Biomimicry – Nature Inspired Design:

What is Biomimicry?

Janine Benyus describes biomimicry as "learning to live gracefully on this planet by consciously emulating life's genius. It's not really technology or biology; it's the technology of biology. It's making a fibre like a spider, or lassoing the sun's energy like a leaf." Designing for sustainability is also important to biomimicry thinking.
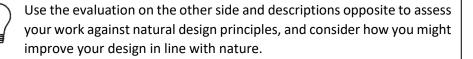
It's this kind of thinking that's inspired some remarkable designs in recent decades, including a Japanese bullet train partially modelled after the aerodynamics of the kingfisher bird; a shopping centre in Harare, Zimbabwe that mimics the cooling strategies of a termite mound; and a synthetic surface called Sharklet that inhibits bacterial growth through texture alone, inspired by the bacteria-repellent skin of a shark.

Here are the nine Basic Principles of Biomimicry that we are working with. They are very simple, but once you unpack them you discover they lead everywhere. For more information on these principles see opposite.

1. Nature runs on sunlight
2. Nature only uses the energy it needs
3. Nature fits form to function
4. Nature recycles everything
5. Nature rewards cooperation
6. Nature banks on diversity
7. Nature demands local expertise
8. Nature seeks balance
9. Nature taps the power of limits

It is possible to use these principles as starting points for design, or as a way of checking our design work and then making improvements.

How does your work assess against these nine principles?

Use the evaluation on the other side and descriptions opposite to assess your work against natural design principles, and consider how you might improve your design in line with nature.

The Nine Principles of Biomimicry
Adapted from the work of Janine Benyus

Nature runs on sunlight: Nature uses sunlight as the main source of energy. Organisms use heat and UV radiation from this never-ending source. We can say that nature is powered by sunshine. Humans use fossil fuels, these sources are not renewable, and burning them creates CO_2 which is one of the gases causing climate change. Why don't we do the same and prevent the climate crisis? A wise person would mimic nature and rely on renewable power.

Nature uses only the energy it needs: Nature takes only what it needs. Why do we not do the same? Our economy is focused on maximizing output and is a big energy consumer. We transport food around the world because that is economically cheaper. Only money seems to count in a lot of decisions, not energy consumption and impact on the natural world. How can we learn to optimize the performance of goods and services to sip energy rather than gulp it?

Nature fits form to function: A tree is rooted in the ground to draw water and nutrients from the soil; it spreads its branches and leaves wide to increase surface area and absorb sunlight to produce energy and grow. Seeds are lightweight and some even come equipped with a sort of umbrella so they can float in the air. Nature creates designs for the function they provide, so should our buildings, transportation systems and schools.

Nature recycles everything: There is no 'away' to throw things. Everything produced in nature is biodegradable, there is no waste. There can still be abundance, look at all the blossom on a cherry tree; but that all serves a purpose and will be food and nutrients for others. Once the natural life of a pinecone has come and gone, it breaks down into essential elements that are repurposed into new life.

Nature rewards cooperation: We see competition in nature, but only when it is impossible to avoid; in general competition costs too much energy. On the other hand, very little in nature exists in isolation. Plants cooperate with pollinators to disperse seeds, and the pollinators feed on nectar. Ladybirds feed on aphids and help plants to stay healthy. Nature favours cooperation because it maintains the health of the whole system.

Nature banks on diversity: Diversity is one of nature's best insurance policies. When one food source is unavailable, others can be found. Plants use several different strategies to spread seed or defend against predators. We know that species with limited genetic diversity have more difficulty adapting to environmental change, and that ecosystems rich with diversity are more stable.

Nature demands local expertise: Nature's systems are inherently local. Certain species thrive under specific conditions; local and regional weather patterns matter, as do other conditions such as soil, air quality and water temperature. Relationships are created locally and local resources are used. Of course, some birds travel long distances but have you seen them take their food with them?

Nature seeks balance: Ecosystems try to keep in balance. More mice? Then you will see more owls to feed on the mice and keep the population in balance. Forest fires are a great example of a natural phenomenon that renews and refreshes, reducing excessive growth and allowing for regeneration. Every natural system has a tipping point, a carrying capacity or a state of disequilibrium that triggers a change to a different state.

Nature taps the power of limits: Unlimited growth on a finite earth is not a good idea. All living things are governed by limitations; age, climate, population density and many other factors determine how species and systems develop. Nature has found ingenious ways to work within these limits to be as productive as possible over the long run.

Product or Project Name: …………………………………………………………………………………………

Desired Function / Concept: …………………………………………………………………………………..

Q1: Based on the nine principles of biomimicry, this is close to how nature would design this product/project.

STRONGLY AGREE	AGREE	NEITHER AGREE NOR DISAGREE	DISAGREE	STRONGLY DISAGREE

Q2: Looking at your design and comparing it to the nine principles of biomimicry, in which areas is it strongest? **Why is this the case?**

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Q3: Which areas are weakest? **Why is this the case?**

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Q4: Think of one practical way you can improve your design.

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Improving your design.

Consider how you might use the nine principles of biomimicry described overleaf to improve your design. How might nature go about designing the product or function you are trying to produce?

TASK: Use the diagram below to plot how your product achieves in relation to each biomimicry principle of design. Use this to consider the strengths and weaknesses of your design.

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Nature fits form to function

Nature recycles everything

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Nature runs on sunlight

Nature banks on diversity

Nature taps the power of limits

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Nature demands local expertise