

# NATURE'S GENIUS

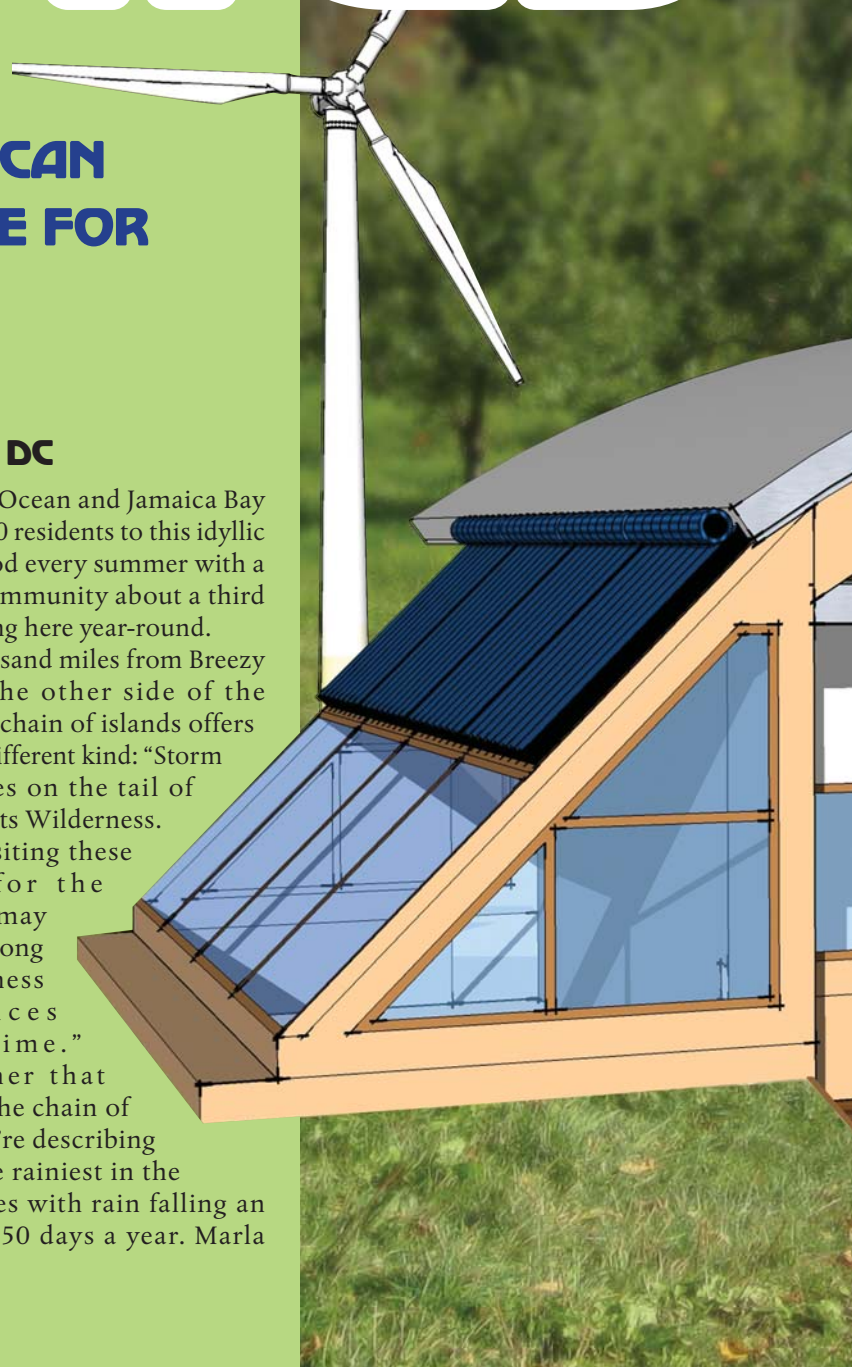
HOW HUMAN DESIGNS CAN CO-EXIST WITH NATURE FOR SUSTAINABLE LIVING.

BY BRUCE SCHNEIDER, DC

The National Park Service described it as the perfect destination for fishing and scenic walks on an unspoiled ocean beach. Indeed, the Breezy Point neighborhood, which sits on the western edge of the Rockaway Peninsula just a short ride from New York City, has been a coveted summer get-away for New Yorkers who want to get lost in the rural setting of ocean-front beach or coastal grasslands. Sometimes called the Irish Riviera – or by its Gaelic name Cois Faraige meaning “by the sea” – Breezy Point grew as a predominantly Irish community built by police and firefighters looking for affordable seaside housing near New York City. “If you are interested in learning anything, the bagpipes or the tin whistle or Irish dancing” said resident Dolores Mulholland, “Breezy Point is the place.” Views of both

the Atlantic Ocean and Jamaica Bay attract 12,000 residents to this idyllic neighborhood every summer with a tight-knit community about a third that size living here year-round.

Four thousand miles from Breezy Point, on the other side of the continent, a chain of islands offers beauty of a different kind: “Storm often arrives on the tail of storm,” boasts Wilderness.net, “but visiting these islands, for the persistent, may well rate among the wilderness experiences of a lifetime.” The weather that dominates the chain of islands they’re describing is one of the rainiest in the United States with rain falling an estimated 250 days a year. Marla





Cone, a reporter for the Philadelphia Inquirer said of these islands that “on a quiet day when the turbulent seas are still, you can hear a killer whale breathe.”

The Aleutian Islands stretch in a southwest arc from Alaska to Russia spanning millions of acres of Alaskan wilderness. They are frequently enveloped in fog. On most of these islands you’ll find lush green tundra dotted with summer wildflowers and carpeted with grasses, sedges, mosses, lichens, and heath. Constant winds prevent trees from growing here. The Aleutian Islands are known best for their birds. More than ten million winged creatures nest on the islands each summer. Attu, the westernmost island of the Aleutians is a birder’s paradise. According to one website “it is a rugged island with beautiful snow covered mountains, and a hike or bike ride anywhere will yield fabulous views albeit sore bodies. Mixed with snow, sleet, rain, and wind, any of the aforementioned elements in any order, not to mention the cold, will challenge even the heartiest of souls.” It is a far cry from the warm summer sands of Breezy Point, N.Y.

The Aleutian Islands are home to a strong population of indigenous people called the Aleut (meaning “community”), also known as Unangans (meaning “original people”) who settled on the islands more than nine thousand years ago. They gave Alaska its name: “The Great Land.” Traditionally the Unangans lived in dwellings called barabaras, sod-insulated, semi-subterranean homes perfectly suited for the stormy environment that is a regular part of Aleutian life. It was the barabara that caught the attention of New York architect Janus Welton. Ms. Welton is president of EcoArchitecture Design Works, P.C. In designing Orca House, she and her team placed third in the Living Aleutian Home Design Competition, a competition in which the international design community was invited to create an ultra-efficient three-bedroom home for people living in the remote fishing outpost of Atka in Alaska’s Aleutian Islands.

It would seem that the Irish community of Breezy Point, N.Y. and the 58 residents of Atka, Alaska would have vastly different requirements for living. A warm summer day casting out fishing line from the sandy shores of the Rockaway Peninsula is quite a contrast to a fisherman’s life on a rocky volcanic island in western Alaska. Yet the Living Aleutian Home

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Design Competition was created in part to deal with the fact that the modern dwellings of the Unangans are seriously lacking in addressing the needs of the people and the environment in which they live. It turns out that nature would reveal to the residents of Breezy Point that many of their homes present a similar problem and that projects like Orca House may emerge as potential solutions for both communities. There would be a confluence of forces birthed by the warm waters of the southern Atlantic Ocean and the vast ice-covered oceans of the northern Arctic that would uncover the challenge shared by these two populations on opposite ends of a continent.

On October 19, 2012 a tropical wave moving westward through the Caribbean Sea quietly set a course that would soon reveal the power of wind and sea known to the Unangan people for centuries. On October 24 it reached Cuba, turning into a category two hurricane that unleashed the wrath of its 110 mph winds, ripping

through the island, killing 11 people, damaging more than 200 homes and devastating coffee plantations and life-sustaining crops. A few days later the tempest - now dubbed “Sandy” – turned northward and headed up the east coast of the United States where it met up with an unusually early winter storm coming from the West and fierce Arctic air from the North. On October 29 the squall, now supplied by three combined forces of nature made landfall near the New Jersey coastal town of Mantoloking, beginning a two day assault on New Jersey and the New York metropolitan area.

It was not a particularly strong storm by the time it reached Breezy Point. Winds blew at just around 70 mph. The real damage that Sandy inflicted came from a huge storm surge, an offshore rise of water caused by the storm’s high winds pushing on the ocean’s surface. The Breezy Point peninsula was inundated with waters of the Atlantic Ocean merging with the waters of Jamaica Bay. Its formerly pristine beaches lay three feet beneath a rapidly moving river. A fire that had started on the peninsula just before Sandy’s arrival now escalated to a blaze fueled by the storm’s massive winds. With floodwater filling the streets, frustrated firefighters could only watch as homes burned. They resorted to using boats to rescue people trapped on top floors of apartments and dwellings. In the end 19 people died, 110 homes were destroyed and 30 others were damaged. The topic of conversation in this idyllic community quickly shifted from fishing and scenic walks on an unspoiled ocean beach to a singular point of focus: the weather, and how it had forever changed the lives of people living in Breezy Point, N.Y.

In the words of a New York Times article a month after the storm “Hurricane Sandy presents a shattering picture of what a giant storm can do to a dense metropolitan area. The total price tag,” said New York Gov. Andrew Cuomo,” would be more than \$42 billion: \$33 billion to repair damaged housing and infrastructure and \$9 billion to help protect transit systems, the power network and sewage

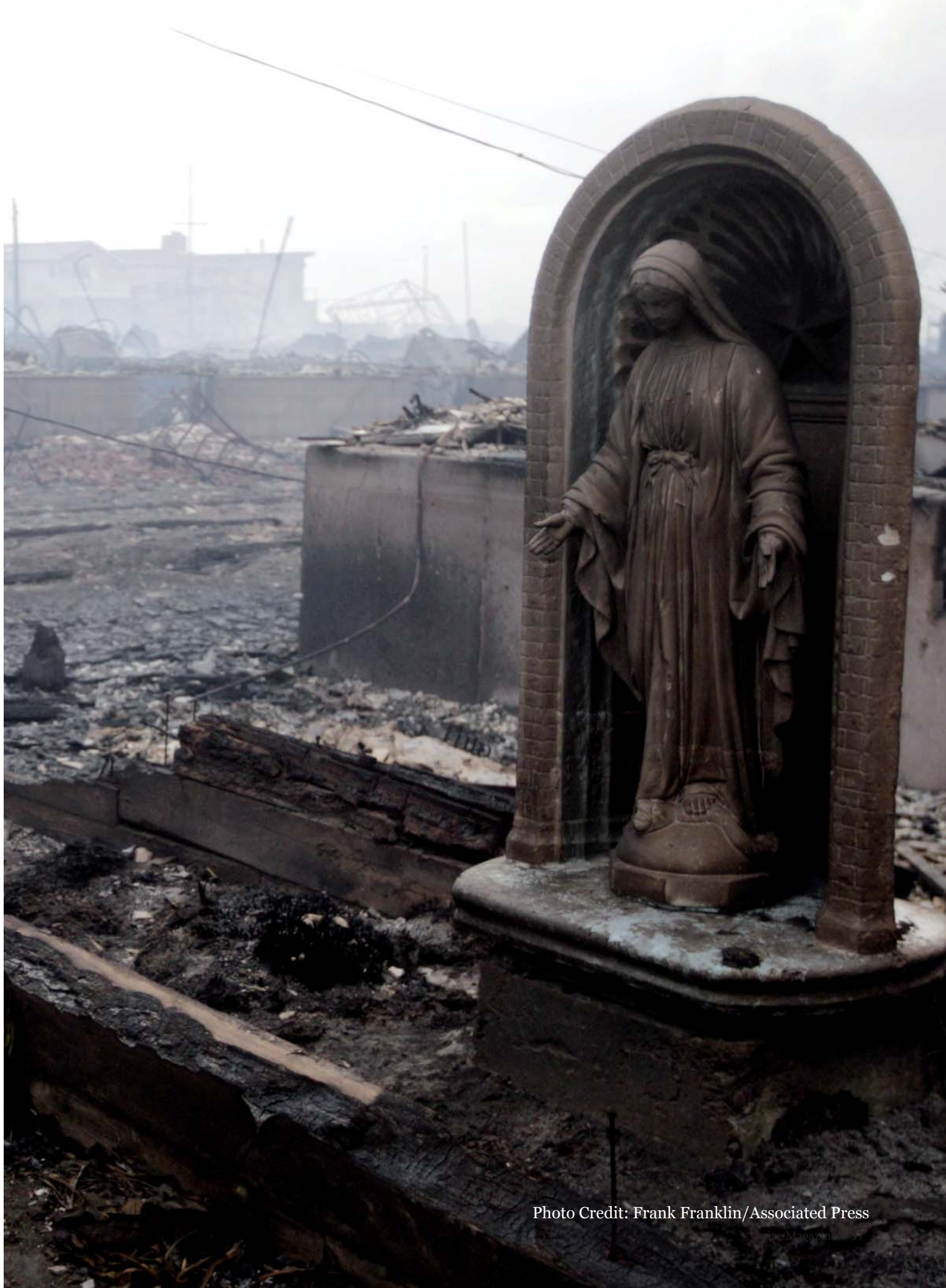


Photo Credit: Frank Franklin/Associated Press

treatment facilities from future storms.” The problems caused by storms such as Sandy are twofold. In addition to damage inflicted by high winds and flooding at the time of the event, many communities were stranded without fuel and electricity for weeks after the storm. Orca house, the dwelling designed by Janus Welton and her team, addresses both of these issues.

The focus of the Living Aleutian Home Design Competition was to “deliver a unique sustainable design and to be willing to bravely confront the challenges of building in such a remote and harsh environment.” Not only was the aim to bring ultra-efficient building options to a harsh land of wind, fire and rain – Atka is a volcanic island – but to do so by reducing fossil fuel consumption by 85%. What may have been seen as an obscure project relevant only to small populations scattered along the outskirts of modern society is gaining wide attention as a result of Hurricane Sandy. Questions about global warming and climate change have taken a front seat in our conversations about the 21st century. Many of the homes on Breezy Point are wooden bungalows. Will an idea born in a stormy and remote fishing village in Alaska be the fresh approach that sparks a new wave of architectural design in the suburbs and towns surrounding our great cities?

To answer that question we look at design principles found in nature. At the turn of the 20th century inventors looked to birds in trying to understand the principles of flight: their shape, the way wings hinged on light feathered bodies, the movement of a tail on takeoff and landing. While the science of aerodynamics departed from avian architecture, observing nature was the first step on the road to developing the aircrafts that fill our skies. Janus Welton and her team looked to the seas for inspiration in designing Orca house. It was not just a poetic notion. Their design for the competition was derived from the functional form of the whale. Orca house – named for the whale that swims the northern Pacific Ocean and the Bering Sea – is a curvilinear structure “that is elegantly

adapted for strength and flexibility in very windy and volcanic environments like the Aleutian Islands,” says Ms. Welton. It also echoes the form of the gentle rolling hills in Atka, the hamlet for which it was designed. This curved structure she points out, would have been much more effective in dealing with the force of Hurricane Sandy than common rectangular structures which take the full force of a storm head-on.

## **Will an idea born in a stormy and remote fishing village in Alaska be the fresh approach that sparks a new wave of architectural design in the suburbs and towns surrounding our great cities?**

Blueprints for projects like Orca house may offer exceptional designs. At the same time, an important question arises, especially when it comes to “green” building: What is it going to cost? It turns out that the finalists for the Living Aleutian Home Design Competition turned in plans for homes that would cost significantly less to build than the homes that exist in Atka now. For example, the price tag to deliver a trailer to the island and set it up with an oil barrel is about \$400,000. Most of the cost is the expense of shipping and skilled labor, says Welton. By contrast Orca house has 1,250 square feet of interior living space and its layout gives 350 square feet of unconditioned enclosed porch entry and a greenhouse. This light-filled analogue of the barabara is less expensive and much more energy efficient than the cost of a home in Atka now. “If we were to build the same design in the lower 48 States,” she says, “we would make a few minor changes and I would expect the cost to be in the neighborhood of about

three hundred thousand.” The cost for a pre-fab version would be lower and this is what Welton and her team are planning for.

An adaptation in the Orca house design that significantly lowers the price tag is “earth bag construction” for the home’s foundation. Instead of using heavy materials like concrete, locals are provided with bags, lightweight steel cables and chicken wire. Janus Welton describes the process: “They gather the local abundant sand, bag up the building blocks and build up the foundation themselves.” Not only does this represent a massive cost savings, but earth bag foundations are highly resistant to tectonic shock as well making this technology attractive in helping to absorb the impact of seismic tremors.

Other adaptations make Orca house an exceptional design for the Aleutian Islands.

Loss of electricity and fuel supply was a big factor in the economic cost and human suffering brought on by Superstorm Sandy. Janus Welton points out that Orca house addresses this problem “because this house concept is designed as its own ecosystem it collects and processes its own energy, water and waste. These ideas make a building more resilient.” The biomorphic shape of Orca house, in addition to being an optimal design for repelling wind and water has the ability to harvest water for later use. It also circulates heat within the home in a way that is much more efficient than the modern rectangular model for construction. Another feature is its super-insulated building envelope design that cuts down on heat loss. The Alaskan prototype is powered by wind and solar panels providing all of its energy needs throughout the year. In the lower 48 States other systems, like geothermal would be more advantageous. Another adaptation slated for the pre-fab version of Orca house “that would work well here are self-contained biogas systems where you can recycle human waste into heating, fuel and lighting.” In places like the British Isles where peat is abundant, on-site wastewater treatment systems



are employed using local peat and bioswales for processing.

On the cutting edge of architectural design is an approach called biomimicry. It is a science and design methodology that uses nature as a model to solve our human design problems. Welton, in addition to being an architect and instructor in sustainable building is a biomimicry specialist. She explains: "Organisms and ecosystems face the same challenges that we do as humans. And they meet those challenges very sustainably." Janine M. Benyus who has authored six books on the subject makes this statement: "We live in a competent universe, we are part of a brilliant planet and we are surrounded by genius." She speaks to the "genius" of nature. There are some fascinating examples of how biomimicry is finding its way into building and design projects throughout the world.

In the late 1990's Japan used nature's best ideas to modify the design of their bullet train. The train, which cruises along at speeds over 200 mph would create a loud sonic boom waking people along the route and disturbing wildlife. When the high-speed train passed through a tunnel, a cushion of air would build up in front of the train. As

the train left the tunnel, this compressed air suddenly expanded making the loud noise. Engineers looked to a bird called the kingfisher whose long and narrow beak is perfectly designed for diving through the air and going into the water with very little splash. Nature endowed the bird with the ideal beak for fishing and the same principles of aerodynamics were applied to the bullet train. It solved the problem of the sonic boom and increased the speed of the train by 10%. And it saved them 10-15% in energy costs because it was more aerodynamic.

In another example, a fascinating architectural innovation was modeled after an unlikely community: a termite mound. The Eastgate Center in Harare, Zimbabwe is the country's largest office and shopping complex. It has no typical air-conditioning or heating, yet stays regulated year round with dramatically less energy consumption than conventional designs. Termite mounds include flues that vent through the top and sides, and the mound itself is designed to catch the breeze. As the wind blows, hot air from the main chambers below ground is drawn out of the structure, helped by termites opening or blocking tunnels to control air flow. The termites maintain the

temperature inside their nest to within one degree of 31 °C/87.8°F, day and night. Architect Mick Pearce collaborated with engineers to design a termite-inspired ventilation system for the Eastgate Center.

That saved 3.5 million dollars in air conditioning costs in the first five years.

As we search in modern times to find human designs that co-exist with nature and brave the earthquakes, hurricanes and tsunamis that visit our lands, it may well be nature herself who is our greatest teacher. After all, it's been an incredible 3.8 billion years since the first bacteria showed up on the planet. "In that time," says Janine M. Benyus, "life has learned to fly, circumnavigate the globe, live in the depths of the ocean and atop the highest peaks, craft miracle materials, light up the night, lasso the sun's energy, and build a self-reflective brain. Collectively, organisms have managed to turn rock and sea into a life-friendly home, with steady temperatures and smoothly percolating cycles. In short, living things have done everything we want to do, without guzzling fossil fuel, polluting the planet, or mortgaging their future. What better models could there be?" ■