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*Janine Benyus On The Virtues Of **Imitating Nature***

DAVID KUPFER

BIOLOGIST AND SCIENCE WRITER *Janine Benyus helped chart a new path for industrial designers in 1997 with her book* Biomimicry: Innovation Inspired by Nature *(Harper Perennial). Since then, she says, her job has been to teach engineers, scientists, and inventors how to "consult life's genius to create sustainable designs." She coined the term "biomimicry" from the Greek* bios*, meaning "life," and* mimesis*, meaning "to imitate." The first step she advises in solving a problem is to look at the solutions that can be found in nature.* Time *magazine named her one of its "Heroes of the Environment," and physicist Amory Lovins wrote in* Time *that her work "will change your life. It has already changed mine. And it may save the world."*

Born in 1958, Benyus grew up in New Jersey on the edge of suburban development, near forests and meadows. From a young age she was entranced by wilderness, and her parents indulged her passion with field guides, leaf presses, and microscopes. In the early 1980s she graduated summa cum laude from Rutgers University in New Jersey with degrees in writing and natural-resource management, and she began working for research labs, translating scientific jargon into layperson's English. Her first book was an ecosystem guide to northern Minnesota, Michigan, and Wisconsin, which led to a series of field guides for different regions of the U.S. In 1992 Benyus wrote an interpretive guide to animal behavior called Beastly Behaviors *(Addison-Wesley). By then she was already researching the book that would define her career.*

A year after the publication of Biomimicry*, Benyus cofounded, with Montana biologist Dayna Baumeister, the for-profit Biomimicry Guild, a consulting firm whose clients have ranged from Patagonia and Seventh Generation to General Electric and Nike. She is also the founder and board president of the nonprofit Biomimicry Institute, which promotes the spread of biomimicry concepts in the broader culture. The institute runs the website AskNature.org, a public-domain resource for anyone looking for nature's answer to a design problem. Benyus is a sought-after speaker, delivering energetic, optimistic talks on sustainable conservation and industrial ecology. Most recently she has been working with entrepreneur and environmentalist Paul Hawken to commercialize nature-inspired, sustainable technologies and make them affordable and readily available, especially in developing nations.*

In person Benyus is funny and downright hopeful. She lives with her partner of twenty-one years on eight acres of grassland in western Montana's Bitterroot Valley, surrounded by the largest designated wilderness in the lower forty-eight states. From her east-facing windows she can see the forested Sapphire Mountain Range, and to the west the U-shaped, glaciated Big Creek Canyon. The peaks surrounding the valley have snow on them year-round.

When not working, Benyus spends a good portion of her time taking care of her land. Over twelve years she and her partner have restored their property from dry, caked soil infested with knapweed back to a rolling meadow of native grasses. Benyus serves on several county land-use committees and is active in protecting and restoring wild lands. She and her partner have four cows and three cats and lead a self-described "foraging lifestyle," sharing resources with neighbors and obtaining nearly all their food locally. When Benyus encounters a problem on her land, she seeks advice from the local elders: the packs of wolves that roam the valley, the bald eagles that swoop down on her cows' afterbirths, the twenty-eight turtles that inhabit a nearby pond, and the cottonwood trees that grow along the Bitterroot River.

Kupfer: What is biomimicry?

Benyus: Biomimicry is the practice of borrowing nature's design principles to create more-sustainable products and processes. When designers, engineers, architects, chemists, city planners, and so on have a problem to solve, I encourage them to ask, "What part of the natural world has already done what I'm trying to do?" With biomimicry we look to design principles in nature as examples for good behavior. I think of it as becoming nature's apprentice.

Kupfer: How did you discover this idea?

Benyus: I had written five books — natural histories, wildlife guides, ecosystem guides, animal-behavior studies

— and I'd been watching how nature knits itself together. In 1990 I asked myself, *Are any designers and inventors trying to mimic the designs of the natural world?*

Once I'd asked the question, a blizzard of examples arrived at my door: people studying photosynthesis to create better solar cells; engineers examining how spiders make their webs; pharmacologists researching how organisms self-medicate. I learned about such burgeoning fields as industrial ecology, which looks at ecosystems as models for new economic patterns. In agriculture I heard about how Wes Jackson, founder of the Land Institute, says we could replace our monoculture crops of annuals with a mix of perennials based on the natural ecology of prairies.

JANINE BENYUS

I started collecting these examples in a file I labeled "Biomimicry." Then there were two files, then a whole drawer, and then a whole filing cabinet. Finally I wrote a book about this new field, never imagining it would catch on the way it has. The architecture community picked up on it first, and then the industrial-design community. Suddenly all these groups wanted a biologist at their tables.

Dayna Baumeister, who was working on a PhD in coevolution biology at the University of Montana, called me up and said that as soon as she'd read my book, she knew: *This is what I want to do.* We became partners, teaching workshops for designers, architects, and engineers and doing consulting for companies. For instance, if a company wanted to invent a new glue, we would tell them how geckos adhere to walls and how mussels glue themselves to rocks underwater — examples of nature's nontoxic ways of adhering. The plywood used to build most houses is stuck together with an adhesive that emits formaldehyde. But with the help of scientists who study nature's adhesives, Columbia Forest Products, the largest plywood manufacturer in the country, switched to a glue that mimics the adhesive mussels use. They make it out of soy flour.

Today we have twelve full-time biologists on staff. We create "Amoeba through Zebra" reports, in which a designer, inventor, or architect asks us a question — like "How does nature reduce vibration?" — and we answer it. Biomimicry is not about harvesting nature's resources but about sitting at her feet as students.

Kupfer: What was the beginning of your fascination with the natural world?

Benyus: I grew up in a part of suburban New Jersey where there were still some open spaces — forests, meadows, ravines, streams. Then suburbia rolled over us, and my parents moved us farther out. This happened several times. I was always a little naturalist. I would go outside in the morning with my lunch packed and stay out all day. My parents had to ring the dinner bell to get me back inside. Although I grew up in the suburbs, I always found wilderness to explore. I firmly believe that wilderness can be found anywhere, even in the cracks of the sidewalk; it's just a matter of seeing it.

Kupfer: Who inspired you?

Benyus: Nature writers Rachel Carson and E.O. Wilson taught me that being a naturalist is a worthy profession. They also taught me that it's OK to put poetry into science. If you're writing about this earth, you want your language to be as lyrical as possible, in order to adequately describe it. I'd thought it was forbidden to write in poetic language about a scientific subject. They gave me permission to do that. They also inspired me to make my voice heard. Carson was a rather timid, quiet person, and Wilson is a very gentle, humble man, but they were both fierce and willing to set aside their timidity and do what is necessary.

Kupfer: You've done extensive studies of the animal world. Are there any species that have served as mentors to you?

Benyus: I love unlikely species, especially ones found in bogs. Most people don't see a lot of beauty in bogs, but I think they're amazing. I've spent time in "quaking bogs," which are green mattresses of sphagnum and other mosses — sometimes called "peat" — floating on cold, acidic water. As you walk on the mattress, it literally undulates. In bogs there are stunted trees and spruces and small, elfin plants that hang their roots in very cold water, which makes it difficult for them to photosynthesize. Some bog plants are carnivorous, and their leaves have special hairs that secrete droplets of sticky adhesive: insects land and get stuck, and the plant releases enzymes to digest the body of the insect. I'm attracted to life-forms like this, which survive in adversity.

Kupfer: Humanity is facing adversity on a global scale. Do you think we took a wrong turn with the petrochemical-fueled Industrial Revolution?

Benyus: I think fossil fuels were discovered before our consciousness had evolved enough to know what to do with all that energy. We've been mesmerized by internal combustion, enthralled by fire. It's given us almost supernatural powers, multiplying our muscle power by thousands and enabling us to move mountains, literally. People think all we need to fix our predicament is a free source of energy, but I think we need to change our behaviors. More energy would just help us deplete the earth's lifeblood faster.

For the most part life operates on very small amounts of energy. When you look at the natural world, you see that organisms do not use high heats or high pressures or toxic chemicals to achieve their ends. A few do use toxins, such as venoms, in small amounts, but none heat anything with explosive force. Biomimicry asks whether we can accomplish our goals without heating things up and smashing them together. Can we start to appreciate the subtle energies around us?

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