BioInspired!

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The Biomimicry Institute

Biomimicry in Monterrey *(Denise DeLuca)*

Denise DeLuca, Masters of Science in Civil Engineering and LEED-AP certified, recently joined the Biomimicry Institute as 'Outreach Director'. She is also developing a Biomimicry Handbook for the Institute.

"What's the matter Nelly? Do you have a headache from the stress of the workshop?" "No! My face hurts from laughing so much! I think it's time for cervezas!"

That was how we all felt at the end of the two-day workshop held at the Tecnológico de Monterrey, NL, Mexico March 22-23, 2007.

A. Nelly Sandoval

The Tec, as it is referred to locally, is the premier technical university in all of Central and South America and is striving to become an international leader in sustainable design. Nelly is A. Nelly Correa Sandoval, Director of the Cátedra Andrés Marcelo Sada on sustainable development, bat expert, and organizer of the workshop. Nelly and others recognized that Biomimicry had the potential to play a key role in forwarding their goal. To convince any skeptics, they arranged for a representative of the Biomimicry Institute to conduct a two-day workshop on Biomimicry and also meet with administrators and faculty to discuss why and how they should add biology into an already difficult engineering curriculum. Since Tec is a technical school, it was decided that I, as an engineer, would be an appropriate representative. Sichem Rizo Álvarez (who is now Director of Industrial Design at the Tec de Monterrey Campus Aguascalientes) offered to join me to share his knowledge and passion for Biomimicry, help translate, and establish himself as Mexico's contact for Biomimicry.

Sichem and Denise, Biomimicry's newest broadcasters

Students watching from a remote studio classroom

Unlike the intense-yet-intimate sandals-and-shorts feel of the Biomimicry workshops in Costa Rica and Montana, the Monterrey workshop was held in a TV studio where the workshop was broadcast to classrooms on all 34 of Tec's campuses via Virtual University as well as over the Internet. For much of the workshop we were tethered to a table with a newscaster-like background. Anyone wanting to share a thought or question would be handed a microphone and would become the focus of a large camera. In spite of the environment, in no time the small group in the studio became enraptured and animated. They began to see the connection between biology and technology, between biomimicry and sustainability. They amazed themselves (and us!) with their

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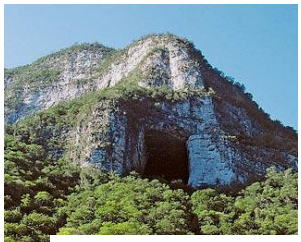
Biomimicry Institute Blooming! (continued)

own innovation during the design challenge. They could envision their biomimetic futures. By the end of the final exercise Friday evening, we were both exhilarated and exhausted. (Then came the much welcomed cervezas…)



Cueva de la Boca

The day after the workshop, Sichem and I joined Nelly and a group of interested entrepreneurs in "hiking up a trail" (it was more like climbing up a forested rock slide) at dusk to experience the emergence of thousands of bats from Cueva de la Boca, a cave for which Nelly and others seek protection (see "To the bat cave! Rescue effort crosses the Mexican border").

We were equipped with masks (to protect us from potentially deadly guano fungal spores) and nets for bat catching, but we soon learned that the cloudy weather caused an earlier-then-usual evening emergence. We did not catch bats, but watched and heard thousands of bats emerging from their looming black cavern, flying and squeaking in a thick stream over our heads (and sometimes zinging past our heads). It was an awesome and unforgettable experience, as was the smell of a cave full of guano! Climbing down that "trail" and crossing a stream in the dark without a flashlight added to our evening adventure.

The workshop and discussions with Nelly and other faculty and administrators left me excited about the role that Biomimicry will play in teaching sustainable design at Tec,

and envisioning how the Biomimicry Institute could facilitate similar efforts at architecture, design, and engineering schools across the U.S. Beyond the Tec, I am also excited to follow-up on the interest expressed in training K-12 biology teachers in Mexico to use the concepts and tools of Biomimicry in teaching biology to the next generation.

Like one of the Cueva de la Boca bats, I felt like a pollinator, making possible the development of many seeds while enjoying the fruits of Mexico.

Denise DeLuca
pollinator, inoculator, incubator

Biomimicry in Sustainable Industrial Design Education *(Carlos Montana)*

Carlos Alberto Montana Hoyos is an industrial designer born in Bogota, Colombia, South America. This proposal is part of his current research for a PhD in Design Theory at Kobe Design University (Japan) under the supervision of Professor Takahito Saiki. The experimental workshop was conducted in the National University of Singapore (where Carlos is a visiting fellow) with second year students of the Industrial Design undergraduate course, during the 2006-2007 academic year.

This article is the edited version of a paper which discusses an integrated approach to sustainable industrial design teaching through the use of ***Biomimicry***. The theoretical background, course curriculum and methodology are described through examples of student work. Although the course was also evaluated and the results analyzed to provide improvements for further development, this article will only briefly describe the pedagogic model and its application.

The main elements of the theoretical proposal were organized and visualized through the use of diagrams . Briefly, the main issues of sustainable design comprise the integration of social, environmental and economic aspects (Figure 1). A general description of the elements and the relationships between them (for the sustainable design pedagogy proposed in this research) is illustrated in the Figure 2.

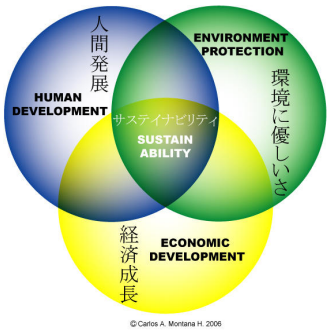


Fig. 1 Sustainability Diagram

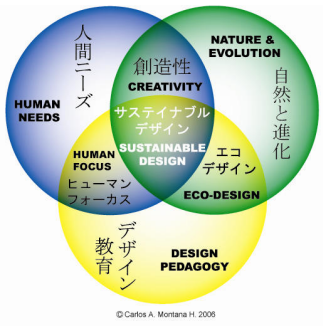


Fig. 2 Proposed Sustainable Design Pedagogy Elements

Biomimicry in Sustainable Industrial Design Education *(continued)*

The main components of the proposed method are the *design pedagogy*, linking the study of *human needs* (social and economic aspects) with *nature and evolution* (environmental aspects). Overlapping areas between these concepts represent *human-centered focus*, *ecodesign analysis*, and the enhancement of *creativity* through this integrated approach.

Biomimicry methodology (Figure 3) was chosen for this proposal as a systemic approach that links nature and evolution, creativity and human needs. In some design and engineering schools, ***bionics*** and ***biomechanics*** have been part of the curricula for several decades. However, these modules are usually very technical, and have no relationship to sustainability or ecodesign issues.

From the point of view of architecture and design, ***Biomimicry*** not only explores the shapes of nature (organic form and biomorphism) and its mechanisms (bionics, biomechanics), but also understands nature as a whole system. It proposes a process of design as an evolution which takes into account the different relationships of parts within a whole, from a micro (cells) to a macro (universal) perspective.

The pedagogic methodology was visualized as a growing spiral, in which the three previous diagrams were interrelated (Figure 4). The model starts from a basis of understanding the elements of sustainability. Afterwards, sustainability is viewed through the filter of biomimicry. Finally, diverse elements related to design are interrelated to provide a holistic view of the complete process.

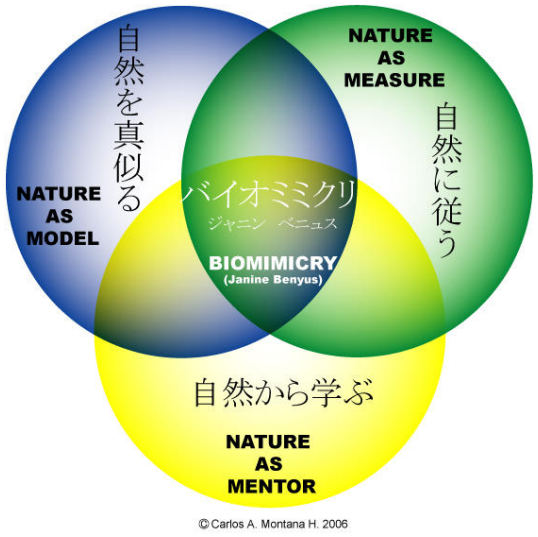


Fig. 3 Biomimicry Diagram (based on J. Benyus' book

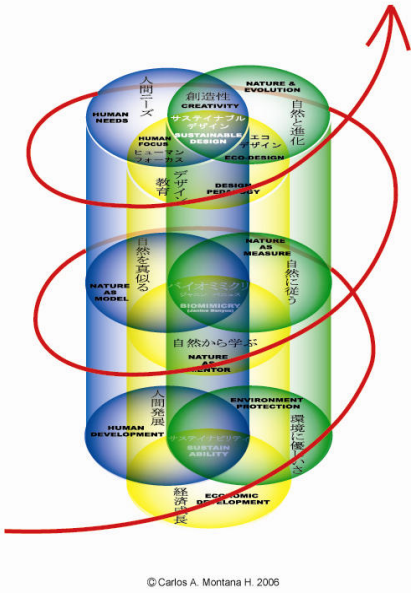


Fig. 4 Learning process of the proposed sustainable design biomimetic methodology

According to this model, the general objective stated for the course was to stimulate an ethical and responsible view of design within our society and the environment.

The awareness and students' sensitivity to the interrelated issues composing the whole spectrum of sustainable development was enhanced by introducing, in an integrated way, different concepts and approaches of bio-inspired, environmentally friendly and socially concerned methodologies that could easily be linked to the design process.

The workshop was divided in two main modules of 6 and 7 weeks respectively (13 weekly sessions in one semester).

Each weekly session had duration of four hours. The first module was named "***design FROM nature***". In order to understand and experience the relationship between design and nature, the initial half of the course explored the methodology of "Biomimicry" through the videos and the use of the methodology from the Biomimicry website.

After studying nature from the point of view of design and understanding human beings as part of nature, the workshop then explored diverse strategies for designing products, systems and services which are friendly to nature and at the same time fit within our economic and social needs. This second module was described as "***design FOR nature***".

Biomimicry in Sustainable Industrial Design Education *(continued)*

An integral and holistic approach to sustainability was encouraged through the study of diverse tools. These tools were chosen within the basic three pillars of sustainability: social, environmental and economic development. In relation to the ***social aspects***, the tools included user focused design methodology and human needs analysis inspired by the classic work of Maslow and the contemporary proposal of Chilean economist Manfred Max Neef. ***Environmental aspects*** included diverse eco-design tools, such as industrial ecology, hierarchy of waste management, life cycle assessment, eco-efficiency analysis, cradle to cradle and ISO 14000, among others. Finally, the ***economic aspect*** was studied through Paul Hawken's book "The Ecology of Commerce, A Declaration of Sustainability" and through the discussion of particular case studies in industry.

The diverse themes of each module were explored through lectures. Basic general and introductory themes were presented either by the author or by a guest lecturer, while particular themes were assigned at random to be prepared and presented by the students.

In parallel to the presentations in the lecture part of the course, a ***practical case study*** was developed in order to apply the learned concepts in a concrete design project. Students worked in groups of three. The initial assignment was to choose a natural element of low complexity and thoroughly analyze it from the point of view of design (shapes, functions, structures etc.). After watching the Biomimicry videos and studying the Biomimicry methodology, students worked on a systemic analysis adapted to their own needs. This analysis included a description of the analyzed natural element and the relationship with its context (ecosystem). A system (for example digestive system) or a specific part of the natural element (shell, claw, feather, etc) could also be chosen for a deeper bionic or biomechanic analysis.

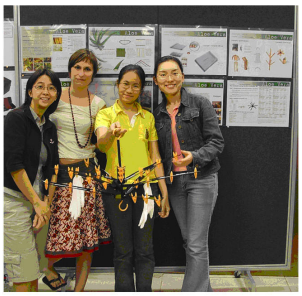


Fig 5. Clothes hanger designed and developed from the analysis of aloe vera plant. The arrangement of the leaves, which maximizes exposure area to the sun, was translated into more space for clothes. (Lu Yang Fan, Pauline Lazareff, Koay Siwei and Mchimon Suwansaksri)

Fig 6. Diving fin and flexible material designed and developed from the analysis of the geometry and structural properties of dragonfly wings. (Lee Wei Chung, Dominic Poon and Sanny Paiman)

This first module finished with the presentation of the analysis and a proposal of three different possible design applications in concept sketches. The presentations included four posters in A3 size and the various study models of the process.

In the second module, students continued working with the same group on the same project, but addressed the design process from a different perspective. Solutions from nature found in the first module were evaluated through different tools (such as questionnaires with a user focused approach) and were associated with concrete human problems, derived from the study and analysis of human needs (according to the alternative methodology proposed by Manfred Max Neef). Students developed and evaluated various concepts, then chose a final solution and developed it as a product. This final solution was finally evaluated and optimized by the use of ecodesign analysis tools, such as eco-indicator 99 .

The only requirement for the project was that they should be able to access the physical element, preferably directly (as the case of a leaf, feather, or shell) or at least indirectly (as in the case of an animal that could be studied in the zoo, for example). During this course, students analyzed tendrils, dragon fly wings, sea shells, ants, bats, pill bugs, Aloe Vera, snail shells, and octopus suckers.

The course produced some very interesting results from the students. Two sample projects are depicted in figures 5 and 6.

Biomimicry in Sustainable Industrial Design Education *(continued)*

Biomimicry as a concept generation and design thinking tool, combined with the study of human needs and eco-analysis methods, can provide a useful integrated methodology for design students to develop and evaluate their own projects with a sustainability focus. Further research aims to refine this pedagogic method, making it easier to understand and applicable in diverse design contexts.

Carlos Alberto MONTAÑA HOYOS

Posting for Instructor, Biomimicry *(Tom McKeag)*

The California College of the Arts has posted the following position:

> Instructor for undergraduate level course, Applied Biology for Designers and Artists. This is a part-time, temporary position requiring three hours of classroom instruction per week and associated administrative and curriculum development time.

All submissions must be received by July 15, 2007.

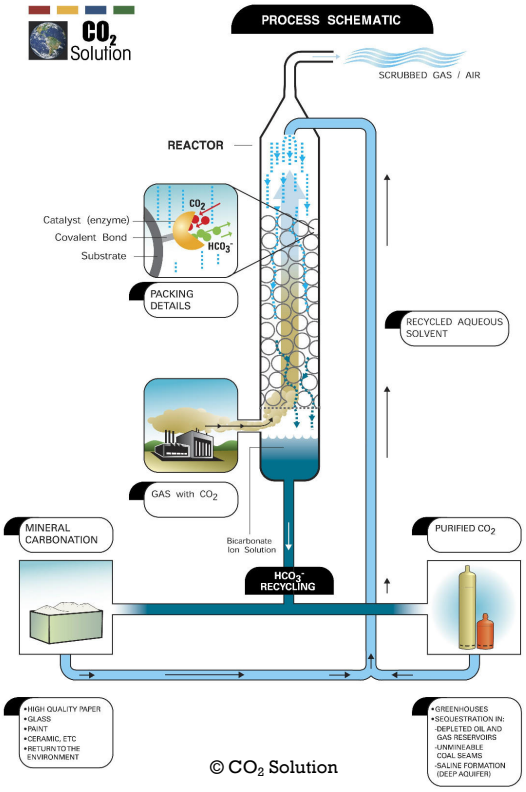
For additional information, please see http://biomimicry.typepad.com/events/2007/06/july_152007_pos.html or contact Tom KcKeag, the current instructor, at tmckeag@cca.edu.

CO_2 Solution and Climate Change *(Dr. Sylvie Fradette)*

(Dr. Fradette is VP of Research at CO_2 Solution. Previously, she was part of the team at Laval University that researched key parts of the solution).

The relationship of greenhouse gas emissions (of which carbon dioxide is the largest component), global warming and climate change is increasingly recognized as one of the major challenges facing the environment and the human species. Ultimately, we need to switch from fossil fuels to renewable and carbon-neutral sources. In the interim, interest is growing on technologies that capture or 'sequester' carbon dioxide at the source and store it safely.

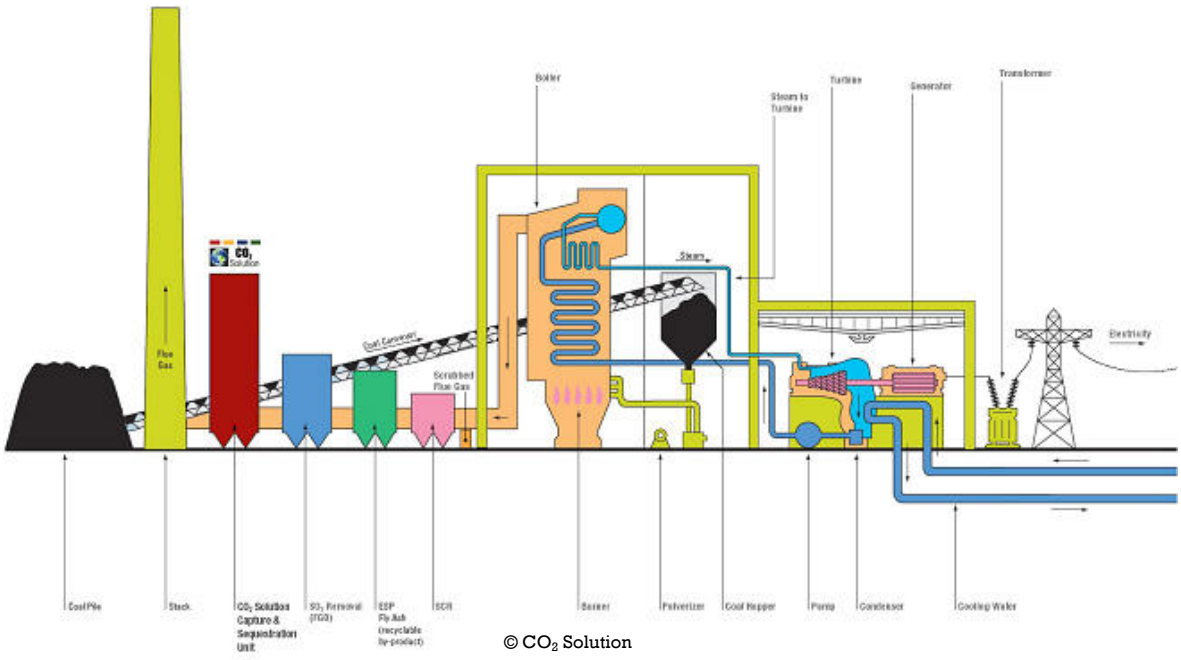
CO_2 Solution, headquartered in Quebec City, Canada, has developed a method of scrubbing carbon dioxide from flue gases using a technology based on natural mechanisms. As a result, the process works at atmospheric pressure and ambient temperatures, increasing energy efficiency. The goal is a system-wide net reduction in carbon dioxide that takes into account any carbon dioxide released in the production of energy required to drive the process, even if that energy is produced from fossil fuels. The process generates stable bicarbonate which is harmless to humans and the environment. The bicarbonate can be converted to a solid for storage or industrial processes. It can also be converted to highly concentrated gaseous CO_2 for industrial applications or storage in depleted oil or gas wells, aquifers, or the ocean depths.



CO_2 Solution and Climate Change *(continued)*

The original idea developed out of research at Laval University around 1995 on the role of the enzyme carbonic anhydrase in the conversion of carbon dioxide to bicarbonates in human muscle tissue. One of the researchers attended a talk at a Space Agency conference that described the challenges of managing carbon dioxide in closed environments, which often involved toxic chemicals that need to be replenished regularly. The researcher wondered if carbonic anhydrase could be used instead. CO_2 Solution was founded in 1997 and signed its first contract in 1998 with Canada's Department of National Defense to control carbon dioxide levels on submarines.

Applying the process to mitigate global warming was an early objective of the team. CO_2 Solution developed a proof of concept in 2000 and a prototype in 2001. The process uses a "packed column" bioreactor, a device that often employed in the chemical industry to remove contaminants from gases or separate volatile compounds from liquids. A gas containing a high concentration of carbon dioxide enters the bioreactor where it is mixed with an aqueous solution. The enzyme within the bioreactor acts as a catalyst, transforming carbon dioxide and water into bicarbonate which is then extracted for further processing. A key part of the process involves immobilizing the enzyme by bonding it to a polymeric substrate within the bioreactor. The enzyme molecules are very small and fragile - using them in a suspension would reduce efficiency and increase cost.



© CO_2 Solution

CO_2 Solution has continued to refine the process to improve yield and reduce cost. For the early trials, the enzyme was extracted from bovine blood. An enzyme modeled on a form of carbonic anhydrase found in human red blood cells is now produced in large quantities using genetically modified bacteria. CO_2 Solution has successfully demonstrated that the process can be scaled up through field trials at an Alcoa plant in 2004 and a Quebec City incinerator in 2005. Carbon dioxide capture rates of up to 80% have been achieved, without any pre-treatment of the flue gases to remove impurities or enhance the carbon dioxide concentration.

Worldwide, 42% of carbon dioxide emissions are believed to come from heating and energy production, with another 25% from industry. CO_2 Solution is aggressively looking for partners in both sectors. Cement plants use large amounts of energy, typically obtained from fossil fuels. The contribution of cement plants to global carbon dioxide emissions is estimated to be nearly 10% that of coal-fired power plants. CO_2 Solution has had discussions with a number of North American and European cement companies and associations.

Due to the abundance of coal, coal-fired power plants will be with us for years. Although great strides have been made in removing many pollutants from these plants, reducing the carbon dioxide emissions has proved elusive, especially in older plants that cannot be easily converted to 'clean coal' technologies. In March 2007, CO_2 Solution signed an

CO_2 Solution and Climate Change *(continued)*

agreement with Babcock & Wilcox to adapt the bioreactor for coal-fired plants. If the pilot project is successful, a full-scale implementation is planned. The opportunities are enormous – US coal-fired power generation is estimated to have released 2 billion tons of carbon dioxide in 2006 alone, one-third of the US total carbon dioxide emissions and roughly equivalent to the entire transportation sector.

CO_2 Solution has been able to develop an effective and efficient process for capturing carbon dioxide by starting with a mechanism that has been 'tried and tested' in nature's laboratory over millions of years. As a result, the industrial process originally inspired by our understanding of human metabolism has retained benign operating characteristics, avoiding the need for toxic chemicals, high temperatures or high pressures. The output of the process can become a valuable raw material for other industries, rather than being treated as a waste, again mimicking cyclical processes in nature. Last, but not least, the process has the potential for making a significant impact on carbon dioxide emissions and global warming, one of the major challenges of the century.

For more information, please see http://www.co2solution.com/ or contact me using the link below.

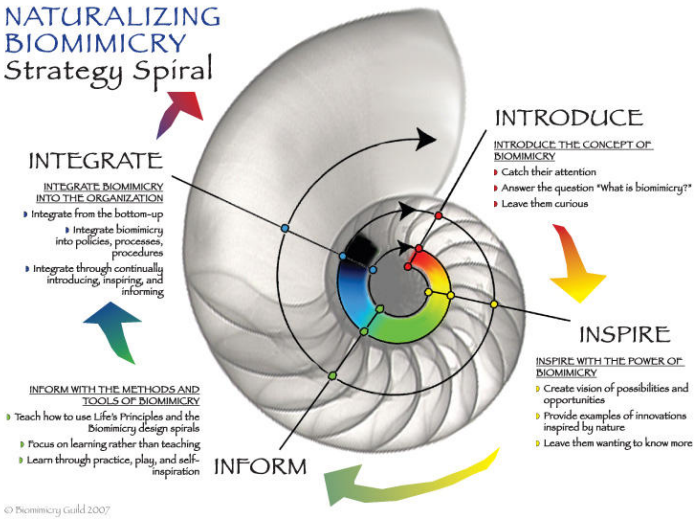
Dr. Sylvie Fradette

A Quick Update from the Institute staff *(Denise DeLuca)*

It's been more than a month since I joined the fun and fantastic staff of the Biomimicry Institute and though we haven't quite figured out what all we are doing, we sure have been busy doing it! There is certainly no shortage of ideas and enthusiasm.

One of my first tasks is to identify and create a database of who's who and what's what in the world of biomimicry among universities and colleges. There are some amazing academics out there doing innovative research and teaching biomimicry -- and even more that want to dive in. My goal is to find out who these people are and what they are doing, and then use this information to facilitate our goal of integrating biomimicry into higher education. Among other things, we want to set up feedback loops to help identify and fill needs, keep people informed and interconnected, enhance opportunities for exchange of ideas and materials (cross-pollination and recycling) … the list goes on. I am also working on identifying the best opportunities for introducing biomimicry into new schools, particularly schools with an engineering focus. If you would like to share information about people or programs that are actively doing or teaching biomimicry at universities and colleges, please send me an e-mail by clicking on my name at the end of the article.

An on-going task is the creation of the Biomimicry Resource Handbook. It is a tremendously creative and challenging project, especially because I have committed myself to applying the biomimicry method and life's principles along the way. I have been working with Amy Kelley at the Montana Environmental Information Center to develop graphics and formatting that will keep the handbook interesting and inspiring. We will let you know as soon as the handbook is ready for distribution. Here is a sneak preview of the strategy spiral for naturalizing biomimicry into your organization.



As the new Outreach Director, I am excited about hearing from many of you and creating new opportunities for all of us to reach out to one another!

Denise DeLuca
pollinator, inoculator, incubator

Age Old Ideas for a New Economy *(Jeff Blend)*

Jeff Blend, Ph.D. in Agricultural Economics, is an economist and energy analyst at the Air, Energy and Pollution Prevention Bureau of the Montana Dept. of Environmental Quality.

If an asteroid hit the planet and threw up enough debris to plunge the earth into a "nuclear winter" for centuries to come, the results would be devastating. Sadly, the cumulative effect of human activity today is having the same effect, destabilizing global climate, rewriting whole ecosystems, and likely leading to the extinction of half of all life on earth this century. Clearly the earth is a victim of humanity's successes, and the result is global ecological instability that could lead to unprecedented crop failures, starvations, mass migrations and economic and political instability.

While past economic strategies have been immensely successful at manipulating environments and resources for human benefit, new strategies are desperately needed to foster truly sustainable economic activity. Specifically, humans need to adopt new business models that mimic natural survival strategies and that emphasize intelligent adaptation of the holistic processes of nature into our everyday lives. We need to comprehensively and completely integrate industrial systems into planetary ecological systems and close the metabolic loops in our economies to redefine 'waste'. In other words, our human economies and the consciousness that built them need to drastically change.

Biomimicry can be used to look at whole systems such as human economies in order to determine how to make them work efficiently and effectively like nature. Biomimicry can help the human economy mimic natural economic models millions of years old that have attained sustainability. The table below outlines three important ways in which our industrialized economy needs to change.

Please contact me using the link below if you are interested in a longer version of the paper.

Jeff Blend

Other resource used:

- *Natural Capitalism—Creating the Next Industrial Revolution* by Paul Hawken, Amory Lovins and L. Hunter Lovins, Rocky Mountain Institute
- *Living Economies for a Living Planet*, David C. Korten

Table 1: Companies, Business Models

Business as Usual	***New Economy using lessons from Biomimicry***
Profit/Competition/Survival Aggressively maximize short-term profits, gain market share and destroy competitors.	Respond to information feedback provided by one's surroundings, creating integrated patterns of adaptation and negotiation that ultimately hold the competition and cooperation of all companies in creative tension and dynamic balance. Use competitors to gain additional survival knowledge or to create a symbiotic relationship.
Throughput More output and profit requires more 'throughput'. Maximize throughput of materials, energy, volume of product, and waste.	Maximize quality and become a provider of services. Instead of selling air conditioners, a business might provide a 'building cooling service' and do so as efficiently as possible. Minimize throughput by maximizing intellectual capital, while still providing best service possible.
Corporate Structure • Hierarchical • Conservative in all aspects • Rigid • Male dominated "Good Ole' Boys Network"	Living Companies based on Arie de Geus' book, *The Living Company*, are sensitive to their environment (e.g. respond to changes in real time), have a unified, comprehensive goal, will experiment at the margins using informational feedback loops for discipline, will let innovators innovate, encourage openness and diversification, are decentralized in power, are resilient and flexible, self-correct, network, seek out stable relationships of mutuality, and orchestrate bifurcation/jumps in response to a changing environment.
Advertising/Marketing • Big Box stores that are price competitive only • Junk Mail/Gimmicks • "Loss leaders" • Cookie cutter business simply trying to lower costs	Businesses find a niche by advertising uniqueness, quality, and reputation. Businesses are place-based (adapted to their locality), stakeholder-owned, and promote work done on a human scale as well as community.

Age Old Ideas for a New Economy *(continued)*

Table 2: Manufacturing	
Business as Usual	***New Economy using lessons from Biomimicry***
Waste Waste is a cost and nuisance and is sent to a landfill.	Waste is an asset and a chance to team up with another company. Waste has a use.
Manufacturing Centralized economies of scale in huge plants.	'Lean manufacturing' which is the elimination of waste in every area of production and where fewer steps are needed in the energy/time/ conservation process. Factories are built to the proper scale.
Product Design Bigger, better, faster, flashy products with no thought of usefulness or surrounding environment. Example: Oversized house with poor insulation, flimsy materials, north facing windows, green lawn, and far from town.	Products and services consider form, structure, and the product's relationship to the larger environment. They use less energy during their lifetime and recycling/reuse is designed into products from the beginning. Beauty and functionality are the same in the product. Example: a house using local materials with minimal "viewshed" impact and ecosystem disturbance, Xeriscaped™ lawn, south facing windows for solar gain, well-placed shade trees, and thermal mass floors.

Table 3: Capitalism	
Business as Usual	***New Economy using lessons from Biomimicry***
Economy Economy increasingly produces and consumes more over time, requiring more complex bureaucracy and greater maintenance. A few people manipulate free markets for their own profit and wealth is increasingly concentrated.	Autonomous agents work together in competition and cooperation, following the laws of nature. Recycling is emphasized as a major economic component closing the loop on waste. Maintenance costs are low, planning time frames are long, intentional symbiosis and patience prevail, and diverse companies in each economical niche are creating embedded multiple levels of organization.
Exports versus Local Economy Economy exists for exports. Export earnings from one or a few main industries are used to meet basic needs, most of which are imported. Example: Detroit's auto industry.	À la Jane Jacobs, *The Nature of Economics*, locally produced, value-added goods are emphasized, resulting in lower transportation requirements, more sophisticated local energy flows, greater money retention in a local area, and less chance of bust if one business/industry goes under. Economic development becomes a complex and robust web of locally oriented economic activities where the flows of energy become slower and more complicated. Examples: Kalundborg eco-industrial park and Wheat Montana.
Sledgehammer versus soft approach to economic issues • Bomb and drill, nuclear energy • World Bank • Bigger highways (The Big Dig), more roads, greater budgetary requirements • Build new coal generation plants adding to greenhouse gas emissions • Industrial farming and grazing • Lobbying, military action, subsidies, trade quotas, more rules.	• Renewable energy • Grameen Bank • Decrease maintenance costs of society with better planning, increased energy efficiency, green buildings and smart land use planning • Solar ovens, CFLs, distributed generation, fuel cells, on-site and neighborhood micro-power, passive solar heating and cooking, wetland water treatment, plant trees, wind and solar power • Permaculture, Holistic Resource Management • Use leverage points in the system à la Donella Meadows. Examples include manipulating the size of buffers in the economy, understanding system limitations and bottlenecks to refrain from straining capacities, reducing or slowing the growth of positive feedback loops (birth control), using negative feedback loops, and changing the goals of a system.

"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: short articles relating to Biomimicry.
- Resources: pointers to more extensive information.
- Events: workshops and relevant conferences.

These Weblogs can also be monitored 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

Calendar of Public Events

Date	Location	Event
July 9-11	Uxbridge, Middlesex, UK	8th International Conference on Ecomaterials

Date	Location	Event
Sept. 20	Bath, UK	BIONIS Conference
Sept. 21	Bath, UK	Biomimetics 12