



BIOMIMICRY: INTERSECTION OF BIOLOGY & TECHNOLOGY

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ABSTRACT

People have always been inspired by nature -- and engineers are no exception! The idea is that, during its 3.8 billion years of research and development, nature has evolved highly efficient systems and processes that can inform solutions to many of the waste, resource efficiency and management problems that we now grapple with today. Biomimicry, describes a new science that studies nature's best ideas and then imitates these designs and processes to provide innovative and sustainable solutions for industry and research development.

The purpose of this paper is to introduce and create interest in the ideology of biomimicry that refers to sustainability by looking to Nature for solutions.

KEYWORDS : Biomimicry, Biology, sustainable solution, nature etc.

INTRODUCTION

Through history the chasm between mankind and Nature has steadily grown and at some point humanity stopped asking nature for answers.

It wasn't until a woman named Janine M. Benyus in 1997, created a field of subject called Biomimicry (also known as biomimetics) that combined engineering and biology, that mankind started to look purposefully to nature for solutions again.

Benyus published a book called *"Biomimicry: Innovation Inspired by Nature"* that book popularized Biomimicry and made it well known. Benyus is the founder and the Board President of the Biomimicry Institute, and also a co-founder of Biomimicry Guild. She is also a Natural Sciences writer, innovation consultant, author as well as teacher and lecturer at the University of Montana. She has degrees both in Natural Resource Management and English Literature/Writing from Rutgers University where she graduated with highest honors.

In 1997 Benyus was awarded the Rachel Carson Environmental Ethics Award and in 2007 she was honored by the Time magazine as "Heroes of the Environment" where the most innovative and influential protectors of the planet are honored.

In 2005, Benyus was a speaker at a TED conference that was devoted to "Inspired by Nature" where she talked about how people who make the world, for example architects and engineers, started to contact her after she published the book and ask for a biologist to help them solve problems. She also had another lesson in a story she told, how the thinking of people can change, when demonstrated and taught about this new ideology. She had a group of wastewater engineers, who at the beginning thought they were using biomimicry by using bacteria to clean the water, except that's not biomimicry, that's bio-processing. So she asked them to give her one of their biggest problems, a design challenge, that they said was scaling of calcium carbonate, in the pipes. Then she pointed out that seashells are made from the same material and explained how seashells grow and that they stop growing because of a protein. This changed instantly the group's way of thinking and now there is a product used called TPA that mimics the seashell's protein. .

The word biomimicry is composed of two words, one being bios that means life and the other being mimesis that means to imitate.

By knowing the meaning of the word it easier to understand the concept, but that is a design discipline that seeks sustainable solutions by emulating nature.

In biomimicry, Nature is looked at as model, mentor and measure because when looking and learning from Nature these are the three groups everything is divided into.

In the model group Nature's models are taken and tried to emulate their forms, processes, systems and strategies to create a sustainable solution of human problems. By looking at Nature as a mentor, the idea to take and use from nature is change to the idea to look and learn instead, because Nature's experience from 3.8 billion years of evolution, has found out what works and what does not. In biomimicry nobody uses the organisms; they only use the blueprints or the recipes from the organisms.

Biomimicry's solutions are sustainable, perform well, save energy, cut material costs, redefine and eliminate "waste", heighten existing product categories and define new product categories and industries.

In Biomimicry we look back to the future and into nature's development/evolution and uses something that's right in front of us to improve our life's and create new technology for mankind. This basic idea to combine biology and engineering is to help humanity treat Nature better and in more harmony, so anyone from a single individual to the largest enterprise, can create better products, become greener and work in harmony with nature.

APPLICATIONS OF BIOMIMICRY:

1. Transportation: Learning from Kingfishers

When the West Japan Railway Company had a noise problem with one of their train, the fastest one in the world, the train's chief engineer and a bird-watcher decided to look in to Nature for solution. In the end he decided to design the front of the train after the kingfishers, a bird which dives from the air into water with very little splash. As a result, the train got quieter and uses 15% less electricity even while the train travels 10% faster.

2. Toxics: Learning from Lotus Plants How to Clean without Cleaners

The lotus leaf is one of the most water repellent leaves in the world.

Many would think the leaf to be smooth because of its quality but on the contrary the lotus leaf is rough. Even though it's microscopically rough it is enough to trap a maze of air which water droplets float on and as a result cleans the leaf. A University professor at the University of Bonn in Germany has developed a surface based on the lotus leaf. This knowledge has led to a new generation of paint, glass and fabric finishes all to minimize the use of chemical or laborious cleaning.

3. Energy: Learning from Humpback Whales How to Create Efficient Wind Power

Whether you are watching TV or whale watching on a boat, the first thing that comes to your mind seeing a swimming whale isn't how fast it's going, it is how easy and effortless it looks. It looks big and heavy and it is around 36,000 kilograms. Surprisingly the humpback whale is very dexterous and mainly due to his flippers, when taken closer look at, have bumps called tubercles, on the front tip of their flippers. This resulting in a better control as the bumps make it easier for the whale to split the water as it swims and turns. Now scientists have tried the aerodynamics of humpback whales flipper with and without the tubercles and the result are staggering. With the tubercles there is an 8% improvement in lift and 32% reduction in drag. These information's have now been used by a company named WhalePower to design wind turbines to increase their efficiency as well as to have the potential to improve safety and performance of airplanes, fans and other similar technologies.

4. Medicine: Learning From Chimpanzees How to Heal Ourselves

Chemicals that have shown promising results in treating various parasites in humans such as pinworm, hookworm and giardia have been found in a plant named Vernonia genus. Researchers who were watching chimpanzees discovered how they behaved when ill and how the chimpanzees seek out the plant Veronia genus.

Even though about one out of four medicines derived from a plant, there is just a fraction of the plant world known to humanity. By learning from other species and use the knowledge those species have gathered through their history of thousands, if not millions, of years, to make our search for new medical plants easier.

5. Architecture: Learning from Termites How to Create Sustainable Buildings

When the Eastgate building in Zimbabwe was created the goal was to reduce energy usage as to be sustainable. In Zimbabwe, where the temperature outside can vary from 3 °C up to 43 °C the air condition plays a significant role. To obtain this goal, Mick Pearce the architect, looked at termites and how they are able to keep the temperature in their nest within one degree. His solution was to have specially designed hooded windows, variable thickness walls and light colored paints as a part of a passive-cooling structure to reduce heat absorption. By doing so Eastgate uses 90% less energy for ventilation than conventional building its size.

6. Human Safety: Learning from Dolphins How to Warn People about Tsunamis

A Company called EvoLogics has developed a high-performance underwater modem for data transmission, due to dolphin's technology of communicating and processing sound information accurately. The problem until now has been how unreliable the sound waves are when traveling through water because of the destructive interference with one another due to reverberate. Now EvoLogics has found a way to make them more accurate by imitating the dolphins, by having several frequencies in each transmission. This has opened a new door and quality in the safety equipment that is used to let people know if a tsunami is on its way to land. The equipment that is combined of four things, the sensor that has to be in water as deep as 6000 meter, the buoy that's on the surface and a satellite that sends the information to an early warning center. Due to this information from dolphins the signal from the sensors to the buoy is now more reliable that results in greater human safety.

7. Industrial Design: Learning from Trees and Bones How to Optimize Strength and Materials.

When looking closely at a tree you are able to see how the tree works, how it maximizes its strength and minimizes its stress, by adding material and arrange the fibers where needed. While bones take this one step further by removing material where it's not needed, is the difference due to the reason that bones have to carry moving loads but trees don't. Now an engineer named Claus Matteck has created software called "Soft Kill Option" that uses the information gathered about the trees and the bones to optimize strength and minimize the use of materials in industrial design.

CONCLUSIONS

Even though Biomimicry is a rather young field of subject it is very likely to have a great impact on our society in the future, as a new way of thinking bringing forward a sustainable solution harmonizing with nature. While the Biomimicry is getting better known by societies around the world, the biologists are getting their seat at the designing table, as a result the solutions in those projects they participate in are moving humanity closer to Nature. Each step in the right direction will help mankind to endure here on Earth for the time to come. One of the important things in this quest is to get people on board with ideology and by initiating the work of as many as possible, by amongst other ways utilizing the tools shown and given in the Biomimicry Guild, Biomimicry Institute and AskNature.org

Inspired by Nature is a concept that we look at afterwards and don't understand why we didn't see it before it was pointed out to us

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