



Greetings from Montana!

The sun is rising and setting lower and lower on the horizon as we approach the winter solstice in our neck of the woods. Short cold days are buffered by a beckoning fire in the woodstove, and the biological needs of staying warm and well-fed are evident. After a busy fall and with an upcoming packed spring, we both welcome the winter solstice as an opportunity to build upon the Guild from and within Montana. In that light, we welcome two new members to the Biomimicry community. We are pleased to introduce Bryony Schwan and Rose Tocke.

Bryony comes to us originally from South Africa, but by way of Missoula, Montana where she founded and ran the non-profit Women's Voices for the Earth (WVE) for the last 10 years. Bryony has wholeheartedly taken on the growth and evolution of the Biomimicry Institute, our newly founded non-profit. She will begin at half-time, slowly weaning herself from WVE, with the intent to be full-time by the end of 2006. Janine and I are thrilled to have someone as genuine, warm, and adept as Bryony to help the Institute flourish. Several projects, which were developed by the Guild, will be adopted by the Institute, including much of the education work, the database/portal, and the Innovation for Conservation project.

See page 2 for a more complete description of the Institute's mission. Feel free to send Bryony a note to welcome her to the community: bryonys@biomimicry.org

Rose Tocke recently joined the Guild, moving to Helena from Gunnison, Colorado. Rose attended the Biologists at the Design Table training in North Carolina this past May. In addition to thoroughly impressing both Janine and I, she took the initiative to build a relationship with the Guild by committing to move to Montana. We replied with a temporary (hopefully to be permanent) position to help us move forward on projects that need some fertilization. You'll likely be hearing from her in one form or other as different events come to fruition. First on the list is our upcoming workshop in Costa Rica. If you'd like to learn more or just say hi to Rose, her e-mail is: roset@biomimicry.net

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We all continue to be grateful for all the work, encouragement, and contributions each of you make to Biomimicry. We look forward to our next encounter. Happy Solstice to all of you and may you too stay warm, well-fed, and in the joyful company of friends and family.

Best wishes,
Dayna and Janine

Mission of the Biomimicry Institute

The mission of the Biomimicry Institute is to naturalize biomimicry in the culture by promoting the transfer of ideas, designs, and strategies from biology to sustainable human systems design.

The goals of the Biomimicry Institute are to:

- Educate the general public about the concept of Biomimicry.
- Establish Biomimicry programs in K-12 schools, colleges, and universities.
- Sponsor a "Worthy Challenges X Prize" to encourage a Biomimicry approach to sustainable innovation.
- Seed an "Innovation for Conservation" program in which companies donate a percentage of the sales of bio-inspired products to restore the habitat of the organism that inspired the breakthrough.
- Launch the "Biomimicry Design Portal," the world's first digital library of nature's solutions and online information exchange between biologists and innovators.



For more information about the Institute, please contact [Bryony Schwan](#) at:

The Biomimicry Institute
P.O. Box 9216
Missoula, MT 59807

Public Education:

In addition to general lectures, public workshops, the [CBC Nature of Things television broadcast](#), and an "in-the-works" children's book and coffee table book, our specific education efforts include:





BaDT Training: The Institute has also developed a [Biologists at the Design Table](#) (BaDT) course that trains biologists to inspire innovators at the design table. Through this 5-day course, biologists learn the skills necessary to work with designers and practice finding natural models to help solve design challenges.

Exhibits: The Institute is preparing a general public exhibit with the goal of creating a sense of awe and wonder about the natural world. The exhibit will emphasize not just aesthetics or gee-whiz facts, but rather the successful strategies that have resulted in the "survivors" we find on our planet today. Most critically, visitors will see how these strategies can be applied to human challenges to create more sustainable technologies. A walk through the exhibit will expose the visitor to thought-stimulating natural artifacts, case studies, and several hands-on, creative activities designed to allow the visitor to practice and explore a new source of inspiration-nature. A visitor to this exhibit will:

- **Discover ways in which life's strategies can be successfully applied to human systems.** Biomimicry is a problem-solving tool, an approach to innovation. The exhibit will begin to teach this approach and open a wellspring of new ideas that have already been time-tested and are sustainable.
- **Be excited about nature's wealth of untapped solutions.** Nature's catalogue of design blueprints and process strategies is extensive, well-researched, and ready to be explored. Visitors will leave with a sense of hope about an environmentally healthy future.
- **Be inspired to learn more about nature and biomimicry.** In a fun, creative atmosphere, individuals from all walks of life will become engaged in the process of exploring science and design and using bio-inspired technologies to help solve local and global sustainability challenges.

To learn more about this project, please contact [Dayna Baumeister](#).



Formal Education:

The Biomimicry Institute's goal is to establish educational programs in formal educational institutions including schools, colleges, and universities.



K-12 Schools: A pilot project has been developed in several California K-12 schools. For more information on this project, contact [Jeremy Eddy](#). Work is underway to develop biomimicry-based curricular materials that meet national and district content standards in math, art, and the sciences.

Universities and Colleges: Biomimicry Courses are being taught at the following universities:

- Ontario College of Arts & Design
- The [Center for Biologically Inspired Design](#) at Georgia Institute of Technology
- University of Northern Illinois
- California College of Arts and Crafts
- University of Minnesota, College of Architecture
- [Additional courses/programs with biomimetic themes](#)

We have worked closely with the first five schools to set up biology-taught-functionally courses alongside bio-inspired design studios. These are the only biology courses that most of these students will encounter in their university education!

We would like to grow this list by at least five schools every year by hosting train-the-trainers workshops in which experienced teachers from the first five schools meet with the next wave of teachers to pass on best practices. To spread the idea further, curricula and student projects will be posted on our Biomimicry Design Portal.



Innovation for Conservation:

The biomimetic path outlined in [Biomimicry: Innovation Inspired by Nature](#) (*Benyus 1997*) described four steps:

- quieting human cleverness,
- listening to life's genius,
- echoing what we learn,
- giving thanks.



This all-important thanksgiving gesture will take the form of a program that enables companies to donate a percentage of the sales of products and processes that were inspired by nature. We will work with leading conservation organizations to find projects that will help protect and restore the home habitats of the organisms that inspired the breakthrough.

After all, shouldn't we properly honor the organisms and ecosystems that evolved these ingenious, sustainable ideas, and thank them for showing us the way? Habitat conservation gives us the chance to give credit where credit is due, while protecting the wellsprings that gave rise to these great ideas.

Next, we'll find a way to give the Nobel Peace Prize to geckos, mussels, redwood forests, and fungi! For more information about the Conservation for Innovation Program, contact [Janine Benyus](#).

Biomimicry Design Portal:

Practitioners of biomimicry design have one consistent complaint - they lack access to relevant biological information organized by design and engineering function.



Innovators working on desalination, for instance, can't learn about how nature filters - mangrove roots, kidneys, and sea bird salt glands - all in one place. There is no catalogue of nature's solutions to design and engineering challenges.

We're trying to remedy this by creating a digital library of nature's solutions organized by function that is both a cross-pollinating tool and a collaboration forum.



Imagine the design insights from 3.8 billion years of evolution being available on demand, for free, to any innovator in the world at the moment they are creating new technologies. The Biomimicry Design Portal is a bio-inspiration website where innovators can learn from nature's solutions, biologists can find a whole new audience for their research, and collaborators can work together to create sustainable, bio-inspired designs. It's amazing what can happen when you build a Rosetta stone that translates knowledge from one world, biology, into the language of design and engineering. The genius flows.

Fully built out, we hope the Biomimicry Design Portal will provide:

- **Inspiration:** Innovators can browse a catalogue of nature's solutions (organized by design challenge), publish their own design challenge classification schemes, and post questions for biologists.
- **Biology Know-How in Engineering Language:** Biologists can share their knowledge of how life works (How does nature filter? Adhere? Reduce friction? Dissipate heat? Communicate, etc.) by uploading summary articles, visuals, End Note bibliographies, comments, etc.
- **Open-Source Research:** Industry can post design challenges and award "X prizes" for bio-inspired solutions.
- **Education:** Students can take classes online and post their bio-inspired designs.
- **Collaboration:** Innovators and biologists can meet, and bio-inspired breakthroughs can be born.

An early prototype of the portal, available [here](#) for alpha-testing, has been created the Biomimicry Guild and [Rocky Mountain Institute](#). The Biomimicry Institute is interested in keeping this site in the public domain while taking it to the next level. For more information about the Biomimicry Design Portal, contact [Jeremy Faludi](#).



Biomimicry Case Study - The Story of Entropy

Interface is a US\$1B global company specializing in free-lay carpet tiles. About 10 years ago, Ray Anderson embarked on a mission to "be the first company that, by its deeds, shows the entire industrial world what sustainability is in all its dimensions: People, process, product, place and profits - by 2020 - and in doing so, to become restorative through the power of influence."

I was given the challenge of implementing Ray's vision. My first thought was to wean Interface off petroleum by adopting natural materials. Unfortunately, this would have had a significant business impact on Interface. Aside from issues of cost and durability, a simple 'back of the envelope' calculation suggested that the land required to grow cotton or raise sheep for wool would be enormous.

I was at a loss as to what I could suggest next. Paul Hawken referred me to Janine's book, which emphasized the importance of taking an 'end-to-end' view to both appreciate good designs and understand the limitations of poor designs. Janine states that everything is natural, but designs vary in the degree of 'fit' to natural systems. I posted Janine's principles of mature systems prominently on my desk and began to think how I could align Interface closer to these goals.

Life's Principles	Opposing Principles
Nature runs on sunlight	We rely on nonrenewable resources
Nature uses only the energy it needs	We rely on cheap, abundant fossil fuels
Nature fits form to function	We employ 'heat, beat and treat'
Nature recycles everything	We waste more than we use
Nature rewards cooperation	We reward competition
Nature banks on diversity	We rely in monocultures
Nature demands local expertise	We emphasize globalization
Nature curbs excesses from within	We measure success through excess
Nature taps the power of limits	We strive to defeat or overshoot limits
<i>Janine Benyus, "Biomimicry, Innovation Inspired by Nature"</i>	<i>David Oakey</i>



A workshop led by Janine and Dayna sold Interface on the value of Biomimicry. It became clear that the carpet business was heavily invested in uniformity and standards-based quality. Interface demanded perfection from suppliers - any variation led to rejection and waste. In contrast, nature thrives on diversity - analogies included the patterns and textures of rivers and the forest floor. Any individual section was different from any other section, yet the 'whole' had an overall structure that blended the individual sections into a seamless pattern.

We implemented a similar concept by using multiple shades of yarn in the manufacture of each carpet tile, introducing diversity within the tile and making each tile slightly different from adjoining tiles. The impact of applying the principle of diversity was much greater than we had expected. We were able to eliminate waste in the manufacturing process - differences in shade or color from our suppliers were no longer critical, and we could reuse yarn across projects. Carpet tiles were no longer being rejected by the installers. Installers could lay the carpet without worrying about the direction of the 'nap'. Customers could easily replace carpet tiles years after the carpet was laid.

Ironically, the principle of diversity reconnected us to an older way of designing with natural materials. Uniformity has only been possible with the introduction of synthetic materials. Much of the aesthetic value of silk garments, oriental rugs and fine woodwork comes from the subtle differences inherent in the raw materials. Designers not only worked with these differences, but used those differences as a positive force.

Synthetic materials have allowed us to embrace a "command and control" mentality where we impose our will on nature. We invest time, fertilizer, pesticides and water to achieve the perfect, lawn - 30% of municipal water is consumed by lawns in the eastern parts of the United States, with up to 60% in the drier western areas. In comparison, the diversity of a sustainable lawn reduces or eliminates the need for external resources. We build our cities on a grid pattern in the belief that straight lines are the fastest route between two points. Yet studies in fluid dynamics suggest a more leaf-like design such as found in the London water system is more efficient.



Recently, we have started to explore the implications of local pattern, color and texture on interior design. To a large extent, we live and work in synthetic, uniform settings that are disconnected from the local environment. We need vacations to reconnect with nature. Why should our built environment not learn from the local context, reintegrating nature back into our everyday lives?

Going further, we can apply the principles of how nature designs shapes. Although our geometric shapes use space efficiently, corners tend to be areas of weakness. Nature relies on more organic shapes involving curves - we already follow nature's lead in areas where strength is critical. Our designs are often stiff and brittle, while nature is flexible, fluid and resilient. We tend towards large scales, while nature relies on smaller units in a modular fashion. We use wheels (requiring a smooth, uniform surface), while nature uses legs. The challenge is to extract the principles from nature's designs and appropriately apply them in the right context.

Giving up uniformity has been difficult for both me and Interface - so much of our thinking revolves around this one concept. Fortunately, Entropy has proven to be a better product than anything we had produced in the past. Customers are willing to pay a premium for the carpet, looking beyond the immediate costs to the larger picture. Rather than limiting the creativity of our designers, applying the principle of diversity has created opportunities to explore new avenues to be leaders in our field. Entropy has proven to be a significant contributor to Interface's growth, and continues to provide inspiration for future innovation.

David Oakey: neodes@mindspring.com





Biomimetics - it just keeps growing!

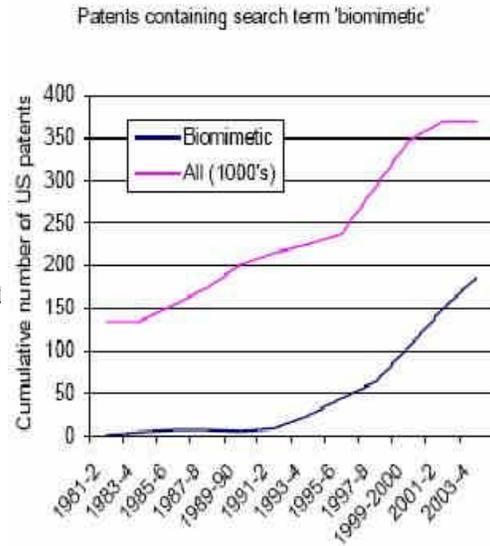
The [University of Bath](#) and [University of Reading](#) are the key centers for biomimetic research in the UK. One of the many current projects is the [Replicating Rapid-Prototyper](#):

“a machine that can replicate itself and - in addition - make other industrial products. Such a machine would have a number of interesting characteristics, such as being subject to Darwinian evolution, increasing in number exponentially, and being extremely low-cost.”

For an overview, check out [3D printer to churn out copies of itself](#) (New Scientist).

The following is extracted with permission from the August 2005 BIONIS newsletter. For more information, please see [The Biomimetics Network for Industrial Sustainability](#).

“Ever wondered how the field of biomimetics is growing globally? A quick look at global patent databases will give you an answer. Since 1981, the total number of patents containing the search term ‘biomimetic’ has increased by a factor of 93, whereas the total number of patents has increased by a factor of 2.7. Of course, this simplistic search has just taken account of the numbers of papers where the term biomimetic appears in the title, whereas the actual total of patents where bio inspiration has been part of the creative process is undoubtedly much higher.



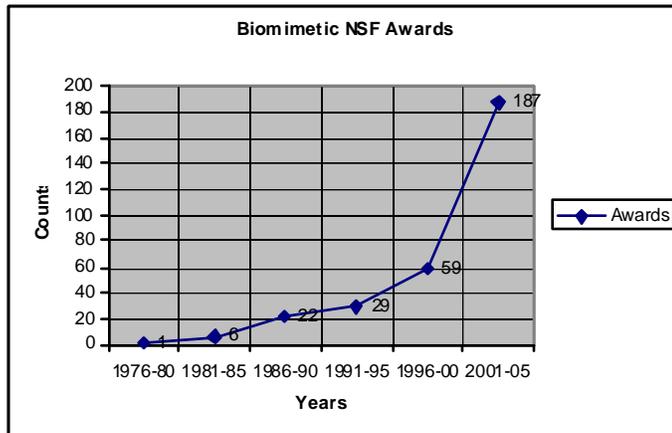
Whilst the granting of a patent does not indicate commercial success, it does give an indication of the number of innovations that might, in the future, give rise to novel industrial products and processes.”

Richard Bonser

Centre for Biomimetics, University of Reading



A quick check of the [National Science Foundation](#) Awards database shows a similar growth in active and expired awards where any of the following terms are found: **bio-inspired, bioinspired, biomimetic, bionic, biomimicry**. The NSF search engine does not easily identify the total number of awards in each time period, making it difficult to factor in any general growth in awards.



Members Corner

Sue Redding - Getting Young Children Interested in Biology

Thirty years ago I was a design student at Arizona State University. Although focused on design, I continued to have an intense interest in mammalogy and the study of animals. Since it was impossible for me to study both majors, I managed to secure a job as a zoo keeper at the Phoenix Zoo. I would spend my days taking care of animals - reading and researching their habitats and lives, while at night designing logos, packaging, and creating brand identities. I don't think any of my friends truly understood my schizophrenic life.

Flash forward 25 years.

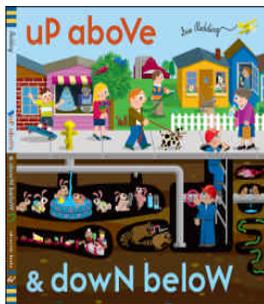
While working as an Industrial Design professor at CCA-California College of the Arts teaching the cultural history of design, I read "Biomimicry" and suddenly it all began to make sense. Design and biology were not mutually exclusive. In fact the more a designer could learn about biology the better their work would be. I found myself walking around thinking "How can I make this interesting to design students?"



This question followed me everywhere: at the store, at lunch, in the park with my dog.

One day in the park as my dog was patiently doing some nature studies of her own (watching a gopher pop his head in and out of a hole) I realized that there must be a whole gopher infrastructure right under the ground. There must be a complete gopher world down there with families and children and comfy gopher beds. In fact this concept was true for ants, rabbits, and other animals as well. And while penguins were marching around on the hard Antarctic ice, inches below them might be massive whales lurking in the icy waters. I thought that this would be a good way to teach young children that animals have a whole microcosm of their own. Just because you can't see it, doesn't mean it doesn't exist. If you look closely you'll find very different worlds living side by side - at a picnic, in the ocean, in the blazing desert, even inside a two-story home.

Two years ago I parlayed this concept of hidden worlds into a children's book titled "Up Above and Down Below." I wrote short rhyming prose with colorful illustrations and proposed it to Chronicle Books Children's division. Three months later I got a call from my editor telling me that my book was accepted. In the publishing world having a first time author/artist publish a children's book is the golfing equivalent of getting a hole-in-one. I was ecstatic.



After a year of development and hard work, my book is finally printed and will be out in late February. Hopefully this will be the first in a series of books that are geared towards helping young children understand my "other love" —the world of animals.

Sue Redding: reddo@pacbell.net



The book will be available in February from [Chronicle Books](#).



Biomimicry and Design Workshop

The next Biomimicry and Design workshop is scheduled for March 5th through 11th, 2006. As a result of the great feedback from last year's workshop participants (see the [August 2005 Newsletter](#)), the workshop will once again be held at La Cusinga Lodge on the Pacific Coast near Uvita, Costa Rica.

The workshop is intended for students and professionals interested in applying nature's strategies and solutions to sustainable design. Led by instructors Dayna Baumeister and Janine Benyus, you will have an opportunity to:

- Solve a design challenge by asking "what would nature do here?"
- Brainstorm with biologists.
- Learn from local plants, animals, and ecosystems.
- Become acquainted with life's inherently sustainable design principles.
- Learn how to incorporate bio-inspired design techniques in your own organization.

For details on the course and to register, see <http://www.biomimicry.net/cr.htm>. Early Bird registrations need to be paid in full by January 15th. The general registration deadline is February 20th, 2006.





Clippings and Events

Two public-access Weblogs are now available to communicate information of interest to the Biomimicry community.

Clippings <http://biomimicry.typepad.com/clippings/>

Events <http://biomimicry.typepad.com/events/>

You can comment on any entry through the **Comments** field in the entry trailer. TypePad asks for an e-mail address which will be publicly visible - I set up an e-mail account on Yahoo (Hotmail is also popular) specifically for this purpose, in case the e-mail gets SPAMed.

Contributions to the Clippings and Events Weblogs are greatly appreciated!

Resources

The Biomimicry Newsletters are generally available through ThinkCycle at http://www.thinkcycle.org/tc-space/tspace?tspace_id=49344. You do not need to register with ThinkCycle to read the newsletter.

If you have any problems downloading or reading the newsletter, please let me know.

Norbert Hoeller: nhoeller@primus.ca

