Intro: Can you guess what they have in common?

East Gate Center, 1996 (Zimbabwe)

Velcro, 1955

Shinkansen, 1990s (Japan)

Nature-Inspired Invention, Biomimetics

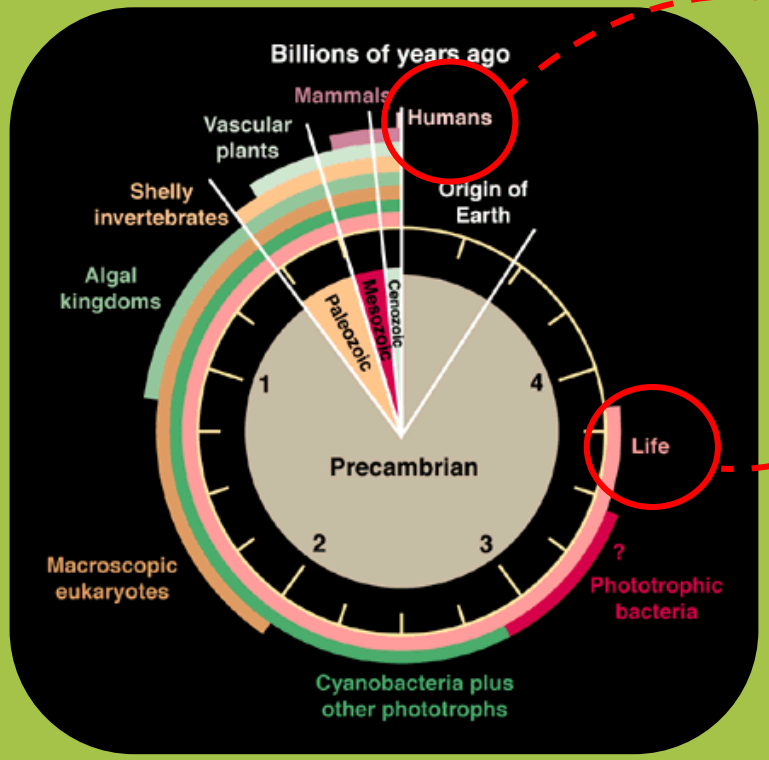
20200163 Kim Ji Hwan
20200639 Chae Woo Jin

What is Biomimetics?

- **Biomimetics=“Bio-”(Biology)+“-mimetics”(Imitation)**
- **Solving Human Problems through imitating characteristics of nature**
- **Types of Imitation: Design, Structures, Mechanisms, Function,…**

Background

- **Our planet is the oldest and wisest teacher!**



Human 23:58:43 (200,000 years ago)

Origin of Life 4:00 (3,800,000,000 years ago)

[History of earth in 24-hour clock]

Background

- **Our planet is the oldest and wisest teacher!**
- **Related Concepts: Natural Selection**

3.8 Billion Years

Natural Selected Traits

Background

- **Our planet is the oldest and wisest teacher!**
- **Related Concepts: Natural Selection**

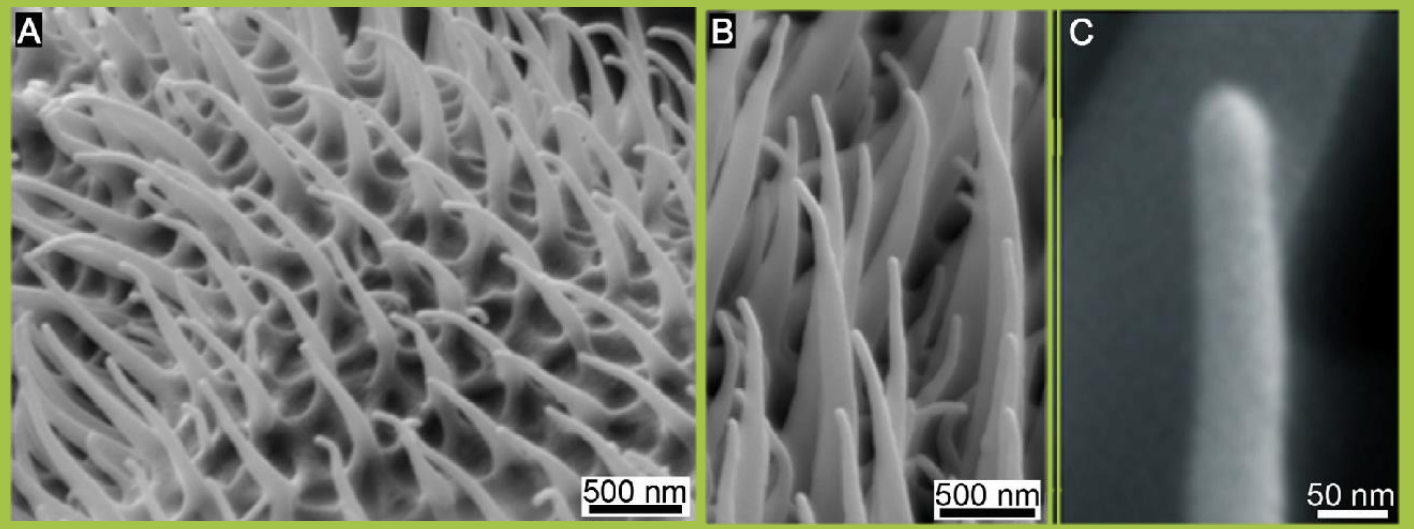
Natural Selected Traits

Most Suitable and Efficient Traits to Survive in Nature!

Overcome Human Challenges

Interesting Biomimetic Research

1. Gecko Lizard (게코도마뱀)

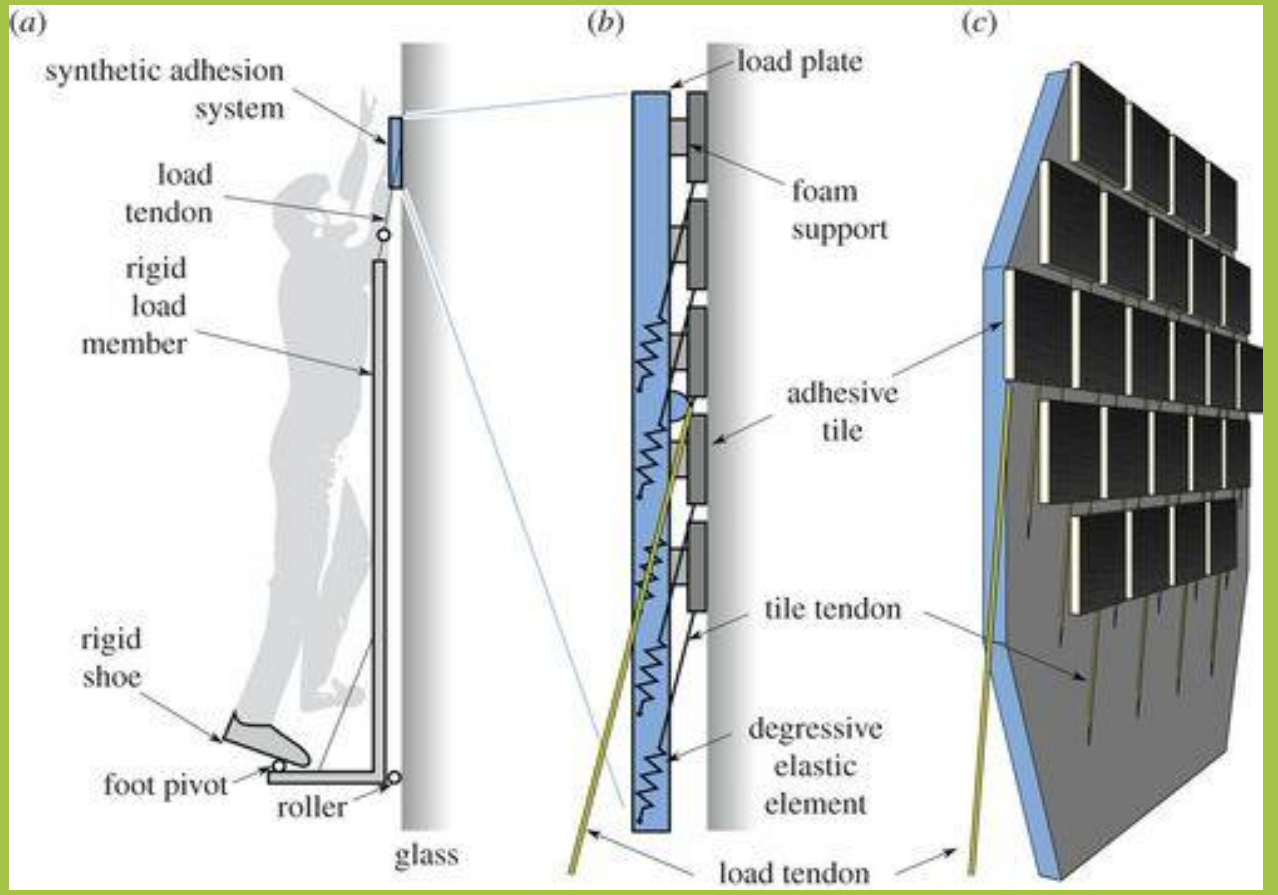


[SEM images of the microstructure on the gecko]

Application from Gecko Lizard-Wall Climbing Gloves

Clips from [Mission Impossible-Ghost Protocol]

This is Real…!



[Stanford engineers climb walls using gecko-inspired climbing device]

https://www.youtube.com/watch?v=Mw-tol5ur84

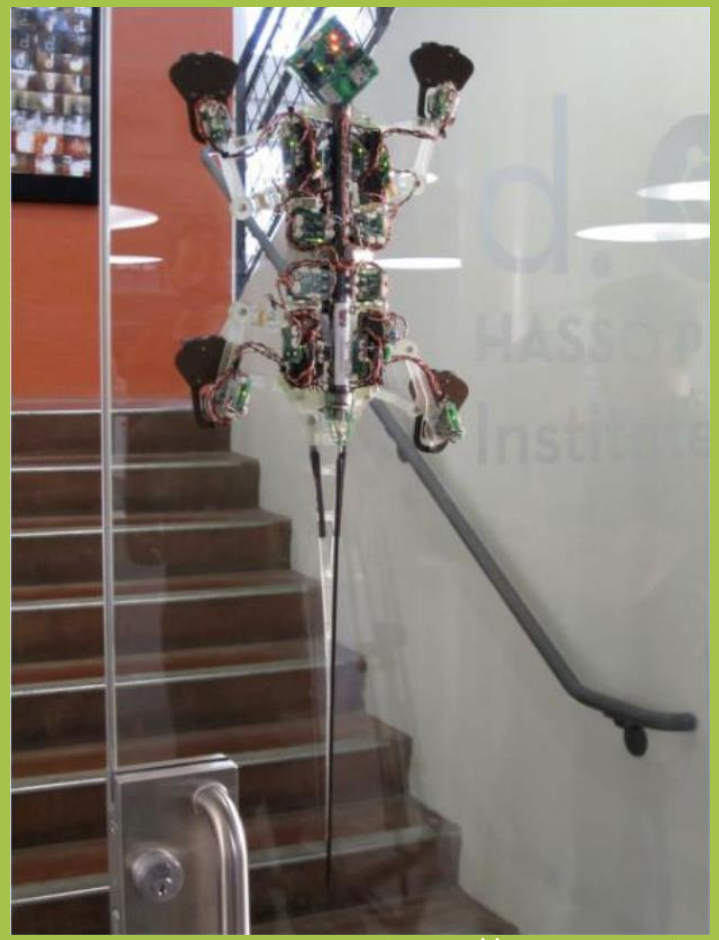
Human climbing with efficiently scaled gecko-inspired dry adhesives

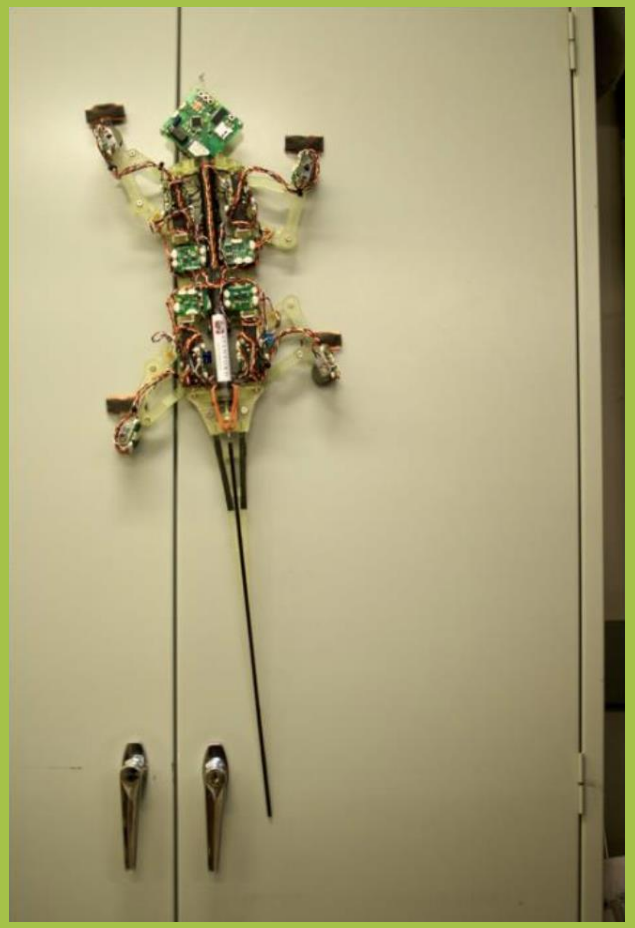
E.W. Hawkes, E.V. Eason, D.L. Christensen and M.R. Cutkosky
Stanford University

Biomimetic
Dexterous
Manipulation
Laboratory

Similar Example:

[Stanford's 'Stickybot,' a Gecko-like robot, climbs vertical services]

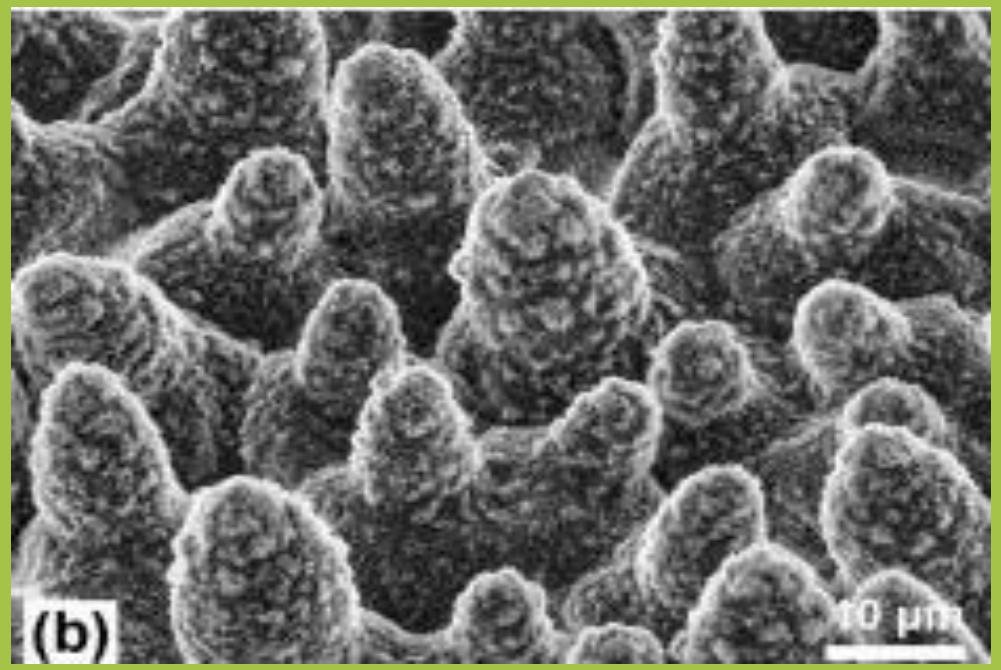




https://www.youtube.com/watch?v=o5lMJtQOKSY

2. Lotus (연꽃)

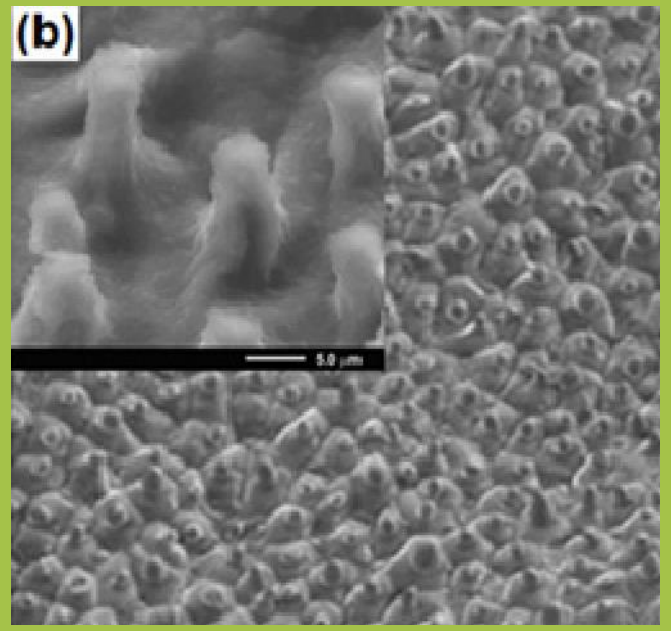
[Lotus Effect (Ultrahydrophobicity)]



[SEM Image of the Surface of Lotus]

Application from Lotus Leaf: Waterproof Shirts

Lotus-inspired nanotextile



SEM Image of Nanotextile

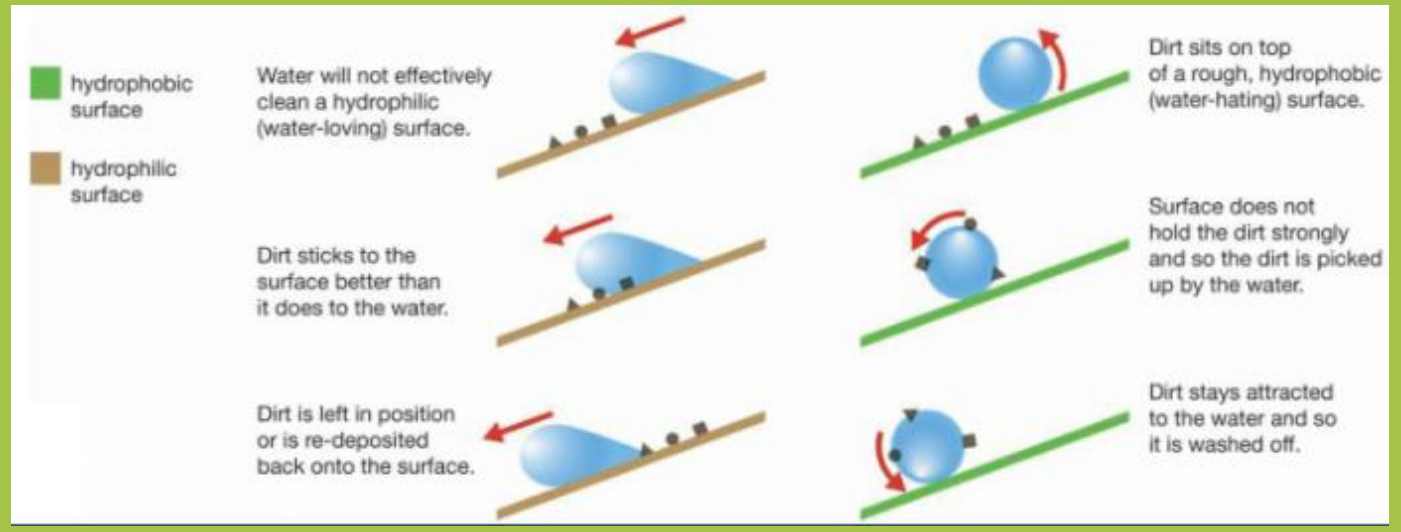
Waterproof Shirts


Threadsmiths Hydrophobic T-Shirt
100% Cotton

Application from Lotus Leaf: Self-Cleaning Glass

PILKINGTON

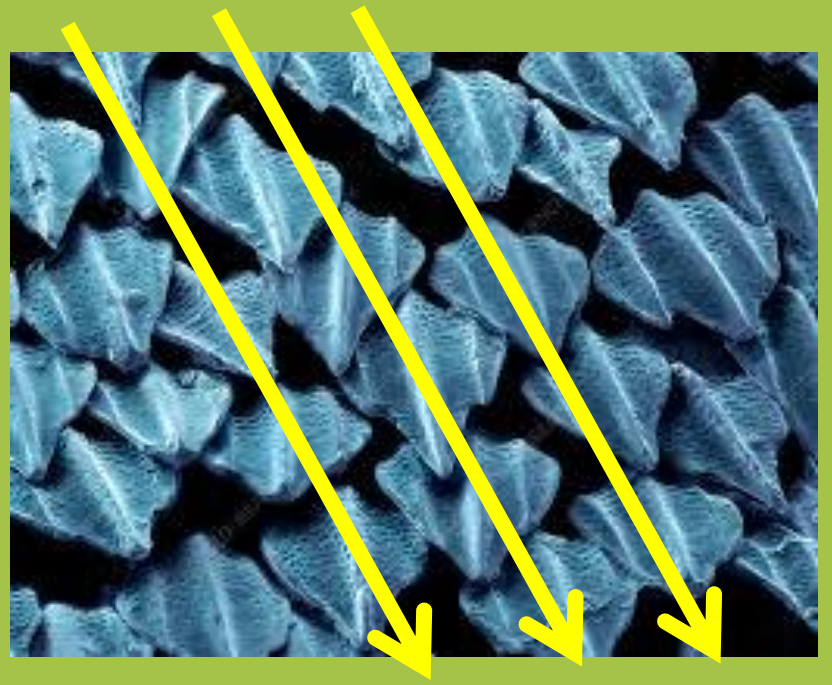
NSG Group Flat Glass Business



3. Shark

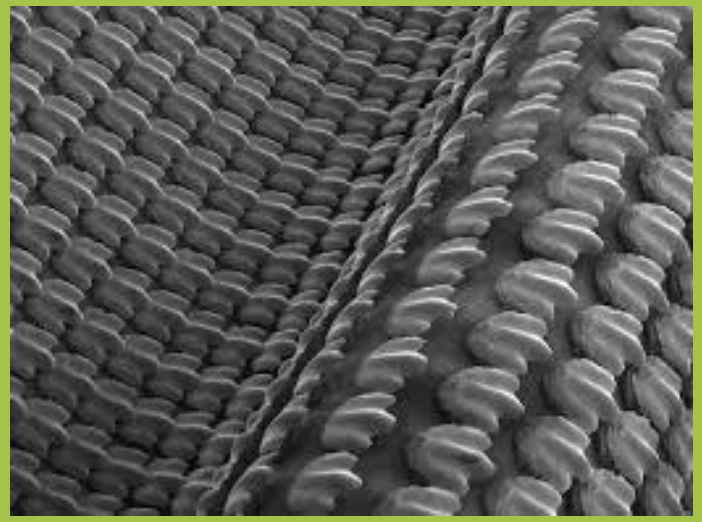
Over 100km/h

Shortfin Mako
(청상아리)



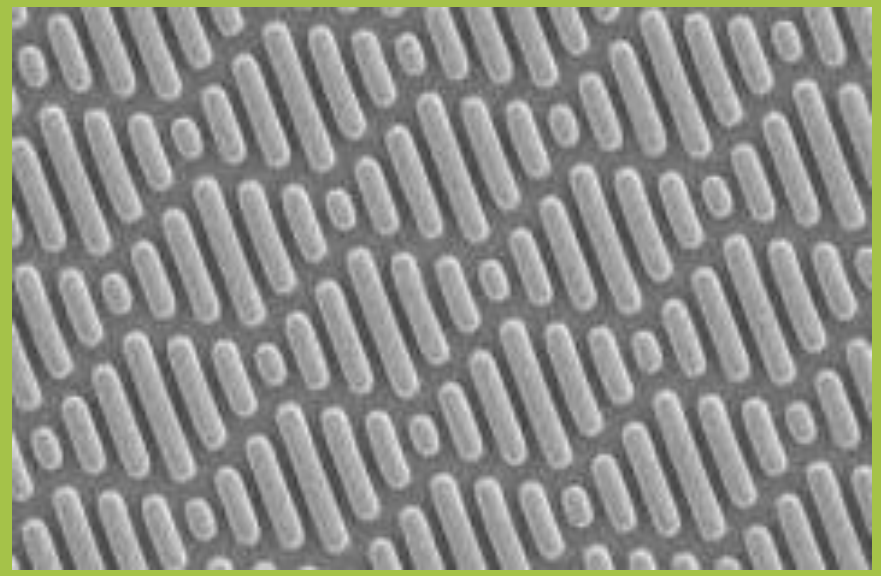
Colorized SEM of shark skin

Application from Shark Skin: Swimsuits



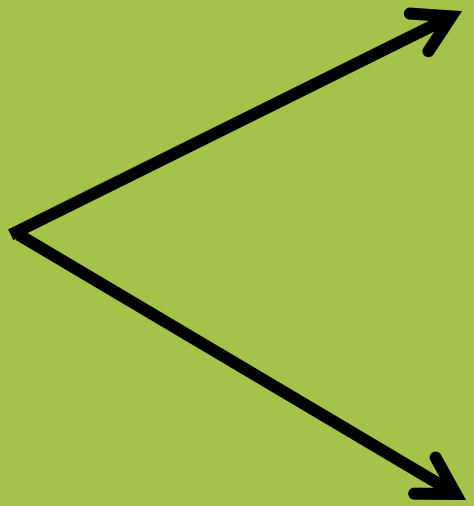
Application from Shark Skin: Microorganism Proof

Sharklet®

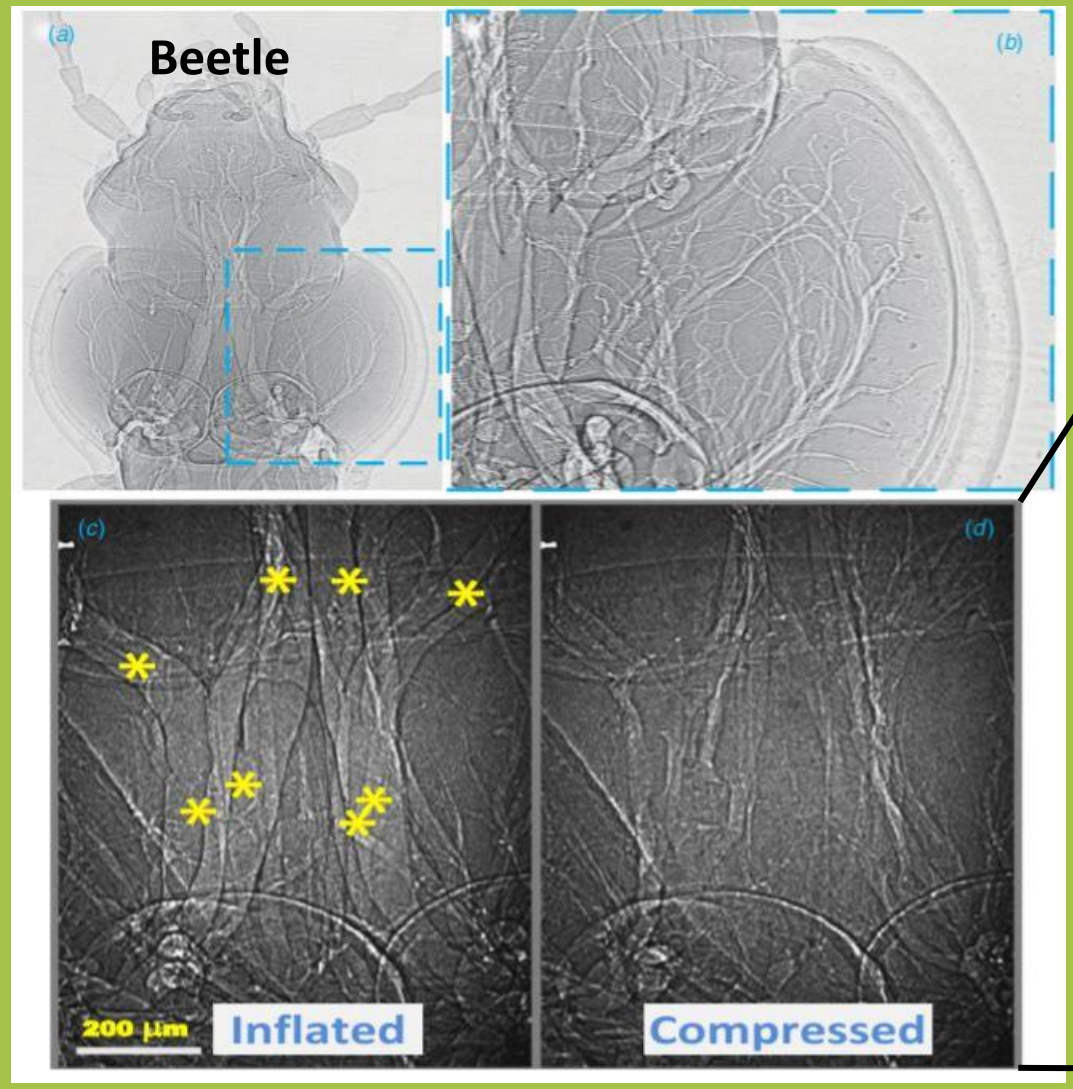


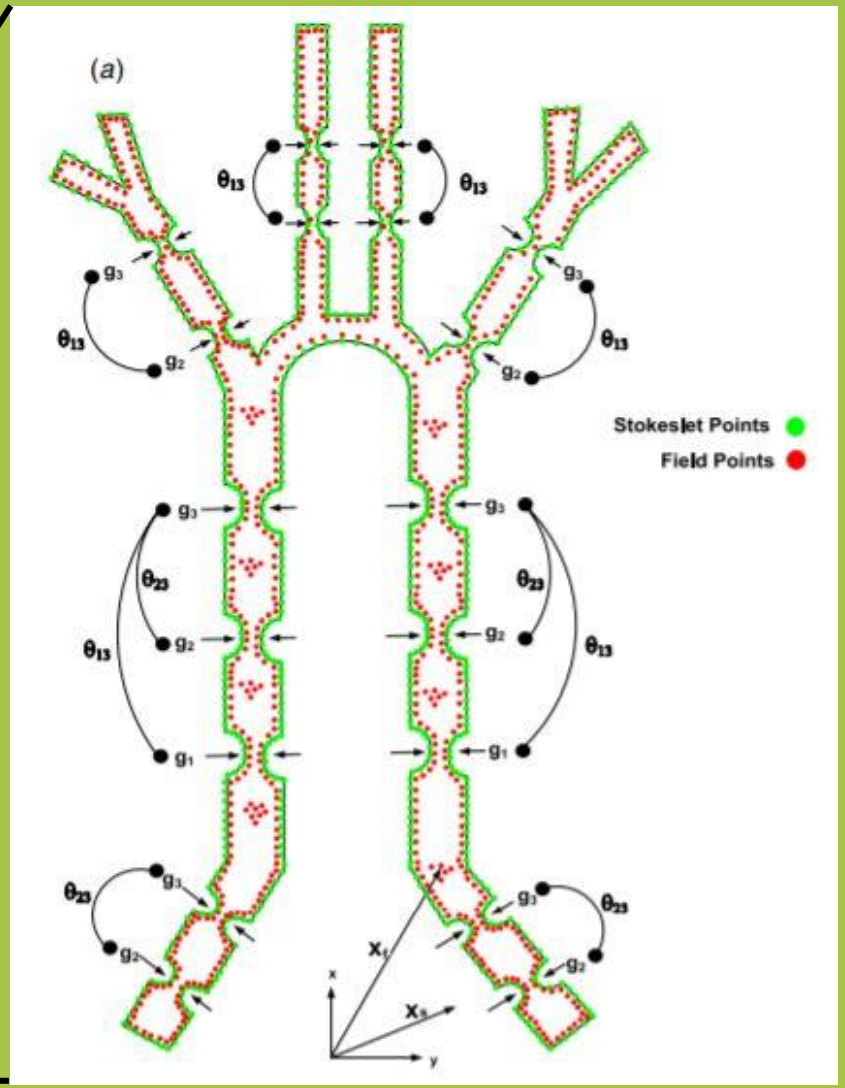
Prevent Microbes Making Colonies

4. Insect

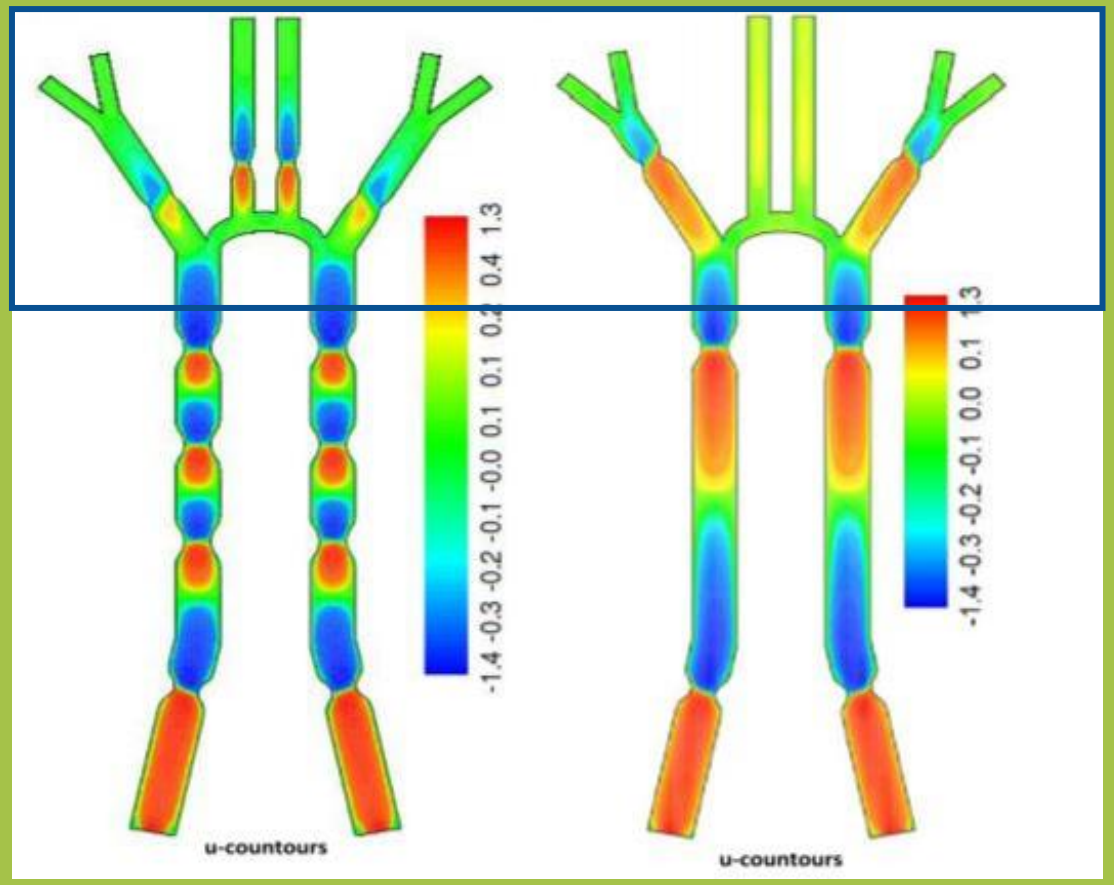


Application from Insect Respiratory System: Micro-scale Fluid Control

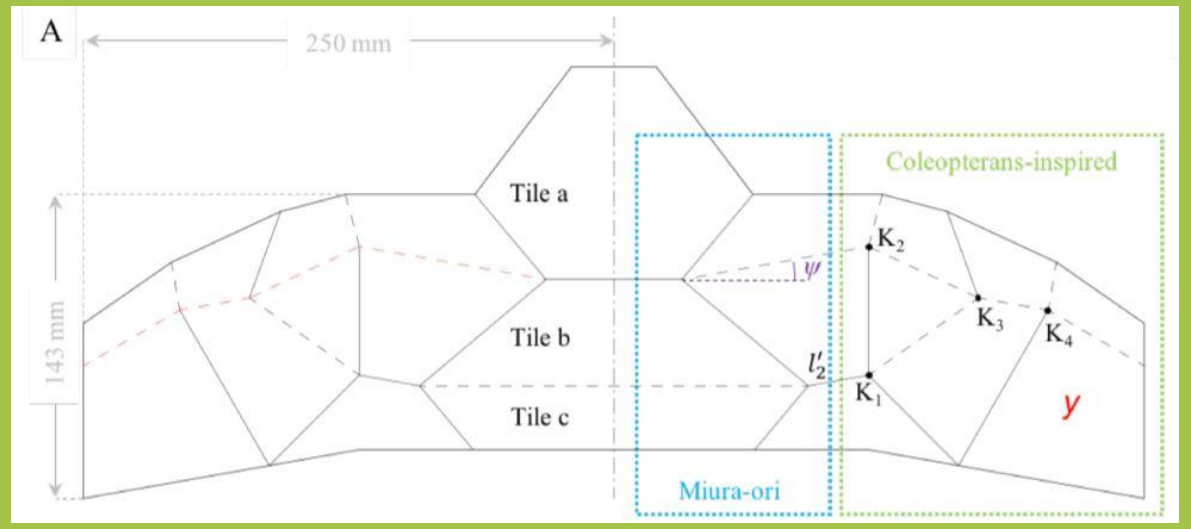


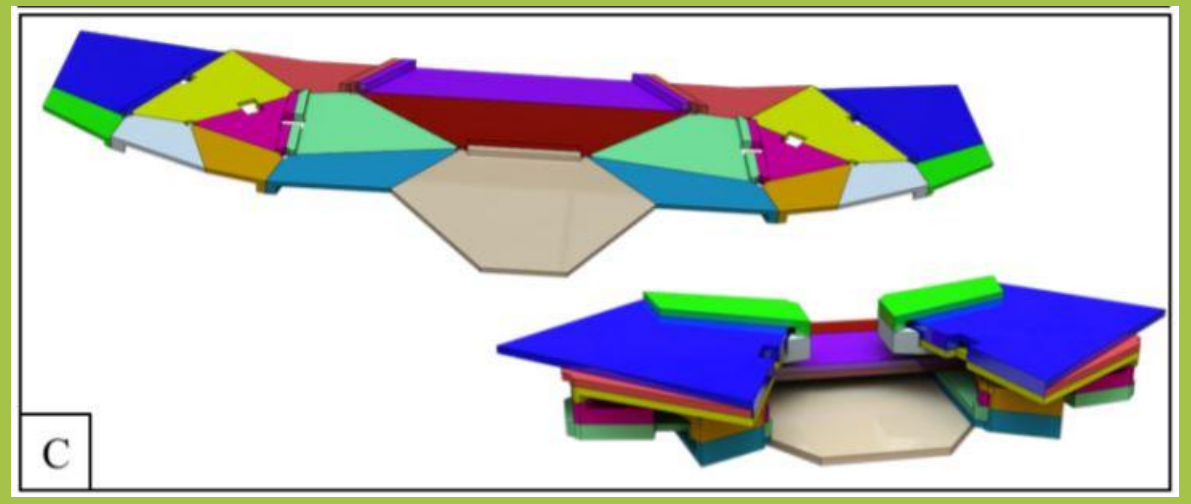


Application from Insect Respiratory System: Micro-scale Fluid Control



Application from Flying Insect: Micro Air Vehicles



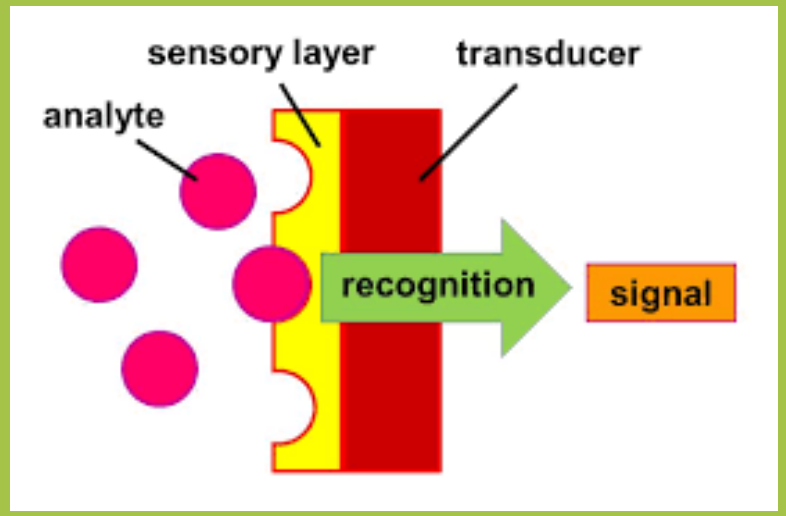


Application from Flying Insect: Micro Air Vehicles

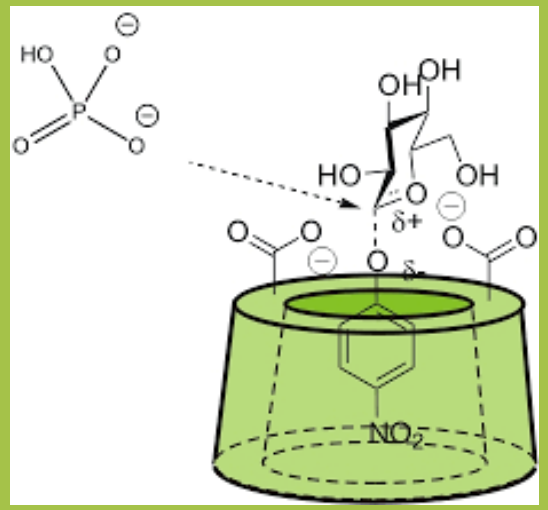
Looks simple, but works extremely well

Furthermore…

Biosensors



Artificial Enzyme



Architecture

Summary

References

- **Gecko Lizard**
- Watson, G. S., Green, D. W., Schwarzkopf, L., Li, X., Cribb, B. W., Myhra, S. and Watson, J. A. (2015). A gecko skin micro/nano structure – A low adhesion, superhydrophobic, anti-wetting, self-cleaning, biocompatible, antibacterial surface. Acta Biomater. 21, 109-122. doi:10.1016/j.actbio.2015.03.007
- Mission: Impossible - Ghost Protocol (2011) - Climbing the Burj Khalifa Scene (4/10) | Movieclip: https://youtu.be/wr4rZEPQ09Y
- https://news.stanford.edu/news/2010/august/videos/837.html
- **Lotus**
- https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3148040/
- https://www.technicaltextile.net/articles/self-cleaning-textile-an-overview-2646
- https://www.pilkington.com/
- **Shark**
- https://www.sharklet.com/our-technology/technology-overview/
- https://en.wikipedia.org/wiki/LZR_Racer
- **Insect**
- Aboelkassem, Y., & Staples, A. E. (2013). Selective pumping in a network: insect-style microscale flow transport. Bioinspiration & Biomimetics, 8(2), 026004.
- A Drone with Insect-Inspired Folding Wings L. Dufour, K. Owen, S. Mintchev, Member, IEEE and D. Floreano, Senior Member, IEEE
- Liu H, Ravi S, Kolomenskiy D, Tanaka H. 2016 Biomechanics and biomimetics in insect-inspired flight systems. Phil. Trans. R. Soc. B 371: 20150390.
- **Others**
- Breslow, R. (1995). Biomimetic Chemistry and Artificial Enzymes: Catalysis by Design. Accounts of Chemical Research, 28(3), 146–153.