



Webinars

Welcome!

The program will begin soon.
You will not hear audio until we begin.





Biomimicry Deep Dive

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5th December 2022



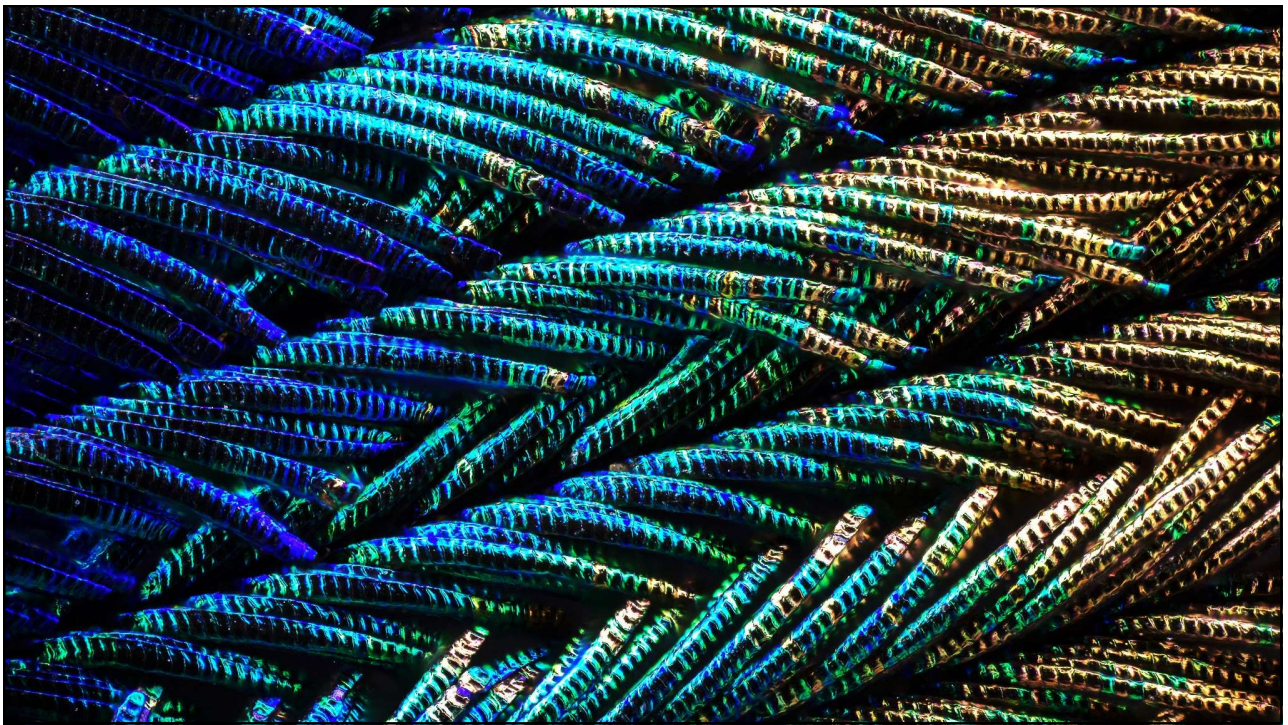


OVERVIEW



- Biomimicry – Definitions and Essential Elements
- Case Studies
- Biomimicry Thinking Methodology
- Innovation framework based on Natural Evolution Principles







"The color green can never be green, because of the way it is made."

Michael Braungart, co-founder of Cradle to Cradle



Biomimicry
is the conscious
emulation of
nature's genius.

It's not borrowed materials,
like wood. That's bio-
utilization. It's not borrowed
capabilities, like oil-producing
algae. That's bio-assisted.
Biomimicry is borrowed
inspiration. It's a more efficient
bullet train with the form of a
Kingfisher. That's biomimicry.

Biomimicry 3.8 | Biomimicry.net



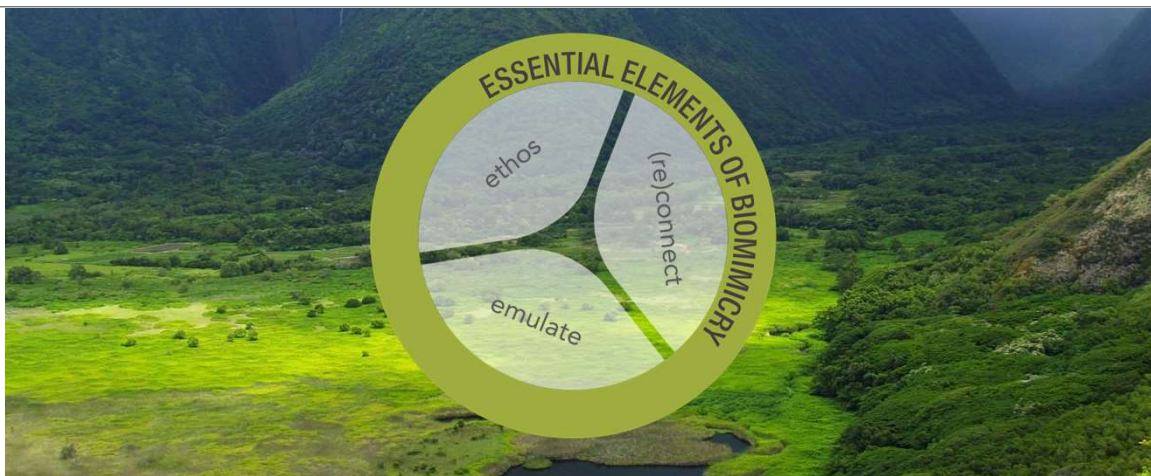
We look to →

Nature as model,
measure, and mentor

Biomimicry is a new way of
viewing and valuing nature,
based not on what we can
extract from the natural world,
but on what we can learn from it.

Biomimicry 3.8 | Biomimicry.net





Biomimicry Essential Elements



Emulate: Bio-inspired Innovation
Well-adapted Design

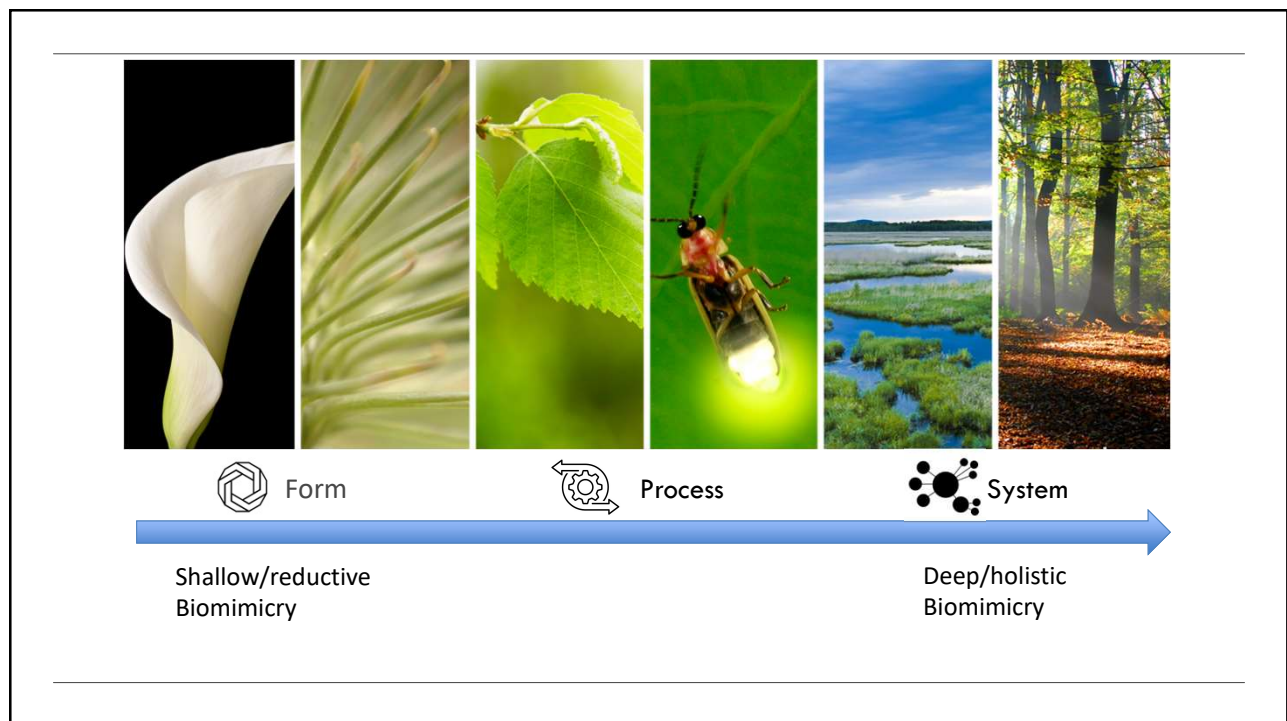


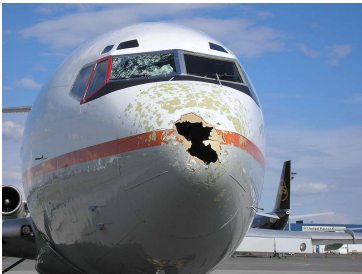
(Re)Connect: Discovery of Life's Genius



Ethos: Deep desire to fit in on Earth

How can our designs create conditions conducive to Life?





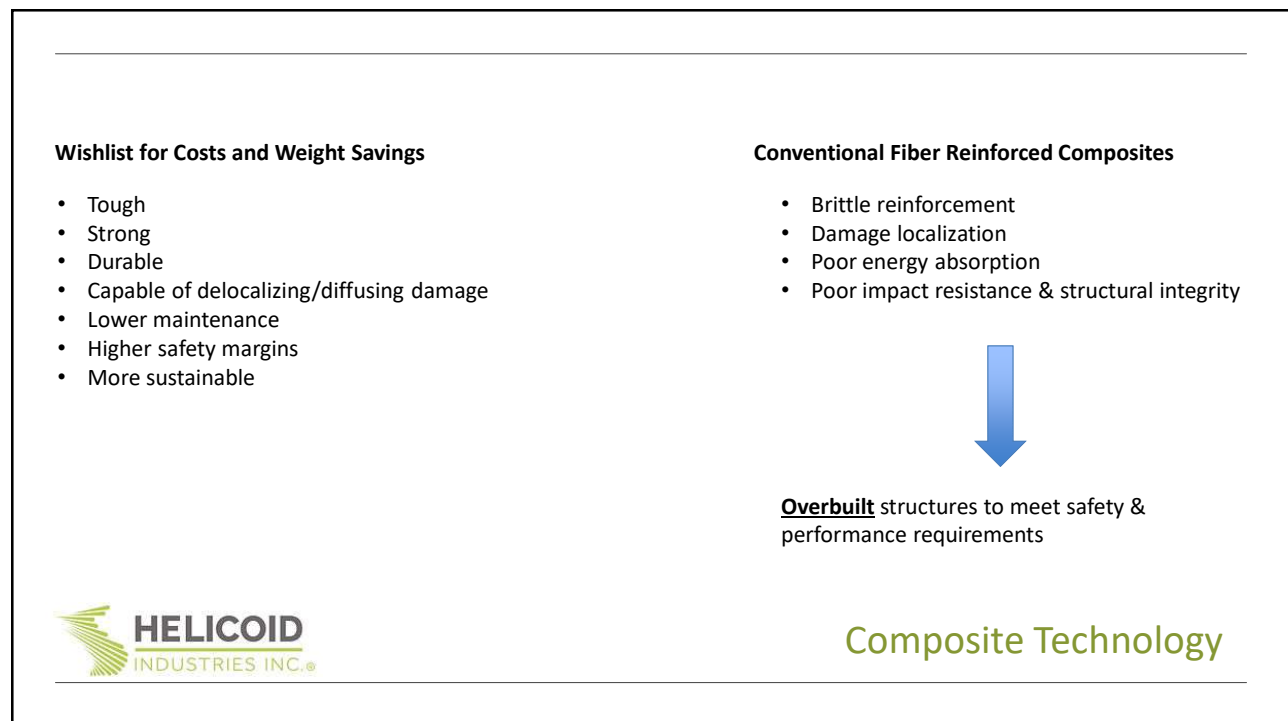
Conventional Fiber Reinforced Composites

- Brittle reinforcement
- Damage localization
- Poor energy absorption
- Poor impact resistance & structural integrity



Overbuilt structures to meet safety & performance requirements

Composite Technology





Composite Technology

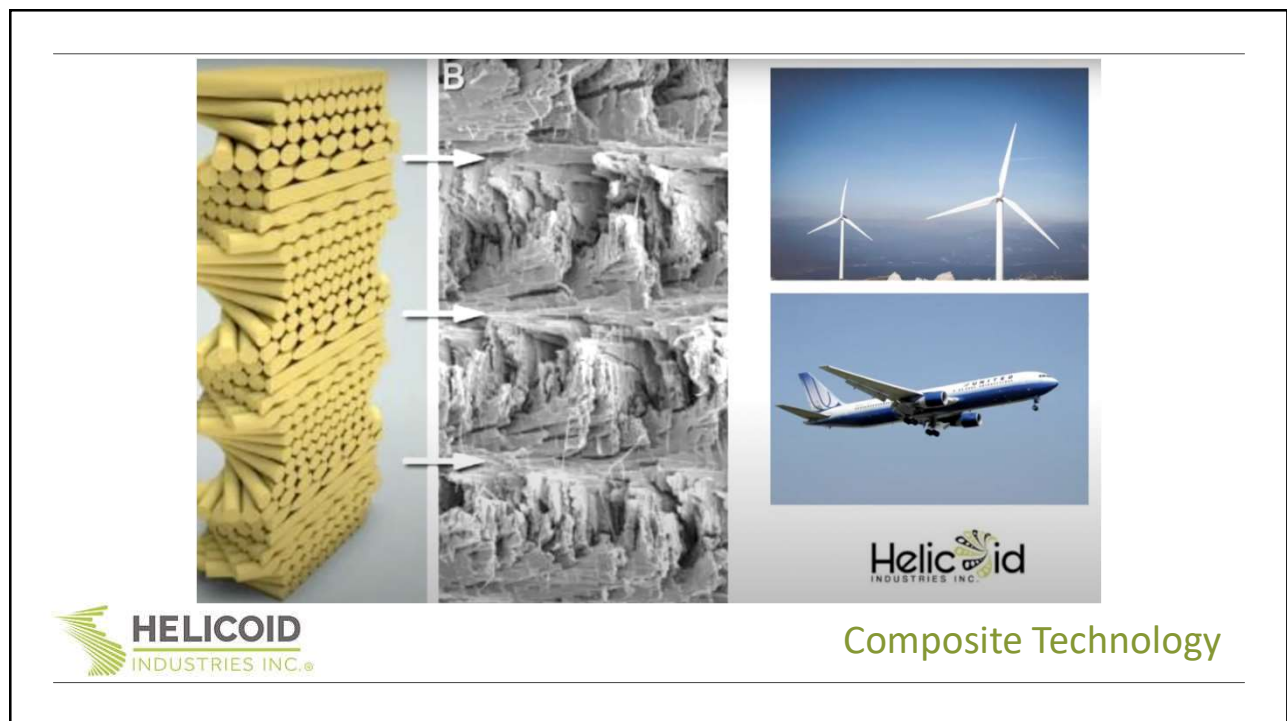
IT'S NOT THE MATERIAL – IT'S THE STRUCTURE

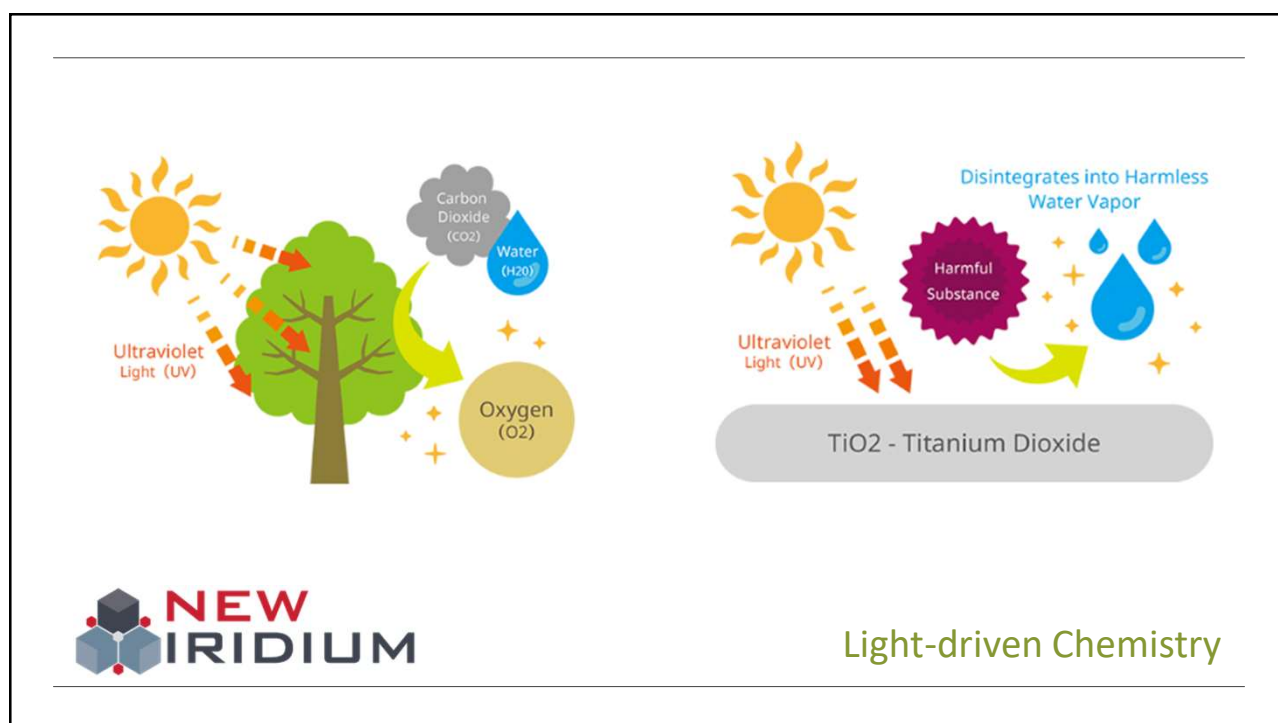


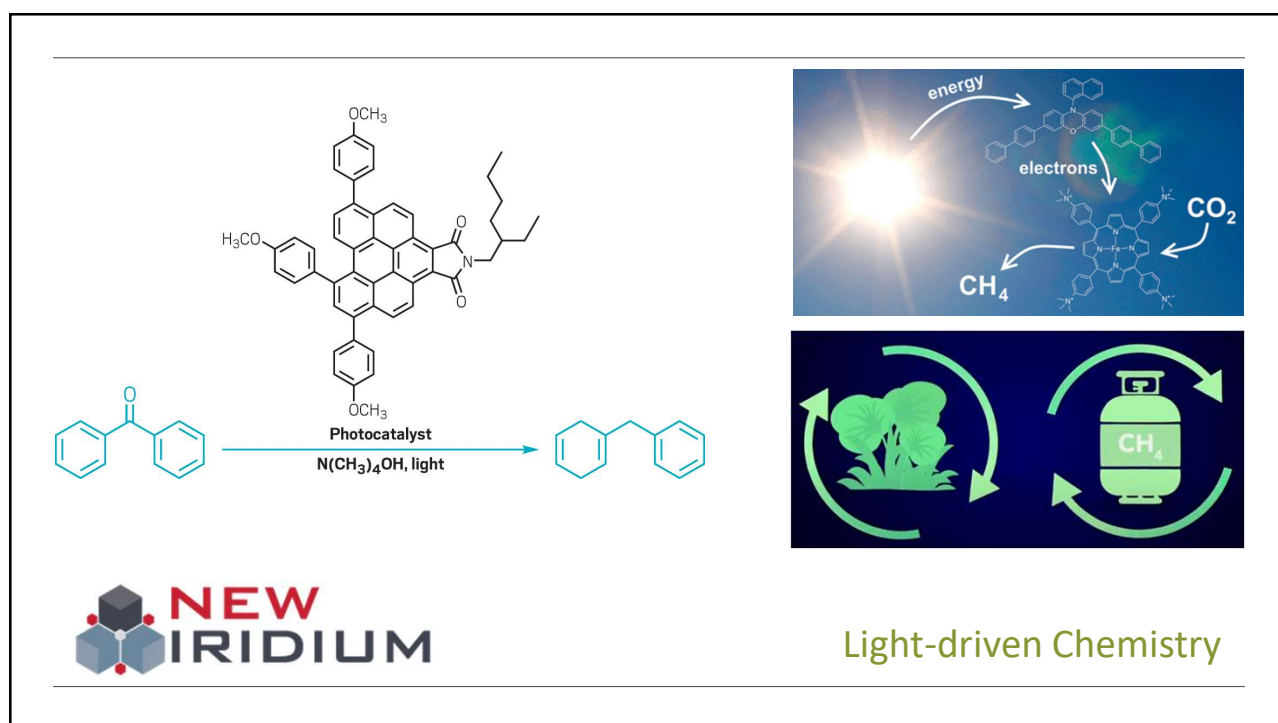
*Mantis Shrimp
Internal Helicoid™ Structure*

HELICOID
INDUSTRIES INC.®

Composite Technology





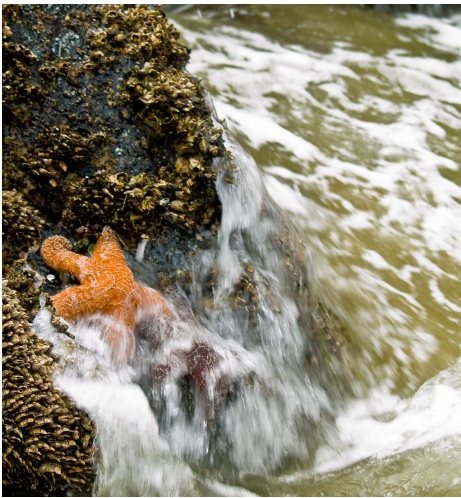




ECONcrete



ECO Armor Block



Admix can be added to regular concrete mix to create a chemically-balanced concrete. This enables healthy and diverse marine ecosystems to develop.

ECONcrete

ECO Armor Block





For the Environment

- ✓ Carbon sequestration
- ✓ Increased biodiversity
- ✓ Promotion of local species
- ✓ Improved water quality
- ✓ Biomimicry



For the Project

- ✓ Increased durability & strength
- ✓ Reduced chloride penetration
- ✓ Seamless integration
- ✓ Longer lifespan & reduced maintenance
- ✓ Compliance with coastal and marine construction standards



For Business

- ✓ Compliance with regulatory requirements
- ✓ Reduced mitigation penalties
- ✓ Increased brand equity
- ✓ Diversified offering (new markets)

ECOcrete

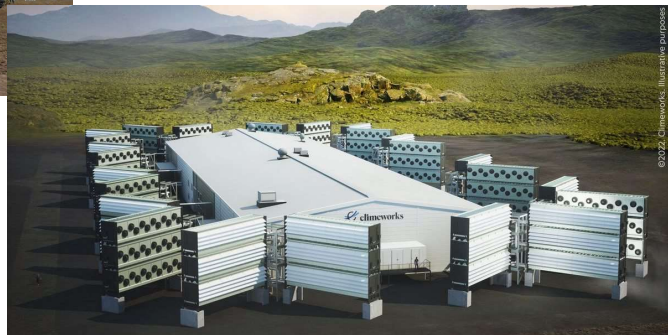
ECO Armor Block

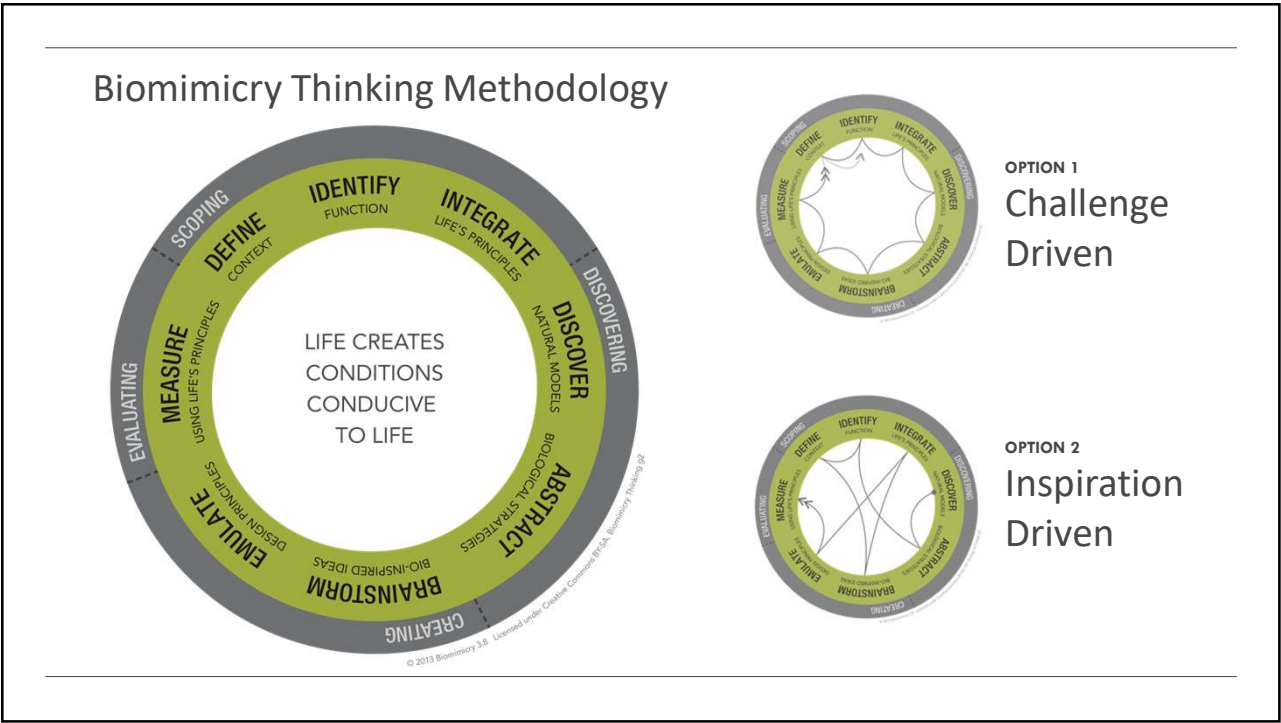
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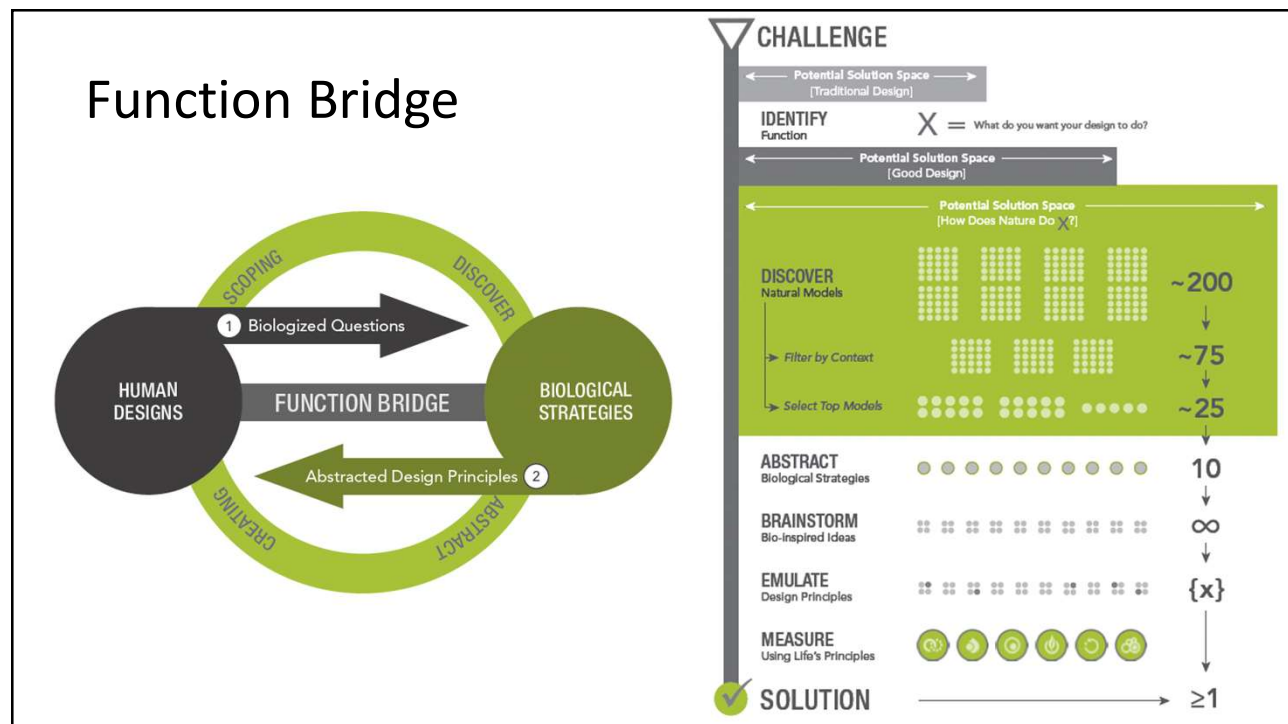
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Are our 'green' technology actually good for the planet?







BIOMIMICRY HAS BEEN APPLIED TO:

Advanced materials	Fibers & filaments	Plastic products
Agriculture	Financial services	Power generation, distribution, & storage
Arts & entertainment	Food manufacturing	Software
Biotechnology	Glass products	Telecommunication
Broadcast	Healthcare	Textiles & apparel
Building construction	Household goods	Transportation
Building systems	HVAC & refrigeration	Utilities
Cement & concrete	Industrial machinery	Warehouse & distribution
Chemical manufacturing	Lighting	Waste management
Consumer products & goods	Metal manufacturing	Water treatment
Data centers	Optics & imaging	Wood products
Electronics	Paints & adhesives	
	Pharmaceuticals	

HOW MIGHT NATURE...

*Incorporate novelty in an
existing field with a
dominant design?*

CROSSING THE FUNCTION BRIDGE

To find functional similarities when source and target domains don't share perceptual similarities:

Biologically Relevant

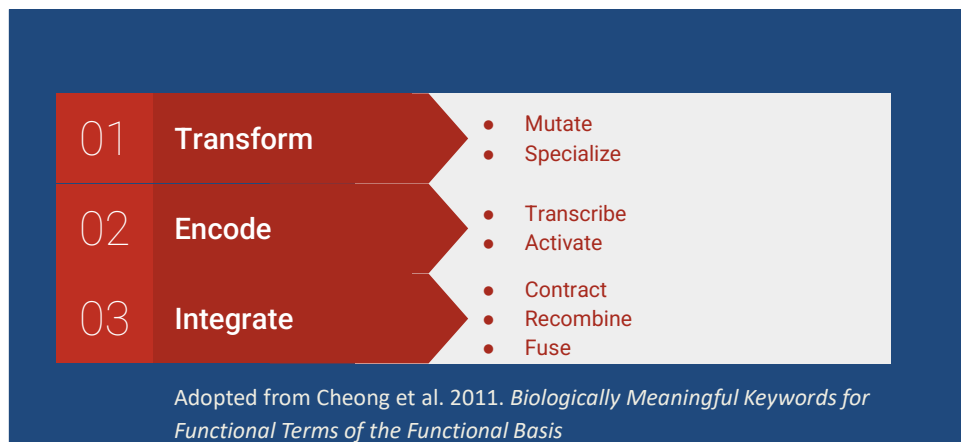
Perceptual & Intuitive

Metaphorical vs. Literal

Deeper Relational Patterns

Adopted from Cheong et al. 2011. Biologically Meaningful Keywords for Functional Terms of the Functional Basis

FUNCTIONS OF INNOVATION IN NATURE



INSTEAD NATURE MIGHT...

Introduce adaptation in an existing ecosystem by

- Mutation
- Emergence
- Specialization
- Convergence
- Selection
- Extinction

THE CRITICAL PATH TO NET-ZERO

70-100

**CCUS facilities needed each year to reach
Paris Agreement Net-Zero Goals**

RISKS IN RETROFIT FOR CCUS

Cost

- CAPEX intense
- Increases OPEX
- Impact on production
- Plant lifespan

Uncertainty

- Future demand for CO₂
- International competition
- Credit risk and payback period

Technology

- Emerging
- Research & development
- Compatibility
- Contingency costs

Location

- Surrounding industry
- Energy resources
- Access to transport & storage
- Incentives

ARE CURRENT COST EVALUATION MODELS UP TO THE TASK?

Best practice is to use a techno-economic assessment that provides enough detail to make a site-specific decision. However, even these models are limited by their assumptions, subjectiveness, and simplicity. Today's models will not accept enough CCUS retrofit proposals to meet critical milestones on the path to net-zero.

THREE NATURAL MODELS TO CONSIDER

Indexing

Pre-adaptive
conditions of biome,
ecology, & niche
specializations

Intrusion

Distance between
current state and
adaptation

Complexity

Optimizing multiple
evolutionary trade-offs
at once

COMPARABLE ANALYTICS

Indexing

Green Retrofitability Index (Ayyad & Fekry, 2016) and 'Closeness' to 'Green Economy' (Shutters, et al., 2016)

Intrusion

Degree of Invasiveness (Smaling & de Weck, 2006) and Design Complexity quotients (McNerney, et al., 2011)

Complexity

Multi-objective evolutionary algorithms (Chen & Zhou, 2022; Li, et al., 2016)

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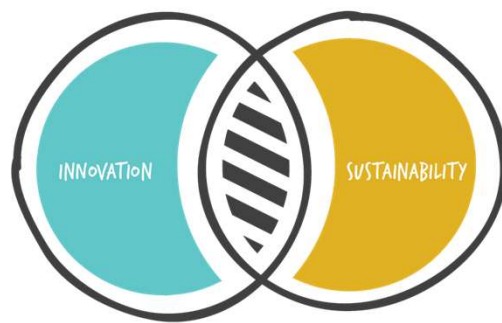
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Complexity

Multi-objective evolutionary algorithms (Chen & Zhou, 2022; Li, et al., 2016)



BIOMIMICRY



Life creates conditions conducive to life



On behalf of 30 million soft spoken species...

THANK YOU

To learn more:

Biomimicry.net

Biomimicry DesignLens [Free download](#)