Promoting the transfer of ideas inspired by Nature to the design of our world, for a more sustainable, healthier planet.

"The more our world functions like the natural world, the more likely we are to endure on this home that is ours, but not ours alone."

~ Janine Benyus

Case Studies

Red Seaweed Inspired Antibiotics

Learning from Seaweed to Repel Bacteria without Creating Resistance

The discovery a few decades ago that bacteria use chemicals to communicate with each other, coordinate their behavior, and alter the activity of their genes in response to density has completely transformed our previous conception of these creatures as relatively simple and isolated organisms. Using signaling molecules called autoinducers, bacteria finding a suitable habitat or host communicate this fact to other bacteria in the vicinity. These bacteria respond by both converging on the habitat or host and producing more signaling molecules, creating a positive feedback loop. Through this process, known as "quorum sensing", bacteria form bacterial colonies or "biofilms". Sensing the relative density of other bacteria through the concentration of autoinducers, bacteria then transform their physical and biochemical behavior as signaling molecule concentration triggers gene expression changes. Bacteria that are benign as individuals, reorganized into biofilms, then begin to pump out the defensive toxic chemicals that result in a range of varied problems, from diseases in humans and agricultural plants to the rupture of oceanic oil pipelines. At the same time, the biocidal antibiotics humans conventionally rely upon to combat bacteria are becoming increasingly ineffective as the small percentage of surviving bacteria commonly reproduce into antibiotic resistant strains in response to this evolutionary "arms race".

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Beetle-inspired Water Harvester

A fog-catching device patterned on the Namibian Beetle's prodigious water harvesting abilities captures ten times more water than existing fog catching nets. The beetle's ability to pull water from fog is due to bumps on its wing scales that have water-loving tips and water-shedding sides. QinetiQ (UK) has developed plastic water-harvesting sheets that mimic the beetle's bumps, useful for capturing water in cooling towers and industrial condensers, arid agricultural systems, and buildings in fog-rich areas.

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Mollusk-inspired Fan

A three-dimensional logarithmic spiral is found in the shells of mollusks, in the spiraling of tidal-washed kelp fronds, and in the shape of our own skin pores, through which water vapor escapes. Liquids and gases flow centripetally through these geometrically consistent flow forms with far less friction and more efficiency. PAX Scientific (USA) has designed fans, propellers, impellers, and aerators based on this shape.

Computational Fluid Dynamics and Particle Image Velocimetry tests showed the technology's streamlining effect can reduce energy requirements in fans and other rotors from between 10 and 85%, depending upon the application; the fan blade design also reduces noise by up to 75%. The first air-handling products scheduled for release are fans in computers, auto air-conditioners, and kitchen range hoods. The PAX streamlining principle could also lead to improvements in industrial mixers, water pumps, marine propellers, and devices for circulating blood in the body.

Termite-Inspired Air Conditioning

Architect Mick Pearce collaborated with engineers at Arup Associates to build a mid-rise building in Harare, Zimbabwe that has no air-conditioning, yet stays cool thanks to a termite-inspired ventilation system. The Eastgate building is modeled on the self-cooling mounds of *Macrotermes michaelseni,* termites that maintain the temperature inside their nest to within one degree of 31 °C, day and night, - while the external temperature varies between 3 °C and 42 °C. Eastgate uses only 10 percent of the energy of a conventional building its size, saved 3.5 million in air conditioning costs in the first five years, and has rents that are 20% lower than a newer building next door.

The TERMES project, organized by Rupert Soar of Loughborough University, is digitally scanning termite mounds to map the three dimensional architecture in a level of detail never achieved before. This computer model will help scientists understand exactly how the tunnels and air conduits manage to exchange gases, maintain temperature, and regulate humidities. The designs may provide a blueprint for self-regulating human buildings.

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More...

- Abalone Inspires Lightweight Building Materials
- Walking Cane Mimics Bat Ecolocation
- Mollusk Inspired Epoxy

How Nature Cleans

Learning How to Clean From a Leaf

Have you ever wondered how things in nature generally look so *clean*? You don't see janitors out there in the woods, afterall, dusting off the trees. People use toxic detergents and costly cleaning treatments, but Nature employs a cleaning strategy as environmentally benign and energy efficient as it is strikingly ingenious. Imagine waking up, stepping outside, shaking your body a little bit, and heading off to your daily routine as clean as if you'd taken a shower. Because that's how Nature cleans; it takes what might be called a *gravity shower*. The leaves of many plants, large-winged insects, most water birds, and other organisms capitalize on basic physical characteristics in the way surfaces of materials interact, achieving cleanliness effortlessly and without detergents.

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