



Bioneers 2003

As an attendee at my second Bioneers conference, my world was rocked with incredible joy, emotion, and most of all, inspiration. This 3-day conference just north of San Francisco has had the ability to not only to revolutionize my world view time after time, but provides me with the hope and courage to step up and face today's challenges with all my brothers and sisters whose will and determination lead my way.

Bioneers, in my eyes, is a must go to event where science, art and spirit meld to become one. The holistic view offered by the conference is really the key to sustainability. We must all learn how to make the connections between disciplines to develop comprehensive solutions to not only sustaining, but restoring Earth. This is the only place you can go to hear talks on topics as diverse as marine biology, woman's rights, soil science, greening corporations, ecological design, ecoliteracy, and youth activism.

This year's conference, for me, was marked by two major themes. One was the prominence of Biomimicry. We were all fortunate enough to have Janine keynote a plenary session where she explored a world of possibility: Nature's Genius. People couldn't stop talking about her presentation and noted that no matter how many times they see her speak, she never ceases to invoke inspiration. I agree. Biomimicry remained in the limelight in the youth tent when about 20 participants joined myself, Onno Koelman, and Marianna Grossman Keller for a Biomimicry workshop. We had a lot of fun with it and got positive feedback from some of the newest biomimics!

The second main theme for me is the union of the social justice and environmental movements highlighted by a talk by Van Jones. Van went on to say that the social justice movement is destined to fail. The environmental movement is also destined to fail. **But where there is hope is at the crossroads of the two.** One cannot succeed without the other. Ultimately, they are one in the same.

With the diversity in content at the conference comes innumerable stories and experiences of participants. It was absolutely amazing to learn about the wide variety of projects currently being undertaken, especially those by today's youth.

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Sharing stories both inspires others to follow similar paths of proactive restoration of our social and ecological fabric, as well as provide encouragement and hope for projects currently underway. Together, we will make this a better world for all of us.

Whether initiating community gardens or spurring social activism, the stories from the youth are an important and valuable tool to help connect all of us and provide an astonishing amount of inspiration. It can be done. It will be done. **Today's youth are doing it!!**" *Adapted from November 2003 BioInspire Newsletter (see **Resources** for link to full article)*

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Feedback on First Newsletter

The responses were unanimous in recommending distribution beyond the Guild, to encourage greater participation. References were made to the Biomimetics listserv as a model for tapping into expertise, as well as the Cousteau society (education and fundraising components). See next article suggesting that we use a Creative Commons license, allowing us to post the newsletter on public web sites while still retaining a degree of control over how the material is used.

Comments about the length, content, format, readability and distribution of the newsletter were positive. Responses were evenly split concerning full-text articles compared to abstracts with links. The plan will be to use a mix, taking into account the length of the article as well as the expected degree of Guild-wide interest.

There is interest in both a history of Biomimicry, as well as development of a database of successes, both as a resource and to block patenting of natural resources.

One respondent suggested creating a list of potential funders for Biomimicry projects. The availability of funding appears to be closely tied to the current hot issues as well as prone to 'political winds'.

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Creative Commons

The original US copyright law of 1790 gave authors full rights over their works for 14 years, with an option to renew for another 14 years. Once the copyright expired, works automatically became part of the 'public domain' and could be freely used. Authors had to specifically mark their works as 'copyright' to reserve their rights, and notify all users that permission was required for any use.

The copyright laws changed in the late 1980s, making all works copyright by default and extending the period of protection to 70 years after the death of the author. The new law did not require that works display the copyright symbol to be protected - this left anyone wishing to use the work unclear on the legal status. In addition, 'intermediaries' (lawyers, record labels, publishers) positioned themselves between the owner and potential user of a work - asking permission suddenly became much more complicated.

Creative Commons (www.creativecommons.org) was born out of a desire to encourage creativity, collaboration, co-authorship and derivative works, in the spirit of the Internet. Complementary to copyright protection, Creative Commons provides both 'user-friendly' and legal licenses that define a continuum of allowed uses, from 'all rights reserved' to 'no rights reserved' (or public domain). These rights are specifically spelled out in advance, reducing legal doubt and avoiding the need to ask for permission for allowed uses.

Licenses specifying how a work can be copied, distributed and modified are determined by answering three questions:

- does the owner require attribution? (licensee must give original author credit)
- will owner allow commercial use without specific permission?
- what degree of modification will the owner allow? (none, 'share-alike', any)

In the spirit of providing a wider audience for the Biomimicry Guild Newsletter and allowing us to post it on public forums such as ThinkCycle, I recommended we apply the Attribution-NonCommercial-ShareAlike license:

- anyone using newsletter material must credit authorship
- no commercial uses without specific permission
- derivative works allowed, but must be distributed under an identical license



I have included the Creative Commons logo on the first page and modified the text in the foot of each page with the recommended wording, along with links to the online Creative Commons license.

Animated introduction: <http://mirrors.creativecommons.org/getcreative>

Creative Commons history: http://mirrors.creativecommons.org/reticulum_rex

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Recent Accomplishments

The Biomimicry Guild held its first-ever Biologist at the Design Table (BaDT) Workshop at the Foundation for Global Community in Palo Alto, CA. Running January 28 through February 2, the workshop seeded 20 participants with tools for communicating biological principles to designers and engineers. Although the participants shared a common passion for the natural world, levels of experience ranged from undergraduate students to practicing professors. Specific interests included sustainability, ecology, molecular biology, chemistry, green architecture, and organizational development.

Mentors Janine Benyus and Dayna Baumeister presented participants with good working definitions of biomimicry, differentiating between the "shallow" mimicry of form/function only and the "deep" mimicry of form/function, manufacturing process, and ecosystem-level interactions. Additionally, Janine and Dayna contrasted biomimicry from the less desirable practices of bio-assistance and bio-utilization. With this framework in place, the BaDT mentors gave strategies for shedding the layers of a design problem, brainstorming biological solutions, and effectively signaling these solutions to people without biological knowledge.

BaDT participants had numerous opportunities for practice. Presented with artifacts from the natural world, participants described form-, process-, and system-level attributes, with an eye toward what could be mimicked. Participants worked in groups to communicate biological principles in easy-to-digest language. In a longer-term group project, participants carried design problems through the entire process - getting to the core of the problem, brainstorming biological solutions, researching solutions, and presenting jargon-free results. As a grand finale, participants met with local designers, and helped expose biological solutions to actual design problems.



Although the workshop required considerable mental energy, it provided replenishment in several forms. Participants enjoyed scrumptious organic meals prepared by caterer and chef Laura Stec, as well as coffee and snacks donated by local businesses. On the fourth day of the course, participants re-tuned their senses at Hidden Villa, an environmental education center nestled in the coastal foothills. Participants were treated to great company in each other, in their mentors, and in the course organizer, Marianna Grossman-Keller. Finally, and most importantly, participants left equipped with resources for rebuilding connections between humans and non-human nature.

Links:

Hidden Villa

<http://www.hiddenvilla.org/>

Foundation for Global Community

<http://www.globalcommunity.org/>

Laura Stec

<http://www.laurastec.com>

Rebekah Griffin: rebekah@biomimicry.net

A Brief History of TRIZ

As global competition becomes increasingly fierce, companies are called upon to find solutions that cannot be found in a book or through subject matter experts. Inventive solutions require different problem solving techniques, such as brainstorming or trial-and-error. Unfortunately, 'psychological inertia', the tendency to search for solutions within one's field of expertise, can significantly impede the problem-solving process or lead to sub-optimal solutions. Creativity is often seen as 'high risk' in a project, leading to undisciplined ideas of uncertain value.

Genrich S. Altshuller, a patent adviser in the former Soviet Union, analyzed 200,000 patents in the 1940s searching for inventive principles that transcend specific subject areas or industries. Only a small proportion represented true innovation - the majority were incremental improvements. Of the former, Altshuller focused on solutions that eliminated contradictions and avoided compromise or tradeoffs. His analysis led to the development of TRIZ (the Russian acronym for "Theory of Inventive Problem Solving").



TRIZ provides a structured way of abstracting and organizing knowledge by function. Altshuller developed:

- 39 factors in engineering and design, where improvements in one typically led to undesirable secondary effects in another
- 40 Inventive Principles, expressed in generic terms that can be applied across subject areas or industries
- a Contradiction Matrix mapping the factor being improved, associated undesirable secondary effect, and the Inventive Principles that can resolve the conflict
- the Law of Ideality, which predicts that over time, systems maximize utilization of internal resources, minimize waste and eliminate inputs from external systems
- a database of specific 'effects' organized by function (see function.creax.com for a sample)

TRIZ includes a wide range of methods for analyzing problems, generating solutions and evaluating the results. Some, such as ARIZ and Substance-Fields are complex and require practice and experience to use. In many cases, simpler techniques have proven to be effective, such as:

- analysis of contradictions
- mapping of resources
- formulation of the Ideal Final Result

TRIZ embodies a number of principles that appear surprisingly compatible with Biomimicry:

- it bridges the abstract (academics) and the concrete (technology)
- embraces conflicting requirements as a positive force in problem solving (a principle first recognized by Plato)
- encourages efficient use of resources
- recognizes limits, including turning drawbacks into useful resources
- focuses on understanding problems as a system
- aspires to identify an ideal solution

TRIZ has been built on solutions taken from chemistry, mathematics and engineering. Dr. Julian Vincent of the University of Bath has been instrumental in extending TRIZ to encompass biology. An analysis of biological solutions along the lines of Altshuller's screening of the patent database suggests that the TRIZ Inventive Principles apply in both realms, but Nature applies the Inventive



Principles in different ways to solve apparently similar problems and technical contradictions. For example, sharks solve the contradiction of speed and energy consumption through the structure of tiny scales covering the skin, delivering a very low drag coefficient. Nature also adds unique 'effects' (specific examples of how a generic function can be performed) not part of our typical repertoire. Work is well underway to creating a database of Nature's solutions and performing the analysis required for integration into the TRIZ framework.

TRIZ has a proven track-record in solving engineering problems, although case studies are hard to find due to the proprietary nature of the solutions. TRIZ shows great promise in structuring and making accessible biological information in a form that is consumable by individuals who are not literate in biology. It also shows promise as a novel way of analyzing biology, generating a new functional approach at all levels of organization, from cell organelle to ecosystem.

Annotated pointers to additional TRIZ material available at http://www.thinkcycle.org/tc-space/tspace?tspace_id=43672

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(edited by Dr. Julian Vincent)

Upcoming Events

The next *Biomimicry in Architecture* course will be held on February 22-25, 2004 at Maho Bay Camps (St. John, U.S. Virgin Islands). Key learning objectives and activities include:

- What is Biomimicry?
- Examples of biomimetic success stories
- How you can use Biomimicry to design new products, processes, systems
- Solve a design challenge by asking "what would nature do here?"
- Learn how to incorporate bio-inspired design techniques in your own organization
- A whole new way of viewing and valuing the genius that surrounds us

For more information and registration, please see:

http://www.Biomimicry.org/virgin_islands.htm

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Members Corner

Mark Dorfman

Perhaps it was the vibrant quality of the Pacific Northwest sunlight reflecting off the surrounding flora in January 1998 that betrayed the prolific chemical manufacturing underneath the seemingly quiet greenery. Regardless of the trigger, this observation was particularly relevant because I was searching for inspiration. For the previous 10 years, I had been working as an environmental research scientist with a public interest group promoting the concept of pollution prevention in the chemical industry. After a decade of concerted work by a coalition of environmental organizations, pollution prevention eventually moved from the fringes of government policy discussions to the forefront, so I was beginning to wonder what the next paradigm shift was going to be - and there it was staring me in the face. I soon learned of Janine's book, and promoting public awareness and government policies leading to a biomimetic chemical industry has been a passion ever since.

Unfortunately, with the exception of the Rocky Mountain Institute, no environmental organization, large or small, seems ready to put time or effort into promoting biomimicry as an environmental and public health strategy - not too surprising given the myriad of environmental issues needing attention and oversight, particularly during this current administration. But history has shown that without the loud and unrelenting voice of the public interest community, changes in government and business policies for the protection of the environment and public health occur at glacial speed.

Even though I earn my bread and butter working on other environmental projects, I continue to worm my way into opportunities to build a foundation for chemical industry biomimetics. Why the chemical industry? According to the U.S. Toxics Release Inventory, the chemical industry released 583 million pounds of manufacturing-related chemical wastes into the environment in 2001 - excluding wastes associated with downstream product use and disposal. The industry ranked third after metal mining (2.8 billion pounds) and electric utilities. A portion of the metal mining industry's products is used by the chemical industry - so biomimicry might reduce the need for these materials and associated wastes.

With a 2002 summer fellowship from the Chemical Heritage Foundation, I was able to craft a Powerpoint presentation that introduces the concept of biomimicry



and its potential for reducing the environmental impacts of the chemical industry. I've given the presentation to a wide variety of audiences, but the most rewarding was with a gathering of seniors at the well-regarded Bronx High School of Science in New York City. The students showed great interest in both the environmental issues associated with the chemical industry and biomimetics as a potential solution.

More recently, I've drafted a five-page section on biomimicry for a much larger publication on sustainability and the chemical industry to be published by John Wiley later this year. My main point in this piece is to frame the public policy challenges, such as establishing criteria for distinguishing biomimetic chemical innovations from largely synthetic ones.

At the writing of this article, I am in Kathmandu, Nepal where I have initiated discussions about biomimicry with members of the Nepal Chemical Society (NCS). Having a long-standing relationship with Nepal since my days as a volunteer math and science teacher with the Peace Corps in 1980, I've been trying to come up with ways that Nepal scientists could be actively involved with biomimicry despite the lack of adequate research facilities. My idea is to work with NCS members in developing a database of natural chemical processes by leveraging the cutting edge scientific discoveries published in prestigious scientific journals, such as Nature, which are increasingly freely available to scientists in developing nations. The database would provide the same types of information on natural chemistries as chemical engineers use to piece together synthetic chemistries. By involving Nepali scientists at this relatively early stage, perhaps they will be called upon to perform services for a growing biomimetics industry just as their neighbors in India have been called up for services related to the information technology industry.

When not busy with professional pursuits, I enjoy biking along the extensive New York City waterfront, swimming at a gym built on a recently renovated set of piers that were intended to receive the Titanic, hiking on the magnificent trails of the Hudson River Valley, dancing to the rhythms of Manhattan's myriad dance venues, and traveling to points near and far. I look forward to a productive relationship with the Guild community.



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Clippings

thoroughbred structures (Mechanical Engineering Magazine, March 2003)
Engineers design lighter and stronger fibre composites that are not weakened by holes, inspired by the composition of metacarpus leg bones in horses.
<http://www.memagazine.org/medes03/thorobrd/thorobrd.html>

Resources

Recent BioInspire newsletters:

- [February 2004 Newsletter: "Beyond Sustainability: From Scarcity to Abundance"](#)
- [January 2004 Newsletter: "Saving the World in Style"](#)
- [December 2003 Newsletter: "This Year's Reflections on Thanksgiving"](#)
- [November 2003 Newsletter: "Bioneers Youth Initiative Overview"](#)

The Natural Step is a global organization based on “easily understood, scientifically-based principles that can serve as a compass to guide society toward a sustainable future.”

http://www.thinkcycle.org/tc-notes/show-note?tc_note_id=48276

Elva Rubio has a set of PowerPoint charts describing two student projects developed as part of a Fall 2003 University of Illinois/Chicago Biomimicry course. The first is a building 'skin' modeled on the thermoregulation capabilities of polar bears. The second involves integrating recycling into both the infrastructure and culture of buildings. Elva is also working with Janine and Dayna on a Chicago building renovation using structural color in the ceilings. For more information, please contact elva_rubio@gensler.com.

