



# BIOINSPIRED!

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THE BIOMIMICRY INSTITUTE

## Biomimicry Institute Blooming! (*Bryony Schwan*)

It is hard to believe the Biomimicry Institute is already just over a year old. At the same time, it is hard to get my head around how much has happened over the same period. The big news of late is the tremendous expansion in our capacity thanks to the generous support of the Kendeda Foundation and another anonymous donor. With two significant grants we have been able to hire several new staff people. The Institute is pleased to welcome Cindy Gilbert, Sam Stier and Denise DeLuca to the staff. Cindy Gilbert is a Ph.D. candidate in wildlife biology at the University of Montana and has extensive experience as a teacher and biological researcher. Sam Stier has a Masters Degree in Natural Resource Conservation, extensive teaching experience and a solid science background. Sam and Cindy will be heading up the Institute's ambitious education program, working with all levels of educational institutions from K-12, college and university programs, as well as the general public.

Denise DeLuca, who has a Ph.D. in Civil Engineering and is LEED certified, will be joining the staff. Denise has been doing some contract work for the Institute (including a "handbook" for people who take Biomimicry workshops) and will be working on outreach to various professional groups as well as a number of other innovative projects. For more information on our staff and their amazing backgrounds please visit the Institute's website [www.biomimicryinstitute.org](http://www.biomimicryinstitute.org). In addition to staff, we have contracted with John Webb of John Webb Consulting to work on developing the next phase of the Biomimicry Web Portal. While John works on taking the portal to the next level, David Hammond, an environmental chemist, is researching examples of green chemistry that are biomimetic in origin. Dr. Hammond's research will help build out the "nature's chemistry" case studies for the web portal.

### Inside This Issue:

<b>Biomimicry Europa on Track</b>	2
<b>Re-Connecting with Nature</b>	3
<b>2007 BaDT Workshop</b>	5
<b>The Biomimicry Resource Handbook</b>	5
<b>Signal Jamming in the Fight Against Bacteria</b>	6
<b>Biomimicry and Educational Innovation</b>	7
<b>A Call for 'Interest Groups'</b>	9
<b>Calendar of Events</b>	9
<b>Clippings, Resources and Events Weblogs</b>	10



Cindy

Sam

Denise

While the Institute staff work to meet the ever-increasing demand for educational curricula for schools, colleges and universities we are excited to announce two new projects that will help us bring the concept of biomimicry to young people. Joshua Cabell, who recently left for the Peace Corps in Morocco, interned with us this past winter and developed a fabulous children's story called "Blue." This story about a young shark that embarks on a journey to understand his unique role in the marine ecosystem will delight many young readers and help bring the concept of biomimicry to children and parents alike. We are working on illustrating the story and will make it available soon.

On an even grander scale, Montana singer songwriter Amy Martin has embarked on a year-long project to write and produce a children's biomimicry music CD. I cannot think of anyone more fitting to work on such a project. Aside from a stunning voice, Amy has a long history of social and environmental activism, composing music and songs that reach people at a deeper level. Amy is planning on partnering with a few big names in the music business to help market the CD and thus biomimicry. To learn more about Amy's music, visit her website at <http://www.amymartin.org>.





## Biomimicry Institute Blooming! (continued)



MICHAEL GALLACHER/Missoulian

While there is barely a day that goes by without someone calling from somewhere in the world to invite Janine Benyus, Dayna Baumeister or someone else from the Biomimicry community to give a lecture or workshop at a conference,

it is always special treat to talk to folks in your own community or “play a home game” as Janine describes it. In mid-February, Janine gave a keynote lecture on Biomimicry at the University of Montana as part of the Wilderness and Civilization Lecture Series. A front-page story in The Missoulian newspaper generated an audience of nearly 500 people. It was a special event for Janine because so many of her friends and family were able to attend. The energy in the room was palpable and after a standing ovation, friends and special guests joined us for a reception to celebrate the Institute’s first public event in Montana.



We are also pleased to announce that the Biomimicry Institute has secured 501c3 non-profit designation from the IRS and we want to thank Women’s Voices for the Earth for serving as our fiscal sponsor and incubator in 2006. We also want to thank all of you who contributed to the Biomimicry Institute’s work in 2006, especially the Kendeda Fund, Adam Lewis, David Orr, The Green Chemistry Institute, David Fox, Margie Haley, Deborah Coburn, the Sustaining Design Fund, Mary Hansel, and Kohler, Inc. Without your help the Institute wouldn’t be where it is today—thank you!

If you would like to contribute to the Biomimicry Institute in 2007 we would welcome your support. We have a lot of exciting work happening and we will be able to do a lot more now with more staff and resources. If you would like to be a part of this team by making a tax-deductible gift, please either send us a check or call/e-mail me for other ways to contribute.

[Bryony Schwan](#)

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## Biomimicry Europa on Track (*Gauthier Chapelle/Raphaël Stevens*)

This winter is hot in Europe! At a time when we face an impressive “media buzz” on climate change issues driven by record breaking temperatures and the last IPCC report, we are proud to announce that Biomimicry Europa, a non-profit organization with an international outlook, was founded in December 2006. More than 25 people have joined us from various ages and backgrounds, including some pioneers of Biomimicry in Europe such as Julian Vincent (UK) and Elizabeth Laville (France). In order to keep a strong link with the Biomimicry Institute, we asked – and received the support of Janine Benyus, who will serve as a member of the Board.

Headquartered in Brussels, the heart of the EU institutions, the main goal of our new organization is to promote biomimicry as a key innovation method in order to accelerate sustainability in the European Community. Our purpose is also to develop and promote a European convergence platform for meetings and exchanges for all biomimicry actors. We will focus part of our efforts on initiatives aiming at helping people from

developing countries find biomimetic solutions to issues pertaining to daily life and development, in dignity and in a sustainable fashion. These goals will be achieved in collaboration with the Biomimicry Institute (USA).

After performing necessary administrative tasks, we have built the first European inventory identifying stakeholders involved in the biomimicry field, started fundraising and designing our website and our presentation folders. The next months will be dedicated to setting up our first projects for 2007-2008 which include:

1. Organizing a “biomimicry and climate change” workshop, inspired by one of the “group challenges” from the last Biologist at the Design Table (BaDT) workshop. The idea is to bring an interdisciplinary audience together to determine what Biomimicry could propose in terms of mitigation and adaptation to climate change, the main environmental, technological and economical challenge of our century.



## Biomimicry Europa on Track (continued)

2. Organizing a “training for trainers” program to spread the Biomimicry concept in Europe. We need people versed in Biomimicry not just in English, but also in their own language. Thus the aim is to invite Biomimicry “enthusiasts” from a number of European countries to a seminar – given in English – at the end of which they would be able to give 1 to 2 hour conferences or seminars about Biomimicry. We are trying to organize this seminar during the “summer tour” of Janine Benyus and Dayna Baumeister.
3. Select the best European success stories from our European inventory and gather a maximum of information about them. They will then be available for use in any kind of communication such as conferences, web sites and books.

Both of us will attend the Biomimicry and Design workshop in Costa Rica to further our understanding of Biomimicry,

strengthen the links across the Atlantic and discuss joint projects. Also, two of our founding members have applied to take part to the next BaDT workshop in Montana.

This is only the beginning ... we keep receiving support and enthusiasm from people we are contacting! The project seems to raise a lot of interest at various levels, and there is clearly a lot of work ahead. We welcome anyone wishing to help and take part in this enterprise. Please contact the Biomimicry Europa team by clicking on the names below.



[Gauthier Chapelle](#)



[Raphaël Stevens](#)

## Re-Connecting With Nature (Dorna Schroeter)

One of the challenges facing us in the 21st century is achieving a sustainable relationship between people and the environment. The mindset of the 20th century was that we were separate from and smarter than nature – we are now experiencing the impact of that thinking. We need to relearn about our connection and the important role the natural world plays in all aspect of our lives. To accomplish this, we have to begin immediately with the re-education of our children as well as our educators. I like to tell students that although we now understand that we are living in a limited, not a limitless world, our behaviors and habits are still based on the old mindset of ‘no limits’. It is going to take time for our behaviors and habits to catch up with our new attitudes. We are seeing the beginnings of this shift with the global recognition that we must include environmental literacy and education for sustainability in our teacher training and children’s curriculum.

Sustainability will have a direct bearing on our children’s futures, not only in terms of the world they will inherit, but also their careers. Tackling the nature-deficit disorder as described by Richard Louv in *Last Child in the Woods* will help expose students to our natural world and encourage creativity. Although many believe ‘the jobs of the future are behind a computer’, I am convinced that the jobs of tomorrow will require a greater understanding and connection to nature

than many of our children experience today. For example, industry is beginning to redesign their processes so that they mimic natural systems where no waste is produced. These scientific advances will and are opening up many new and different career options, some we cannot even imagine right now.

I had the pleasure of working with Gunter Pauli (founder of ZERI) and an amazing local teacher, Scott Beall, on a summer workshop for educators that introduced the concepts of sustainability and systems thinking using the “ZERI fables”. By teaching and integrating systems, science, math, art, ethics and economics, these stories inspire questions and encourage students to see science as exciting and relevant. As part of the workshop, we encouraged participants to create curriculum material linking systems thinking to real-world situations. By making the material relevant, students will be better able to translate classroom activities into everyday life.

The challenge (and the opportunity) is to help children see the world differently by exposing them to new ideas and experiences that they might otherwise not encounter. Elementary students are like sponges, absorbing knowledge. Who knows what kinds of connections they will make with that knowledge in the years to come! They also affect those around them, especially teachers and parents. I have





## Re-Connecting With Nature (continued)

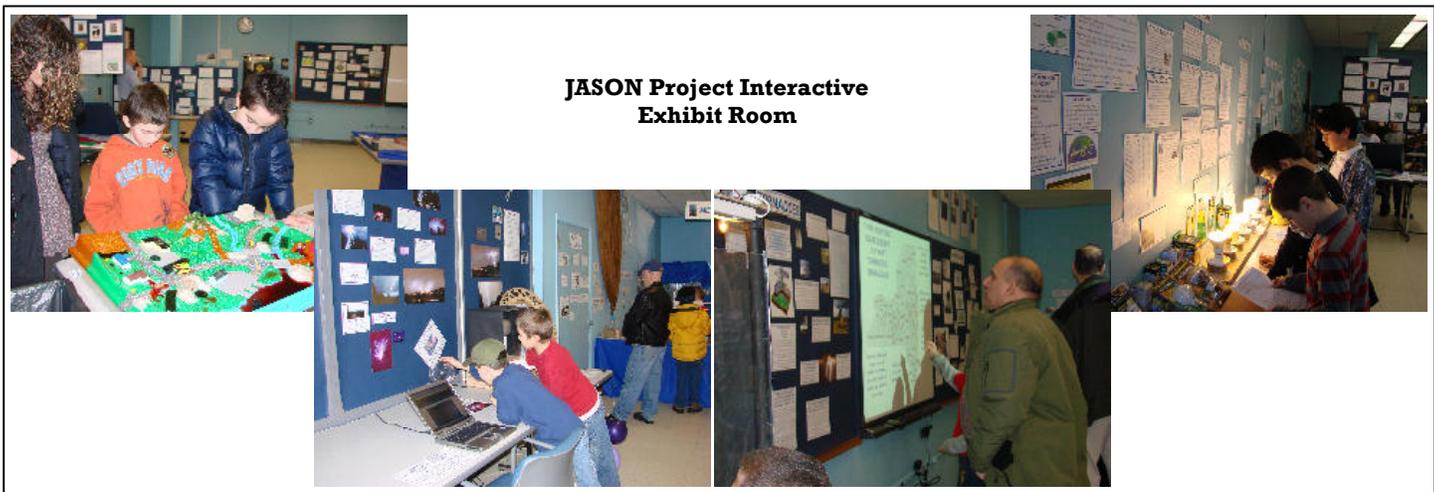
received e-mails from parents telling me about how their children came home from one of our programs all excited about a topic, wanting the parents to help set up experiments and make changes to make their homes more sustainable.

I had a long conversation with Janine Benyus at Bioneers by the Bay and was fascinated by Biomimicry as a powerful way of engaging kids in the world 'out there', opening their eyes to the nature's strategies. Biomimicry links together so many ideas and subjects. It provides new ways of looking at the world as a whole, rather than a collection of isolated parts. The issues we face today need inter-disciplinary, systems approaches, not 'point' solutions. Biomimicry can help facilitate communication across the boundaries of disciplines and specialization.

Biomimicry is also a welcome antidote to the often-negative stories that children hear about current events. It encourages

an innovative, positive and solutions-based approach to problems by opening up a world of possibilities. Nature continually demonstrates that it is possible to act in a sustainable fashion that is at the same time rich and vibrant beyond our imagining. What better way to stretch the imagination and encourage students to continually expand their thinking?

I am working with the Biomimicry Institute to bring Biomimicry into the public schools in southeastern New York through a series of lectures and workshops suitable for kindergarten through grade 12. Students will have an opportunity to learn about nature and Biomimicry through a mix of traditional assemblies, interactive sessions and hands-on exercises. My program is also a co-sponsor of the CELF [Students for a Sustainable Future EXPO'07](#) taking place on April 25 & 26, 2007 in Westchester County, NY. The expo is designed to expose students to sustainable design and business practices.



**JASON Project Interactive Exhibit Room**

The last year has been a turning point for sustainability – suddenly, climate change and our role in driving global warming is front page. After working for years 'in the wilderness', it is great to be part of the mainstream! We just ended our annual JASON Program. This year's theme was Monster Storms and Climate Change. The 1,200 participating students took part in a weather program, a class on *Animals as Meteorologists* and a hands-on, interactive exhibit room built by my staff and myself. The exhibit room is always a very popular part of the student's day.

We also run a Saturday community day in which some 375 people participated. This year, one exhibit in particular received a great deal of interest from visiting adults. It was an exhibit based on a program I present entitled *I'm Only One Person, What Can I Do?* The exhibit offered simple ideas on

how to make one's life and home more sustainable. One woman emailed me because she and her husband are about to renovate their home and she wants to incorporate some of these ideas into their renovation. Now that was gratifying and made our long days of exhibit room construction worth it! I am also receiving requests to develop my *I'm Only One Person* program into an assembly program so that it can reach larger audiences. I am optimistic that this is only the beginning of a shift to a re-connection with nature.

For more information, please contact me.

[Dorna Schroeter](#)  
Coordinator, [PNW BOCES](#)  
Center for Environmental Education





## Calling all Biologists! The 2007 Biologists at the Design Table Workshop

The fourth BaDT Workshop is planned for May 23-29, 2007 at the Theodore Roosevelt Memorial Ranch in Dupuyer, Montana. Led by Janine Benyus, author of *Biomimicry: Innovation Inspired by Nature*, and Dayna Baumeister, PhD, this five-day intensive course trains biologists interested in applying biomimicry to design.

Students will have an opportunity to learn the key concepts of Biomimicry through hands-on exercises with other biologists, engineers, designers and managers. They will take home:

- “A sense of possibility, because sustainable models already exist ... right outside!
- A proven method for bringing nature's ideas to the design table

- Tools and expert contacts for further explorations
- A whole new way of viewing and valuing the genius that surrounds us”

The [December 2006 BioInspired! Newsletter](#) has a number of articles on the 2006 workshop. For additional information, please see <http://biomimicryinstitute.org/edu-badt.htm> or contact me directly by clicking on my name below. All applications must be received by **April 11<sup>th</sup>**.

[Bryony Schwan](#)  
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## The Biomimicry Resource Handbook (*Denise DeLuca*)

*~ a cure for the Monday morning blues*

By the end of a biomimicry workshop – or even at the end of an inspirational biomimicry presentation – you are over-the-top inspired. Biomimicry just makes so much sense! You cannot wait to go back to work Monday morning and change the world, at least your world. But then it hits – the post-inspiration Monday-morning blues. You are bubbling over with biomimicry babble and what you hear in response are things like “Bio-what?” “I guess I don’t get it.” “So exactly how does this benefit the company?” or “Just send me an email and I’ll think about it.” Luckily, you biomimics are resilient and optimistic, so you plow ahead and work on figuring out how to introduce biomimicry into your projects and organizations. You explain it to your colleagues, you give lunch hour presentations, you post cool pictures, you form discussion groups, but somehow you can’t seem to make headway. You wonder if it is you or if other workshop alumni are facing the same seemingly insurmountable hurdles. Sound familiar? If you are wondering, I can tell you from many conversations with workshop alumni (great conversations, by the way!) that most of you are in the same boat.

While immersed in the intellectual explorations of the 2006 Biologist at the Design Table (BaDT) workshop (as a designer), I couldn’t help feeling sorry for all the amazing workshop attendees. The combination of brainpower, creativity, and knowledge running around that room represented a huge potential for action and positive change, but I knew that so many would not be able to realize that potential. I knew, from personal experience, that taking progressive (if sensible)

concepts into the “real world” is a tremendous challenge that most of us are not equipped to face. I thought “If only these guys had a tool kit of some sort... a ‘how to’ book for taking the next steps ...a ‘Biomimicry for Dummies’ manual”. Soon after sharing these thoughts with Janine and Dayna, the concept of “The Biomimicry Resource Handbook” was born.

The purpose of this handbook will be to help you – workshop alums and other inspired biomimetics – naturalize biomimicry into your organizations, your communities, and your personal lives. It will provide strategies and tools for you to introduce, inspire, inform, and integrate biomimicry how and when and where you need to. In it you will find the familiar Life’s Principles, The Biomimicry Method, the design spiral, and many other tools to help you in your quest – things like scripts to help you answer the question “What is biomimicry”, whether you have five seconds to give a crisp answer to your CEO or five minutes to chat with your sister. The handbook will also contain a range of activities from passive to very active, from quickies to longer-term programs, for you to try at every stage of your efforts. In order to keep the handbook adapting and evolving, we hope to initiate a companion web site where new case studies, tools and ideas will be made available.

The handbook is still in the formative stages, so if you have great ideas feel free to email me. I look forward to hearing from you.

[Denise DeLuca](#)





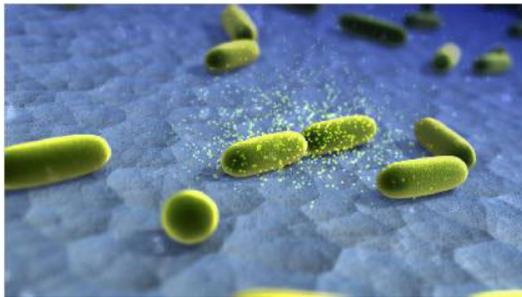
## Signal Jamming in the Fight Against Bacteria (Norbert Hoeller/Peter Steinberg)

In spite of the significant advances in controlling infection through antibiotics, the fight against bacteria is far from won. Chronic infections, such as those involving the middle-ear, are often hard to treat and sometimes require surgery. Infections related to medical devices and implants can require costly hospitalization and possibly additional surgeries. Hospital-acquired infections are on the rise, while the growing use of antibiotics has led to 'super-bugs' resistant to all but the most current drugs.

Until recently, bacteria were believed to be simple, free-floating cells whose rapid multiplication led to infection and illness. Experimental models used to develop and test antibiotics based on these 'planktonic' bacteria are common – they are well known, simple to manage and easily studied. However, bacteria 'in the wild' frequently organize themselves into communities called biofilms. Although first described by Anton von Leewenhoek in the 17th century, biofilms only became a serious field of study in the late 1970s. In contrast to the single cell model, biofilms form intricate

multi-cellular structures of cells, carbohydrates, proteins and DNA, sometimes containing channels to transport nutrients and wastes. Some are comprised of multiple species – biofilms that attack oil and gas pipelines are made up of aerobic (oxygen-tolerant) and anaerobic (oxygen-intolerant) bacteria that in combination can corrode metal.

Biofilms can be from 10 to 1000 times more resistant to antibiotics than free-floating bacteria. Bacteria in biofilms also reproduce slowly – many antibiotics target fast-growing bacteria. Changes in genetic expression of bacteria in biofilms can reduce sensitivity to drugs, and biofilms can physically prevent the antibiotics from reaching the bacteria. Even after an apparently successful course of antibiotics, biofilms may survive and release new bacteria which can then re-infect the individual, requiring yet more antibiotics. Recent research suggests that over 65% of human infections involve biofilms, emphasizing the importance of biofilm-specific treatments.



The insight that bacteria are far from simple organisms is only the beginning of the story. Not only do bacteria organize themselves into complex structures, but they can communicate with each other to engage in coordinated group activity, gaining some of the benefits of multi-cellular life. Bacteria release and detect chemical signals, some of which are specific to species, some common across multiple species. The strength of the chemical signal is related to the number of cells in the bacteria colony – through a mechanism called 'quorum sensing', bacteria detect the density of bacteria and can change their physical or biochemical characteristics by controlling gene expression.

Quorum sensing was first discovered in the early 1970s by Kenneth Nealson and J. Woodland Hastings (Harvard) while studying bioluminescent bacteria in squid. In the 1990s, the AHL signaling system was discovered in other bacteria, including those that cause infections in humans. Since then, additional mechanisms have been uncovered, including the AI-2 system identified by Bonnie Bassler (Princeton) that allows communication both within and between bacteria species. These signaling systems can trigger biofilm production, cause bacteria to become virulent, identify when the bacteria are present in the correct host, and even inhibit

the growth of other bacteria in a form of chemical warfare called "quorum quenching".

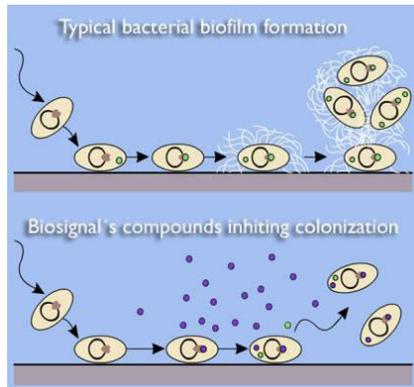
A number of companies are involved in researching and developing products using discoveries in biofilms and quorum sensing. Of particular interest are those that directly affect the quorum signaling mechanism. Quorex was developing AI-2 inhibitors by analyzing the chemical structure of protein targets in the signaling pathways. Sequoia Sciences is creating techniques for high-volume testing of natural plant compounds to determine their ability to inhibit biofilms. Australia's Biosignal Ltd. is researching signal inhibitors from nature.

Peter D. Steinberg, a marine ecologist at the University of New South Wales, is an avid scuba diver. On a diving expedition in Botany Bay with students, he noticed that one species of seaweed, *Delisea pulchra*, was conspicuously free of fouling on its surface. He, along with microbiologist Staffan Kjelleberg and their team discovered that the furanones produced by this red seaweed interferes with the AHL and AI-2 signaling mechanism. Although bacteria might land on the seaweed, they are inhibited from creating a biofilm.



## Signal Jamming (continued)

Biosignal was formed in 1999 as a spin-off from the University of New South Wales and has synthesized over 300 compounds with signal-blocking capabilities, tailored for specific applications. One of these prevented cholera bacteria from switching on their 'virulence factors' which result in the release of toxins. In 2004, Biosignal began work on reducing the build-up of bacterial biofilms on contact lenses. In addition, Biosignal is developing solutions to control biofilm-caused corrosion of oil and gas pipelines, thereby reducing the need for biocides and mechanical cleaning of pipes. Another potential application is a paint for boats that prevents barnacle attachment by inhibiting the biofilms that barnacle larvae use as cues for settlement.



Our understanding of biofilms and quorum sensing opens up new ways to control bacteria. Aside from the direct health benefits in controlling disease and reducing the need for toxic biocides, these techniques have the added benefit that they do not kill the bacteria. The selective pressure induced by signal inhibition appears to be low – *Delisea pulchra* has successfully side-stepped bacterial resistance for millions of years. Even if antibiotics are necessary, smaller amounts are needed – combined with other methods of overcoming the protective effect of biofilms, the incidence of chronic infections due to biofilms can be reduced. These subtle and indirect means of controlling virulence by controlling biofilms can buy time while we develop new antibiotics, and promise to become valuable preventative and curative therapies in their own right.

[Norbert Hoeller](#)

[Peter Steinberg](#)



(Images are Copyright © 2007, Biosignal Ltd.)

## Biomimicry and Educational Innovation (Brian Cambourne)

Since the early seventies I have been seeking an educationally relevant theory of learning, a theory which can inform kindergarten through university teachers about creating learning settings which enable ALL students to learn and apply complex abstract knowledge. I have reviewed thirty years of (so-called) "scientific" research evidence underpinning dozens of learning theories and the hundreds of variants they have spawned. I have complemented these reviews by conducting my own naturalistic inquiries across kindergarten through university classrooms. I have also collected data from homes, backyards, parks, cafes, supermarkets, churches – indeed from any setting in which complex learning can be observed in action.

My incursions into the literature of "evidence-based" learning theories together with my own naturalistic inquiries have emphasized the discrepancies between what Schon (1983) described as "the high hard hill of research based knowledge" and "the soft slimy swamps of real-life professional contexts". After more than thirty years of conducting these reviews and inquiries two things have become obvious. First the multiplicity of theories which educational researchers produce have always been (and will continue to be) too simplistic to be relevant to practitioners. The second is that while it is possible to employ the canons of naturalistic inquiry to develop powerful, practitioner-friendly, educationally relevant grounded theories of teaching and

learning, these seem to have little credibility with the educational policy makers and/or editors of peer-reviewed research journals. No matter how carefully such inquiries conform to the canons of respectable scientific research, neither policy makers or journal editors seem to value them. Only theories which had been "proven" by randomized controlled trials (like those used by medical researchers) seemed to be accorded credibility. After thirty years I was beginning think the development of an educationally relevant theory of education was a futile enterprise.

Fortunately, I discovered biomimicry. Biomimicry has provided me with a new "frame" for pursuing the quest. "Frames" are "mental structures that allow human beings to understand reality" [they] "structure our ideas and concept; [which] shape the way we reason". (Lakoff 2006 p25) Biomimicry helped me realize that I was being influenced by an extremist view of "good science" (the randomized controlled experiment), and used this frame to communicate my message. Locating any conceptual theory within this frame makes it easy for hard-line members of the educational research community to dismiss it as "soft and unscientific".

Biomimicry challenges the assumption that the randomized controlled experiment is the only scientifically valid way of identifying and establishing immutable educational "truths". Benyus' claim "that 3.8 billion years of evolution" provides an



# Biomimicry and Educational Innovation (continued)

ecologically valid standard of the "rightness of our innovations" resonated deeply with me. It provided me with a new frame for establishing the scientific credibility of the theory I was promoting.

### Using Biomimicry to Frame an Educational Theory

What distinguishes *homo sapiens sapiens* from all other forms of life on our planet? Most scientists with a stake in the answer to this question agree it has something to do with our species' ability to:

- i) Create complex knowledge using abstract symbol systems.
- AND
- ii) Apply this knowledge to the everyday problems of species' survival.

Learning one's native language is the most obvious universal exemplar of this ability. Learning how to control the oral language of the culture into which one has been born is a stunning intellectual achievement of incredible complexity. It involves fine degrees of perceptual discrimination. It depends upon abstract levels of transfer and generalization being continually made. It demands that incredible amounts be stored in memory for instant retrieval. It necessitates high degrees of automaticity of very complex processes. Despite this complexity, as a learning enterprise, it is almost

universally successful, extremely rapid, usually effortless, painless, and furthermore, extremely durable. Thirty years of empirically derived learning theories cannot account for this amazing learning enterprise. Instead, the educational research community is forced to invoke a neurological or genetic "hard-wiring/pre-programming" explanation to explain language learning. This argues that pre-knowledge of the complex grammar of all past and future human languages must be hardwired into our genetic structure if we are to explain language learning in terms of currently available learning theories. (Chomsky 1964)

Evolution theory (and biomimicry) strongly suggests that there is more to it than a simplistic, innate "language acquisition device". It argues that the ability to construct complex meanings using abstract symbols is part of the process of natural selection (Deacon 1997, Donald 2001.) The notion that some miraculous genetic mutation, at some time in the distant past, fortuitously produced a gene containing the grammatical blue print of all past, present, and future human languages just does not stand up to evolutionary scrutiny. It makes much more sense to argue that what IS hardwired is the neurological equipment necessary for the construction of meaning using all symbol systems, (not just oral language). The concept of "co-evolution" has significantly more

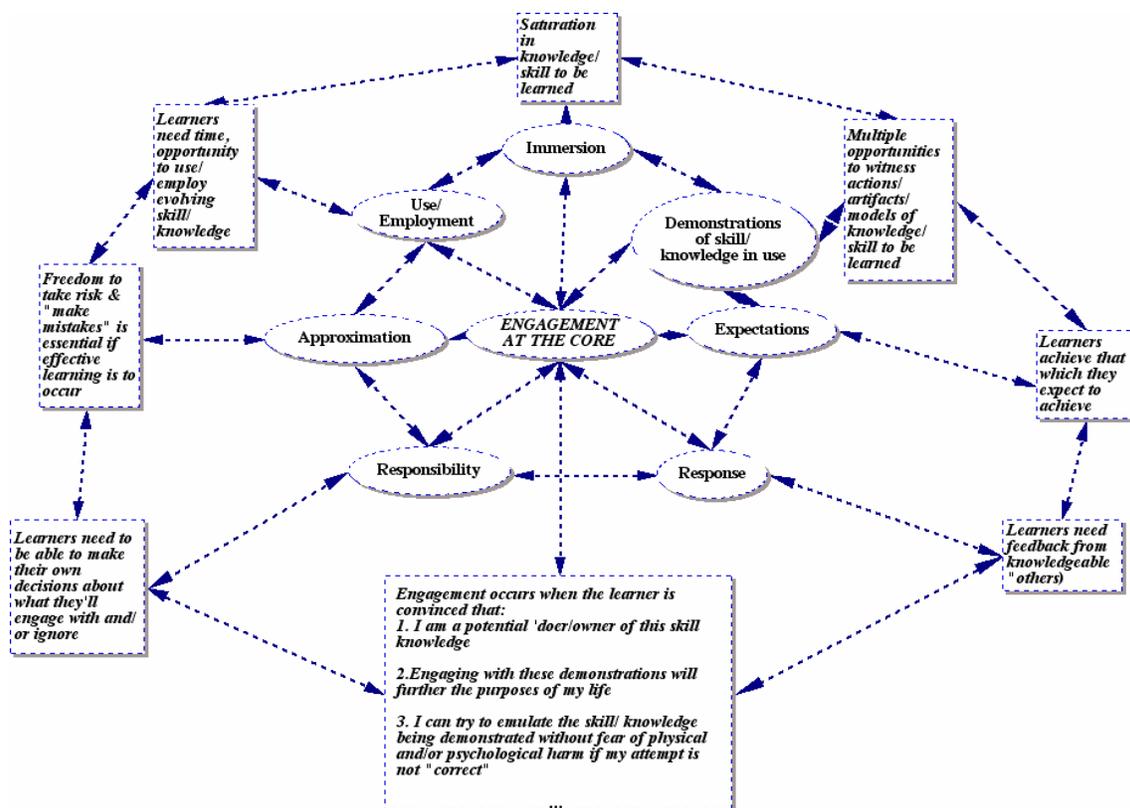


Figure 1: "Nature As Mentor" How complex human learning "works".



## Biomimicry and Educational Innovation (continued)

theoretical support than an innate "language acquisition device". For the last 3.8 million years this neurological hardware has been shaped, refined, and extended by the environmental conditions that best supported *homo sapiens'* survival. Furthermore this "shaping" has not been unidirectional. Our evolving neurological hardware has in turn shaped the culturally appropriate social conditions which nurtured the species meaning-making behavior. The end product of this process is a species (us) which despite its puny body, its lack of speed, teeth, and claws, is currently the most powerful species on the planet.

Why? Because we can create and apply complex meanings. We can learn complex things if the environmental conditions which make such complex learning possible are present in the learning setting. Nature has already worked out what social, cultural and physical factors need to be present in an effective learning setting. Figure 1 shows what they are.

Now all we have to do is sell this theory as "good science". I am hopeful that biomimicry will help me do this.

Chomsky, N. (1964) "Formal discussion of W. Miller and Susan Ervin, 'The Development of Grammar in Child Language'." in The Acquisition of Language 29, no. 1, Monographs of the Society for Research, in Child Development, edited by U. Bellugi and R. Brown, 35-39. Purdue: Purdue University

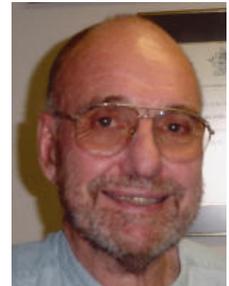
Deacon, T.W. (1997) *The Symbolic Species: The co-evolution of language and the brain.*, NY. W.H. Norton

Donald, M., (1991) *Origins of the mind: Three stages in the evolution of culture and cognition*, Cambridge, MA. Harvard University Press

Lakoff G., (2006) *Thinking Points: Communicating Our American Values and Vision*. New York, Farrar, Strauss & Giroux

Schön, D. (1987) *Educating the Reflective Practitioner*, San Francisco: Jossey-Bass.

[Brian Cambourne](#)  
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## A Call for 'Interest Groups'

I periodically get e-mails from individuals who have been bitten by the 'Biomimicry bug', want to learn more and want to get actively involved. In addition to providing them with pointers to various materials, it would be great to put them in contact with local expertise.

In the spirit of Curt McNamara's article *Seeding and Growing Expertise* in the [December 2006](#) issue of the *BioInspired! Newsletter*, I would like to build an index of local interest

groups involved in Biomimicry or bio-inspired design. I might even try to figure out how to integrate the information with Google Maps.

If you are interested in being a contact, please drop me a note at the link below.

[Norbert Hoeller](#)

## Calendar of Public Events

Date	Location	Event
Apr. 3-4	Glasgow, Scotland	<a href="#">Biomimetics and Biomechanics</a> (Society for Experimental Biology)
May 2-4	Gran Canaria, Spain	<a href="#">Microtechnologies for the New Millennium 2007</a>
May 8	Seattle, Washington	University of Washington - <a href="#">College of Architecture and Urban Planning Lecture Series</a>
May 23-29, 2007	Dupuyer, Montana	<a href="#">Biologists at the Design Table</a>

Date	Location	Event
June 3-6, 2007	Springfield, Massachusetts	<a href="#">2007 SEM Annual Conference and Exposition</a>
July 9-11	Uxbridge, Middlesex, UK	<a href="#">8th International Conference on Ecomaterials</a>
Sept. 20	Bath, UK	<a href="#">BIONIS Conference</a>
Sept. 21	Bath, UK	<a href="#">Biomimetics 12</a>



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"Biomimicry (from *bios*, meaning life, and *mimesis*, meaning to imitate) is a new science that studies nature's best ideas and then imitates these designs and processes to solve human problems. Studying a leaf to invent a better solar cell is an example. I think of it as "innovation inspired by nature."

The core idea is that nature, imaginative by necessity, has already solved many of the problems we are grappling with. Animals, plants, and microbes are the consummate engineers. They have found what works, what is appropriate, and most important, what lasts here on Earth. This is the real news of biomimicry: After 3.8 billion years of research and development, failures are fossils, and what surrounds us is the secret to survival.

Like the viceroy butterfly imitating the monarch, we humans are imitating the best and brightest organisms in our habitat. We are learning, for instance, how to harness energy like a leaf, grow food like a prairie, build ceramics like an abalone, self-medicate like a chimp, compute like a cell, and run a business like a hickory forest.

The conscious emulation of life's genius is a survival strategy for the human race, a path to a sustainable future. The more our world looks and functions like the natural world, the more likely we are to endure on this home that is ours, but not ours alone."

[A Conversation with Janine Benyus](#)

[BioInspired!](#) is published quarterly and is posted on a public-access [Weblog](#) hosted by TypePad. For those of you familiar with RSS Readers, TypePad supports various feed formats (look for the [Subscribe to this blog's feed](#) link in the right navigator).

Comments can be posted on the newsletter Weblog. At this time, the TypePad RSS feed does not deliver comments.

If you wish to subscribe to this newsletter, please complete the [BioFeedback](#) form and check off 'Quarterly Newsletter'.

Last, but not least, please send any feedback or comments to:

[Norbert Hoeller](#)



## Clippings, Resources and Events

Three public-access Weblogs hosted on TypePad are now available to share information of interest to the Biomimicry Community.

- [Clippings](#) contains short articles on issues relating to Biomimicry.
- [Resources](#) contains pointers to more extensive information.
- [Events](#) covers workshops and relevant conferences.

These Weblogs can be viewed with your favorite RSS Reader. Anyone can post comments. Please be aware that TypePad

requires an e-mail address and will display this address to people viewing the comment. Each Weblog has a 'sticky' post at the top with suggestions on how to reduce the impact of getting SPAMed.

Past issues of John Mlade's [BioInspire](#) magazine are posted on ThinkCycle. BioInspire will be migrated to TypePad shortly.

Contributions of clippings, resources and events are greatly appreciated! Please see the note at the top of each Weblog for instructions.

Thanks, Norbert Hoeller