards by Fluid Earth.

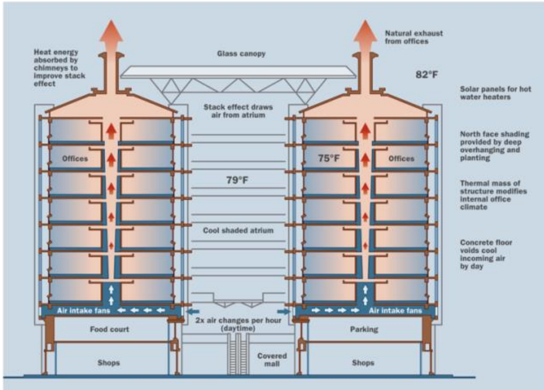
2.8. Gecko Feet Adhesives


Geckos are born with the magical power to scale smooth walls and scamper upside-down across ceilings. The source of their grip is millions of microscopic hairs on the bottom of their toes. Each hair's attraction is minuscule, but the net effect is powerful. Researchers calculate that the setae from the small toes of a single gecko could theoretically bear 250 pounds. The original trick is that by changing the direction of the setae, the grip is instantaneously broken: no sticky residues, no tearing, no pressure necessary. A team of University of Massachusetts, Amherst, researchers has made Geckskin, an adhesive so powerful that an index-card-size strip can bear up to 700 pounds. A type of gecko tape could replace sutures and staples in the clinics. And the ability to don a pair of gecko-tape gloves and scale walls like Spiderman may not be far off.

3. Biomimicry in Civil Engineering

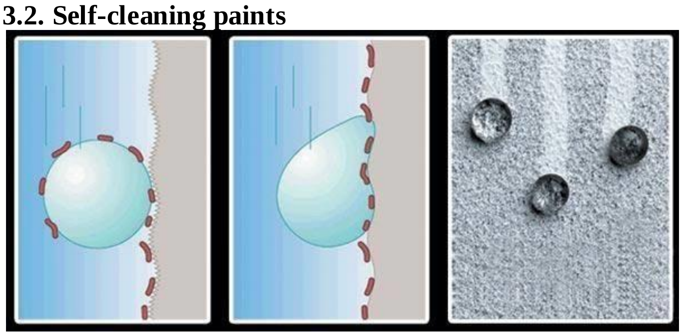
3.1. Passive cooling in buildings



The Eastgate Complex, situated in Harare, Zimbabwe, is a 324 000 sq.ft commercial office and shopping mall which consists of 29-storey office buildings and a glazed atrium. In Zimbabwe's very warm climate, the building's basic cooling method is natural ventilation. Engineers from firm Arup, led by Mick Pearce, sought inspiration for the ventilation design from termite mounds since termites require their home to remain at an exact temperature of 87°F (30.5°C) throughout a 24-hour daily temperature range of between 35°F at night and 104°F during the day (1.6°C to 40°C). The answer was a passive-cooling structure with specially architecture hooded windows, different thickness walls and pale coloured paints to reduce heat absorption.

3.2. Self-cleaning paints



German company, Sto AG, have made a biomimicry inspired exterior coating with a water-resistant surface based on that of the lotus leaf. Prof. Wilhem Barthlott, from the University of Bonn in Germany, discoverd the surface after looking for environmentally temperory alternatives to poisonous cleaning detergents in order to reduce envi-ronmental impacts. He asked the question 'How does nature clean surfaces?' It became obvious that nature doesn't use detergents at all – instead it designs self-cleaning surfaces with hydrophobic properties.

3.3. Honeycomb structure

Bees produce more honey than they actually require and store it in honeycombs. The hexagonal structure of the honeycomb is known to everybody. Have you ever thaught why bees make hexagonal honeycombs rather than octagonal, or pentagonal?

Mathematicians looking for solution to this question reached an interesting conclusion: "A hexagon is the most appropriate geometric form for the best use of a given area."

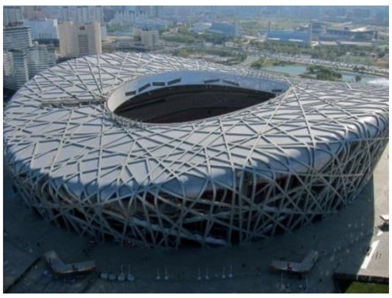
A hexagonal cell requires the least amount of wax for construction while it stores the most amount of honey. So the bee uses the most appropriate form possible.

The method used in the construction of the honeycomb is also very astonishing: bees begin the construction of the hive from two-three different places and weave the honeycomb in two-three strings at a time. Though they begin from different places, the bees, great in number, construct identical hexagons and then weave the honeycomb by combining these together and meeting in between. The joint points of the hexagons are arranged so deftly that there is no sign of their being subsequently combined.

In the face of this extraordinary performance, we, for sure, have to admit the existence of a superior will that ordains these creatures. Evolutionists want to describe away this achievement with the concept of "instinct" and try to present it as a simple attribute of the bee. However, if there is an instinct at work, if this rules on all bees and provides that all bees work together though uninformed of one another, then it means that there is an exalted Wisdom that rules over all these tiny creatures.

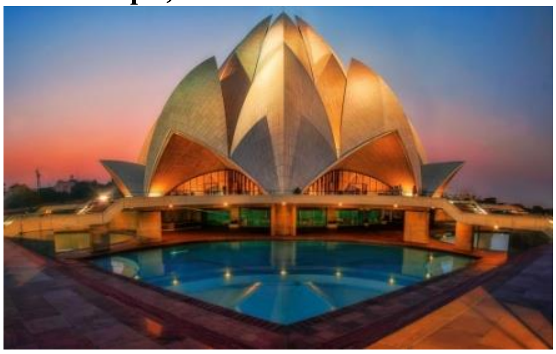
4. Some Popular Buildings whose designs are inspired by nature

4.1. Bird"s Nest Stadium



The Beijing National Stadium or also known as the Bird's Nest Stadium was architectured by Swiss architecture firm Herzog & de Meuron for the 2008 Summer Olympics and Paralympics in Beijing, China. As the name suggests, the stadium appears like huge bird's nest made out of 110,000 tons of steel.

4.2. Lotus Temple, India



Iranian architect Fariborz Sahba, who inspired by the lotus flower for the project, architectured the Lotus temple in New Delhi, India. The temple is the site of worship for followers of the Bahá"í Faith

4.3.Taipei 101

Taiwan Taipei 101 is situated in the Xinyi District in Taiwan"s capital city, Taipei. The building was architectured by C.Y. Lee & friends and was inspired by the indigenous slender bamboo that the country sees as an icon of learning and growth

5. CONCLUSION

We can conclude that the Nature can resolve civil engineering challenges nowadays. We can design many mega structures and buildings by studying the body structures of living organisms coping with same or similar problems. Nature has solved most of the day to day problems due to billions of years of evolution, all we have to do is to study how nature solved the problem. Biomimicry technique has proved by resolving many problems faced for years. Nature has solutions to most of our problems, biomimicry can solve many major problems in future and improve quality of our lives.

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