

Biomimicry's Life's Principles

Evolve to Survive

- ✓ Replicate strategies that work
- ✓ Integrate the unexpected
- ✓ Reshuffle information

Be Resource (Material & Energy) Efficient

- ✓ Use multi-functional design
- ✓ Use low energy processes
- ✓ Recycle all materials
- ✓ Fit form to function

Adapt to Changing Conditions

- ✓ Maintain integrity through self renewal
- ✓ Embody resilience through variation, redundancy, & decentralization
- ✓ Incorporate diversity

Integrate Development & Growth

- ✓ Combine modular & nested components
- ✓ Build from the bottom up
- ✓ Self-organize

Be Locally Attuned & Responsive

- ✓ Use readily available materials & energy
- ✓ Cultivate cooperative relationships
- ✓ Leverage cyclic processes
- ✓ Use feedback loops

Use Life-Friendly Chemistry

- ✓ Build selectively with small subset of elements
- ✓ Break down products into benign constituents
- ✓ Do chemistry in water

Using Nature-Based Strategies to Solve Environmental Challenges

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The tightly-knit forests, corals, and grasslands of this planet are the envy of all of us who thirst for a sustainable and equitable world. As communities, they not only create, but continually heal and enhance their places, our places, too.

What better models could there be?" Janine Benyus : Biomimicry Handbook, 2012

A truly sustainable model: Where do you look for models of sustainability? How about just outside your front door. In 2012, a group of local, state and federal government scientists and engineers, along with innovators from the private sector, were asking the same question. The one thing they had in common was the desire to explore and the courage to look in a new direction. Brought together by the promise of biomimicry, these innovators took a deep dive into the world of biology to find answers to some pressing environmental challenges.

Government organizations have a unique set of resources and perspectives that can be used to solve organizational and environmental problems, but are often stifled by the bureaucratic systems they work in. We know that sustainability requires more than just a mechanical adoption of new policy requirements. To be successful, a fundamental reframing of problem solving activities is needed. Asking the question, "*What would Nature do here?*" reframes the way we look at a problem, while bringing us into right relationship with the rest of the natural world. One advantage of this approach is that we know it is possible, the models are organisms that manufacture without "heat, beat, and treat" and ecosystems that run on sunlight, manufacture in water, depend upon effective feedback loops, and actually create opportunities rather than waste.

What is biomimicry? Biomimicry is the conscious emulation of nature's genius. It is a way of seeking sustainable solutions by borrowing life's blueprints, chemical recipes, and ecosystem strategies. This approach implies forethought, actually seeking nature's design ideas before something, a product or process, is designed. The intent is to fulfill human needs with ideas that will fit within the natural systems on earth, designs that will follow Life's Principles (see sidebar). Life's Principles are a set of operational strategies that all organisms, except humans, follow in order to fit in on planet earth. Human designs that meet Life's Principles will likely emerge as well adapted to the local conditions and ensure that the solution has been designed with nature in mind. Evaluating using Life's Principles is a way for humans to critique the appropriateness of our designs as well as check for missed opportunities. This approach provides a higher standard than conventional measurement tools such as those for quality, safety, and compliance.

This workshop provided an opportunity to use the biomimicry methodology, a systematic approach to extract these sustainable strategies, and shift from learning about nature to learning from nature. Using Life's Principles and the biomimicry methodology we strive to emulate more than just the look or form found in nature, but rather uncover her deep design principles and living lessons. This approach recognizes that nature has discovered, after 3.8 billion years of evolution, how to do everything we want to do as humans and do it in a way that creates conditions conducive to all life. Here is how these innovators took the risk to reframe their problems and look to nature for sustainable solutions.

Biomimicry Workshop 2012

Biomimicry Practitioners

Team Communicate:

- ▶ John Brink, Natural Scientist
- ▶ Diana Hammer Life Scientist
- ▶ Deirdre Hanners Engineer
- ▶ Greg Varhola Graphic Designer

Team Adaptors:

- ▶ Laura Farris Engineer
- ▶ Sarah D. Hayes Possibility Cartographer
- ▶ Kirk Mills Engineer
- ▶ Margot Smit Mediator
- ▶ Lynne Sullivan Biologist

Team Organize:

- ▶ Doug Beall Architect
- ▶ Rachelle Meyer Biologist
- ▶ Mary Wagner Designer
- ▶ Ailsa Wonnacott, NGO Executive Director

Team H2O:

- ▶ Sarah Baker Engineer
- ▶ Mary Blanchard Engineer
- ▶ David Conner Engineer
- ▶ Greg Hill, student Environmental Studies
- ▶ Myla Kelly Biologist

The U.S. Environmental Protection Agency Region 8 had the foresight to encourage and support one of their innovative engineers as she went through the 2 year course of study to become a Certified Biomimicry Professional in 2010. EPA's goal is to spread the word about this new science and to expand expertise across the public and private sector. Hosting a biomimicry workshop was the first step in educating interested individuals. To find the right solution, biomimicry must be practiced with an interdisciplinary mindset and approach, including biologists, engineers, designers, and business people.

Environmentally focused government agencies have a wide range of scientists and engineering experts on staff. They often lack the business and design perspective found in private sector companies. To address this deficiency, EPA sought individuals who were interested in exploring a more connected approach to problem solving. An offer to participate in a low-cost biomimicry workshop was answered by small business owners, a local university student, and a non-profit organization. By including the expertise of the private sector, workshop participants were able to form four multi-disciplinary teams (see sidebar) and allow for increased access to information, experiences, understanding of the challenges, and a diversity of strategies that could be applied as solutions. This approach also served to expand the understanding of the system beyond that of the public work force.

Success with biomimicry is more than just a set of steps to find the right solution. It requires a change of mindset, a renewed connection to nature and a proven methodology. Workshop participants chose this approach because they already have a deep seated respect for Nature and understand that she represents a truly sustainable model. To support and expand this belief, activities designed to reconnect to the outdoors were encouraged. These activities, called iSites, are intended to develop observational skills, a practice of just being in nature and observing how she works. Observing the natural world, and deepening their understanding of what they see through reflection, sketching, journaling, and sharing, served to expand this connection. Sitting quietly in a chosen natural place, participants undertook iSite activities such as tracking changes over time, looking for multi-functional designs and considering their business as an ecosystem.

The challenge teams learned the biomimicry methodology via six 2-hour monthly webinars, from March through August, 2012. Each session provided information on the next step in the biomimicry methodology and included Team homework assignments and instructions on completing that step. Team progress was shared and discussed in the following webinar. Because nature cannot be studied through computer interaction alone, an in-person session in the natural environment of the Great Sand Dunes National Park and Preserve was scheduled for 3 days in September. This gave Teams an opportunity to meet in person, to conduct iSite exercises in the natural setting, and consult with experts in using nature-based designs. Taryn Mead, of Symbiosis, a Biologist at the Design Table (BADT) and Jason Gerhart, of Real Earth Designs, an expert in permaculture and natural water systems design, and Fred Bunch, Resource Manger for the Great Sand Dunes NP&P provided this guidance and support. Humans are not the first organisms to have to address current issues of our time. The challenges that were identified by the workshop participants have been done for billions of years by other organisms, and done in a way that fits into life on earth. In this workshop the four teams asked Nature:

- How can we develop an organizational structure that can adapt and evolve over time?
- How can we create community?
- How can we design water systems that use low energy processes?
- How can we adapt to changes in climate?

Biomimicry Methodology



SCOPING PHASE: A preliminary identification of the problem and the contextual issues surrounding it prior to designing a solution.

It is a means to define the challenge, create a vision and identify the context of the problem. In this phase we looked at the overall function(s) that we were trying to achieve. For example, Team Communicate initially wanted to develop a better system to communicate environmental messages to the employees of Grand Canyon National Park. In the scoping phase, they realized

that communication about sustainability actions was pretty good; the REAL barrier to taking steps necessary to change to more sustainable actions was that some employees did not feel that they were part of the park community. *How does Nature foster communities that thrive?* became their new challenge. By identifying the context, *“How does Nature perform this function here – in this ecosystem?”* additional information was gathered.

CREATING PHASE: An exercise in finding creative design solutions for your challenge and searching for the sustainable design solutions in nature. Many ideas on how to solve their challenges were identified by each Team. By asking the question *“How does Nature perform this function?”* they were able to expand their brainstorm list and add the strategies used by nature as well. The research methodology used consisted of initiating phone meetings with each of the four teams and the EPA student intern Nessly Torres. Once Teams identified their function, and translated their request into biological language, research was conducted using different resources such as AskNature.org and scientific databases from universities and from the EPA library database. This research provided a suite of information on how the function was achieved by nature. An additional step, abstracting, is also necessary. Abstracting includes two components: distilling the biological mechanisms and translating them into design principles. Accurate distillation of the biological mechanism is a difficult yet important step. One lesson learned on how to overcome the barriers encountered during research was to have a good mix of members with curiosity and good communication skills.

EMULATE and EVALUATING PHASE: An exercise to measure and evaluate the design solution and audit for missed opportunities. Teams compared their abstracted strategy solutions to the Life’s Principles check list. Designs that follow Life’s Principles will likely emerge as well adapted to the local conditions. During the in-person session, Teams had an opportunity to consult with biological experts Taryn Mead, Jason Gerhart and Fred Bunch. These scientists provided a biomimicry lens to view their proposed solutions and provided guidance on how to organize their data and develop a final product that will be useful for their audience. For example, Team Organize had discovered numerous strategies that nature uses to organize and was having difficulty in deciding on a format for applying this information to organizational challenges. Taryn suggested that they could share all of these strategies via a set of Organizational Cards. The Team developed a game that expanded on this suggestion and provides a structured approach to apply the strategies to any organizational challenge.

THANK NATURE: Thank your teacher for the inspiration. The in-person session, as well as the habits developed during the iSite exercises, provided the participants with an opportunity to appreciate the genius of nature and thank her for her insights.

*“Biomimicry
is the
conscious
emulation of
Nature’s
genius”*

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This final report and the final products from each of the Biomimicry Teams is posted on their web site at:

peakstoprairies.org

Peaks to Prairies is part of the P2RX™ national network of regional centers dedicated to improving the dissemination of pollution prevention information in the service provider community.

Next Steps

The tipping point for biomimicry is when enough people try accessing Nature's genius and have the *AH-HA* moment when they realize it really works. Instilling this new perspective within government and private organizations will serve to accelerate the shift to embed biomimicry into our culture. The Biomimicry Practitioners who completed the workshop not only solved their environmental or organizational challenges, they discovered the value of multi-disciplinary team work, learned how to quiet their cleverness and connect with Nature and practiced a methodology to identify new ideas from Nature. They underwent a paradigm shift and changed how they view Nature: not as a warehouse of resources, but rather as our teacher.

From this overview of the biomimicry Workshop 2012, think about how biomimicry could help solve the problems your organization faces, visit Asknature.org and <http://biomimicry.net>, and don't forget to thank our oldest, and wisest, teacher — Nature!

Resources:

Biomimicry, Innovation Inspired by Nature, Janine Benyus (1996)

Biomimicry Resource Handbook, Biomimicry Group 3.8, 2012

