

Biomimicry Concepts: A Functional Approach

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?



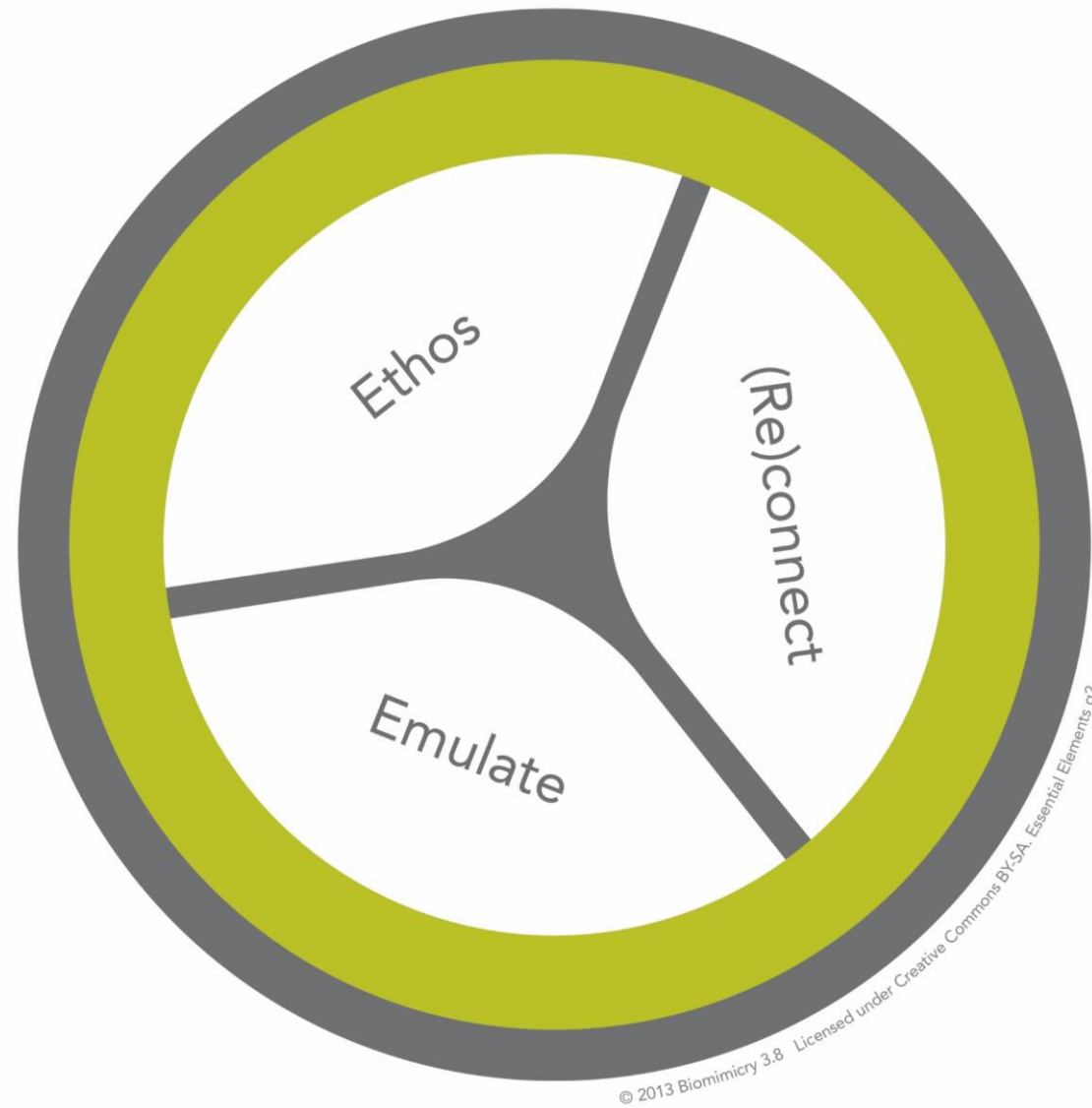
Purposely bringing nature's genius to the design table

What is Biomimicry?

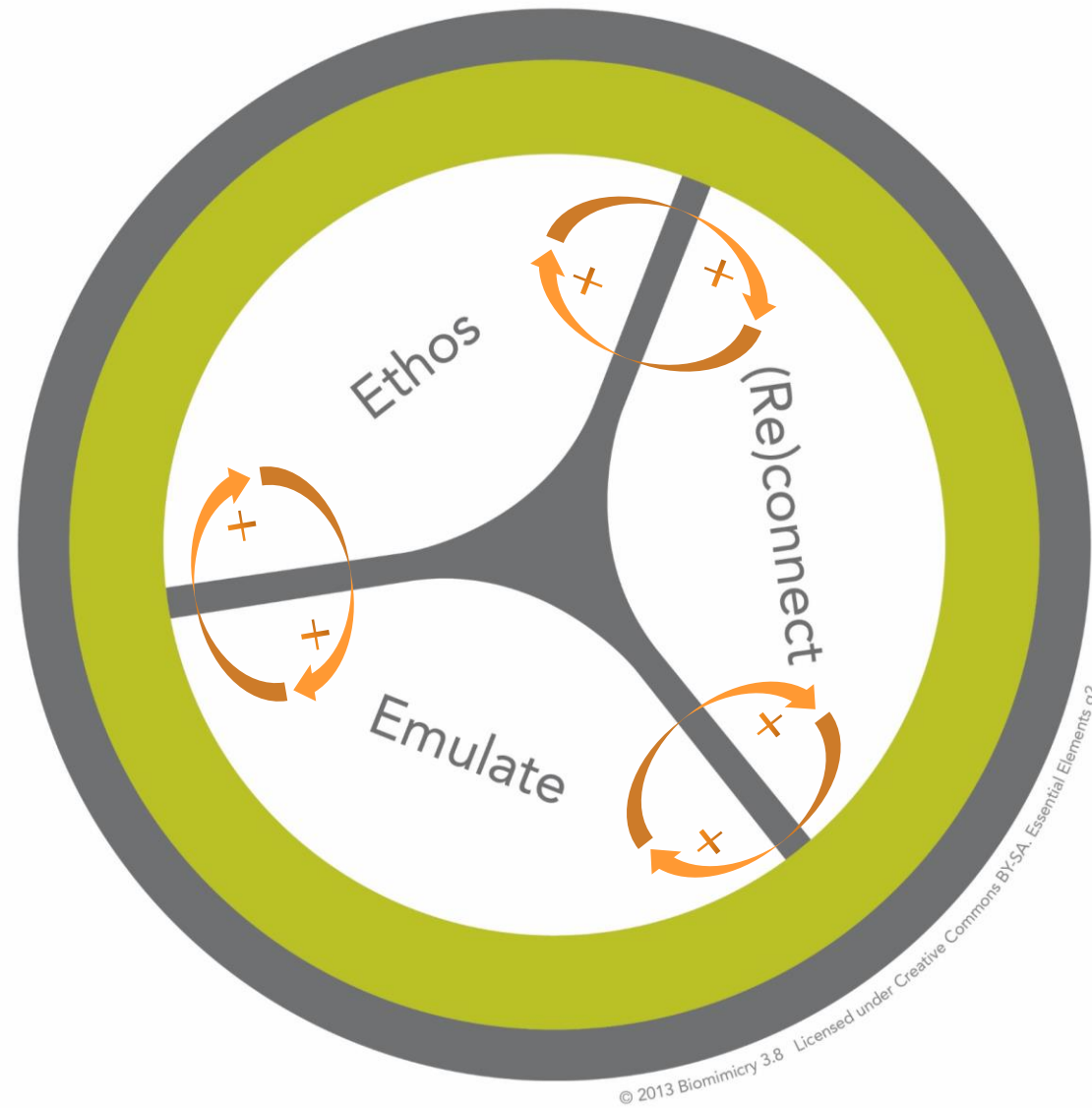


Remembering that we aren't the only species

What is Biomimicry?



Three Elements of Biomimicry



Three Elements of Biomimicry



Famous Biomimicry Example



Quick thought experiment



Imagine the Earth 4.6 billion years ago



Our world today



What happened?



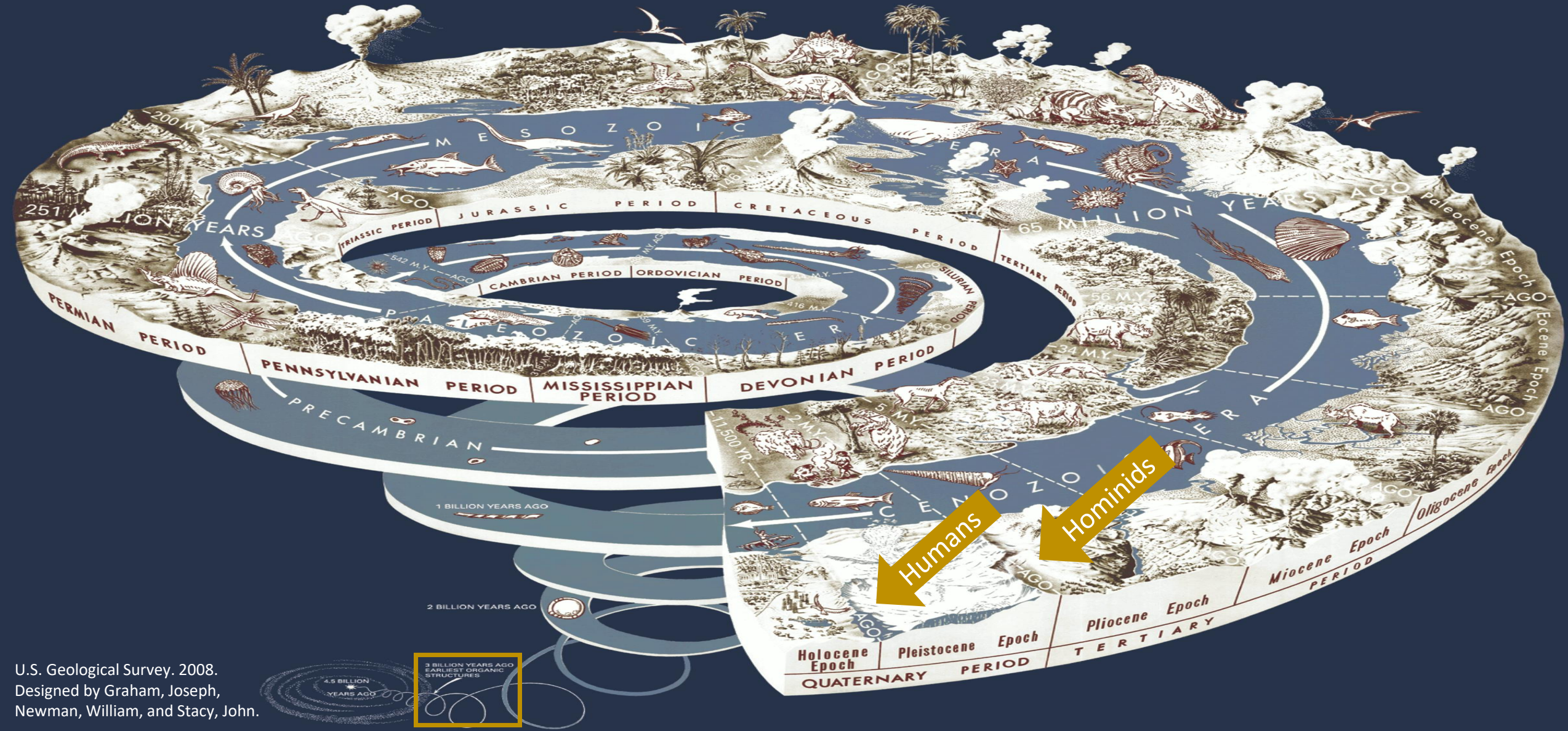
Life appeared 3.8 BYA



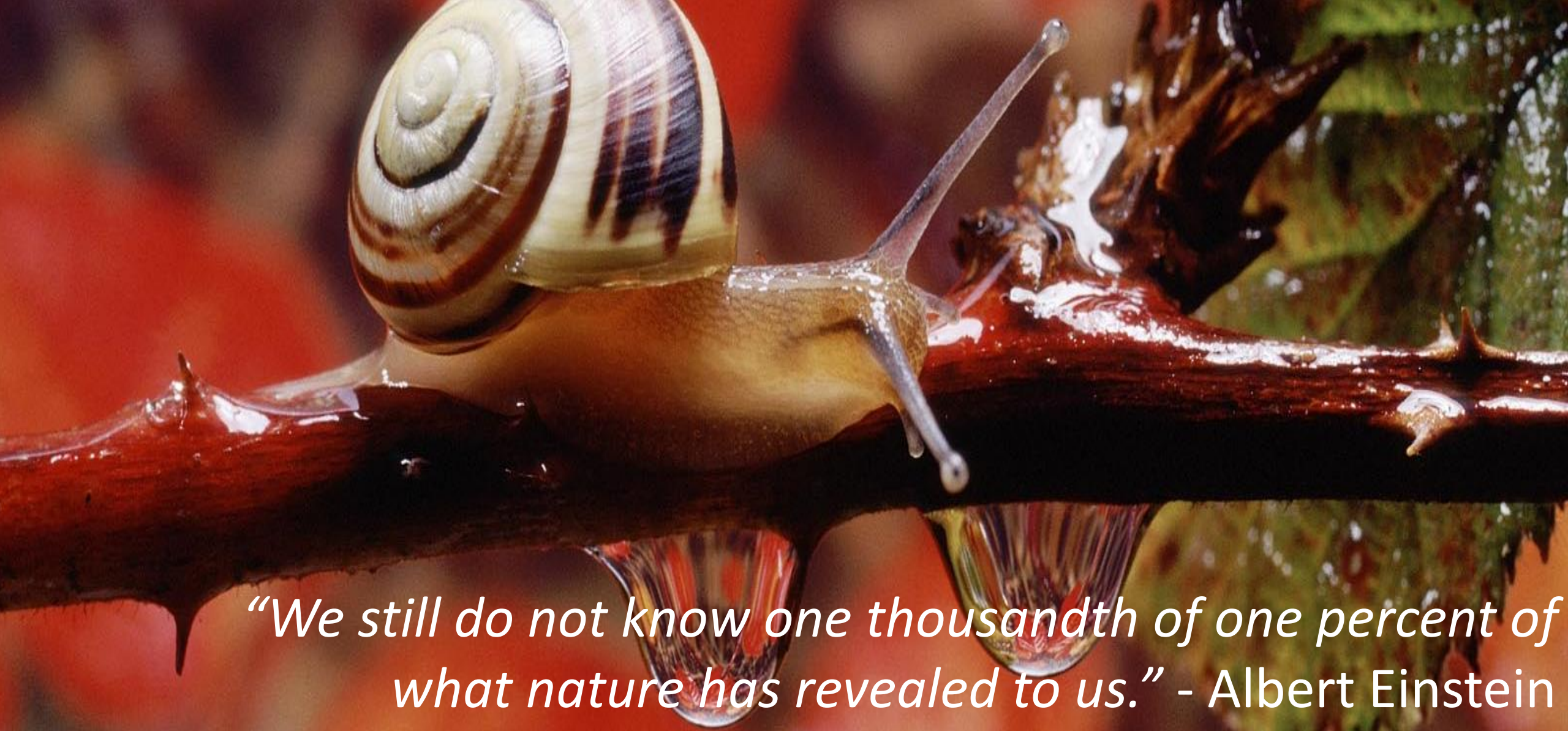
LIFE CREATES CONDITIONS CONDUCIVE TO LIFE



Life offers the ultimate model for regenerative design

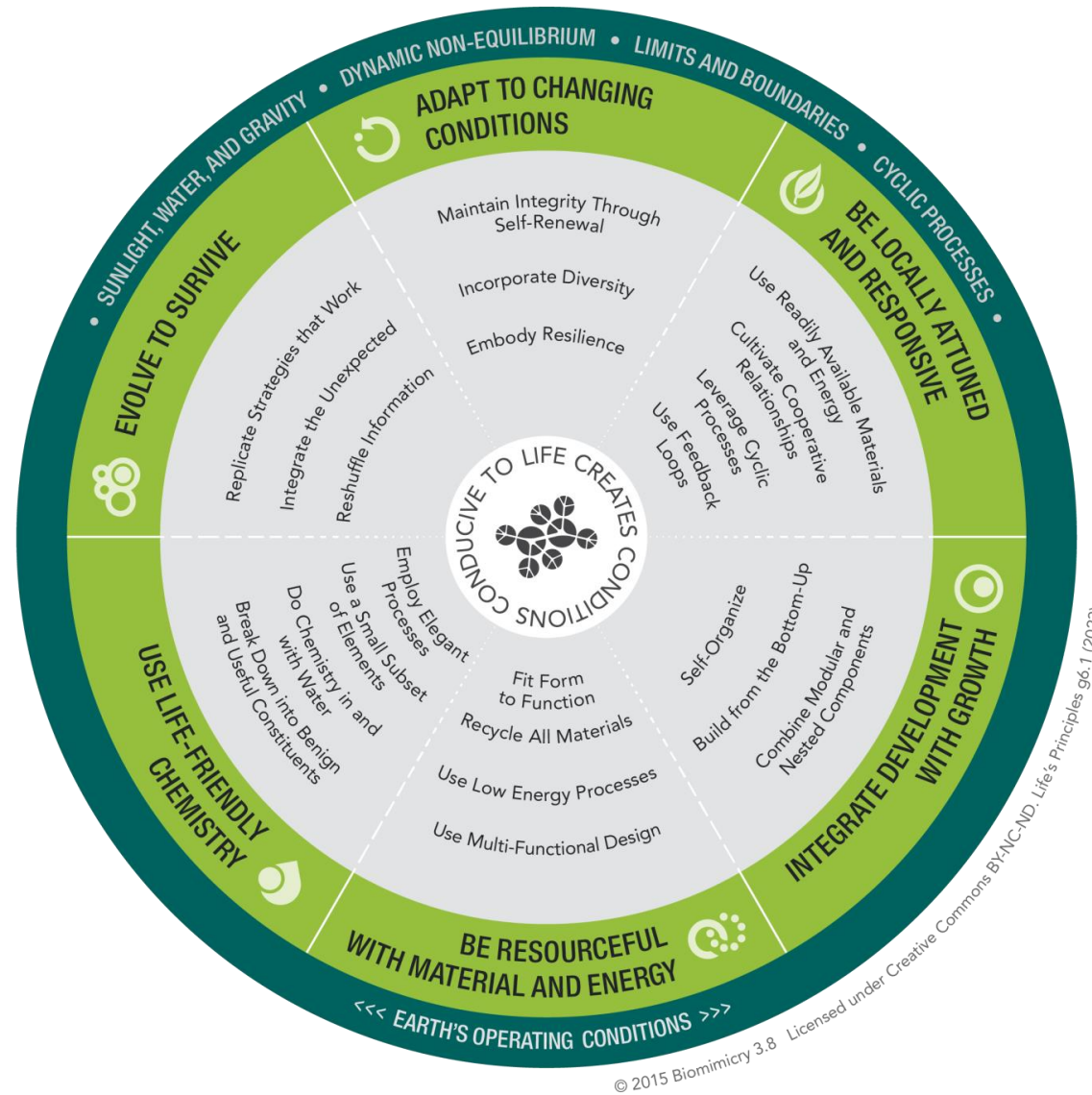


We're very young!



“We still do not know one thousandth of one percent of what nature has revealed to us.” - Albert Einstein

Nature's genius awaits discovery



Life's Principles

Learning from Nature's Genius (40 min)

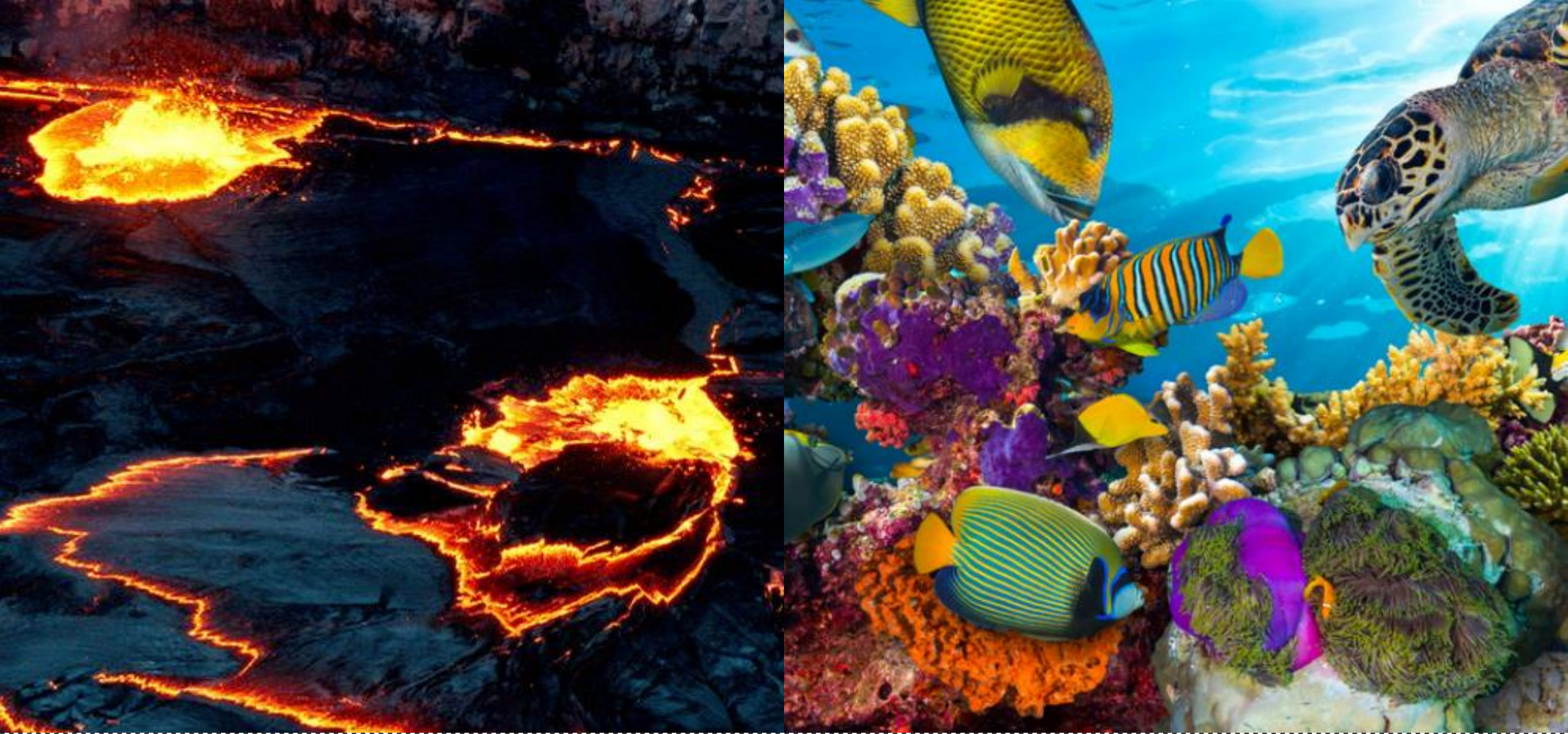
Communicates via Color	Stores Energy	Attaches Temporarily	Responds to Signals
Gathers Waste	Reflects Light	Cools	Transports
Provides Packaging	Shelters Others	Absorbs Light	Provides Structure
Cooperates	Communicates via Sound	Stores Water	Protects from Attack
Utilizes Wind	Cushions Impact	Breaks Down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



Ethos: Purpose unites and motivates



What is the purpose of life?



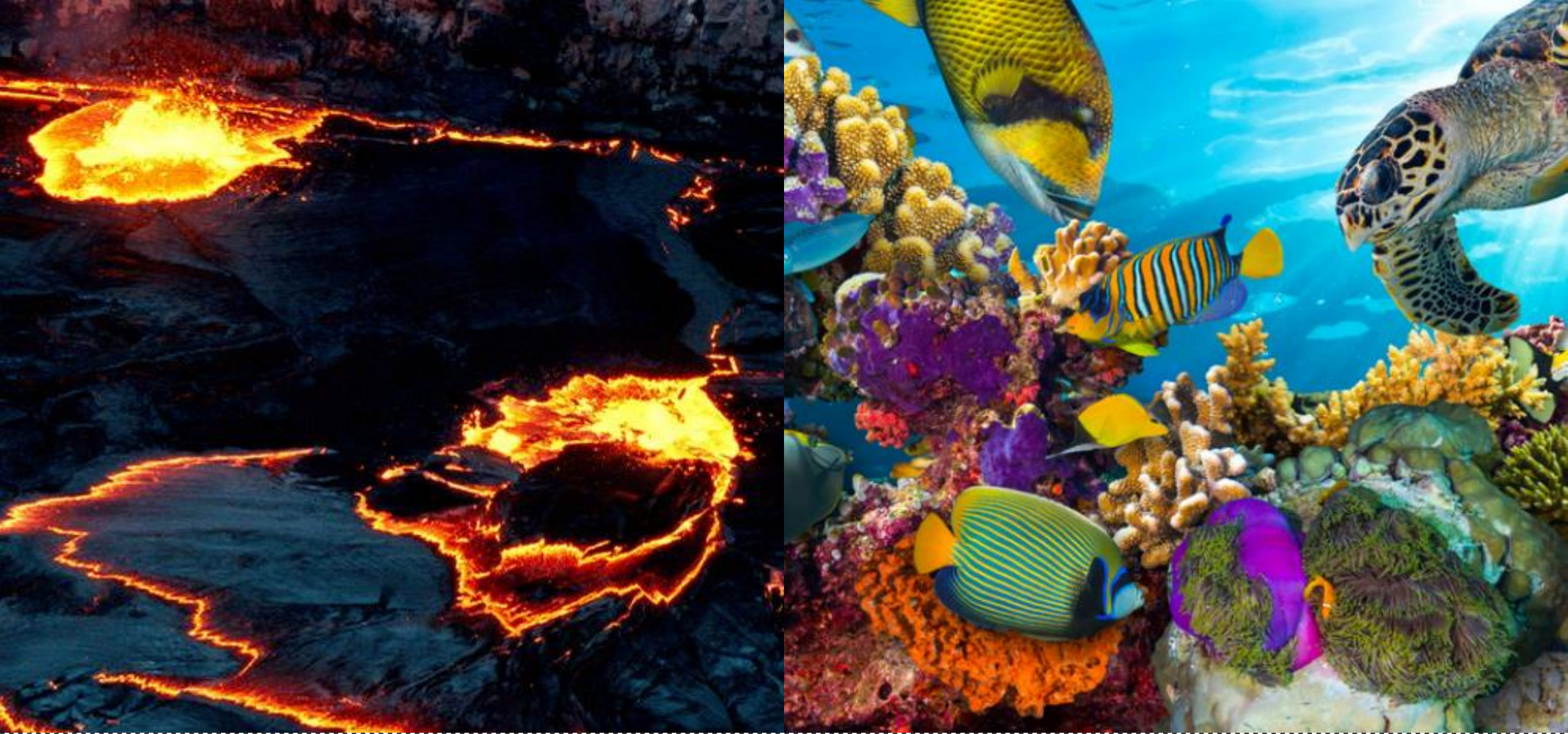
Life Creates Conditions Conducive to Life



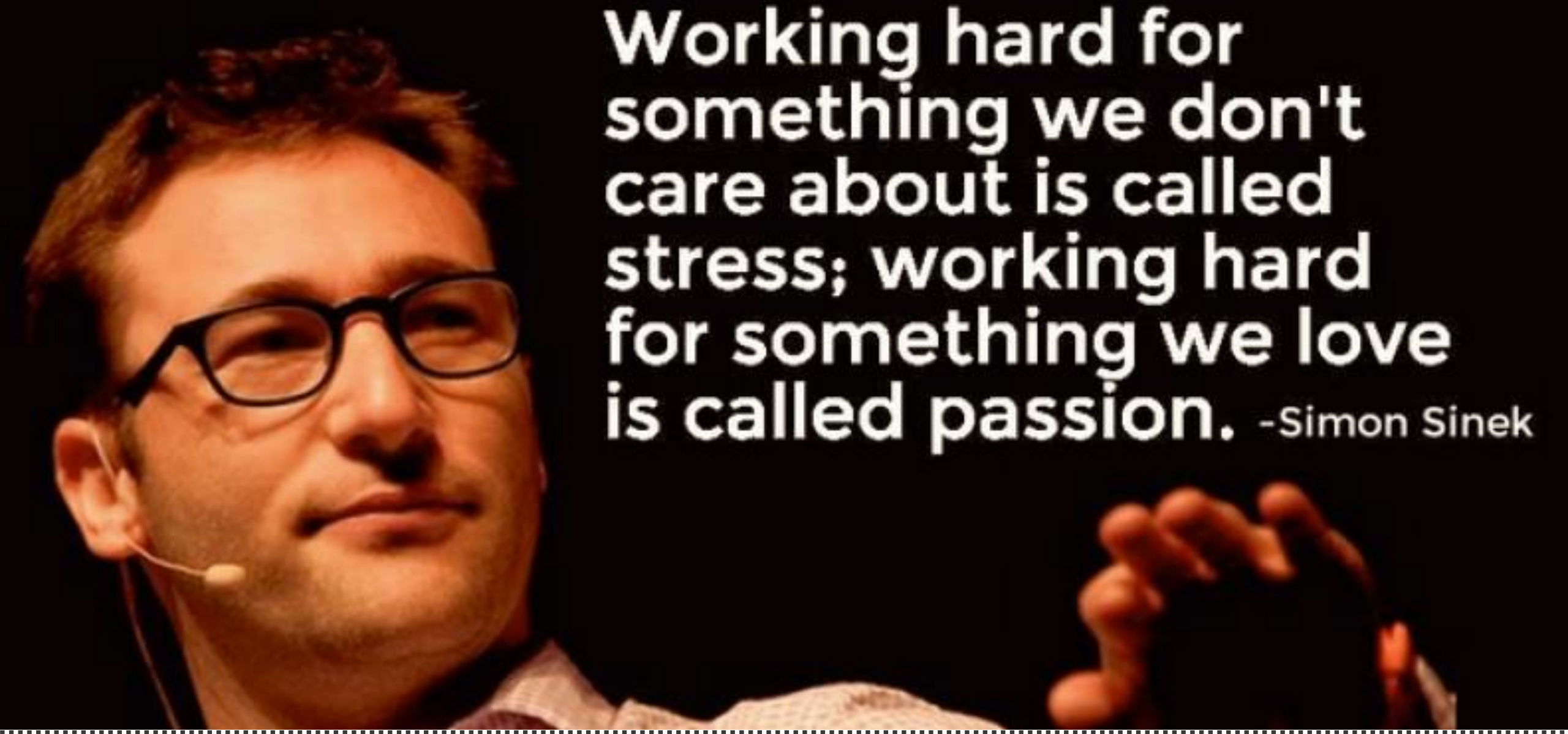
Do we?



This is not inevitable



Life Creates Conditions Conducive to Life



Working hard for something we don't care about is called stress; working hard for something we love is called passion. -Simon Sinek

The Power of Why

A HARVARD BUSINESS REVIEW ANALYTIC SERVICES REPORT



**Harvard
Business
Review**

THE BUSINESS CASE FOR PURPOSE

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/19392HBRRReportEY.pdf>

© 2017 EYGM Limited. All rights reserved. ED None.



(Re)Connect: Benefits of Nature Contact



Openness to nature's genius



Evolutionary “programming”



HEARING IS BELIEVING

LEARN MORE

Our soundscapes

Behaviorally Modern Humans

60,000 BC - Present

Recorded
History

60,000 BC

Humans
Migrate Out of
Africa for
the First Time

Humans widely
considered to
have language
by this point
(50,000 BC)

First humans migrate over the Bering land
bridge into the Americas
(the debate over when this first happened
ranges from 40,000 – 15,000 BC)

Humans First
Cultivate Wheat
(9,000 BC)

Image from Tim Urban

Humans evolved in contact with nature

Imagine your ideal workplace





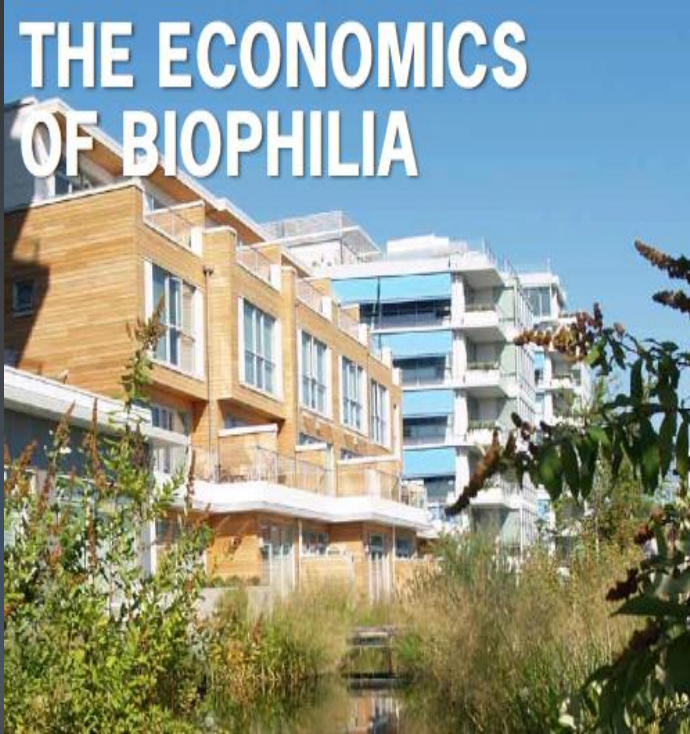
- Improved stress recovery rates
- Improved cognitive functions
- Enhanced mental stamina and focus
- Elevated moods
- Increased learning rates
- Lower blood pressure



Evidence for Biophilic Design

**Save over \$2,000
per employee per year**

**THE ECONOMICS
OF BIOPHILIA**





Emulate: Asking “How Does Nature...?”



How does nature manage coastlines?



ECOncrete®



Photograph from India On Wheels by
Aniruddha - licensed under a Creative
Commons Attribution 2.5 India License

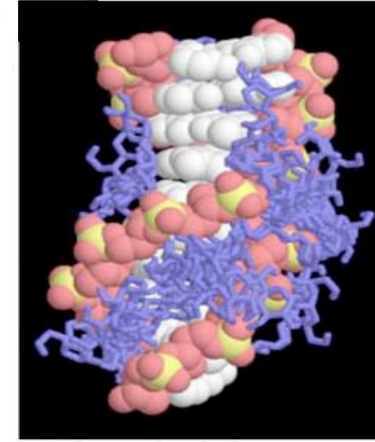
Function is the bridge between biology and design



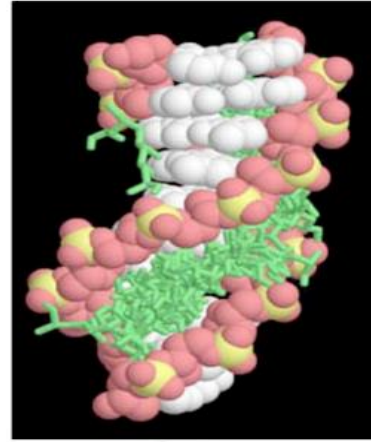
How does nature keep cold? Or...



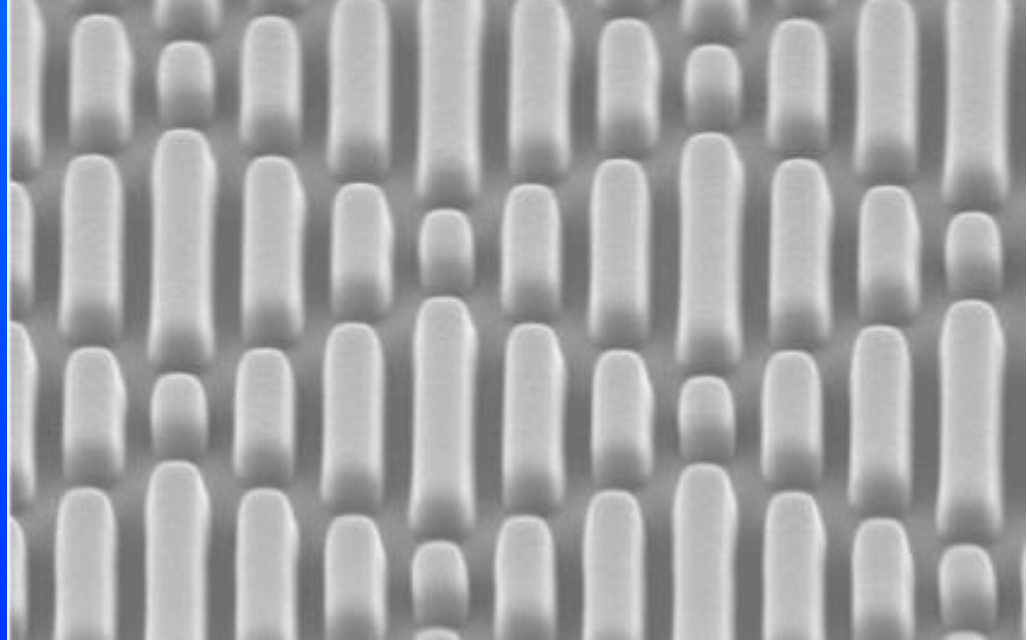
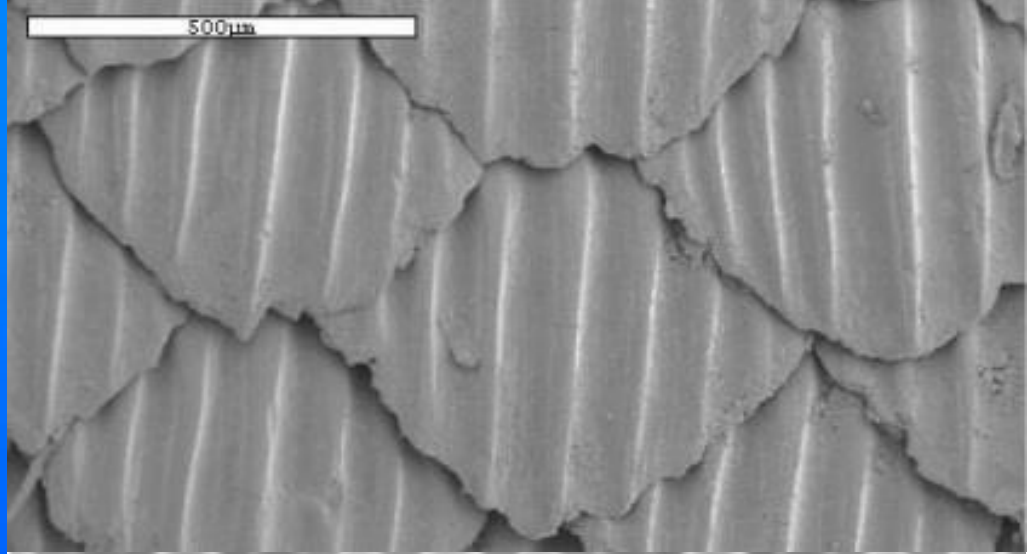
Anhydrobiosis



Biomatrica



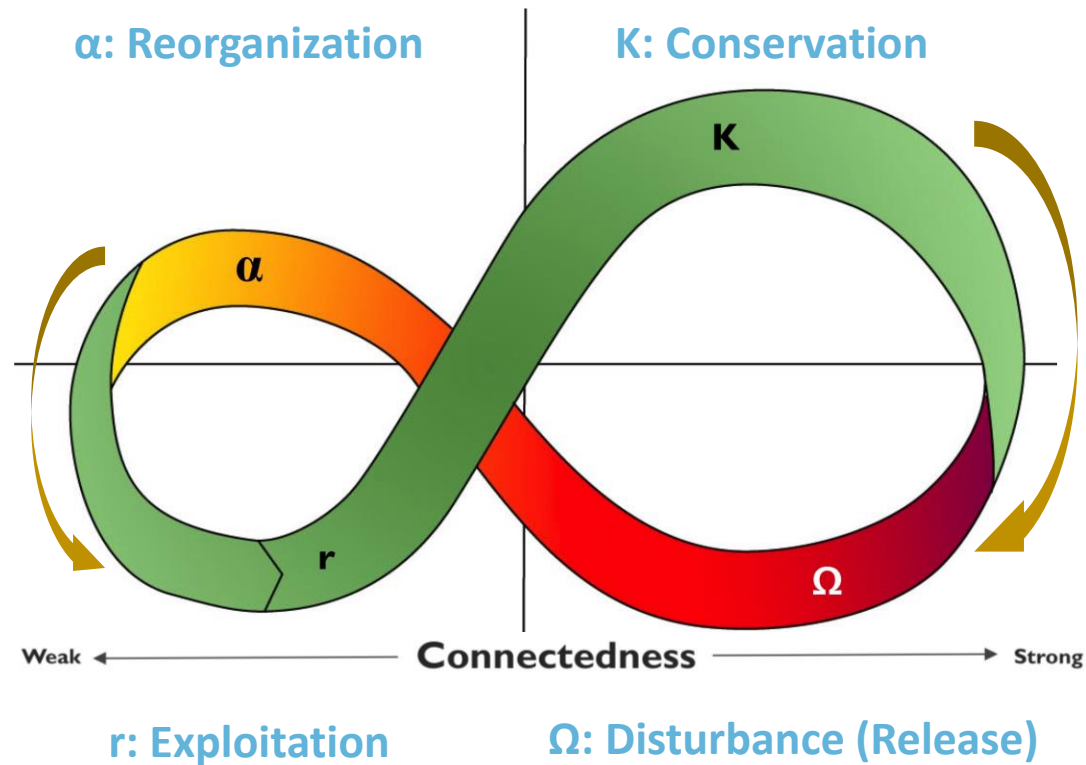
How does nature preserve biological molecules?
Biomatrix DNA SampleGard



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



How would nature design an organization?



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

What is most abundant is released into bigger, looser loops to be reused by others.



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

1 H																	2 He
3 Li	4 Be											5 B	6 C	7 N	8 O	9 F	10 Ne
11 Na	12 Mg											13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr
37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe
55 Cs	56 Ba	57 - 71 La - Lu	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn
87 Fr	88 Ra	89 - 103 Ac - Lr	104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Uun	111 Uuu	112 Uub	113 Uut	114 Uuq	115 Uup	116 Uuh	117 Uus	118 Uuo
Lanthanide series		57 La	58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb	71 Lu	
Actinide series		89 Ac	90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr	

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



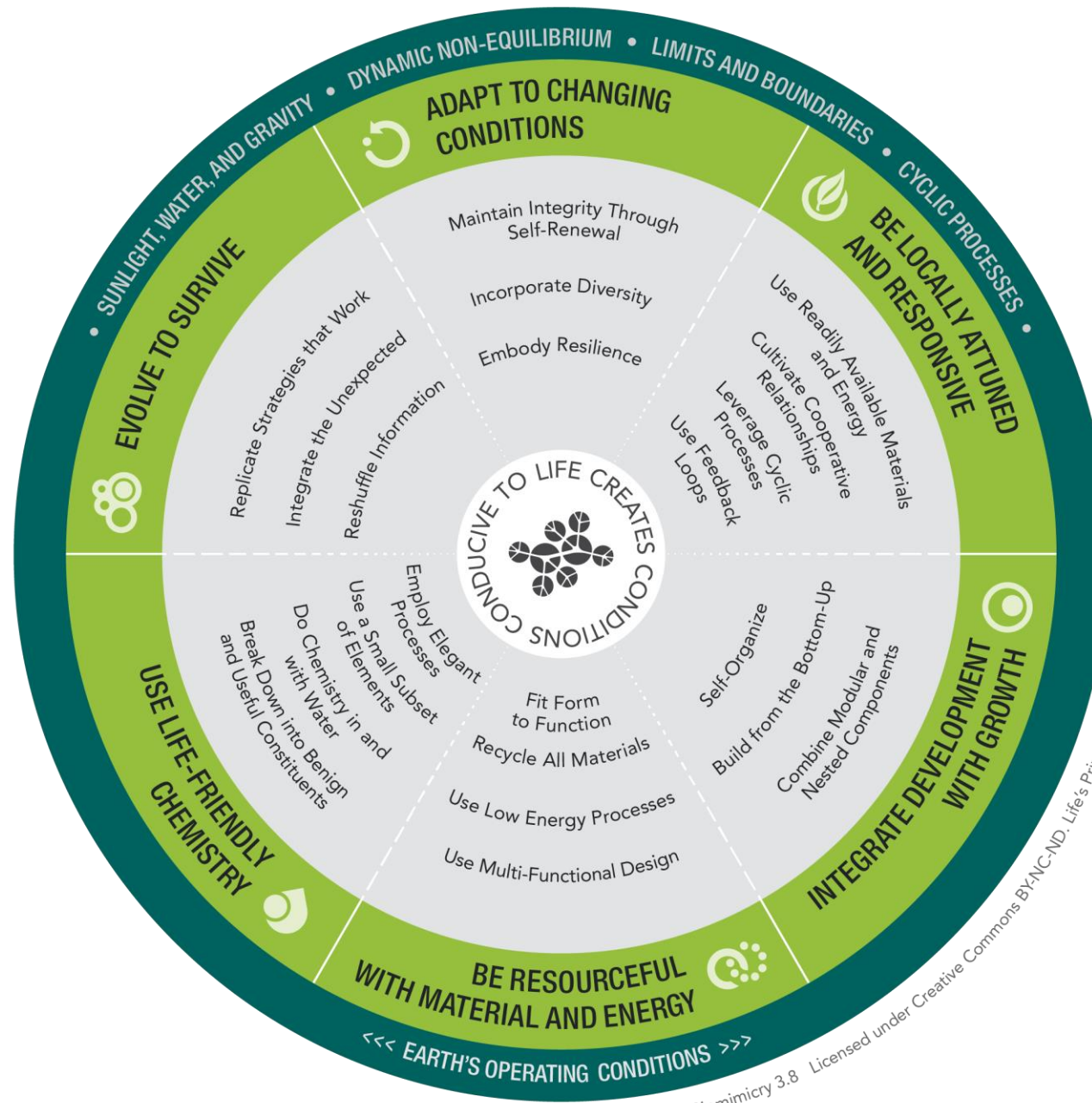
Nature keeps materials
in loops.

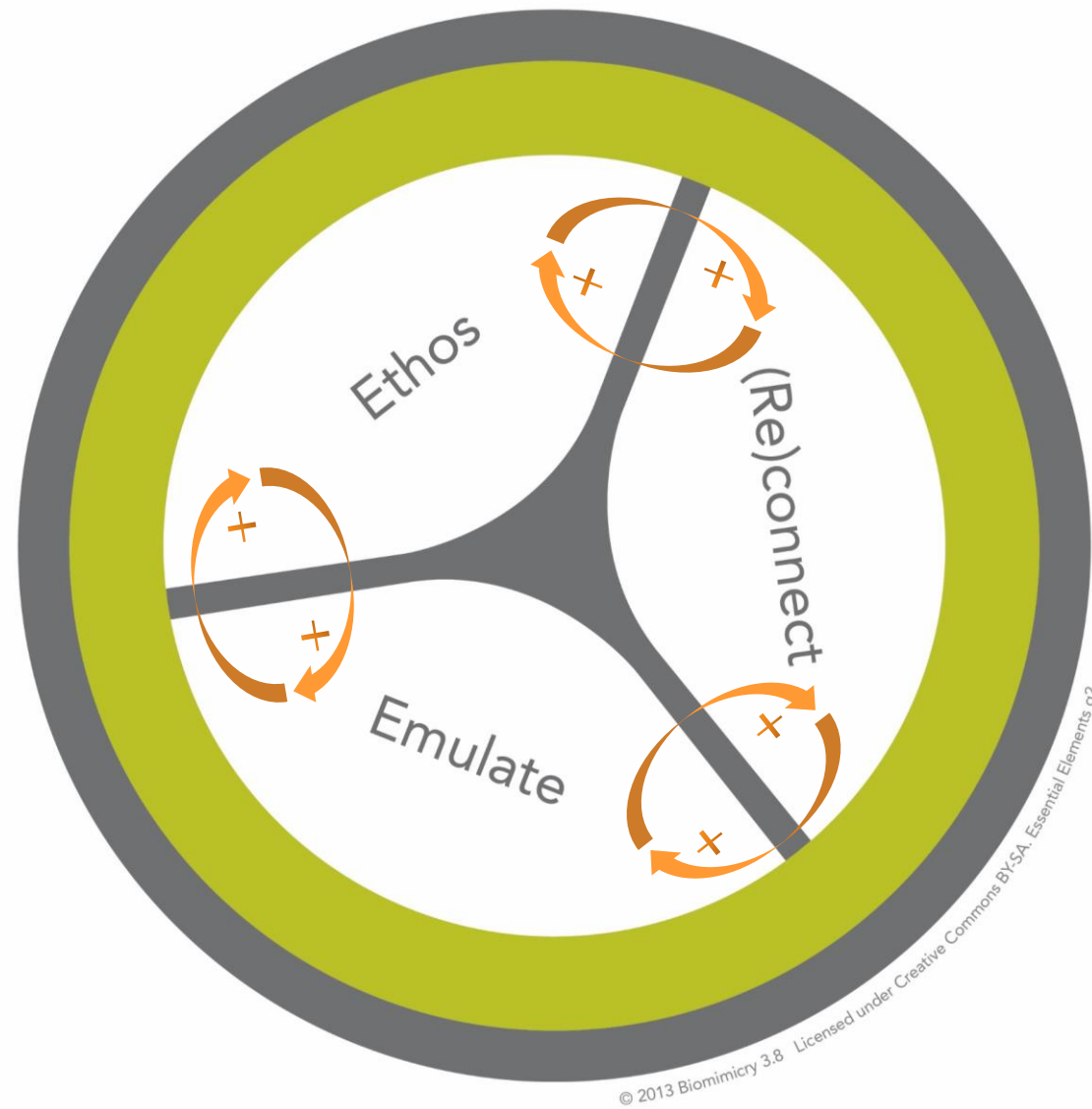
Decomposers play an
important role in making the
loops work.

There are multiple loops that
manage different materials.

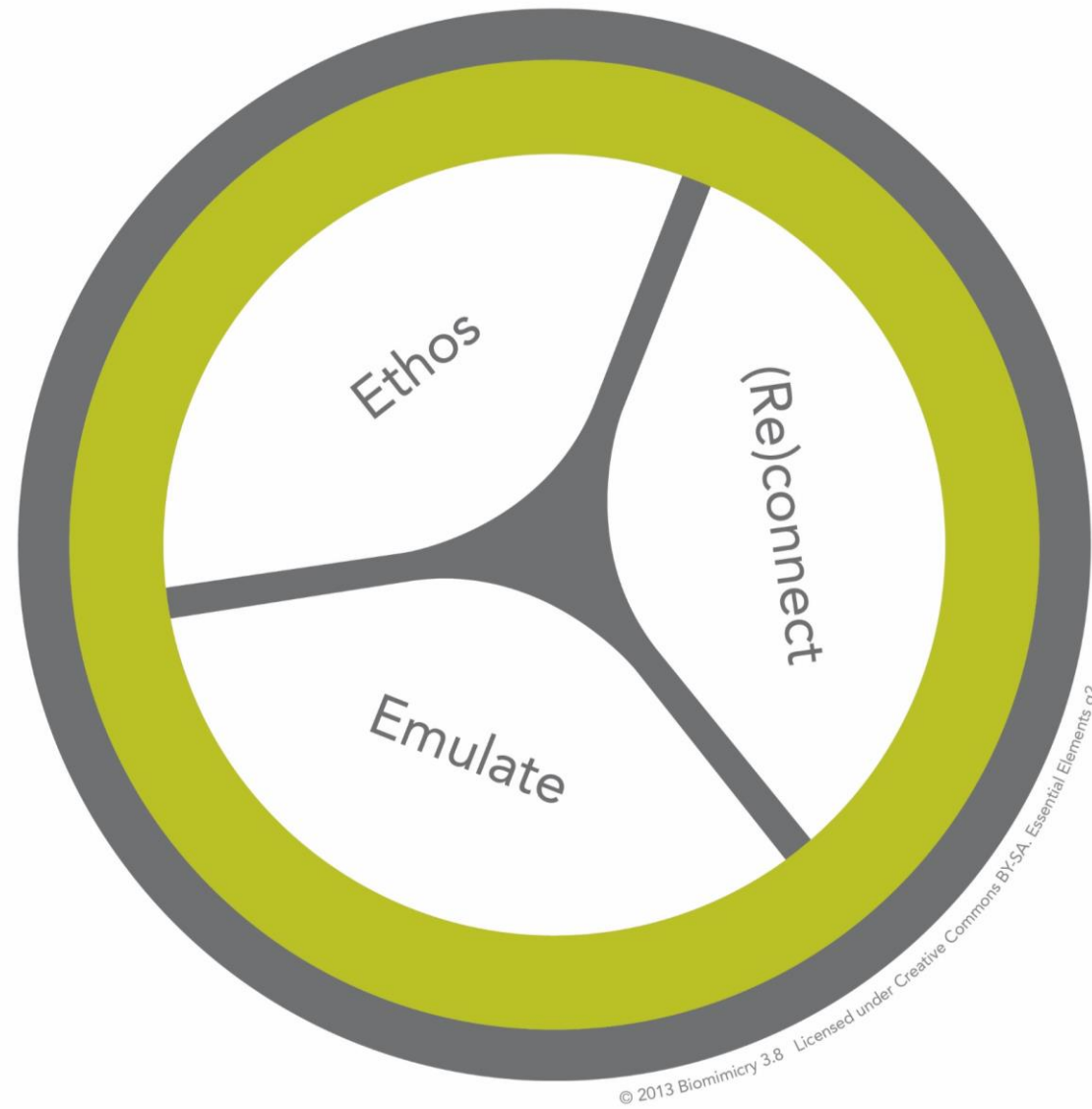
Decomposition is
decentralized.

Nature does not turn materials
into the same “product”.





Three Elements of Biomimicry



Now what?