Biomimicry Concepts:
A Functional Approach

Photograph by Olegas Kurasovas, National Geographic

Biomimicry Concepts

A Functional Approach

Lindsay James

Biomimicry is an approach to innovation that seeks sustainable solutions to human challenges by emulating nature's time-tested patterns and strategies

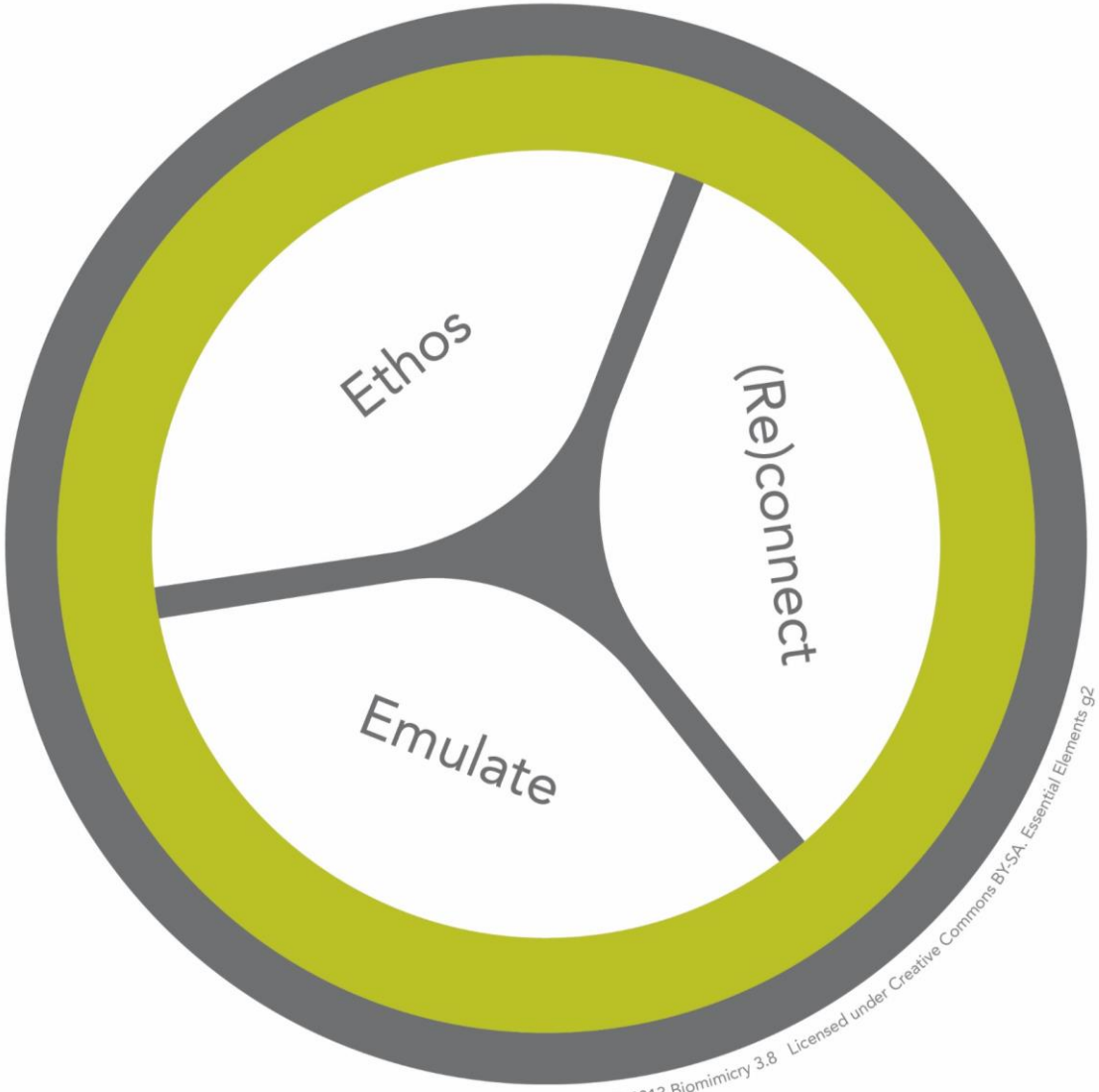
What is Biomimicry?

Purposely bringing nature’s genius to the design table

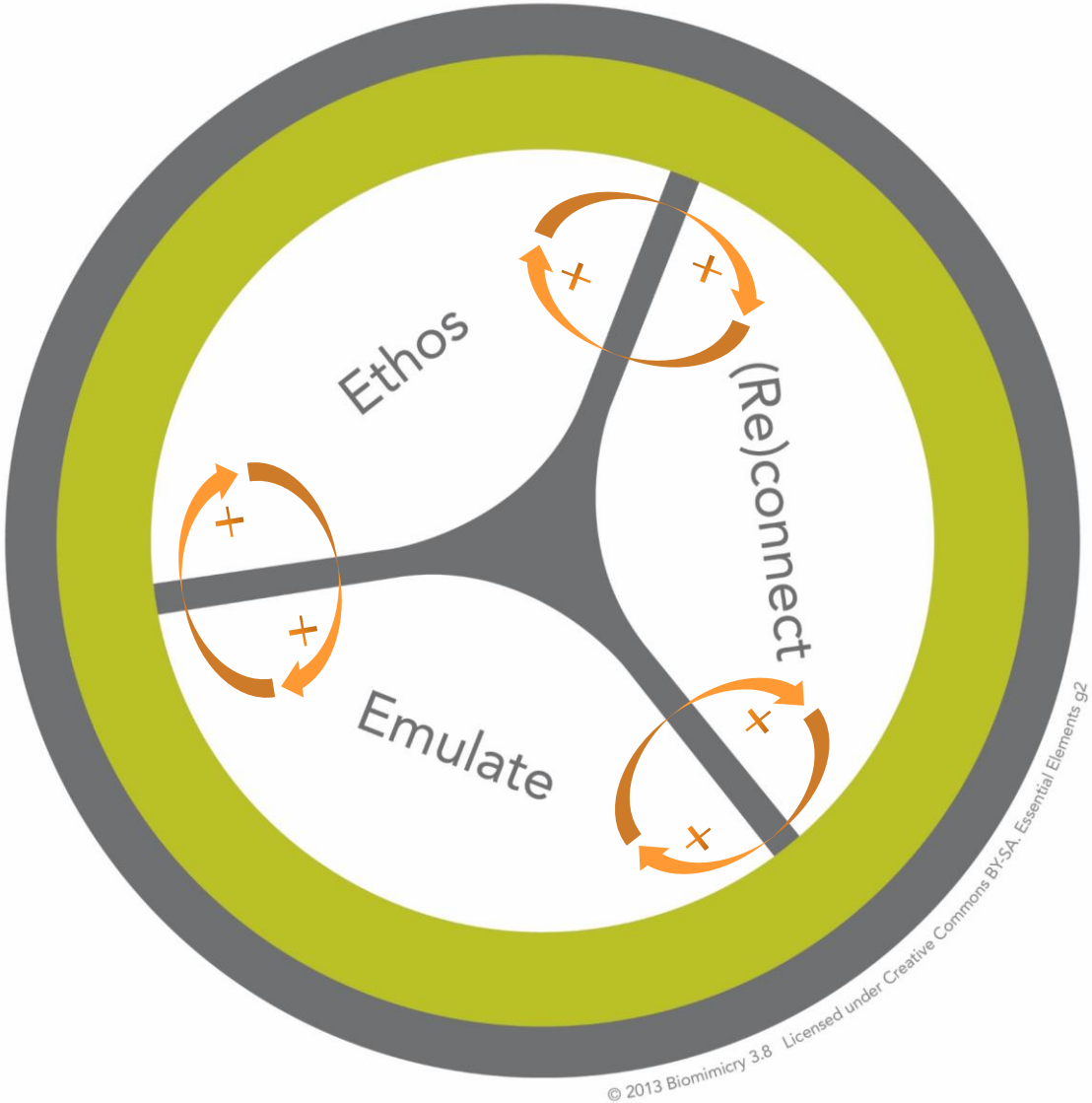
What is Biomimicry?

Remembering that we aren’t the only species

What is Biomimicry?



Three Elements of Biomimicry



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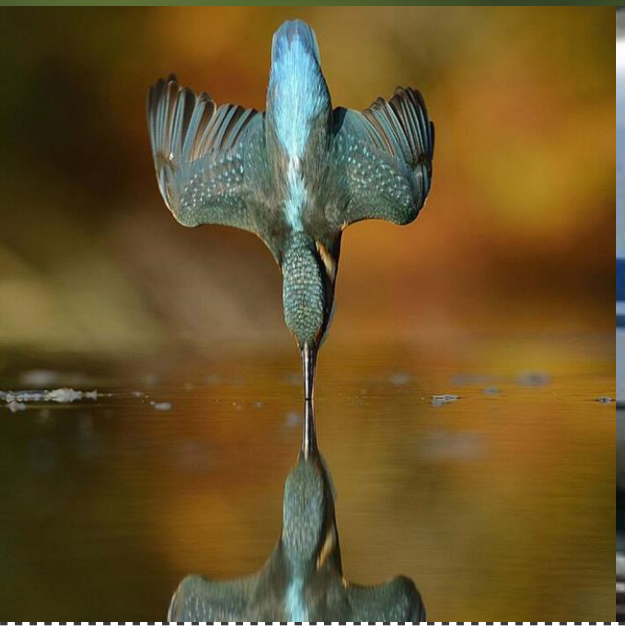


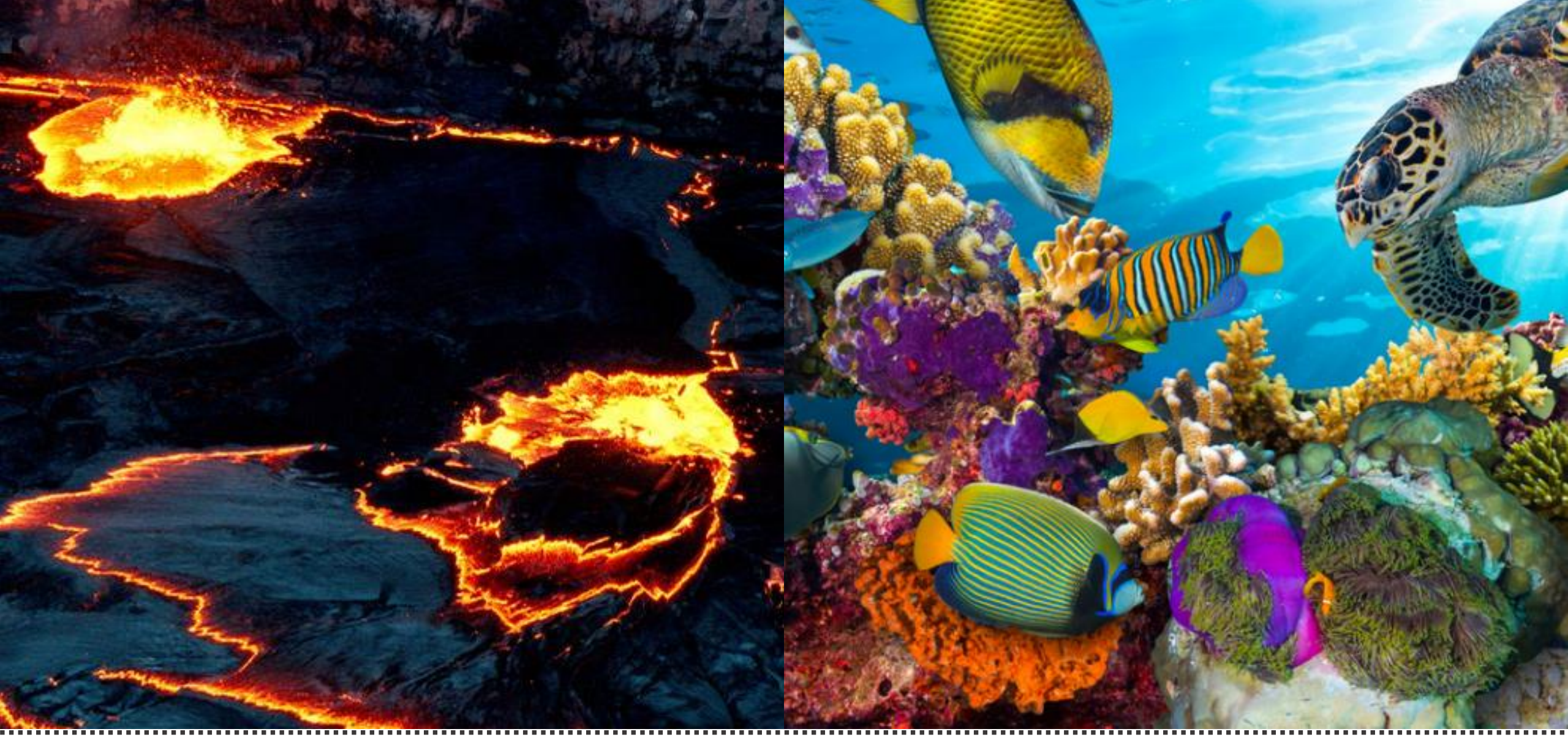
Famous Biomimicry Example

Quick thought experiment

Imagine the Earth 4.6 billion years ago

Our world today

What happened?



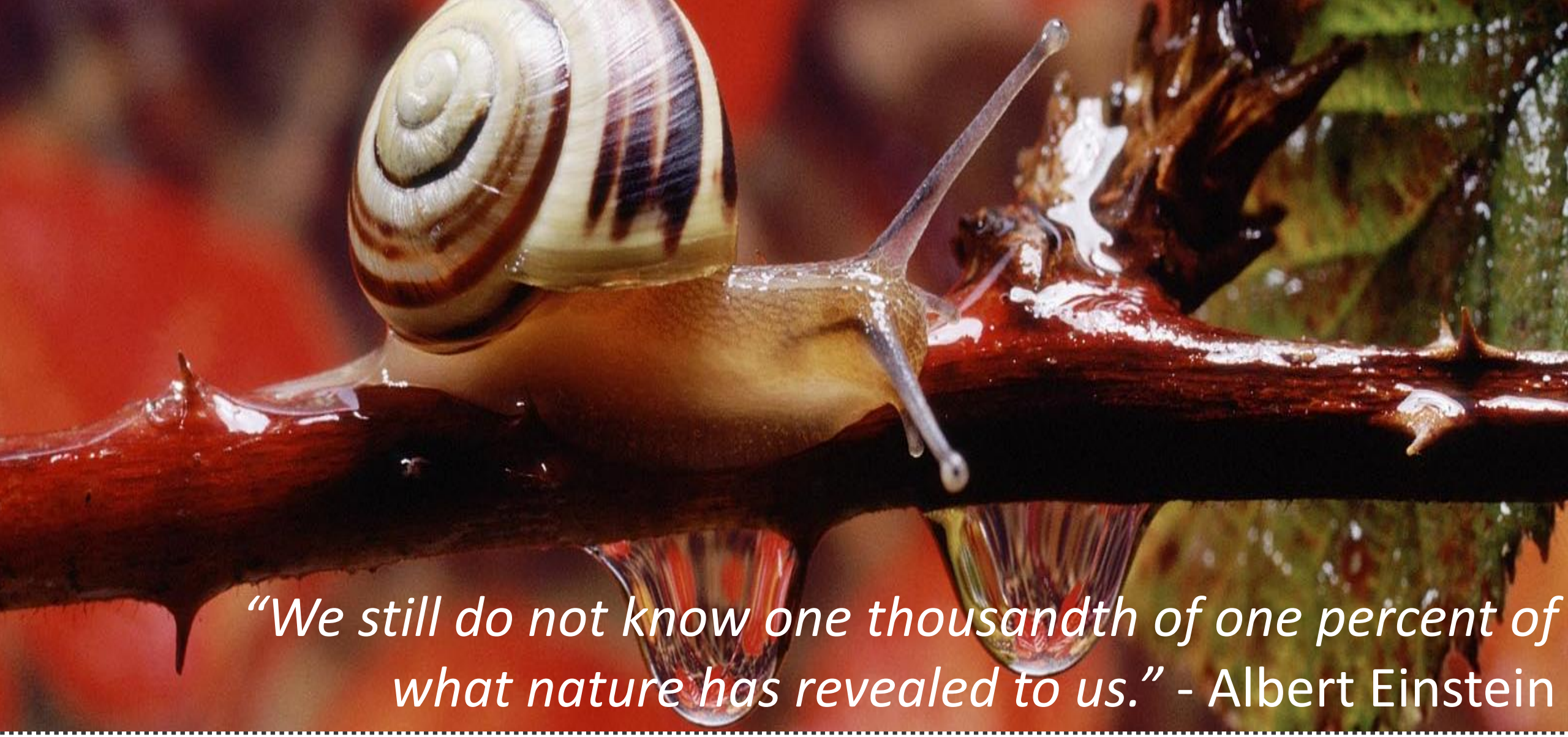
Life appeared 3.8 BYA

LIFE CREATES CONDITIONS CONDUCIVE TO LIFE

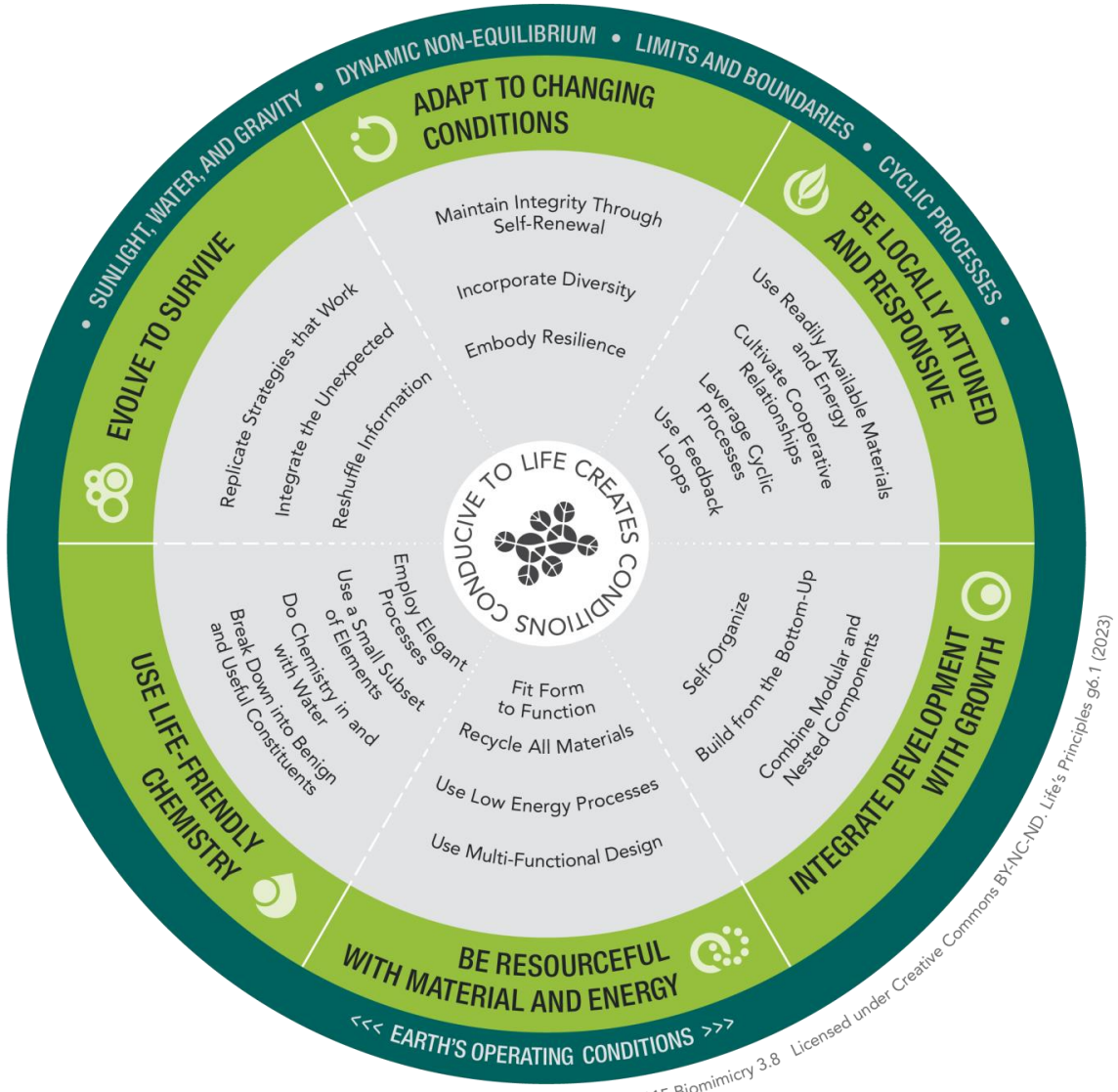
Life offers the ultimate model for regenerative design

U.S. Geological Survey. 2008.
Designed by Graham, Joseph, Newman, William, and Stacy, John.

We're very young!



Nature’s genius awaits discovery



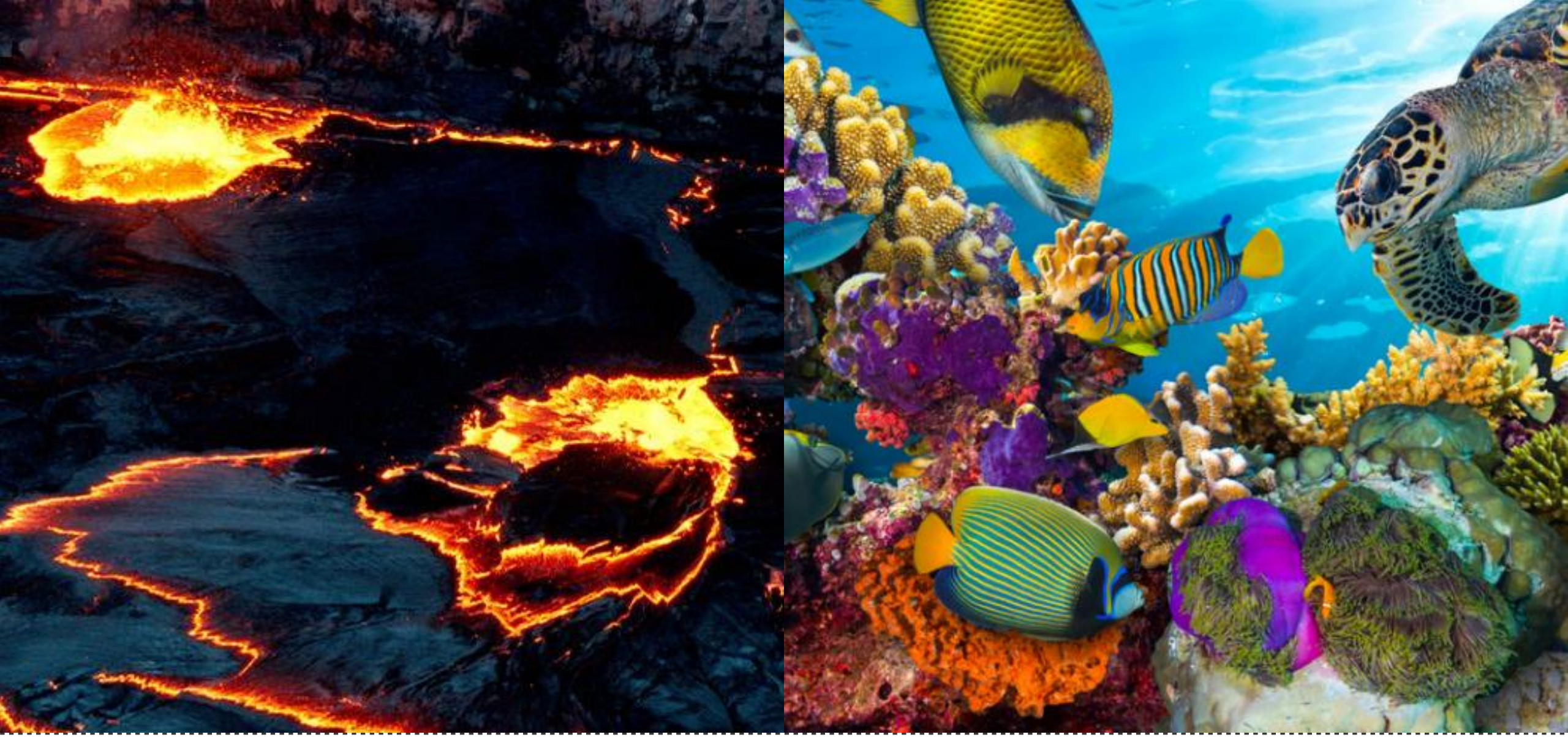
Life's Principles

Learning from Nature's Genius (40 min)

Communicates via Color	Stores Energy	Attaches Temporarily	Responds to Signals
Gathers Waste	Reflects Light	Cools	Transports
Provides Packaging	Shelters Others	Absorbs Light	Provides Structure
Cooperates	Communicates via Sound	Stores Water	Protects from Attack
Utilizes Wind	Cushions Impact	Breaks Down Waste	Insulates

Ethos: Purpose unites and motivates

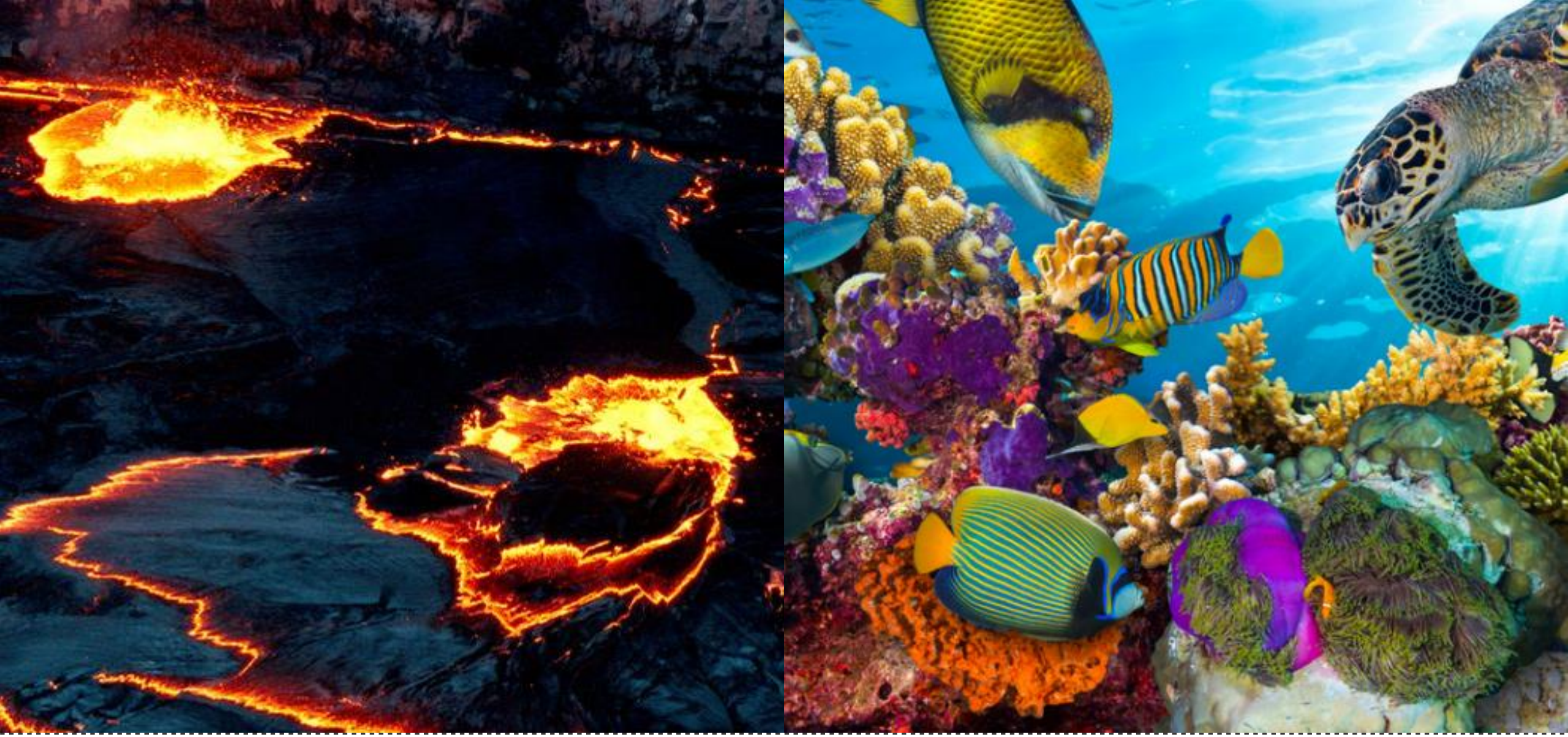
What is the purpose of life?



Life Creates Conditions Conducive to Life

Do we?

This is not inevitable



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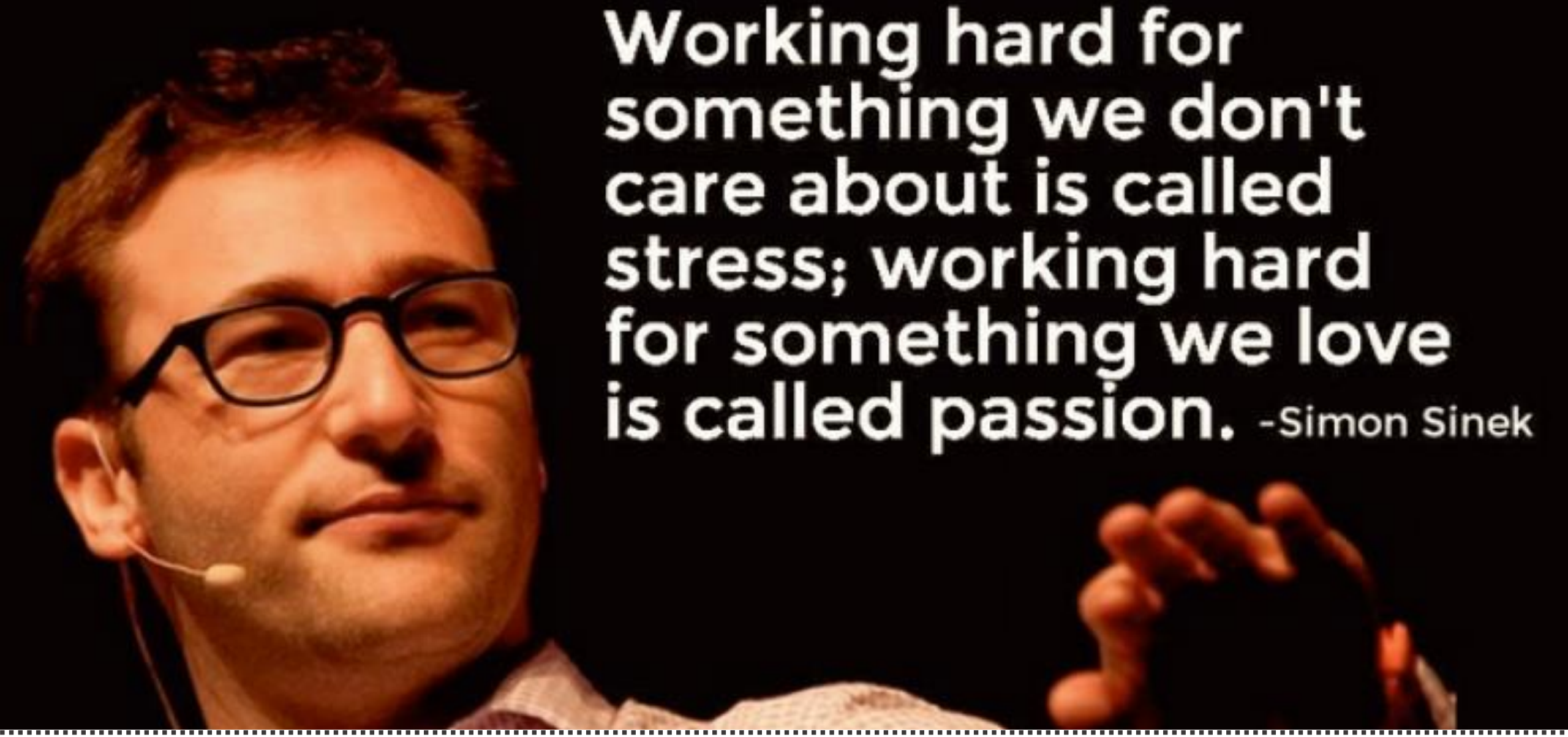


The Power of Why

A HARVARD BUSINESS REVIEW ANALYTIC SERVICES REPORT

Harvard Business Review

THE BUSINESS CASE FOR PURPOSE

Building a better working world

PURPOSE

The benefits of purpose

88%
say it helps create value for customers.

73%
say it inspires innovation and positive change.

72%
say it gives employees a sense of fulfilment.

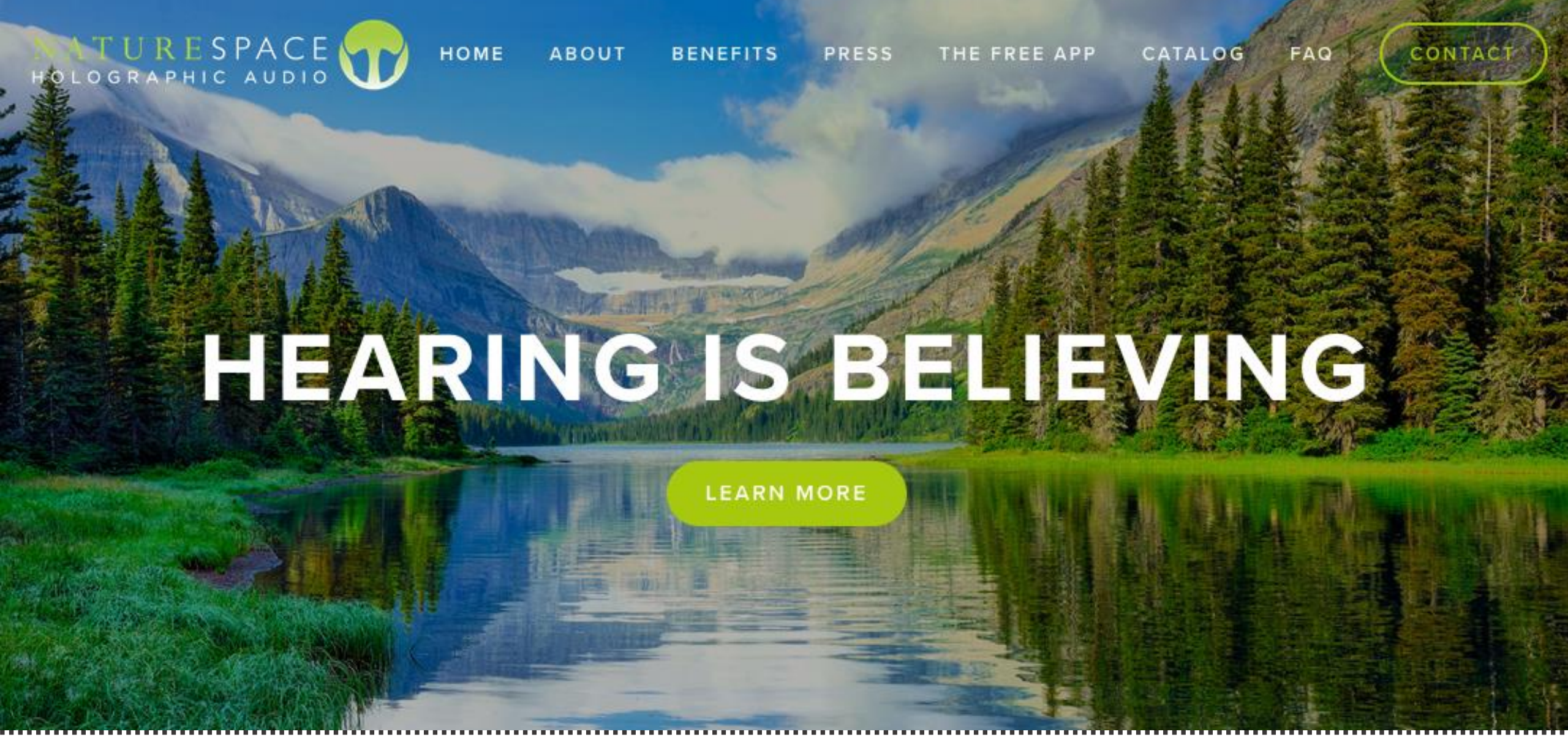
64%
say it helps generate financial returns for shareholders.

Source
The Business Case for Purpose, Harvard Business Review (sponsored by EY Beacon Institute), https://hbr.org/resources/pdfs/comm/ey/19392HBRReportEY.pdf

(Re)Connect: Benefits of Nature Contact

Openness to nature’s genius

Evolutionary “programming”



Our soundscapes

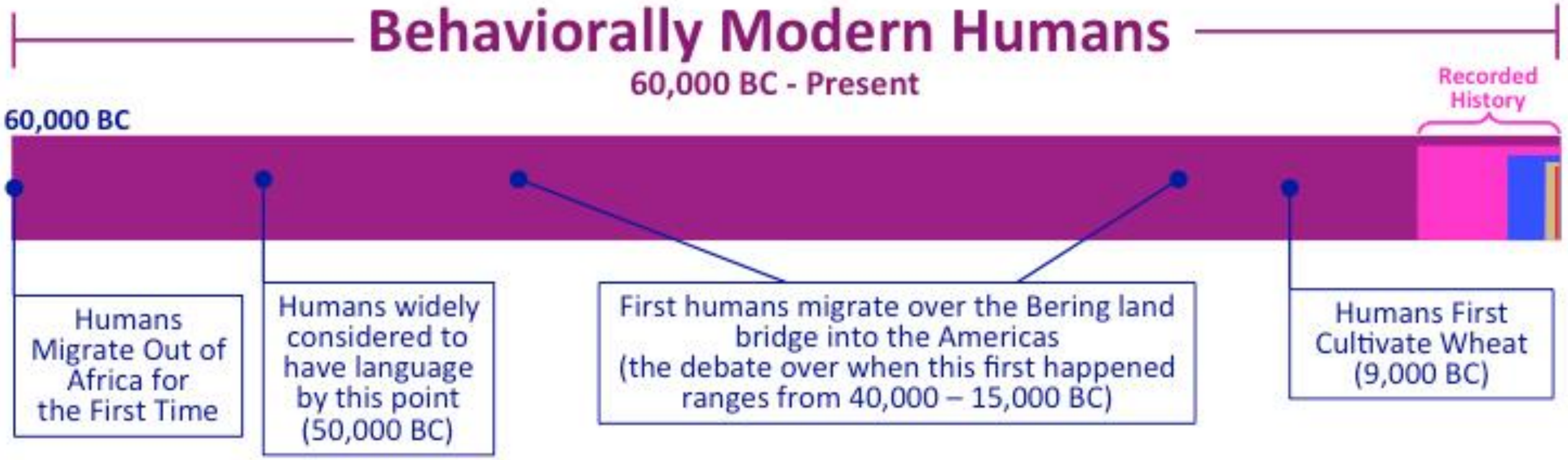


Image from Tim Urban

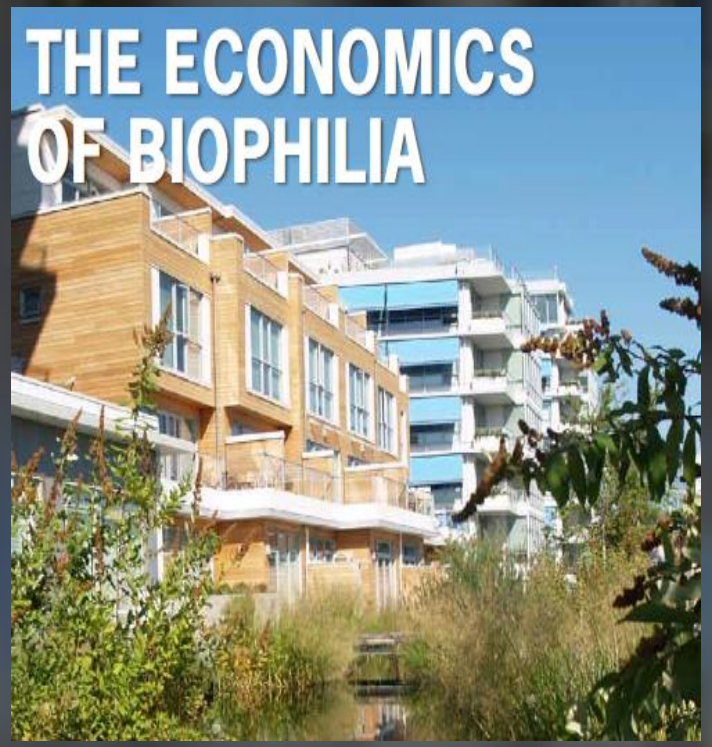
Humans evolved in contact with nature

Imagine your ideal workplace

- Improved stress recovery rates
- Improved cognitive functions
- Enhanced mental stamina and focus
- Elevated moods
- Increased learning rates
- Lower blood pressure

Evidence for Biophilic Design

Save over $2,000
per employee per year



Emulate: Asking “How Does Nature…?”

How does nature manage coastlines?

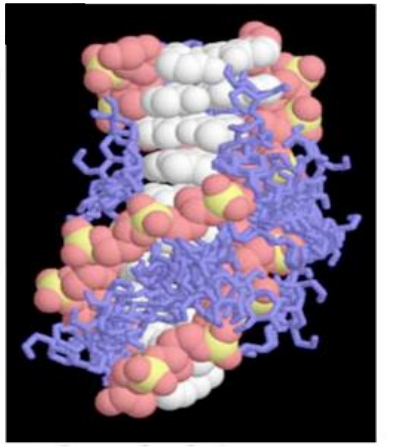



ECOncrete®

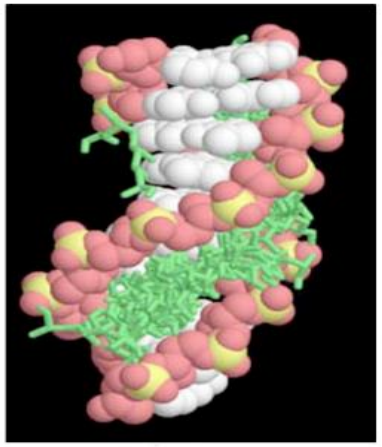
Function is the bridge between biology and design

How does nature keep cold? Or…

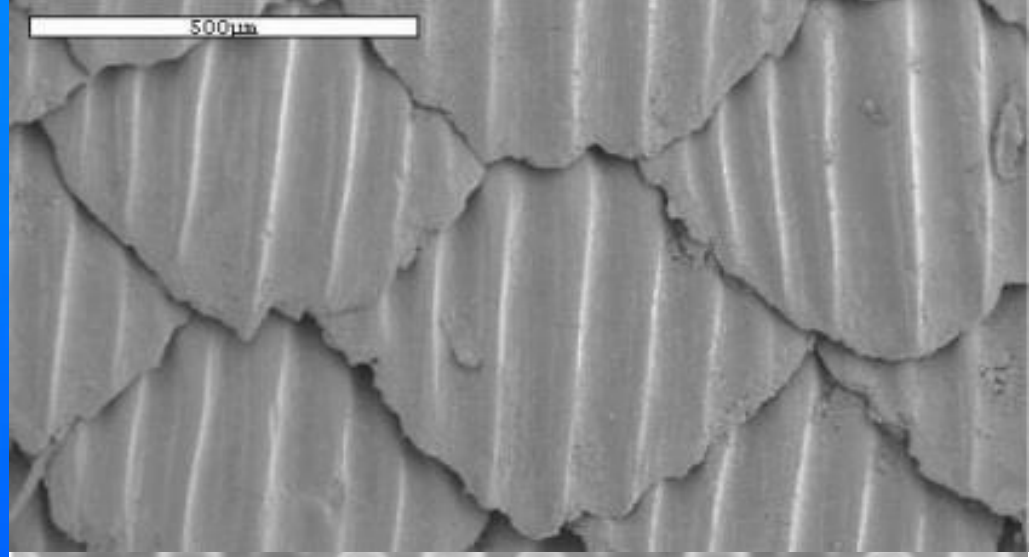
Anydrobiosis

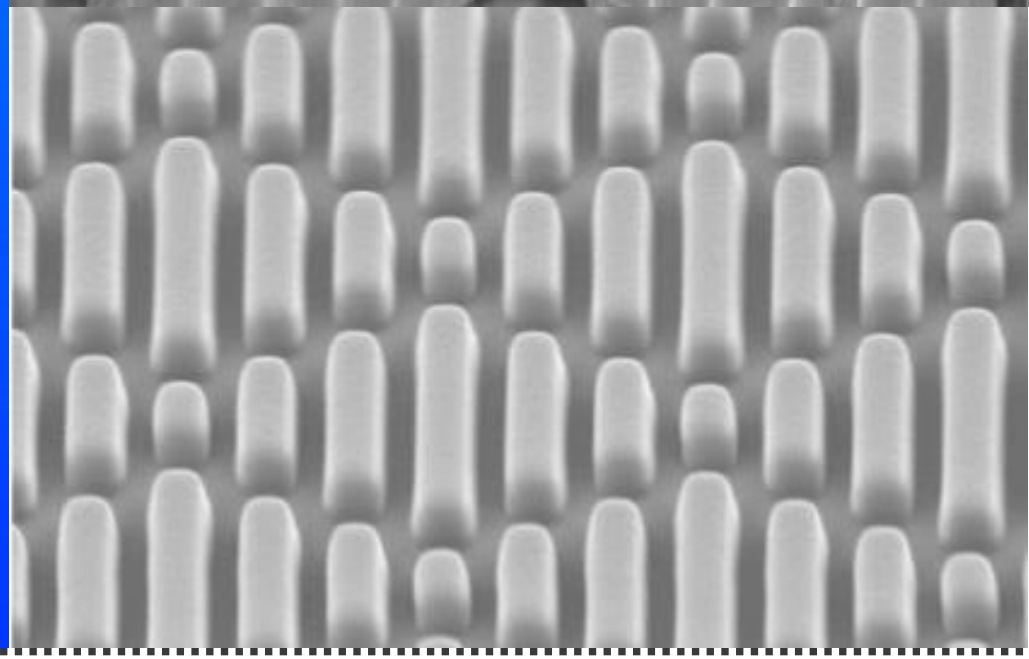


Biomatrica



How does nature preserve biological molecules? Biomatrica DNA SampleGard



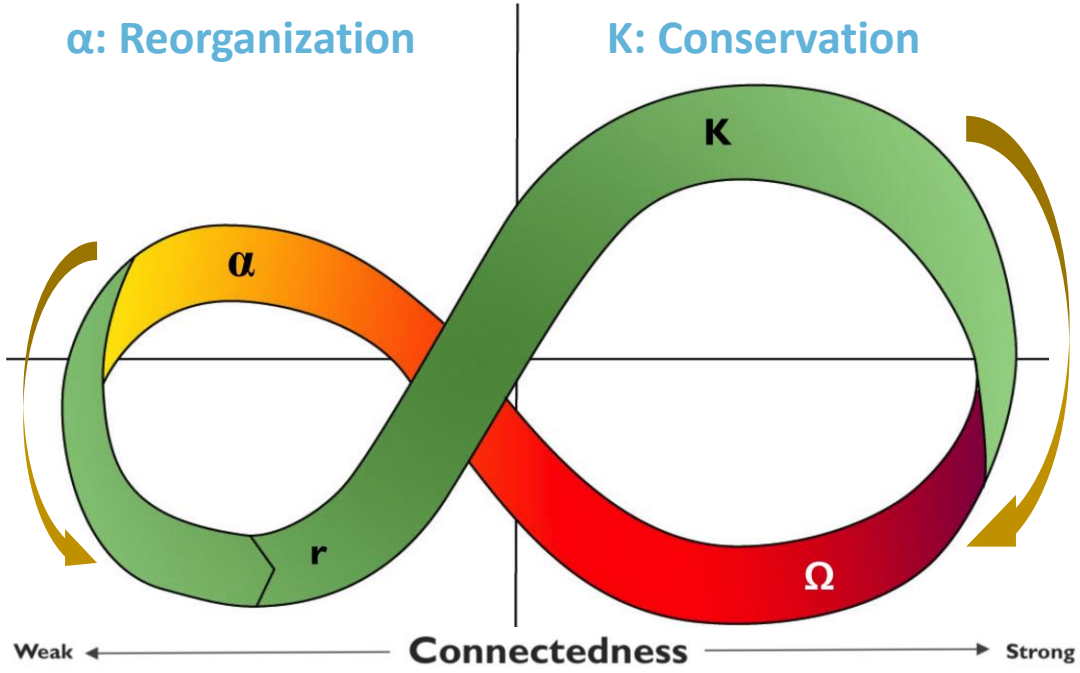


How does nature kill microbes? Or…prevent microbial growth?
Sharklet Technologies

How would nature design an organization?

α: Reorganization

K: Conservation



r: Exploitation

Ω: Disturbance (Release)

Source: C.S. Holling

Resilience in Nature: The Adaptive Cycle

- Disturbance precedes renewal
- Resilience requires diversity, redundancy, and decentralization

Emulate: Asking “How Does Nature…?”

How Does Nature…Recycle All Materials?

How industrial supply chains begin

How industrial supply chains begin

How industrial materials are made

How industrial materials are disposed

How Does Nature…Recycle All Materials?

Products break down into their benign constituents – materials that are both benign and useful and are incorporated into other products.

Nature does *not* turn materials into the same product

Nature’s loops for materials that are rare tend to be tighter than those for materials that are readily available.

Nature keeps all materials in loops

There are multiple loops

C H N O

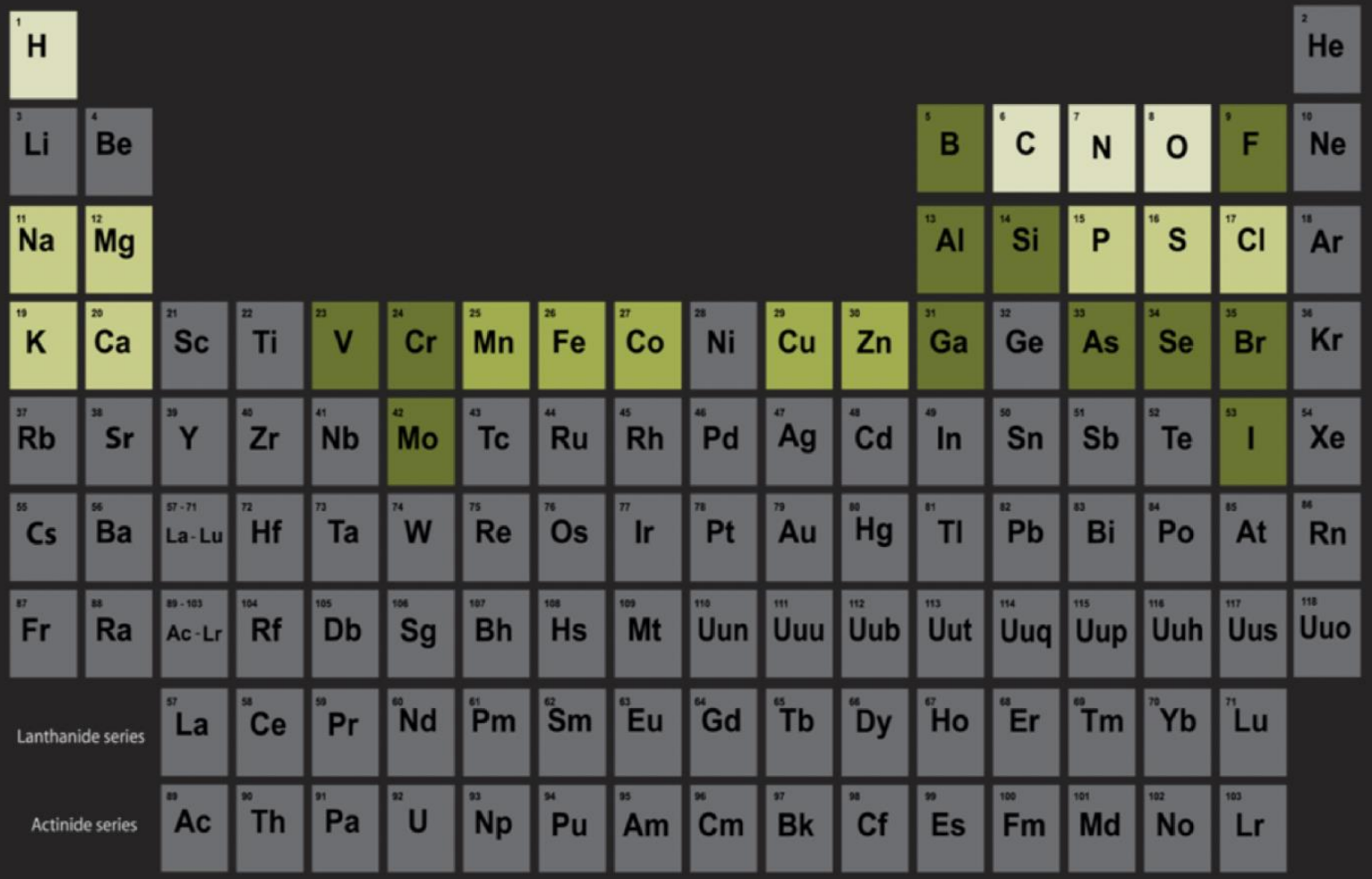
Ca Cl Mg P K Na S

Co Cu Fe Mn Zn

Al As B Br Cr F Ga I Mo Se Si V

Use a subset of elements

Elements found in organisms



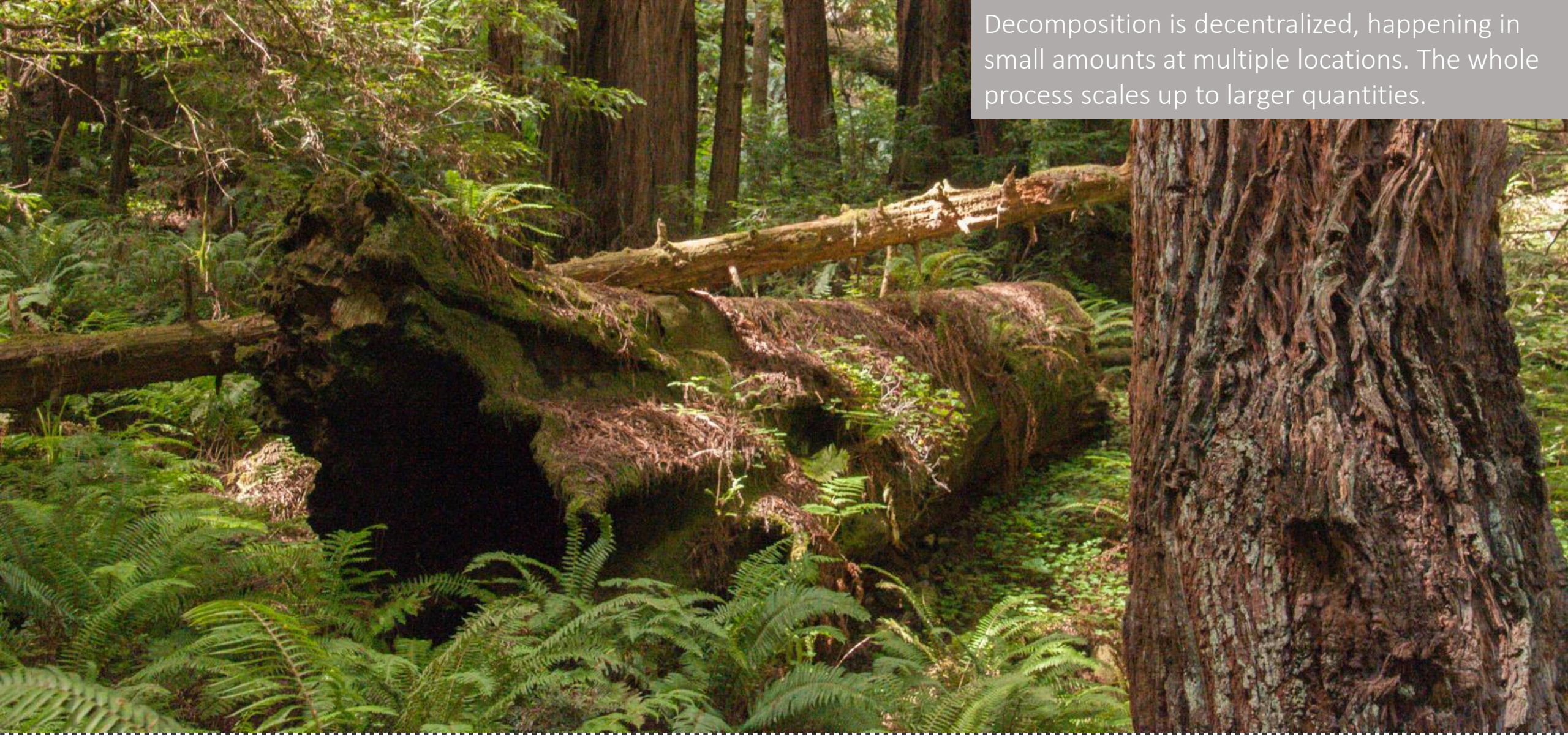
Decomposition is too critical to leave to a single player in the system. Many types of decomposers act on different levels in the system.

Nature’s unsung heroes

Three Major Functions In Every System:
Producers

Consumers

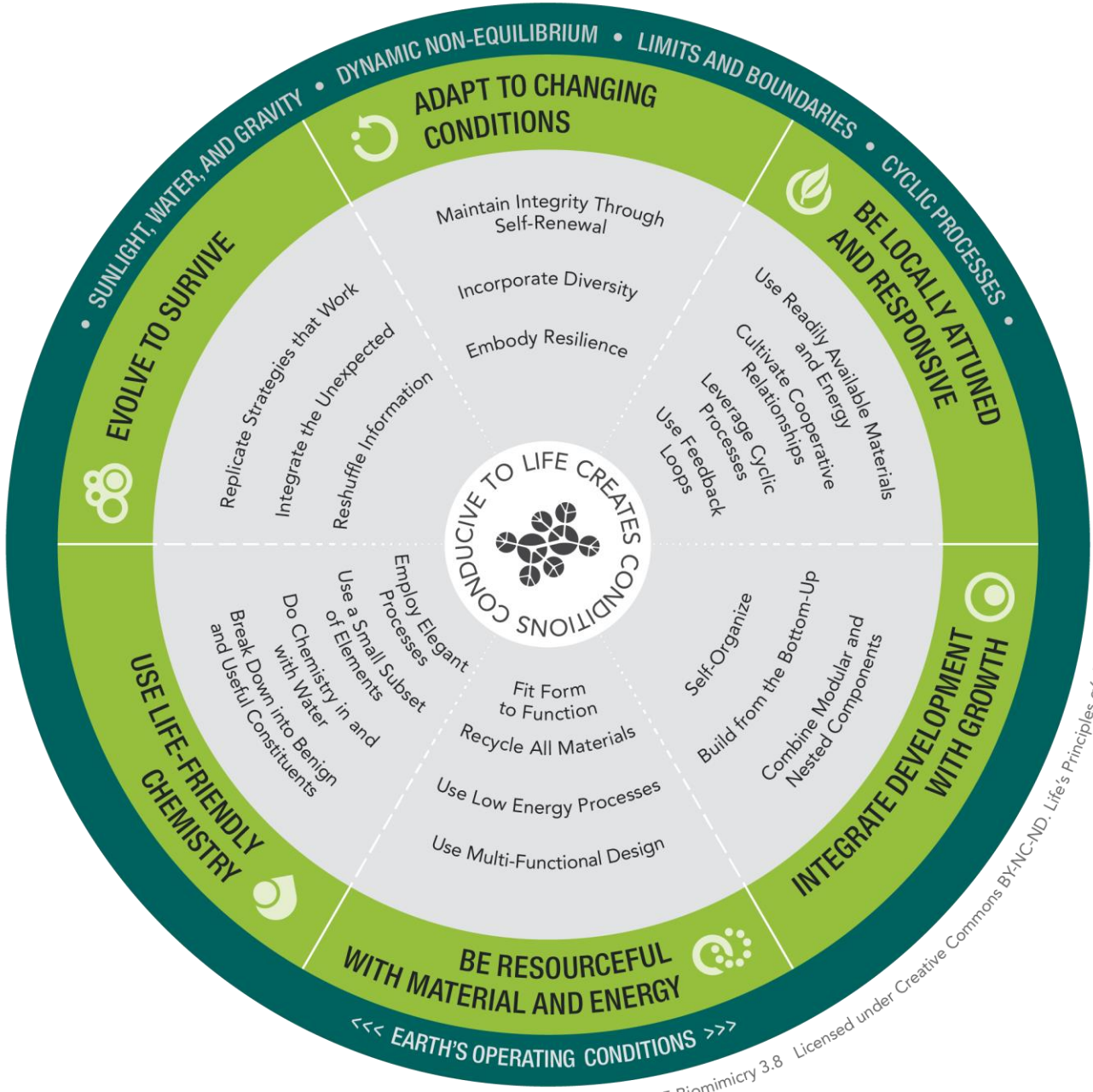
Decomposers

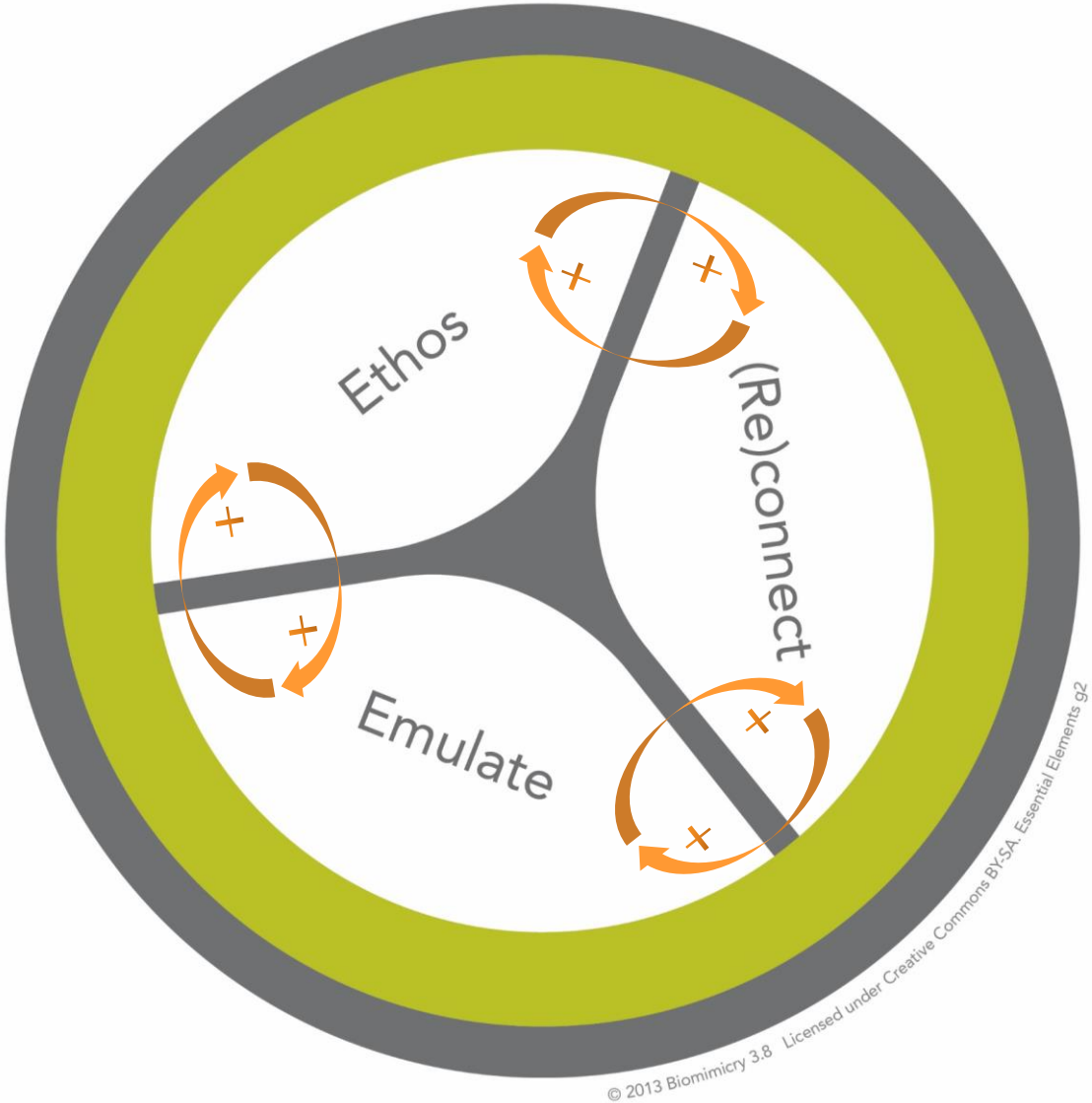


Decomposition is decentralized, happening in small amounts at multiple locations. The whole process scales up to larger quantities.

Natural economies of scale


Nature keeps materials in loops.
Decomposers play an important role in making the loops work.
There are multiple loops that manage different materials.
Decomposition is decentralized.
Nature does not turn materials into the same “product”.





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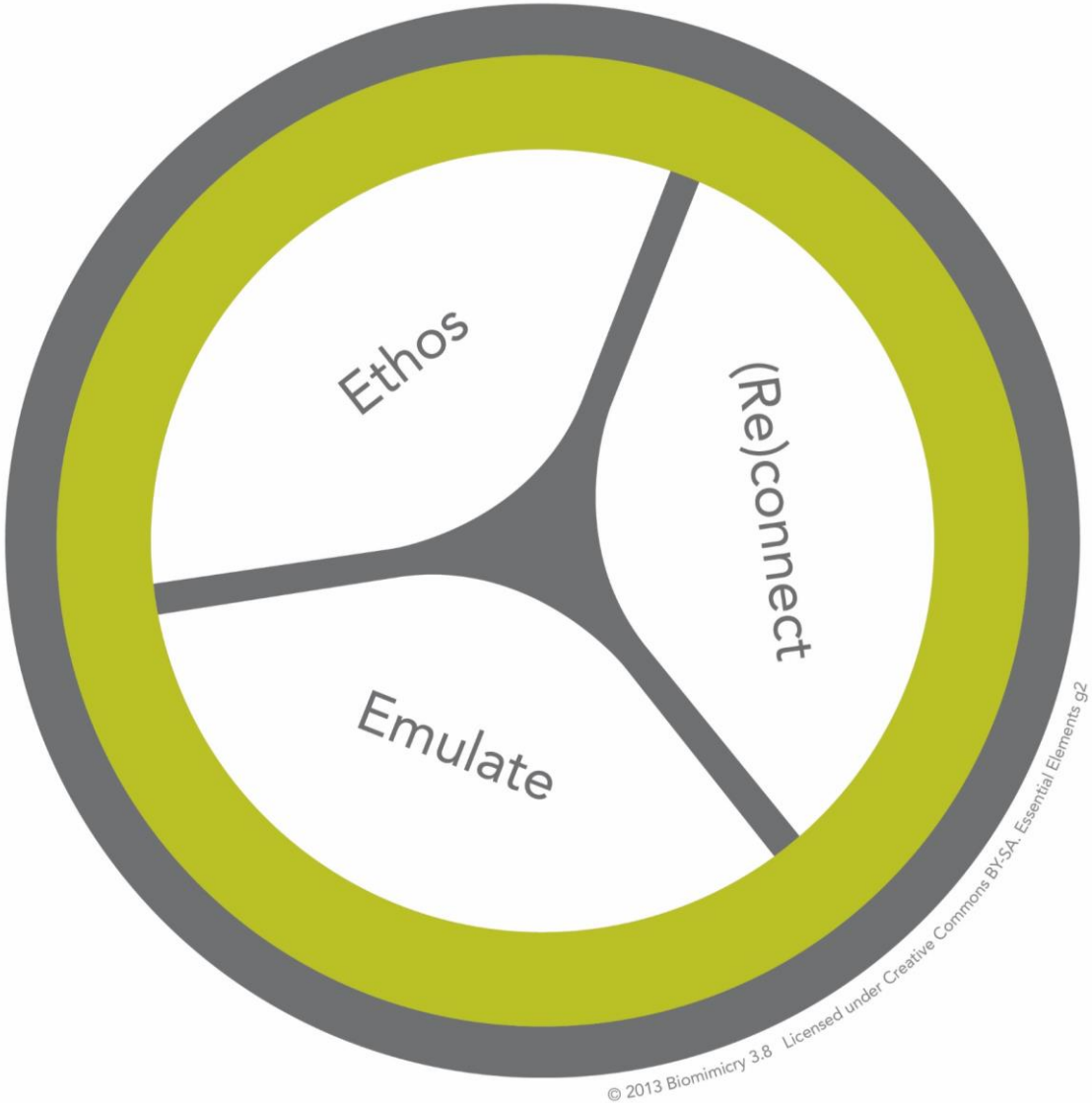
Ethos
(Re)connect
Emulate
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Now what?