

Biomimetics: Drawing Inspiration From the Design in Living Things

H A R U N Y A H Y A

There is instruction for you in cattle. From the contents of their bellies, from between the dung and blood, We give you pure milk to drink, easy for drinkers to swallow. (Qur'an, 16:66)

And there is certainly a lesson for you in your livestock. We give you to drink from what is in their bellies and there are many ways in which you benefit from them, and some of them you eat; and you are conveyed on them and on ships as well. (Qur'an, 23:21-22)

Before scientists and research and development experts embark on new projects, they usually look for models in living things and imitate their systems and designs. In other words, they see and study the designs created in nature by Allah and, inspired by these, go on to develop their own new technologies.

This approach has given birth to biometrics, a new branch of science that seeks to imitate living things. In recent times, this branch of science has come to be widely applied in the world of technology. The use of the word "*ibratan*," (to learn from, advice, importance, important thing, or model) in the above verses is most wise in this regard.

Biomimetics refers to all of the substances, equipment, mechanisms, and systems that people produce in order to imitate the systems present in nature. The scientific community currently feels a great need for the use of such equipment, particularly in the fields of nanotechnology, robot technology, artificial intelligence, medicine, and the military.

Biomimicry was first put forward by Janine M. Benyus, a writer and scientific observer from Montana. This concept was later analysed by many other people and began to find applications. Some of the comments made regarding biomimicry are as follows:

The theme of "biomimicry" is that we have much to learn from the natural world, as model, measure, and mentor. What these researchers have in common is a reverence for natural designs, and the inspiration to use them to solve human problems. **1**

David Oakey, product strategist for Interface Inc., a company that uses nature to increasing product quality and productivity, says:

Nature is my mentor for business and design, a model for the way of life. Nature's system has worked for millions of years ... Biomimicry is a way of learning from nature.**2**

Scientists who began to favour this rapidly spreading idea accelerated their studies by using nature's incomparable and flawless designs as models. These designs represent models for technological research, for they provide the maximum productivity for the least amount of materials and energy, and are self-maintaining, environmentally friendly, silent, aesthetically attractive, resistant, and long-lasting. The High Country News newspaper described biomimetics as "a scientific movement" and made the following comment:

By using natural systems as models, we can create technologies that are more sustainable than those in use today. **3**

Janine M. Benyus, who believed that models in nature should be imitated, gave the following examples in her book, *Biomimicry: Innovation Inspired by Nature* (Perennial: 2002):

- Hummingbirds cross the Gulf of Mexico on less than 3 grams (one tenth of an ounce) of fuel,
- Dragonflies outmanoeuvre our best helicopters,
- Heating and air-conditioning systems in termite mounds are superior in terms of equipment and energy consumption to those made by human beings,
- A bat's high-frequency transmitter is more efficient and sensitive than our own radar systems,
- Light-emitting algae combine various chemicals to illuminate their bodies,

- Arctic fish and frogs freeze solid and then spring to life, having protected their organs from ice damage,
- Chameleons and cuttlefish change the pattern of their skin to blend instantly with their surroundings,
- Bees, turtles, and birds navigate without maps, and
- Whales and penguins dive without scuba gear.

These astonishing mechanisms and designs in nature, of which we have cited only a few, have the potential to enrich technology in a wide range of fields. This potential is becoming ever more obvious as our accumulated knowledge and technological means increase.

All animals possess many features that amaze human beings. Some have the ideal hydrodynamic shape that allows them to move through water, and others employ senses that appear very foreign to us. Most of these are features that researchers have encountered for the first time, or, rather, that they have only recently discovered. On occasion, it is necessary to bring together prominent scientists from such fields as computer technology, mechanical engineering, electronics, mathematics, physics, chemistry, and biology in order to imitate just one feature of a living thing.

Scientists are amazed when confronted with the incomparable structures and systems they are discovering with every passing day, and use that amazement to inspire themselves to produce new technologies for humanity's benefit. Realising that the existing perfect systems and extraordinary techniques applied in nature are far superior to their own knowledge and intellect, they became aware of these matchless solutions to existing problems and are now resorting to the designs in nature to resolve problems that have eluded them for years. As a result, they will perhaps achieve success in a very short time. Moreover, by imitating nature, scientists are making very important gains with regard to time and labour and also to the targeted use of material resources.

Today we see the developing technology gradually discovering the miracles of creation and using the extraordinary designs in living things, as in the case of biomimetics, in the service of humanity. Benyus has stated that "‘Doing it nature's way’ has the potential to change the way we grow food, make materials, harness energy, heal ourselves, store information, and conduct business." ⁴The following are just a few of the many scientific papers to have considered such subjects:

"Science is Imitating Nature,"⁵

"Life's Lessons in Design," ⁶

"Biomimicry: Secrets Hiding in Plain Sight," ⁷

"Biomimicry: Innovation Inspired by Nature," ⁸

"Biomimicry: Genius That Surrounds Us," ⁹

"Biomimetics: Creating Materials from Nature's Blueprints," ¹⁰ and

"Engineers Ask Nature for Design Advice." ¹¹

In the nineteenth century, nature was imitated only in aesthetic terms. Artists and architects of that time were influenced by nature and used examples of the structures' external appearances in their works. Yet the realisation of nature's extraordinary designs and that these could be used to benefit human beings only began in the twentieth century with the study of natural mechanisms at the molecular level. Scientists today are learning from living things, as revealed in the Qur'an 1,400 years ago.

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- 1- Frederick Pratter, "Stories from the Field Offer Clues on Physics and Nature," Christian Science Monitor, www.biomimicry.org/reviews_text.html.
 - 2- "Biomimicry," www.bfi.org/Trimtab/spring01/biomimicry.htm.
 - 3- Michelle Nijhuis, High Country News, 6 July 1998, vol. 30, no. 13, www.biomimicry.org/reviews_text.html.
 - 4- "Biomimicry Explained: A Conversation with Janine Benyus," www.biomimicry.org/faq.html.
 - 5- Bilim ve Teknik Dergisi (Journal of Science and Technology) (August 1994): 43.
 - 6- Philip Ball, "Life's lessons in design," Nature 409 (2001): 413-16, www.nature.com/cgi-taf/DynaPage.taf?file=/nature/journal/v409/n6818/full/409413a0_fs.html&filetype=&_UserReference=C0A804EF465069D8A41132467E093F0EDE99.
 - 7- "Biomimicry: Secrets Hiding in Plain Sight," NBL (New Bottom Line) 6, no. 22, 17 November 1997, www.natlogic.com/resources/nbl/v06/n22.html.
 - 8- Janine M. Benyus, Biomimicry: Innovation Inspired by Nature (New York: William Morrow and Company, Inc.: 1998), www.biomimicry.org/reviews_text.html.
 - 9- Ed Hunt, "Biomimicry: Genius that Surrounds Us," Tidepool editor, www.biomimicry.org/reviews_text.html.
 - 10- Robin Eisner, "Biomimetics: Creating Materials from Nature's Blueprints," The Scientist, 8 July 1991, www.the-scientist.com/yr1991/july/research_910708.html.
 - 11- Jim Robbins, "Engineers Ask Nature for Design Advice," New York Times, 11 December 2001.