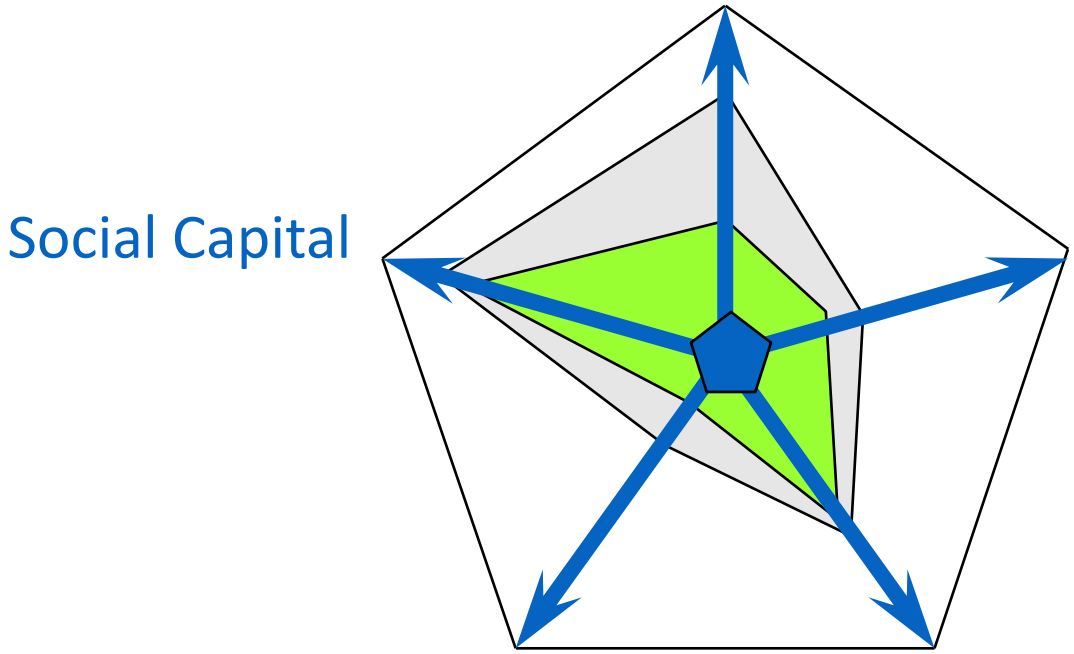
Eco-Innovations

Balakrishna Pisupati

United Nations Environment Programme (UNEP)

Balakrishna.Pisupati@un.org

The Development Paradigm

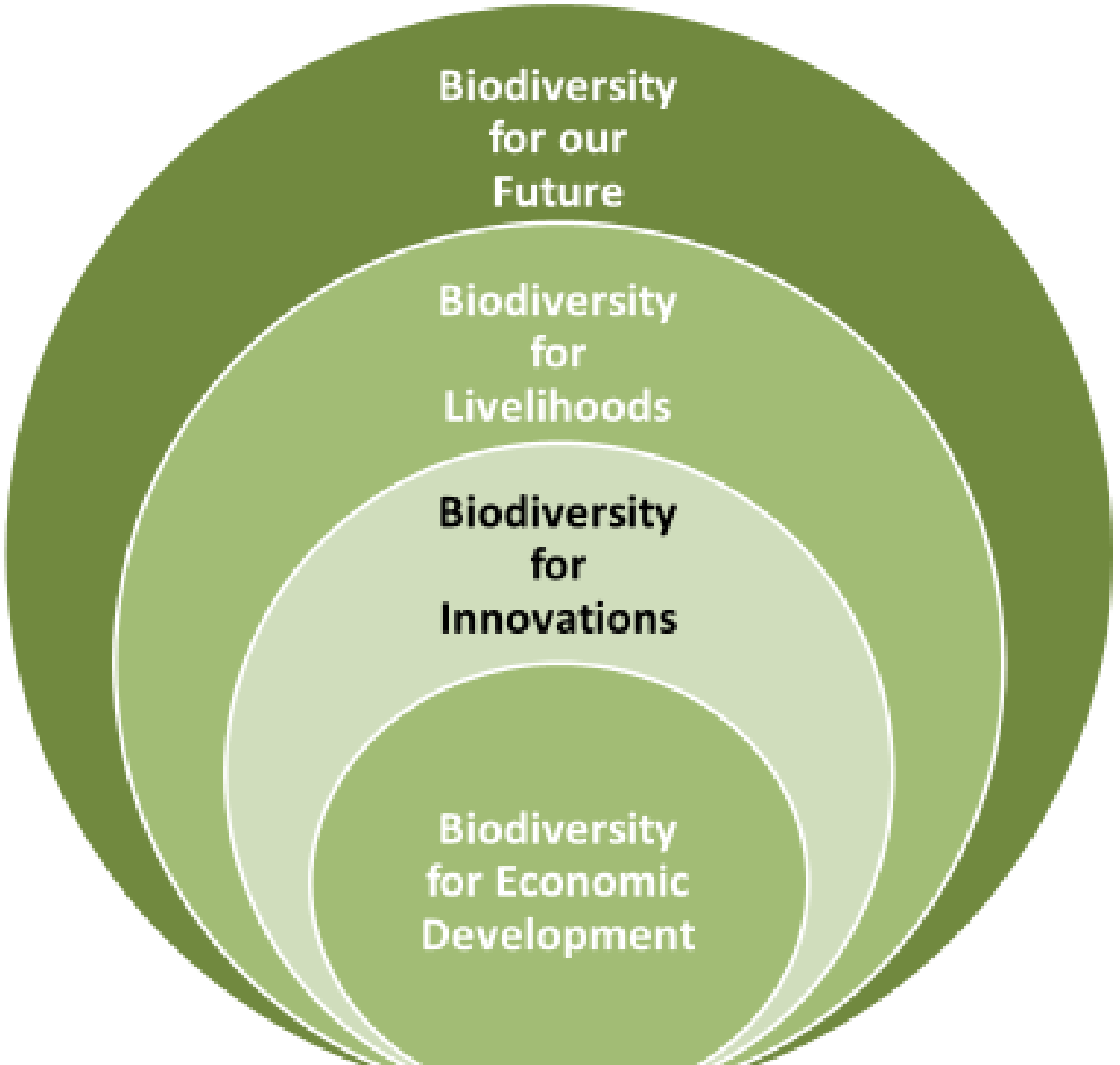


Is this possible?

Never Accounted for

(Bhaskar, 2006)

Biodiversity for Life !



How BIG is this Diversity ?

1.7—2.0 million
species described

Up to 100 million not YET described !

Accounting for Development

- One hectare of mangrove forests are worth **USD 6,250 per year**
- Trade in medicinal plants is worth **USD 60 Billion per year**, globally
- **42% of anti-cancer** drugs in use are from natural sources
- Coastal capture fisheries is worth **USD 34,000 Millions** annually
- Forests provide employment for **60 Million work years**, 80 % of it in developing countries

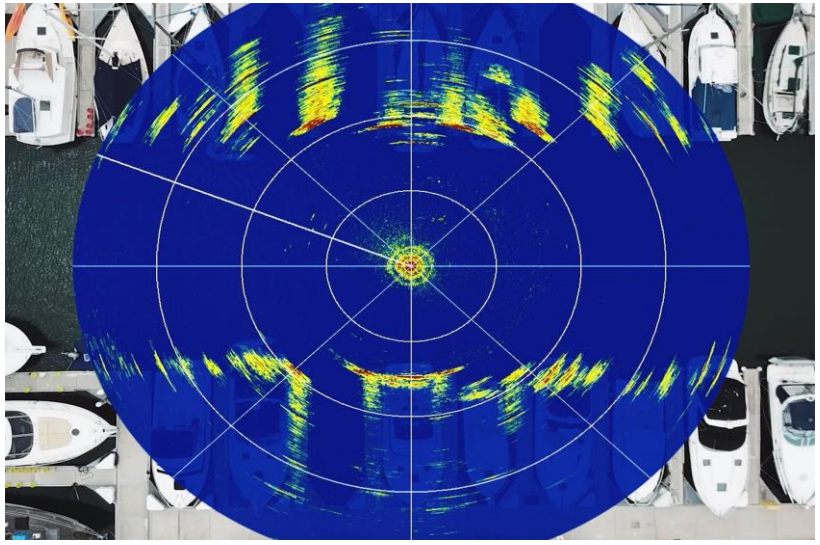
Early Views

"The genius of man may make various inventions, encompassing with various instruments one and the same end; but it will never discover a more beautiful, more economical, or a more direct one than nature's, since in her inventions nothing is wanting and nothing is superfluous."

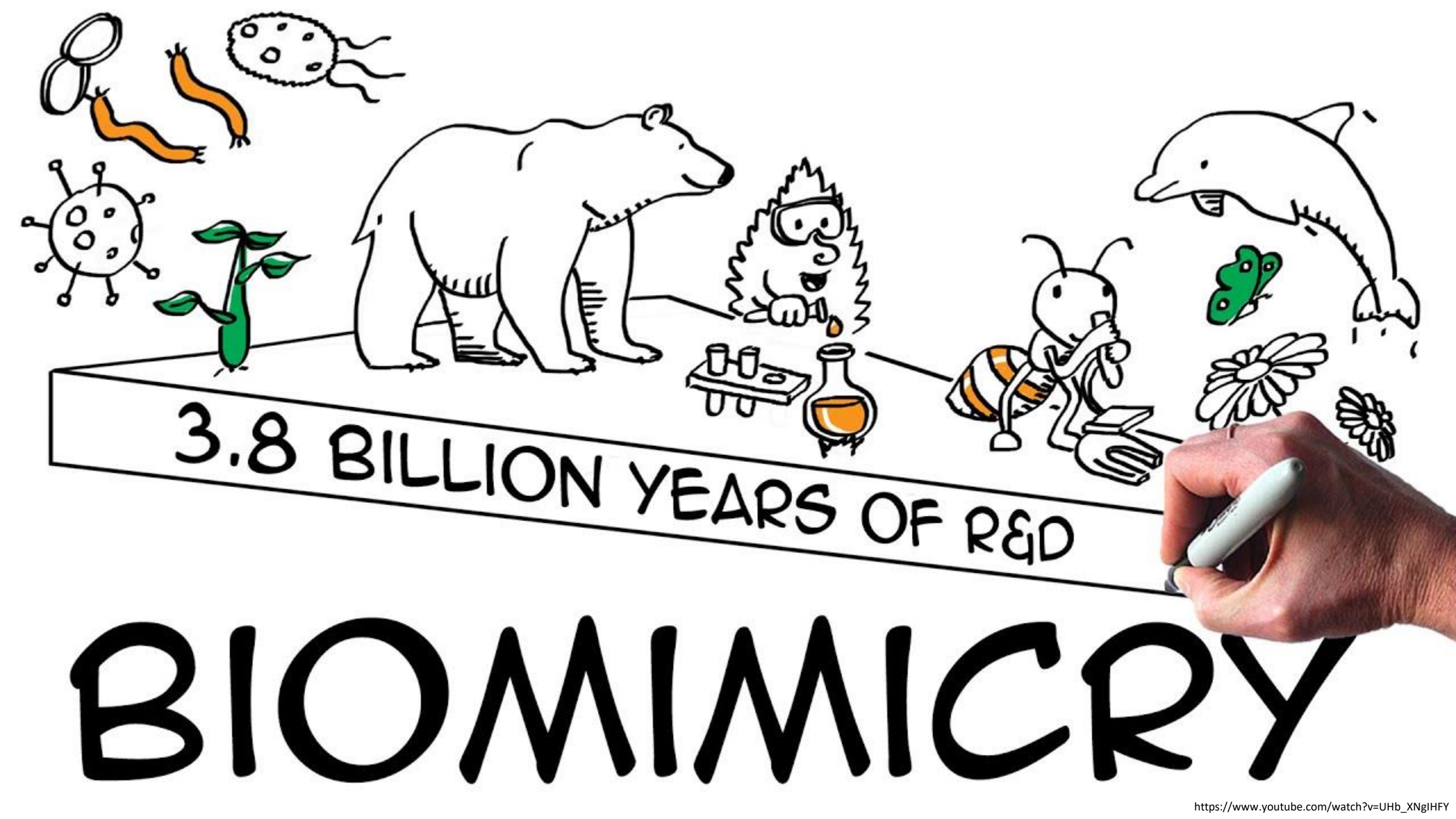
-- Leonardo da Vinci

http://firststreetconfidential.com/images/images-history/0103-leonardo-da-vinci-flying-machine.jpg

What do these have in common?

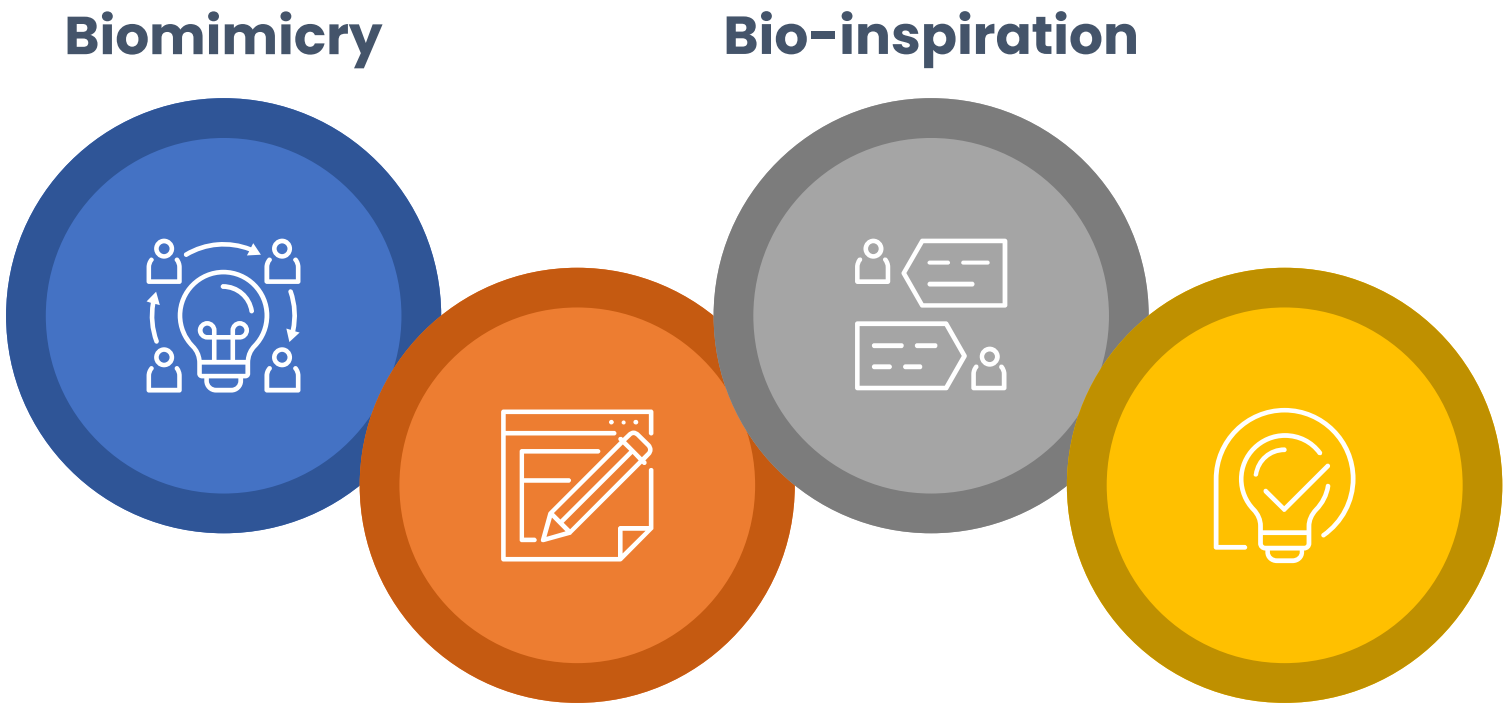


The inspiration from Nature !!



https://www.youtube.com/watch?v=UHb_XNgIHFY

Approaches


Biomimicry
Bio-inspiration
Biomimetics
Nature-based solutions

FOCUS

Form

Process

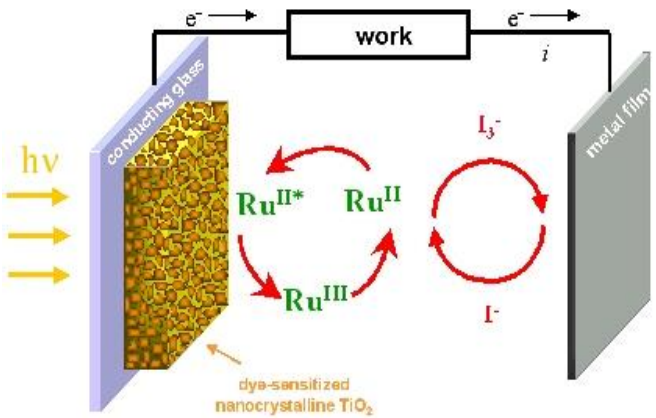
System

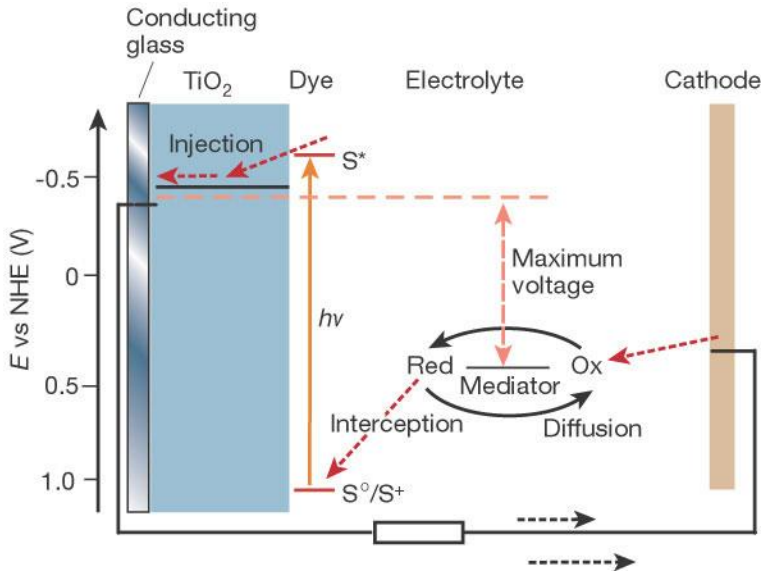
Nature is fun!

Hippo sweat to inspire a waterproof sun lotion with antiseptic, insect-repelling, and antifungal properties

Biodiversity Technologies – Solar Energy

***Kokia Cookei* – The Plant that Inspires Most Efficient Solar Cells**





Making it work !

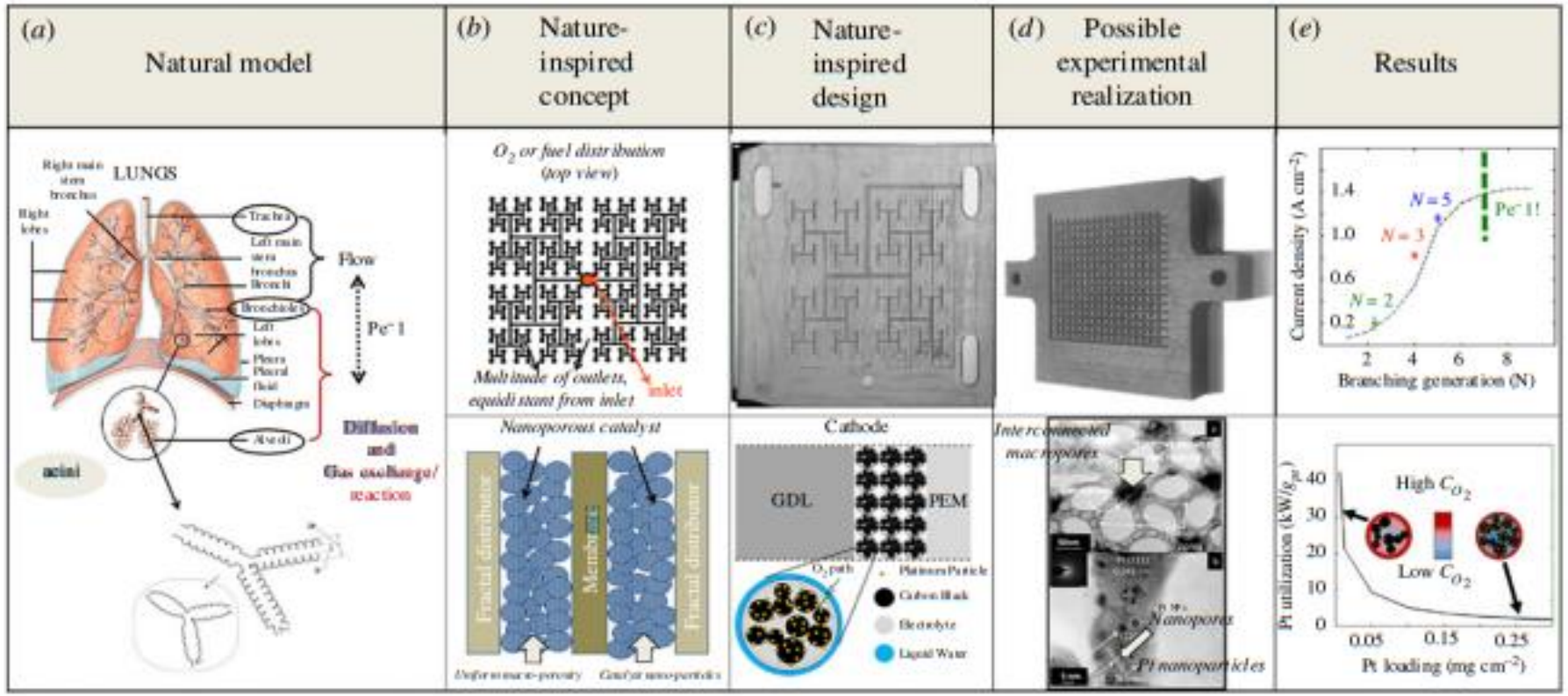
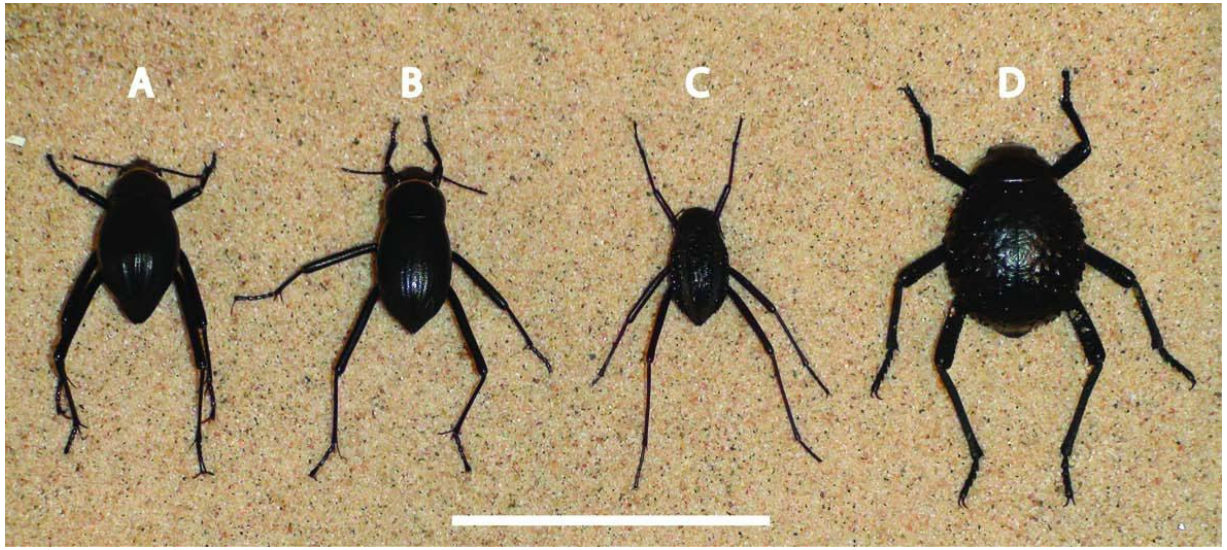
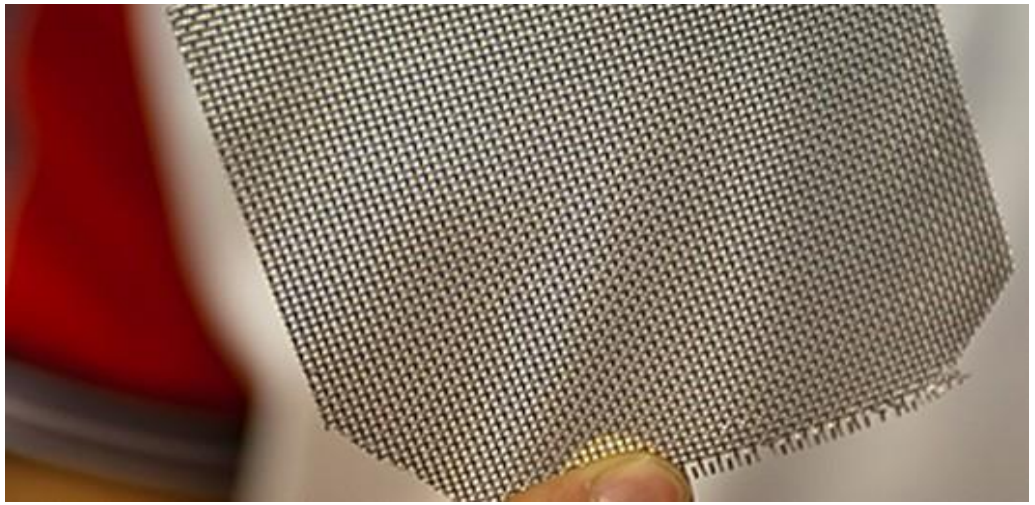


Figure 3. Lung-inspired fuel cell. Illustration of the NICE methodology, which uses fundamental mechanisms underpinning the scalability and efficiency of transport in the lung (*a*) to inspire a concept for transport in a fuel cell (*b*), which is fractal at the macro- to mesoscales of the flow plates (top) and uniform at the meso- to microscale of the porous catalyst (bottom) that is the basis for a new design (*c*), which can be realized thanks to progress in additive manufacturing and chemical synthesis (*d*), which leads to exceptional improvement in fuel cell performance (*e*). This versatile methodology could be applied to trigger innovation in biomedical applications as well. (Online version in colour.)

Ayomi Perera, Marc-Oliver Coppens, 2018

Rainwater harvesting – Namib Beetle





What is it worth?

- By 2030, the field could account for $425 billion of U.S. GDP and $1.6 trillion of total global output (Fermanian Business and Economic Institute)

Eco-innovation Applications

Material Sciences

Strength, durability;

Applications;

Adaptability

Engineering

Structural engineering;

Mechanical engineering;

Motion technology

Social sciences

The "bucket brigade“;

Self-organization

Environmental management

Climate adaptation;

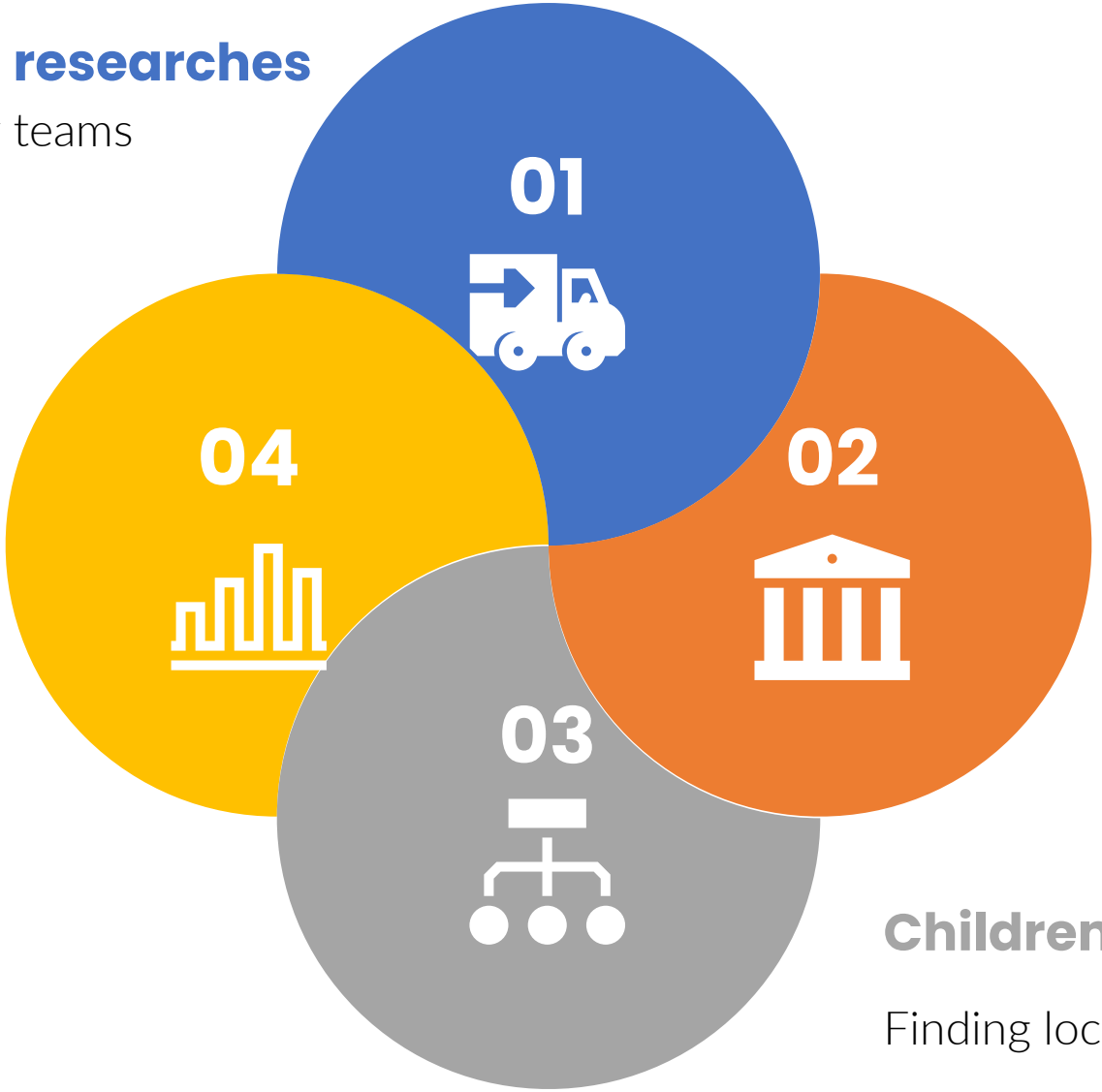
Waste management;

Regeneration and restoration

Who are working?

Scientists and researches

In transdisciplinary teams



Designers

Translating research results into products

Policy makers

To protect, manage and use Nature sustainably

Children and Youth

Finding local solutions

nature materials

Perspective | Published: 31 March 2022

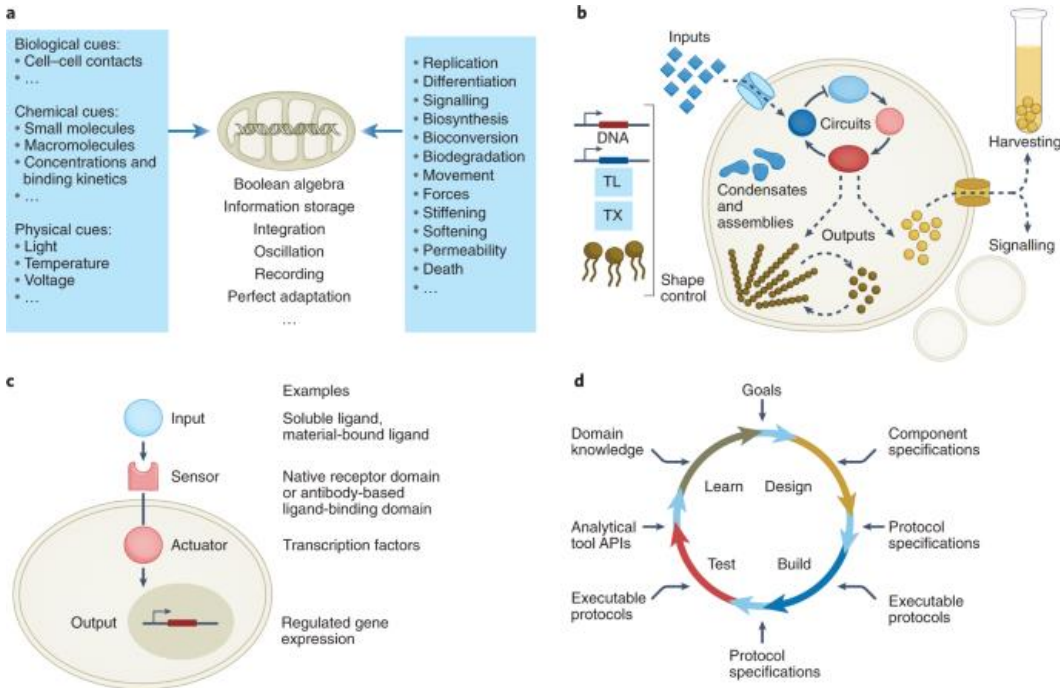
The living interface between synthetic biology and biomaterial design

Allen P. Liu ✉, Eric A. Appel, Paul D. Ashby, Brendon M. Baker, Elisa Franco, Luo Gu, Karmella Haynes, Neel S. Joshi, April M. Kloxin, Paul H. J. Kouwer, Jeetain Mittal, Leonardo Morsut, Vincent Noireaux, Sapun Parekh, Rebecca Schulman, Sindy K. Y. Tang, Megan T. Valentine, Sebastián L. Vega, Wilfried Weber, Nicholas Stephanopoulos ✉ & Ovijit Chaudhuri ✉

Nature Materials **21**, 390–397 (2022) | Cite this article

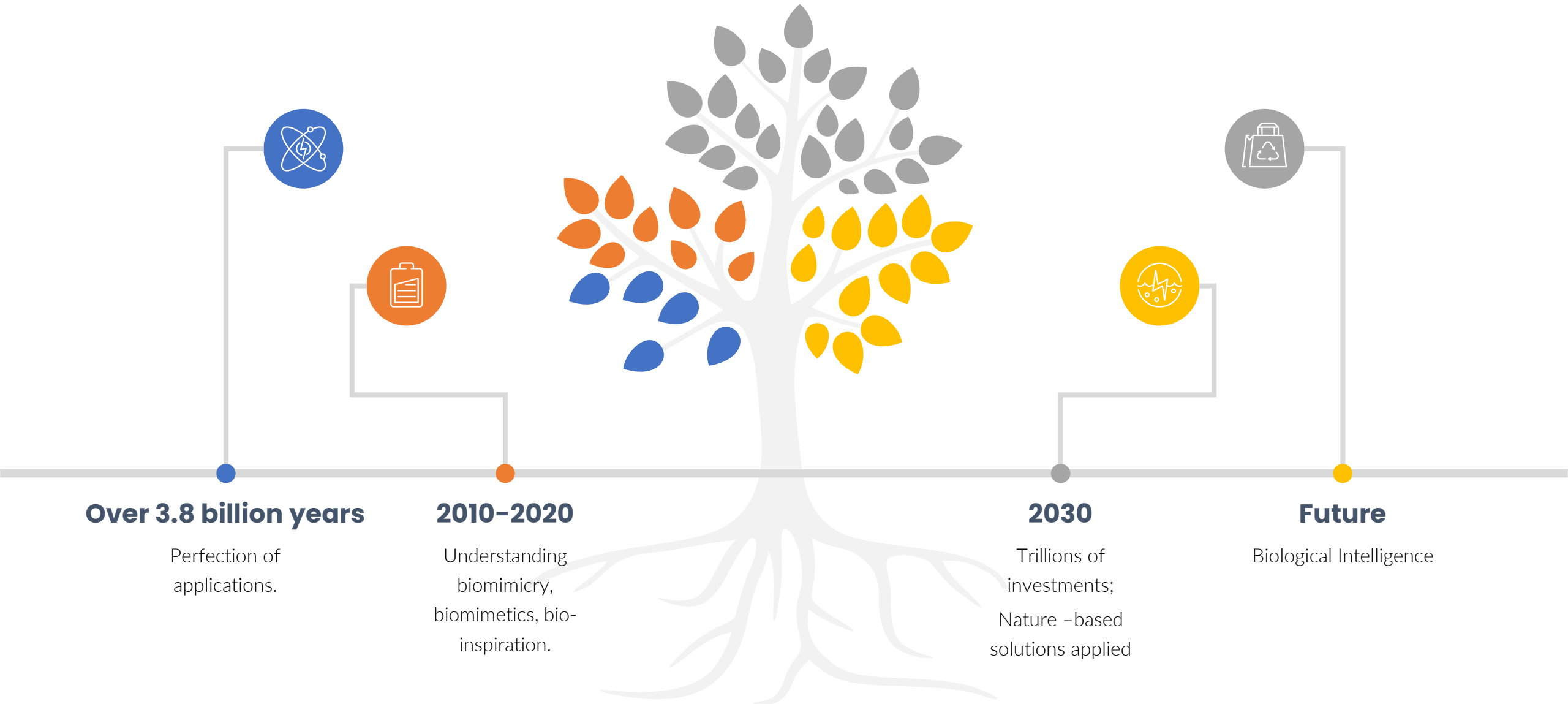
Abstract

Recent far-reaching advances in synthetic biology have yielded exciting tools for the creation of new materials. Conversely, advances in the fundamental understanding of soft-condensed matter, polymers and biomaterials offer new avenues to extend the reach of synthetic



ECOLOGY TIMELINE – BIO-INSPIRATION

"There will be a biologist in every design table," Janine Benyus



Over 3.8 billion years

Perfection of applications.

2010-2020

Understanding biomimicry, biomimetics, bio-inspiration.

2030

Trillions of investments;

Nature –based solutions applied

Future

Biological Intelligence

What's coming??

1. A cement replacement that can help with reducing carbon emissions
2. Pulsed jet propulsion that is modeled after jellyfish
3. The next generation of LEDs designed after the nanostructured lens of a firefly
4. Joints modeled after the necks of ants that enable devices to withstand extreme stresses
5. High-capacity lithium batteries based on the packing design of pomegranate seeds

Some inspirations – from school children

The SunTile

To design for global warming and increased urban heat, a middle school team out of Honolulu devised the SunTile. Inspired by the hexagonal shape of the honeycomb and grooves on the Saharan Silver Ant, the SunTile aims to both cool homes and protect from erosion. "Knowing that you've done or made something that could save or help someone's day is probably one of the best feelings in the world…"
-Student, SunTile Team, Punahou Middle School, Hawaii

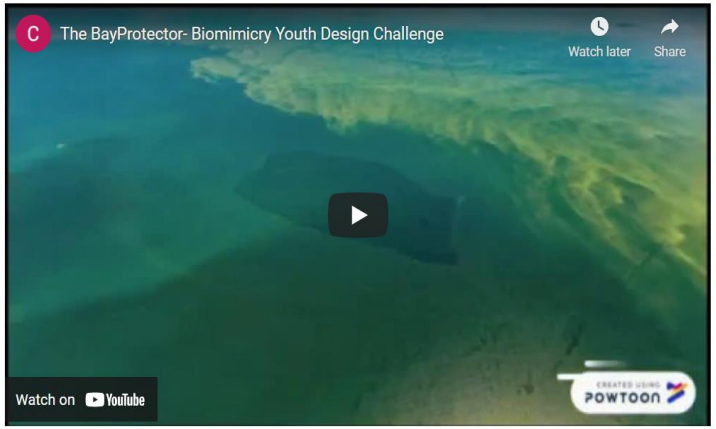
Black Carbon

2021 Youth Design Challenge High School Design Cycle Award

Wind Dance Farm & Earth Education Center, Berkeley Springs, WV – The Black Carbon Keeper is a design concept to capture black carbon

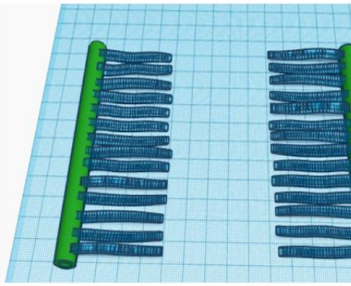
Team BayProtector with Project "The BayProtector"

Corona del Mar High School, Newport Beach, CA



This group of 9th graders sought to solve the issue of eutrophication caused by nutrient pollution

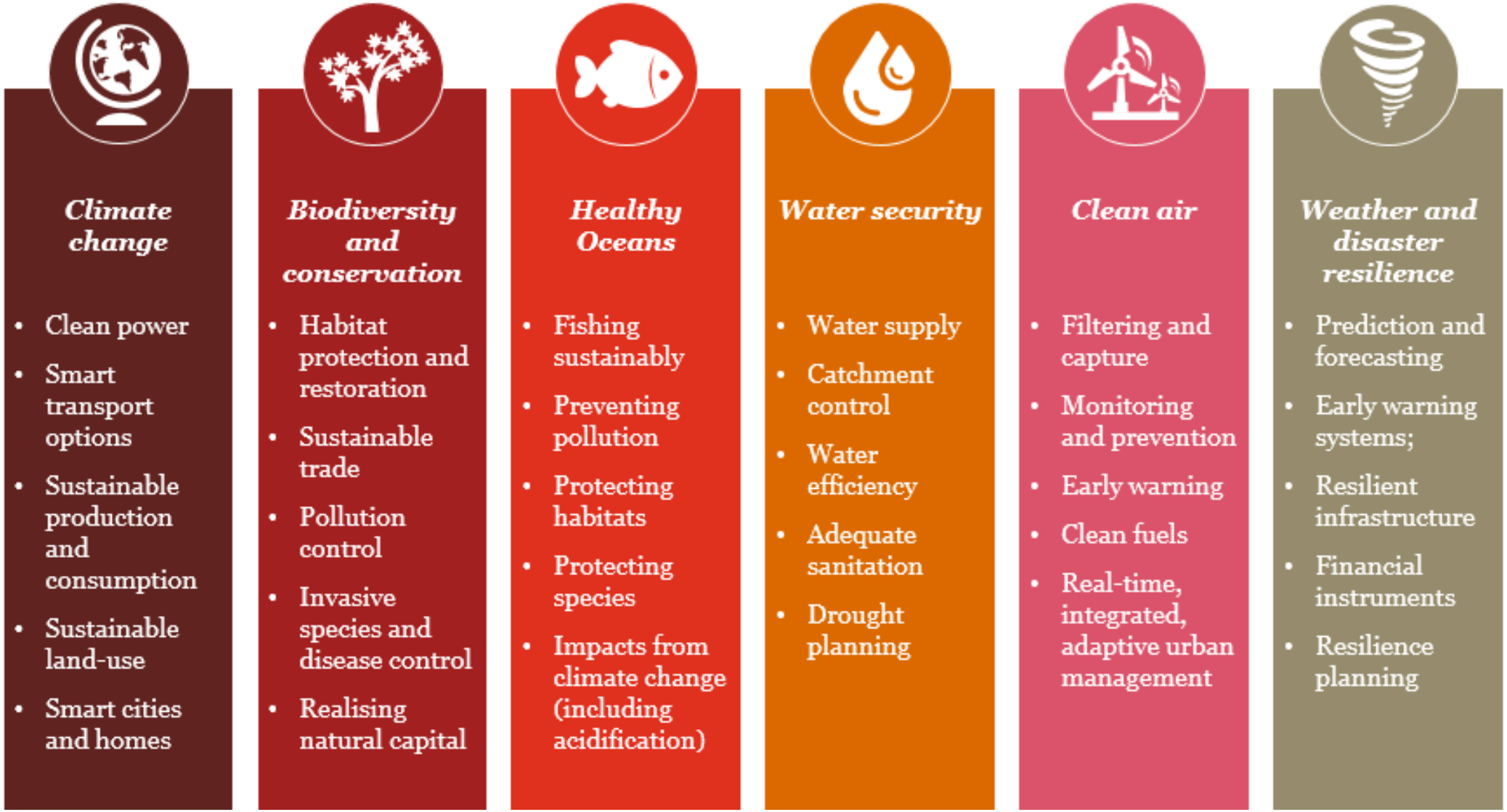
Current Cleanser



2021 Youth Design Challenge High School Naturalist Award

Hillsborough High School, Hillsborough, NJ – This team chose to address water pollution caused by agricultural runoff as a re
increasingly intense storms. The Current Cleanser is a conceptual design for a system that extracts common pollutants from fl
using the principle of countercurrent multiplication observed in numerous organisms including fishes' gills and the human ki
works by circulating water through a tendril-like tubing system that maintains a continuous concentration gradient so pollutar

New Technologies and Eco-Innovation : Artificial Intelligence



Nature-inspired solutions

Research and Development

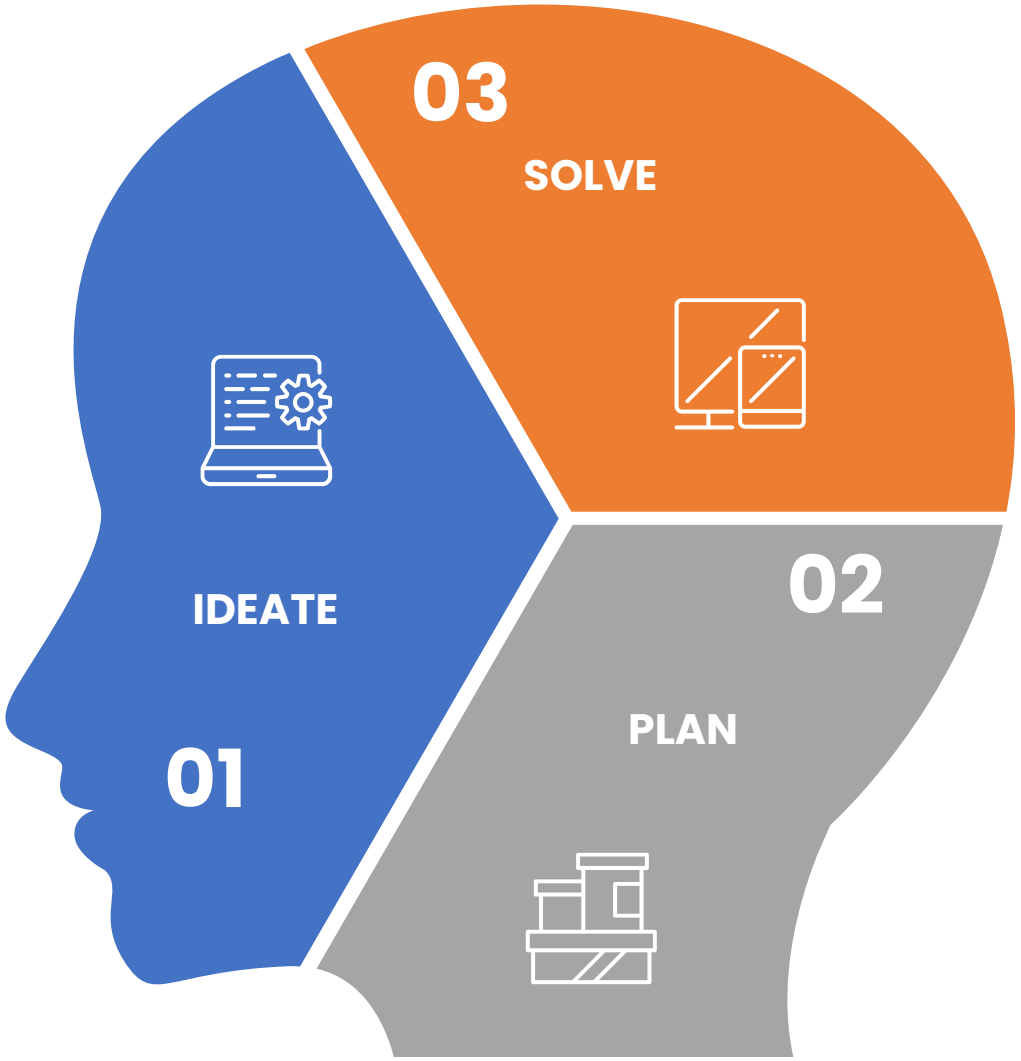
Grants

Patents

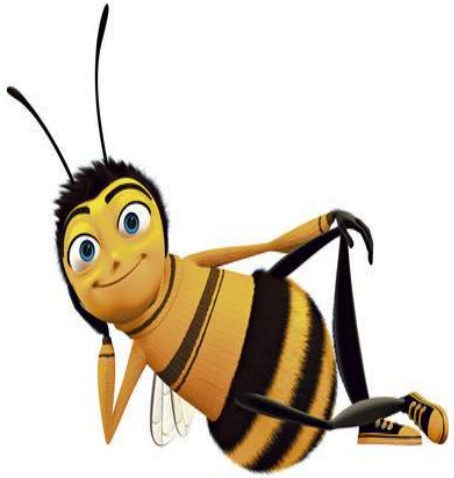
Collaborations

Citizen science

Look for a cap-stone project??



GO DISCOVER !!!!



The World is More Beautiful and Diverse than we think!