BIOMIMICRY BRAINSTORMING IN-A-BOX

BIOMIMICRY 3.8

BIOMIMICRY 3.8

Biomimicry.net | Synapse.bio

"After 3.8 billion years of evolution, nature has learned what works, what is appropriate, and what lasts here on Earth."

~Janine Benyus
Biomimicry 3.8 Co-founder

Instructions

This deck of cards is designed to help facilitate a *biology to design* brainstorming process in biomimicry. Bring your creative minds and some colorful markers—everything else you need to support your ideation can be found in these cards and digital download files. Complete facilitator instructions are found in the digital download packet.

1. Review Purpose-Outcome-Process
2. Give each table Concept Board worksheets, 3-4 Nature's Technology Summary (NTS) Cards, and Brainstorm Map sheets.
3. Let each group review the biology on their NTS cards before starting.
4. Prepare the Riffler set so that you can choose each combination for each round of brainstorming.

5. Each table should choose an NTS card prior to hearing the Riffler card set.
6. Participants brainstorm using the map at each table.
7. Individuals capture concepts on their Concept Board worksheets. Each round should generate a minimum of 3 concepts.
8. Repeat steps 4-7 for as many rounds as you like. For added diversity, tables can swap NTS cards or people.
9. Choose the vetting process most applicable for your setting and select the best concepts to advance forward.
10. Celebrate your expanded minds and thank your biological mentors.

Time

To run the full-process for a real challenge, a full-day is recommended. If you are just experimenting and playing with the deck, a minimum of 1 hour will be necessary, but 2-3 will yield better results.

Set Up

Find a room that supports creative thinking—natural light, views towards nature, minimal clutter, open & white walls, big tables, healthy brain snacks & chocolate!

Materials

Biomimicry Brainstorming-in-a-Box card deck with chosen topic cards, fine markers/ pens with multiple color options; printed out Concept Boards (min. 10/individual); printed Brainstorm Map sheets (1/team/round); voting dots for vetting (optional).

People

The set can be utilized by an individual, but will yield far richer outcomes with a diverse group. A group of 10-15 is an ideal size for one card deck, and should come from mixed disciplines to yield the most creative concepts.

FACILITATOR QUICK GUIDE
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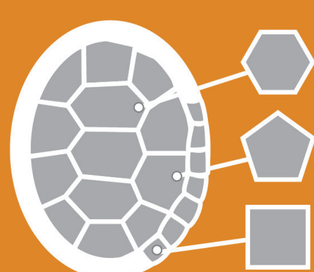
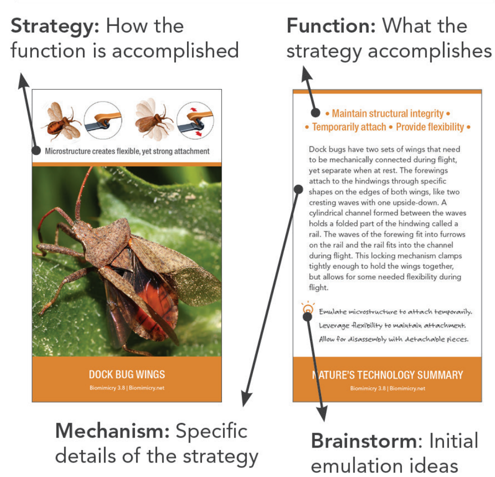
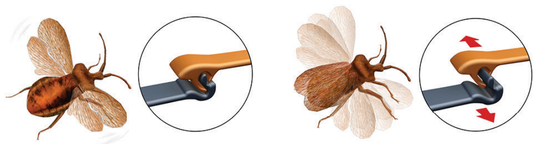
Nature's Technology Summaries



The following cards represent a collection of biological strategies that have high relevance in the realm of packaging. Each card contains necessary information about the biology to inspire and inform a biomimetic concept. With the support of the Riffler Cards, many concepts can be generated from a single biological strategy.





Microstructure creates flexible, yet strong attachment

DOCK BUG WINGS

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• Maintain structural integrity •
• Temporarily attach • Provide flexibility •

Dock bugs have two sets of wings that need to be mechanically connected during flight, yet separate when at rest. The forewings attach to the hindwings through specific shapes on the edges of both wings, like two cresting waves with one upside-down. A cylindrical channel formed between the waves holds a folded part of the hindwing called a rail. The waves of the forewing fit into furrows on the rail and the rail fits into the channel during flight. This locking mechanism clamps tightly enough to hold the wings together, but allows for some needed flexibility during flight.

Emulate microstructure to attach temporarily.

Leverage flexibility to maintain attachment.

Allow for disassembly with detachable pieces.

NATURE'S TECHNOLOGY SUMMARY

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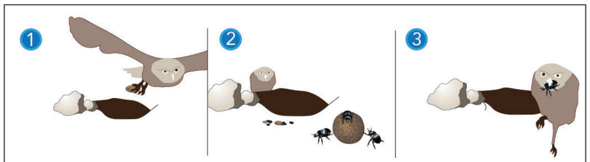

Concentrate desirable resources
to lure higher value resources

BURROWING OWL

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• Attract resources •
• Send signals • Leverage waste •

Burrowing owls nest and roost in underground burrows. A prized food are dung beetles, which can be elusive. To lure their prey, burrowing owls find discarded dung and place it around the opening and within their burrows. Dung beetles are attracted to the scent of the dung, which they consume and use for breeding chambers. As the unwitting beetles arrive to roll away the "waste," the burrowing owls pick off an easy meal. By leveraging a readily available resource, the owls get access to one that is far rarer.

Revalue resources by changing their location.

Use incentives to alter the flow of resources.

Leverage waste to attract more desirable resources.

NATURE'S TECHNOLOGY SUMMARY

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Cell shape allows expansion

BARREL CACTUS

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• Maintain structural integrity •
• Collapse • Expand • Store water •

Cacti are known for living in dry conditions with infrequent precipitation. Their drought strategy is to store large quantities of water in their tissue. The cactus has outer and inner layers composed of rigid and smooth cell walls. A third cell layer between the two consists of collapsible cells that are wrinkled, allowing the cells to change in volume without changing surface area. When water becomes scarce, the collapsible cells forfeit water to the more rigid smooth cells. This allows the plant to maintain its structural integrity despite changes in ambient water availability.

Use deformable shapes.

Vary layer characteristics to support expansion.

Leverage rigid and soft shapes.

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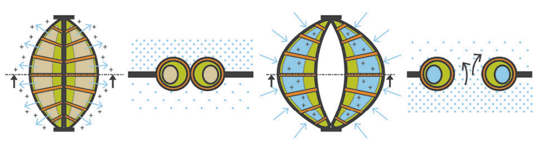
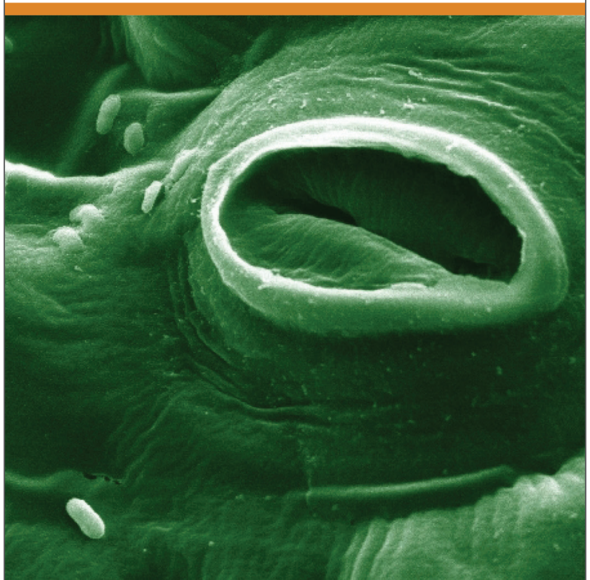


Valve opens/closes in response to moisture



LEAF STOMATA

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• Respond to cues •
• Change shape • Regulate flow •

A leaf cools by releasing water vapor into the air through its stomata—self-regulating pores on its surface that control water vapor and gas exchange. Moisture-sensitive guard cells regulate the opening and closing of the stomata. Water is drawn into the guard cells by osmosis, filling a special pocket. The swelling pockets causes each of these two guard cells surrounding the pore to change shape and open the stomata. Conversely, guard cells contract with loss of water to ambient air and seal the opening, inhibiting further water loss from the leaf.

Use shape-shifting smart materials.

Adjust components to vary function.

Regulate transmission properties by changing shape.

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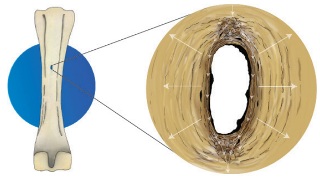

Orient fibers to direct stress away from weak areas

HORSE FORAMEN

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• Maintain structural integrity •
• Manage forces • Prevent cracks •

A half-ton horse exerts tremendous pressure on its leg bones, yet they don't break, even around the foramen, a functional hole and often a structural weakness in bones. Horse bones are composed of cylindrical structures packed tightly together. Cement-like rings circle the structural bundles. The cylindrical structures orient along the length of the bone, but around holes, they lie tangential. The tangential cement rings stop crack propagation around the hole and direct stresses away from into reinforced regions of bone.

Divert forces to protect weak locations.

Prevent stress fractures by dissipating energy.

Manipulate orientation of microstructures to reinforce holes.

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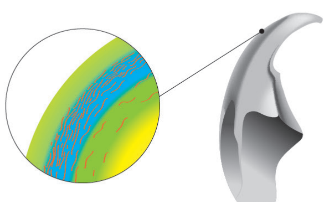
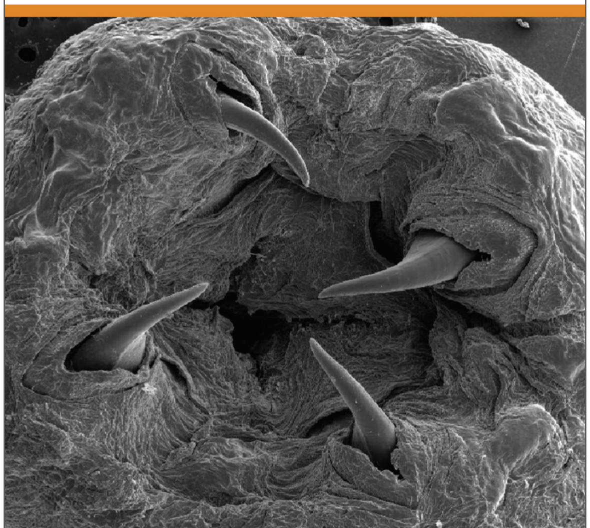


Material gradation changes physical properties



BLOODWORM

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• Manage mechanical wear •
• Maintain integrity • Be hard yet flexible •

Marine bloodworms have some of the hardest jaws in the animal kingdom. The tip of each jaw must be stiff and hard for piercing prey and abrasion-resistant to the sand in which it lives, while the rest of the jaw must be relatively flexible to prevent cracking. By leveraging a concentration gradient of unmineralized copper in a cross-linked scaffold of melanin and protein, each jaw can be both hard at the tip and flexible at the base without having a weak point that would otherwise occur if two dissimilar materials (hard and soft) were joined together.

Resist abrasion using layered composites.

Leverage scaffolds of softer materials to hold hard materials.

Create multi-functionality with material gradation.

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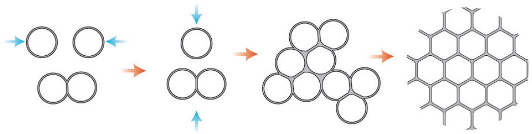
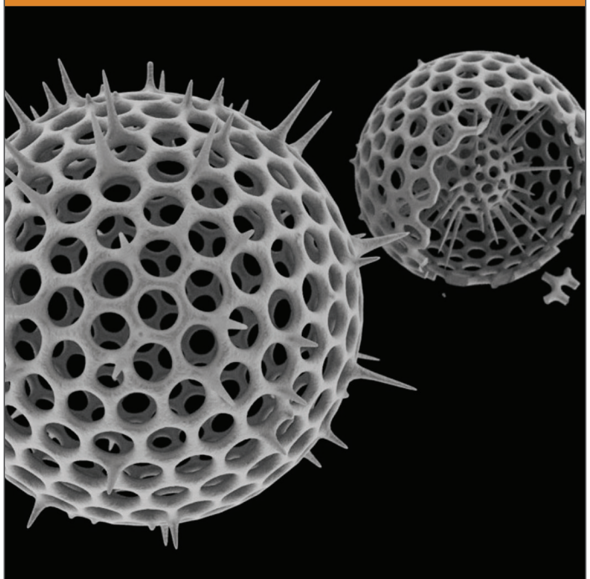


Optimize structural design using responsive framework



RADIOLARIAN

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• Self-assemble • Build to shape •
• Optimize distribution of forces •

Radiolarians are single-celled marine organisms with glass skeletons. They leverage the packing geometry of bubbles to template their designs. Packing bubbles create a series of polygonal shapes where each unit meets. Where these polygonal boundaries occur on the outer cell wall of the organism, specialized proteins trigger biomineralization of silica from seawater, self-assembling an optimized amorphous glass structure. Growth is attuned to local forces, with greater external forces resulting in smaller bubbles and ultimately a denser, stronger skeleton structure.

Minimize materials using optimized structure.

Attune structural integrity to subjective forces.

Generate self-organized structures using triggers.

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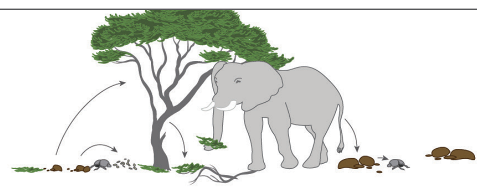

Redistributing system nutrients enhances food webs

ELEPHANT

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• Shape nutrient cycles •
• Disperse resources •

Elephants are engineers of the African savannah. They create nutrient hotspots in the understory when they dig to uncover mineral micronutrients, and when they messily feed from acacia trees, releasing biomass. Elephants disperse seeds long distances by eating them, transporting, then depositing them in their dung, which fertilizes soils. Dung is also food to beetles and fungi, which in turn feed many other species. Ecosystem engineers like elephants facilitate the emergence of ecosystems and food-webs through a bottom-up approach, rather than top-down.

Leverage partners to add value to resources.

Employ bottom-up approaches to foster system emergence.

Redistribute resources to yield new material flows.

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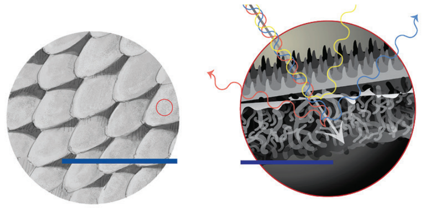

Randomized surface structures scatter all visible light

SCARAB BEETLE

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• Create brilliant white •

• Send visible signals • Scatter light •

The *Cyphochilus* beetles that live among white fungi are camouflaged thanks to unique scales that scatter all wavelengths of visible light, leaving behind only a brilliant broadband white. Their secret lies inside the ultra thin scales covering their body. Within each scale's mere 5 μm thickness is a random network of loosely interconnecting tubular filaments with diameters of about 0.25 μm. Incoming light is bounced around within the scales, effectively diffusing and scattering it. With this arrangement, only an ultra thin layer is necessary to scatter all incoming visible light and create brilliant white.

Eliminate bleach by adding structure.

Tune color to blend with surroundings.

Embed dense random filaments to scatter light.

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Varying response of layered materials controls shape

PINE CONE

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• Change shape •

• Respond to environment •

Pine cones protect seeds throughout maturation. Pine cone scales are composed of two different layers of the same material with varying orientation that controls a varying response to moisture. One layer is composed of long tissues that expand longitudinally under conditions of high humidity. The second layer expands at a much slower rate. During fall when humidity levels drop, one orientation dries faster than the other, causing the individual scales of the pine cone to bend out, thus exposing the seeds for dispersal.

Manipulate orientation to yield varying responses in single materials.

Leverage ambient conditions to control right-timed opening.

Use layers to affect material response to stimuli over time.

NATURE'S TECHNOLOGY SUMMARY

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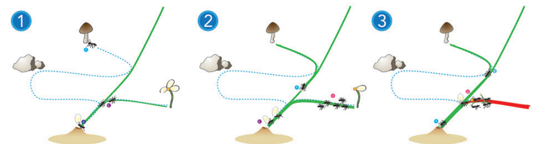

Employ simple rules to coordinate complex behaviors

ANTS

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• Optimize workflow •
• Self-organize workforce allocation •

Ants achieve highly complex and efficient workforce allocation without centralized control. This optimized resource allocation is directed by three pheromone "rules." Ants lay down a searching trail (blue) while they forage for food. When food is found, they lay down a positive trail (green). If the trail does not lead to useful resources they lay down a negative trail (red). This system works to help ants track multiple food sources and distances that are constantly changing. Scent reinforcement by ants that follow identifies the richest and closest food sources using just these simple rules of nonlinear feedback.

Optimize effort by reinforcing feedback loops.

Coordinate using real-time incremental responses.

Apply simple rules to facilitate non-linear decision-making.

NATURE'S TECHNOLOGY SUMMARY

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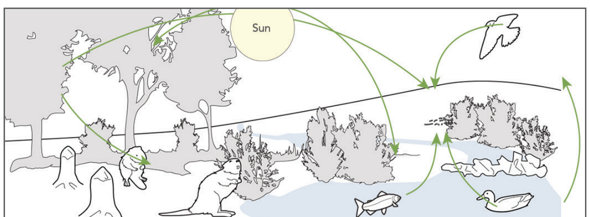

Multiple players and steps increase resource flow

TERRESTRIAL ECOSYSTEM FOOD WEB

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• Process resources efficiently •
• Maintain nutrient cycle • Embody resilience •

Nutrients in terrestrial ecosystems cycle through a non-linear web of interactions amongst organisms. The cycling of resources involves not only photosynthetic plants, herbivores, and various carnivores, but also detritivores, like worms, bacteria, and fungi, that feed on decaying organic matter. Each nutrient travels through multiple organisms undergoing multiple processing steps, providing value for each organism at every phase. This multi-faceted approach ensures a resilient and tightly interconnected system, energy-efficient resource processing, and a no-waste value exchange.

Maintain the food web by recycling materials.

Form many connections to create resilience.

Utilize upcycling & new inputs to sustain a cycle.

NATURE'S TECHNOLOGY SUMMARY

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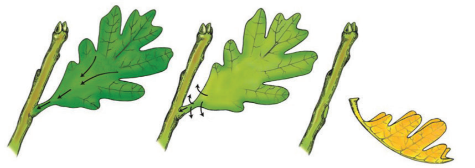

Selective release of valuable resources saves energy

DECIDUOUS TREES

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• Reclaim rare resources •
• Move nutrients • Differentiate value •

As days get shorter and colder and drier, deciduous trees prepare for dormancy. These trees begin to reclaim highly valuable, scarce elements like nitrogen (a key component of green chlorophyll) from their leaves, before shedding them for the winter. The chlorophyll is reabsorbed back into the branches for use in new spring leaves. The reds, oranges, and yellows revealed in the brightly colored autumn leaves are made of more readily available elements (e.g. carbon, hydrogen, oxygen), which can easily be taken from the soil in the spring.

Design for easy retrieval of high value resources.

Use strategic timing to lower resource cost.

Differentiate reclamation strategies based on value.

NATURE'S TECHNOLOGY SUMMARY

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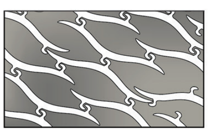

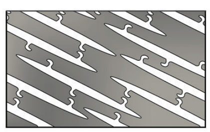

Fibers interlock to increase stiffness temporarily

SEA CUCUMBER

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• Create temporary flexibility •
• Modify stiffness • Manage compression •

Sea cucumbers protect themselves from predation by stiffening their normally soft skin (dermis). The dermis can quickly change from a soft, nearly liquid state to a very stiff, protective mechanical layer. As a nested fiber-reinforced composite, the outer layer contains aligned collagen fibrils with protruding "arms" suspended in a gooey material. The fibrils are triggered by a stiffening protein released when sea cucumbers are threatened, causing the hooked arms to bind fibrils together. While connected, the fibrils have higher bending stiffness, no longer rotate, and make the dermis rigid.

Leverage pressure to increase stiffness.

Use material phase change to impart function.

Manipulate shape flexibility by interlocking structures.

NATURE'S TECHNOLOGY SUMMARY

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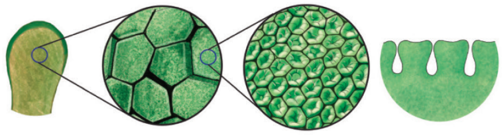

Hierarchical structure increases surface contact

TREE FROG

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• Stick to slick surfaces • Attach temporarily •
• Increase surface area •

Tree frogs cling easily to smooth wet surfaces. Their toe pads have a regular microstructure that significantly increases attachment force. The toe pads consist of regular hexagonal structures approximately 10 μm across. These cells are separated by a 1 μm channel between them, and each hexagonal cell has smaller 0.1-0.4 μm pegs that stand out from the hexagonal cell. The almost fractal nature of the structure at several levels appears to maximize contact with a surface. This hierarchical structure is complemented by a secreted mucus that provides traction in a slippery environment.

Leverage shape rather than chemistry.

Facilitate reuse with temporary attachments.

Increase contact with nested hexagonal structures.

NATURE'S TECHNOLOGY SUMMARY

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RIFFLER CARDS

The following cards support the brainstorming process by helping people explore the full potential of any given biological strategy. By proposing different application realms, scales, levels, and concept types, participants are encouraged to stretch beyond the most "obvious" inspiration, yielding many concepts from a single biological strategy.

Topic Sub-Realm
Specific areas to apply solutions

Application Level
Form, Process, or System

Application Scale
Self-defined scales (time and space)

Concept Type
Degree of flexibility in interpreting the NTS

Life's Principle
An aspirational guideline

RIFFLER CARDS

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MATERIALITY

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Materiality

Ultimately, packaging presents a material challenge that encompasses a wide range of choices amongst paperboard, glass, and polymers, including plastics. How these materials are sourced, used, enhanced for functionality, and designed for manufacture, use, and end-of-life can be considered within this sub-realm.

PACKAGING SUBREALM

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DISTRIBUTION

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Distribution

The distribution chain and all it entails: the flow of materials, from raw source to manufacturing, as well as from packaged goods throughout the distribution chain, and the material flow of post-industrial and post-consumer packaging are all areas within which design solutions can emerge in this sub-realm.

PACKAGING SUBREALM

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SAFETY & SECURITY

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Safety & Security

One of the primary functions of packaging is to provide secure, safe, and clean transport of contents. Current solutions often add to the negative effects of packaging in many sub-realms. Re-imagining ways to provide these same functions, with less impact, in bio-inspired solutions is the intention of this sub-realm.

PACKAGING SUBREALM

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PRE-CONSUMER

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Pre-consumer

While most consumers see only retail packaging, significant amounts of packaging are associated with the distribution of raw materials to manufacture sites, the distribution and processing of goods, and in the packaging of post-industrial waste. Finding bio-inspired solutions within these categories is the intention of this sub-realm.

PACKAGING SUBREALM

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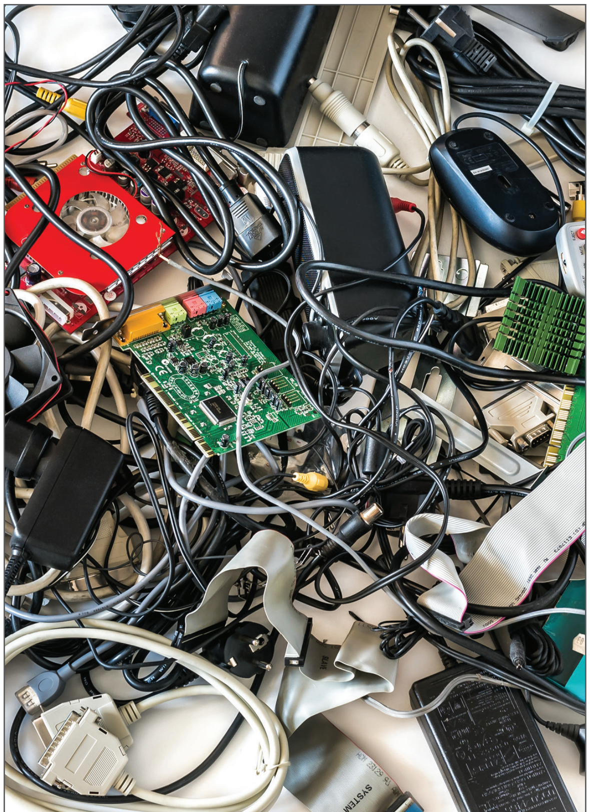

POST-CONSUMER

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Post-consumer

The negative impacts of post consumer packaging garners the most attention as we see overflowing landfills, trash cans, and the ocean gyre. Packaging re-use, recycling, distribution, decomposition, consumer behavior, municipal issues, and the overflow challenges are all included in this sub-realm.

PACKAGING SUBREALM

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RECYCLING

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Recycling

Recycling has been a standard answer to many packaging waste issues for years, but is still replete with challenges, limitations, and incongruencies. Issues around materiality, sorting, recyclability, processes, and material distribution can be considered in this sub-realm.

PACKAGING SUBREALM

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FORM

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Form

- Form is the visible shape or configuration—the three-dimensional composition of something. Structure and patterns are also forms.
- Consider your biological example. How does its form facilitate the mechanism or strategy? Can that form be scaled and applied as a design solution for your challenge?

APPLICATION LEVEL

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PROCESS

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Process

- Process is defined as the steps or actions taken in order to achieve a particular end and might include a chemical reaction, a physical dynamic, a version of information transfer, or perhaps a behavioral trait.
- What process does your biological example use to accomplish the function? What can you emulate from that process?

APPLICATION LEVEL

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SYSTEM

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System

- System (or ecosystem) addresses the larger context defined by the relationships and configurations amongst the components.
- How does your biological strategy relate to the whole system? How can your bio-inspired design solution emulate system level characteristics?

APPLICATION LEVEL

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MICRO

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Micro

- Micro is small scale (relative to the scale at which your design solution might normally be).
- What aspects of the biological strategy are pertinent to the micro-scale? How can those be emulated in your design solution?
- Alternatively, can you emulate a strategy that works on a larger scale at the micro-scale?

APPLICATION SCALE

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MESO

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Meso

- Meso is an intermediate scale (relative to the scale at which your design solution might normally be).
- What aspects of the biological strategy are pertinent at the meso-scale? How can those be emulated in your design solution?
- Alternatively, can you emulate a strategy that works on a larger or smaller scale at the meso-scale?

APPLICATION SCALE

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MACRO

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Macro

- Macro is large scale (relative to the scale at which your design solution might normally be).
- What aspects of the biological strategy are pertinent at the macro-scale? How can those be emulated in your design solution?
- Alternatively, can you emulate a strategy that works on a smaller scale at the macro-scale?

APPLICATION SCALE

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METAPHORICAL

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Metaphorical

- Metaphorical mimicry uses a conceptual model from the biological inspiration.
- Distill out the main concept from the biological inspiration and apply the high level idea.
- Be careful with metaphors to still be true to the biology with your design solution. Remember, there is a gradient of solutions between metaphorical and literal.

CONCEPT TYPE

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LITERAL

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Literal

- A literal translation tries to emulate the original biology as closely as possible.
- Use the technical details of the biological strategy directly to inform your design solution.
- Be careful to not let the literal approach too narrowly define potential applications. Remember, there is a gradient of solutions between metaphorical and literal.

CONCEPT TYPE

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EVOLVE TO SURVIVE

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Evolve to Survive

Continually incorporate and embody information to ensure enduring performance.

EVOLVE TO SURVIVE

Replicate Strategies that Work

Integrate the Unexpected

Reshuffle Information

LIFE'S PRINCIPLE

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ADAPT TO CHANGING CONDITIONS

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Adapt to Changing Conditions

Appropriately respond to dynamic contexts.

ADAPT TO CHANGING CONDITIONS

Incorporate Diversity

Maintain Integrity Through Self-Renewal

Embody Resilience Through Variation, Redundancy, and Decentralization

LIFE'S PRINCIPLE

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BE LOCALLY ATTUNED AND RESPONSIVE

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Be Locally Attuned and Responsive

Fit into and integrate with the surrounding environment.

BE LOCALLY ATTUNED AND RESPONSIVE

Leverage Cyclic Processes

Use Readily Available Materials and Energy

Use Feedback Loops

Cultivate Cooperative Relationships

LIFE'S PRINCIPLE

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USE LIFE-FRIENDLY CHEMISTRY

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Use Life-friendly Chemistry

Use chemistry that supports life processes.

USE LIFE-FRIENDLY CHEMISTRY

Break Down Products into Benign Constituents

Build Selectively with a Small Subset of Elements

Do Chemistry in Water

LIFE'S PRINCIPLE

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BE RESOURCE EFFICIENT
(MATERIAL AND ENERGY)

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Be Resource Efficient (Material and Energy)

Skillfully and conservatively take advantage of resources and opportunities.

BE RESOURCE EFFICIENT
(MATERIAL AND ENERGY)

Use Low Energy Processes

Use Multi-Functional Design

Recycle All Materials

Fit form to Function

LIFE'S PRINCIPLE

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INTEGRATE DEVELOPMENT WITH GROWTH

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Integrate Development with Growth

Invest optimally in strategies that promote both development and growth.

INTEGRATE DEVELOPMENT
WITH GROWTH

Self-Organize

Build from the Bottom-Up

Combine Modular and Nested Components

LIFE'S PRINCIPLE

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Ideas & Case Studies

This collection of cards is designed to help participants understand possible outcomes (near and far) by using this Biomimicry Brainstorm-in-a-Box process. Here you'll find real **concept examples** generated by designers inspired by the Nature's Technologies Summaries specific to this topic, as well as real-life **biomimicry case studies** relevant to this topic. These cards can be particularly useful if you notice the team getting stuck and in need of inspiration to think in innovative ways.

IDEAS & CASE STUDIES

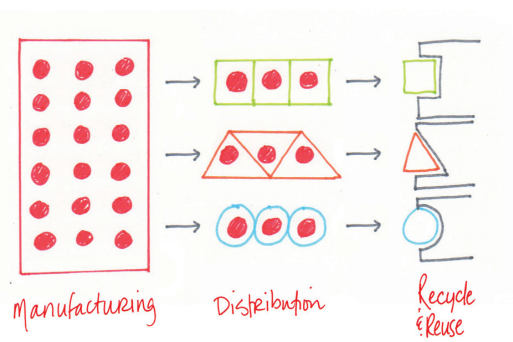
TERRESTRIAL ECOSYSTEM FOOD WEB

PRE-CONSUMER | SYSTEM | MESO | METAPHORICAL

BE LOCALLY ATTUNED AND RESPONSIVE

Feeding Feedstocks | Similar to how a single species of plant feeds many species in a terrestrial food web (bees take pollen and nectar, deer feed on the leaves, etc.), a large retail distribution center could purposefully "feed" multiple partners. Merchandise could be packaged to benefit specific recycling/ reuse partners at the final destinations. For example, if goods are being shipped to a region that has a sustainable way to deal with post-consumer pulp, cardboard packaging could be prioritized. Areas with composting programs would receive shipments that use mushroom-based packaging. Shipping materials could also be appropriate for local food webs.

IDEA #1



Variations

- Incentives embedded in the packaging could encourage distribution to the right "consumer"

Sustainability win

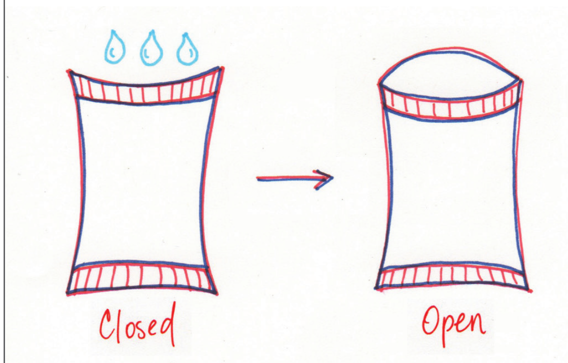
- Higher rates of recycling and/or reuse
- Opportunity for local partnerships and building place-based resource webs

FEEDING FEEDSTOCKS

PINE CONE
SAFETY & SECURITY | PROCESS | MICRO | LITERAL
LIFE-FRIENDLY CHEMISTRY

Presto! Water Opening | Pine cones open and close using a bi-layer composite material. This idea could inspire two-layer packaging for consumer retail goods that opens when triggered with water. Once the consumer is home, they would apply water to the seal to easily open the item and remove the packaging. This could help prevent the opening of packages in-store before purchase, avoid blister pac finger cuts, and help people with arthritis. The entire package, or just portions, could be responsive. Packaging should be made with cellulose waste, to be both biodegradable and leverage its water-responsive properties.

IDEA #2



Variations

- Could be designed to further flatten or break down by applying more water
- Use heat, rather that water as the trigger

Sustainability win

- Maintain security while reducing packaging size
- Increase ease of recycling due to "flat-packing" of plastics

PRESTO! WATER OPENING

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SEA CUCUMBER
PRE-CONSUMER | FORM | MACRO | LITERAL
BE RESOURCE EFFICIENT (MATERIAL AND ENERGY)

Flat Packs | A sea cucumber inspired material would mimic the stiffening and relaxing mechanism. A flat pack of this material would harden under pressure, providing its own protection and support. These flat packs could be stacked flat in a shipping box without individual internal compartments. The bottom packs would harden under the weight of the top packs, but would become malleable for display when removed from the packing box. This could add necessary function to the material and increase the range of applications without unduly adding weight (e.g. thicker cardboard or plastic to prevent crushing).

IDEA #3

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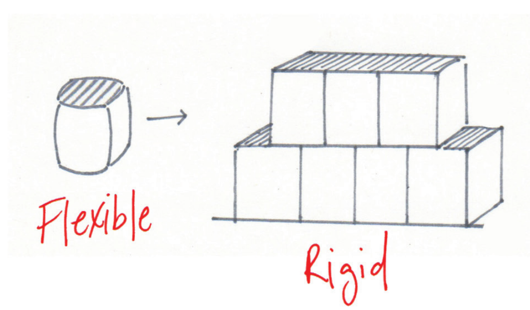

Variations

- Packs that could change shape for shipping versus display
- Could be used for individual packages or bulk packaging

Sustainability win

- Reduce shipping box weight/materials
- Remove need for box dividers

FLAT PACKS

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Stronger water bottle inspired by spiralling trunks

WHITEBARK PINE

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MATERIALITY DISTRIBUTION

Vitalis

To build a 100% recyclable, stronger water bottle with less plastic, designers looked to the spiral growth principle of the fibers of Whitebark Pines. A team from the Logoplaste Innovation Lab mimicked macro and micro helical structures of the trunk to design a lighter, more durable bottle. The inspiration led to a new bottle design for Vitalis, a Portugal-based water brand. The bottle is the lightest polyethylene terephthalate (PET) bottle on the market, and reduces total raw material use by 7%, enabling savings of 250 tons of raw material per year, while maintaining the structural integrity in transport.

CASE STUDY

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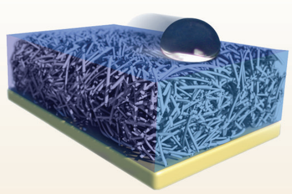

Super slick surfaces inspired by slippery vessels

PITCHER PLANT

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MATERIALITY RECYCLING

SLIPS™

Slippery Liquid–Infused Porous Surfaces (SLIPS) are designed to coat surfaces, including packaging, with non-stick, super-smooth, self-healing surfaces that repel everything from ice to crude oil and don’t involve toxic fluoro chemistry. SLIPS technology was inspired by the slippery surface of the carnivorous pitcher plant, which captures insects that slip off the plant’s surface and fall into an enzyme-laden, water-filled trough for digestion. The plant achieves its slipperiness thanks to a micro-textured surface that immobilizes water, forming a continuous, thin water layer that leaves visiting insects with no solid surface to gain a foothold.

CASE STUDY

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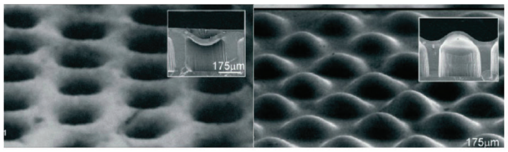

Smart thin-film inspired by concaving leaves

VENUS FLYTRAP

MATERIALITY SAFETY & SECURITY

University of Massachusetts, Amherst

A thin-film modeled after the fast-snapping Venus flytrap is designed to produce better, more sophisticated food packaging films that can sense spoilage or unsafe temperatures and respond by signalling danger to the consumer. Inspired by Venus flytrap leaves, which quickly flip from convex to concave when triggered by prey, researchers from the University of Massachusetts, Amherst, designed a thin-film with microscale hills that mimics each leaf, giving it the ability to rapidly flip between convex and concave surfaces when triggered by environmental cues. The triggering can be tuned to a desired signal, including the presence of spoilage gases, light, or temperature changes.

CASE STUDY

More brainstorming decks coming soon!

Looking for more ways to brainstorm using biomimicry? Visit the Biomimicry 3.8 shop soon to find Biomimicry-in-a-Box card sets covering topics like chemistry, energy, built environment, health/wellness, and more.

Biomimicry.net/shop

BIOMIMICRY-IN-A-BOX

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