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## Entrepreneurs of the Natural World Show Case Their Ground Breaking Solutions to the Environmental Challenges of the 21<sup>st</sup>

### **Nature's 100 Best Initiative Publishes Preliminary Findings on How to Green the Global Economy**

*9<sup>th</sup> Conference of the Parties to the Convention on Biological Diversity 19-30 May*

**28 May 2008, Bonn/Geneva/Nairobi**--A super-small pacemaker modeled on the wiring of the humpback whale's heart and pigment-free colour coatings from the light-splitting structures of a peacock's feather are among a range of extraordinary new eco-breakthroughs emerging from mimicking nature.

Other commercially-promising advances, inspired by natural world and its close to four billion year-old history of "research and development" include:-

- Vaccines that survive without refrigeration based on Africa's 'resurrection' plant.
- Friction-free surfaces suitable for modern electrical devices gleaned from the slippery skin of the Arabian Peninsula's sandfish lizard.
- New antibacterial substances inspired by marine algae found off Australia's coast that promise a new way of defeating health hazardous bugs without contributing to the threat of increasing bacterial resistance.
- Toxic-free fire retardants, based on waste citrus and grape crops inspired by the way animal cells turn food into energy without producing flames—the so called citric acid or Krebs cycle.
- A pioneering water harvesting system to recycle steam from cooling towers and allowing buildings to collect their own water supplies from the air inspired by the way the Namib Desert Beetle of Namibia harvests water from desert fogs.
- Biodegradable, water-tight packaging and water-repellant linings for pipes to tents that mimic the Australian water-holding frog.
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These are just some of inventions, innovations and ideas at the centre of a new collaborative initiative called Nature's 100 Best.

| The initiative is the brainchild of the Biomimicry Guild and the Zero Emissions Research and Initiatives (ZERI) in partnership with the UN Environment Programme (UNEP) and IUCN-the World Conservation Union.

It is aimed at showcasing how tomorrow's economy can be realized today by learning, copying and mimicking the way nature has already solved many of the technological and sustainability problems confronting human-kind. According to Janine Benyus and Gunter Pauli, co-creators of the Nature's 100 Best project, "Life solves its problems with well-adapted designs, life-friendly chemistry, and smart material and energy use. What better models could there be?"

The Nature's 100 Best List, a mixture of innovations at various stages of commercialization from the drawing board to imminent arrival in the marketplace, is set to be completed by October 2008 in time for the IUCN Congress in Barcelona, Spain. The Nature's 100 Best book will be published in May 2009.

Today the collaborators and partners unveiled some of the preliminary projects and products being included on Nature's 100 Best from an original list over 2,000.

It coincides with the ministerial part of the Convention on Biological Diversity meeting taking place in Bonn, Germany where up to 6,000 delegates and over 190 governments are meeting to slow the rate of loss of biodiversity.

Achim Steiner, UN Under-Secretary General and UNEP Executive Director, said: "Biomimicry is a field whose time has come. Anyone doubting the economic and development value of the natural world need only sift through the extraordinary number of commercially promising inventions now emerging--inventions that are as a result of understanding and copying nature's designs and the superior way in which living organisms successfully manage challenges from clean energy generation to re-using and recycling wastes".

"There are countless reasons why we must accelerate the international response and the flow of funds to counter rapidly eroding biodiversity and rapidly degrading ecosystems: Nature's 100 Best gives us 100 extra reasons to act and 100 extra reasons why better managing biodiversity is not a question of aid or an economic burden but an issue of investing in the non-polluting businesses, industries and jobs of the near future," he said.

Janine Benyus, head of the Biomimicry Guild added, " Biomimicry is science at the cutting edge of the 21<sup>st</sup> century economy and based on 3.8 billion years of evolution. Indeed the way nature makes novel substances; generates energy and synthesizes unique structures are the secrets to how humans can survive and thrive on this planet."

Gunter Pauli, head of the Zeri Foundation based in Geneva, added: "Steam and coal transformed the 19C; telecommunications and electronics, the 20<sup>th</sup>. We are now on the edge of a biologically-based revolution and in some of the inventions showcased under this new initiative will undoubtedly be the business models for the new Googles; Welcomes, Unilevers and General Electrics of the modern age. With + one billion Euros already invested in the most important technologies this is a trend in innovation for industry to follow" he said.

## **Humpback Heart Pacemakers**

Over 350,000 people in the United States alone are fitted with new or replacement pacemakers annually. The cost of fitting a new device is up to \$50,000 per patient.

Enter Jorge Reynolds, Director of the Whale Heart Satellite Tracking Program in Colombia, whose research is unraveling the mysteries of how the Humpback's 2,000-pound heart pumps the equivalent of six bath tubs of oxygenated blood through a circulatory system 4,500 times as extensive as a human's.

The work is also pinpointing how this is achieved even at very low rates of three to four beats a minute and how the electrical stimulation is achieved through a mass of blubber that shields the whale's heart from the cold.

The researchers have, through listening devices called echocardiographs and via autopsies on dead whales, discovered nano-sized 'wires' that allow electrical signals to stimulate heart beats even through masses of non-conductive blubber.

The scientists believe the findings could be the key to allowing the human heart to work without a battery-powered pacemaker and to stimulate optimal heart beats by by-passing or 'bridging' dead heart muscle via special whale-like wiring.

The world-wide market for pacemakers is expected to reach \$3.7 billion by 2010. The new invention could cost just a few cents to make; reduce the number of follow-up operations because it avoids the need to install new batteries and thus supplant the traditional pacemaker.

## **“Resurrection Plant”**

Two million children die from vaccine-preventable diseases like measles, rubella and whooping cough each year. By some estimates, breakdowns in the refrigeration chain from laboratory to village, means half of all vaccines never get to patients.

Enter *Myrothamnus flabellifolia*—a plant found in Central and Southern Africa whose tissues can be dried to a crisp and then revived without damage courtesy of a sugary substance produced in its cells during drought.

And enter Bruce Roser, a biomedical researcher who along with colleagues recently founded Cambridge Biostability Ltd to develop fridge-free vaccines based on the plant's remarkable sugars called trehaloses.

The product involves spraying a vaccine with the trehalose coating to form inert spheres or sugary beads that can be packaged in an injectable form and can sit in a doctor's bag for months or years.

Trials are underway with the Indian company Panacea Biotech and agreements have also been signed with Danish and German companies.

The development, based on mimicking nature, could lead to savings of up to \$300 million a year in the developing world while cutting the need for kerosene and photovoltaic fuelled fridges.

Other possibilities include new kinds of food preservation up to the storage of animal and human tissues that by-pass storage in super cold liquid nitrogen.

### **Slippery Lizard**

The two main ways of reducing friction in mechanical and electrical devices are ball bearings and silicon carbide or ultra nano-crystalline diamond.

One of the shortcomings of silicon carbide is that it is manufactured at temperatures of between 1,600 and 2,500 degrees F—in other words it is energy intensive involving the burning of fossil fuels.

The synthetic diamond product can be made at lower temperatures and coated at temperatures of 400 degrees F for a range of low friction applications. But it has drawbacks too.

Enter the shiny Sandfish lizard that lives in the sands and sandstorms of North Africa and the Arabian Peninsula and enter a team from the Technical University of Berlin.

Studies indicate that the lizard achieves its remarkable, friction-free life by making a skin of keratin stiffened by sugar molecules and sulphur.

The lizard's skin also has nano-sized spikes. It means a grain of Sahara sand rides atop 20,000 of these spikes spreading the load and providing negligible levels of friction.

Further tests indicate that the ridges on the lizard skin may also be negatively charged, effectively repelling the sand grains so they float over the surface rather like a hovercraft over water.

The researchers have teamed up with colleagues at the Science University of Berlin and a consortium of three German companies to commercialize the lizard skin findings.

The market is potentially huge, including in micro-electronic-mechanical systems where a biodegradable film made from the relatively cheap materials of kerotene and sugar and manufactured at room temperature offers an environmentally-friendly “unique selling proposition.”

### **Superbugs and Bacterial Resistance—Australian Red Algae to the Rescue?**

70 per cent of all human infections are a result of biofilms.

These are big congregations of bacteria that require 1,000 times more antibiotic to kill and are leading to an arms race between the bugs and the pharmaceutical companies.

It is also increasing antibiotic resistance and the rise of super bugs like methicillin resistant *Staphylococcus aureus* that now kills more people than die of Aids each year.

Enter *Delisea pulchra*, a feathery red alga or seaweed found off the Australian coast and a team including researchers at the University of New South Wales.

During a marine field trip, scientists noticed that the algae's surface was free from biofilms despite living in waters laden with bacteria.

Tests pinpointed a compound—known as halogenated furanone—that blocks the way bacteria signal to each other in order to form dense biofilm groups.

A company called Biosignal has been set up to develop the idea which promises a new way of controlling bacteria like golden staph, cholera, and legionella without aggravating bacterial resistance.

Products include contact lenses, catheters, and pipes treated with algae-inspired furanones alongside mouthwashes and new therapies for vulnerable patients with diseases like cystic fibrosis and urinary tract infections.

The bacterial signal-blocking substance may also reduce pollution to the environment by reducing or ending the need for homeowners and companies to pour tons of caustic chemicals down pipes, ducts and tanks and onto kitchen surfaces to keep them bug free.

### **Beetle-Based Water Harvesting**

By 2025, the United Nations forecasts that 1.8 billion people will be living in countries or regions with water scarcity and two thirds of the world's population could be under conditions of water stressed.

Climate change is expected to aggravate water problems via more extreme weather events. Many intelligent and improved management options can overcome these challenges and one may rest on the extraordinary ability of the Namib Desert beetle.

The beetle lives in a location that receives a mere half an inch of rain a year yet can harvest water from fogs that blow in gales across the land several mornings each month.

Enter a team from the University of Oxford and the UK defense research firm QinetiQ. They have designed a surface that mimics the water-attracting bumps and water-shedding valleys on the beetle's wing scales that allows the insect to collect and funnel droplets thinner than a human hair.

The patchwork surface hinges on small, poppy-seed sized glass spheres in a layer of warm wax that tests show work like the beetle's wing scales.

Trials have now been carried out to use the beetle film to capture water vapour from cooling towers. Initial tests have shown that the invention can return 10 per cent of lost water and lead to cuts in energy bills for nearby buildings by reducing a city's heat sink effect.

An estimated 50,000 new water-cooling towers are erected annually and each large system evaporates and loses over 500 million litres.

Other researchers, some with funding from the US Defense Advanced Research Agency, are mimicking the beetle water collection system to develop tents that collect their own water up to surfaces that will 'mix' reagents for lab-on-a-chip applications.

### **Notes to Editors**

Nature's 100 Best is a compilation of 2,100 of the most extraordinary technologies and strategies that are being mimicked or deserve mimicking.

The 100 Best List will be launched at the IUCN World Conservation Congress in Barcelona in October 2008.

At the same time the Biomimicry Institute will unveil AskNature.org, an online database of biological knowledge organized by engineering function in order to engage and inspire entrepreneurs and investors.

Zeri [www.zeri.org](http://www.zeri.org)

Biomimicry Guild and Institute [www.biomimicryguild.com](http://www.biomimicryguild.com),  
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9<sup>th</sup> Conference of the Parties to the CBD in Bonn [www.cbd.int](http://www.cbd.int)

Case studies from today's preliminary launch and more details on Nature's 100 Best at [www.n100best.org](http://www.n100best.org)

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