

Bionics

How technology of nature is changing the nature of technology

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What is it....

“application of biological methods and systems found in nature to the study and design of engineering systems and modern technology”

What is it called....

Also known as:

biomimicry, biomimetics, bio-inspiration, biognosis

Different from using biological products, like antibiotics, wood, grains etc.

examples . . .

Silence of the train...



Shinkansen 500

**Chief engineer
Eiji Nakatsu**



Serrated edges on the feathers of owls



Pantograph of Shinkansen-500

Boom, boom...

- Tunnel booms
- Uneasiness for passengers



Chip-chip... No chip-chip

This talk focuses on:

- **Bionics in the field of adhesion**
- **Only those technologies which have been successfully marketed or are on the verge of being so...**

Chip-Chip . . .

Walk the dog...



George de Mestral

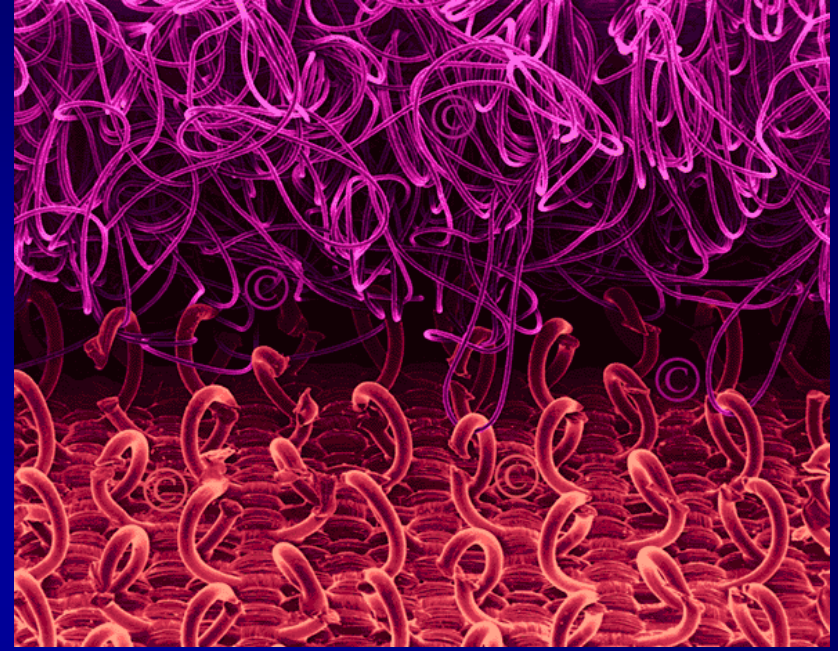


Budrock (*Arctium lappa*)



Details of a budrock seed

Velcro



The name is bond...



Kaichang Li
College of Forestry
Oregon State University, USA

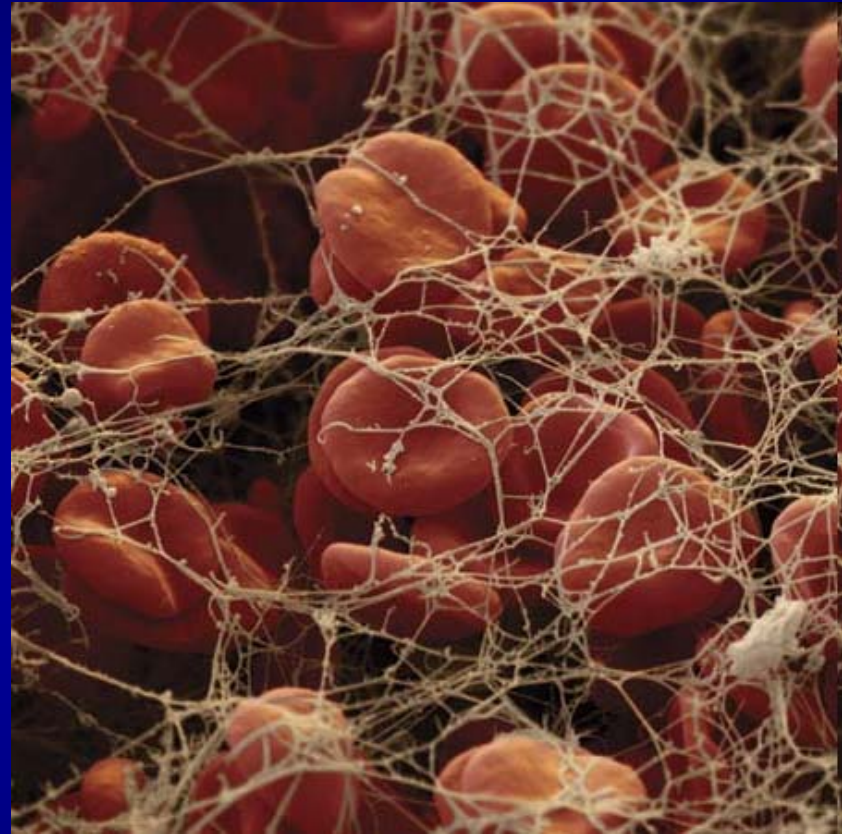
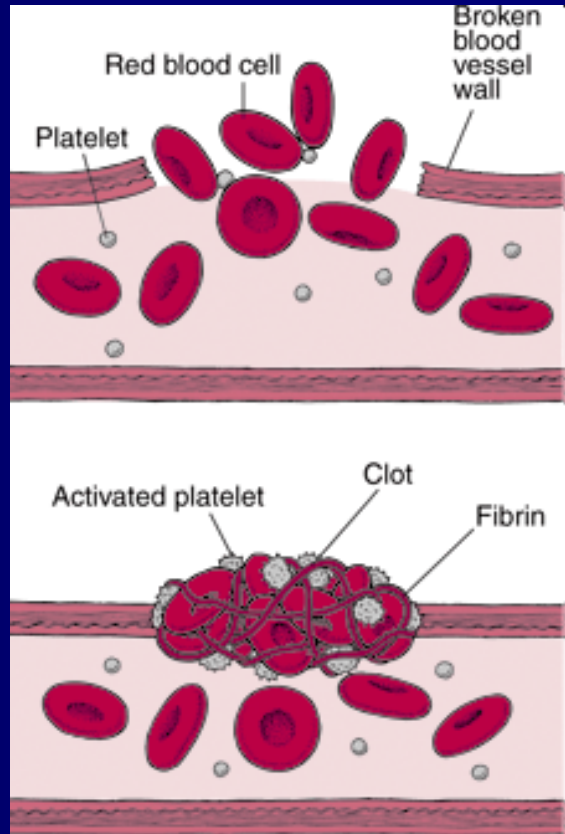
PureBond™...



Byssus threads (keratin+ quinon-based proteins, etc)

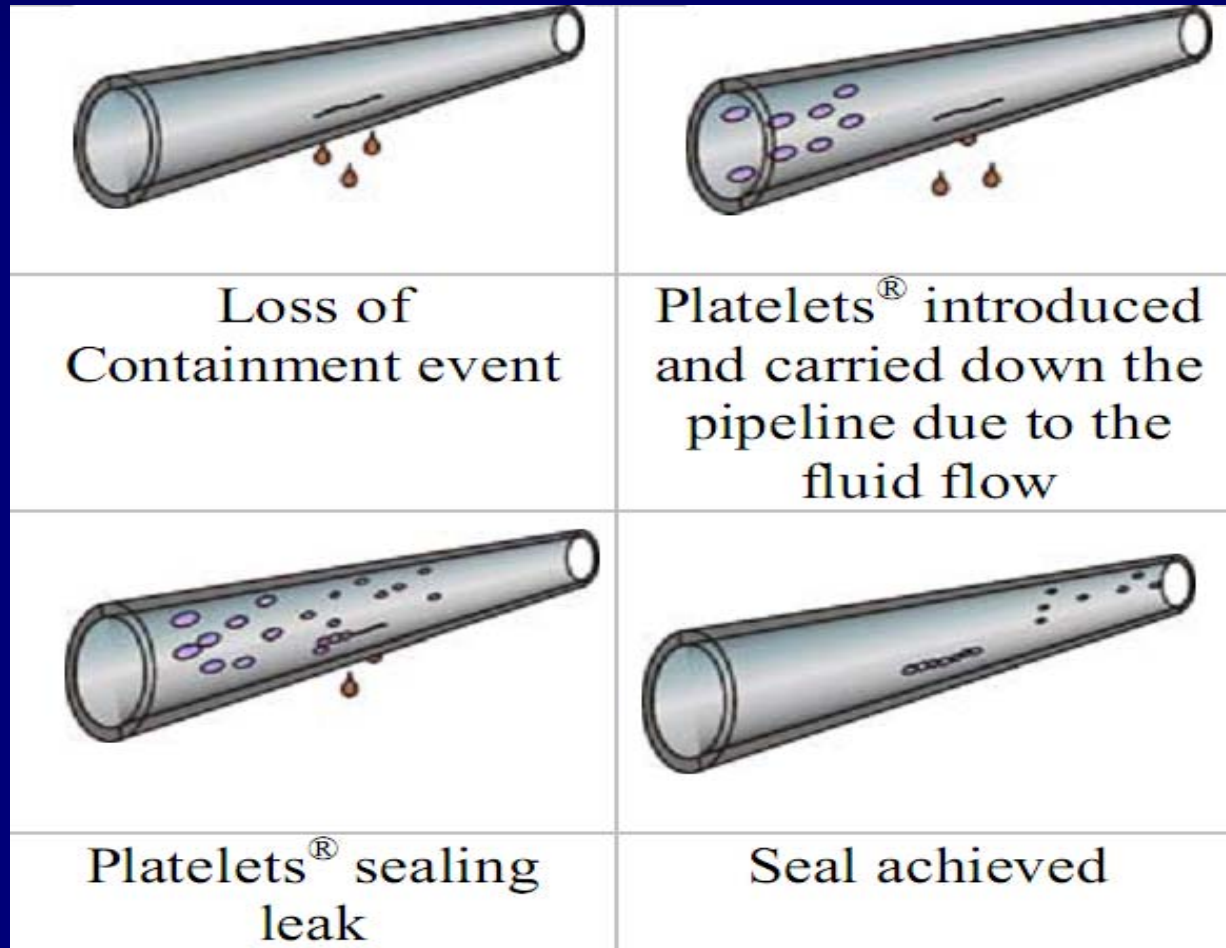
- Process for modification of Soy-protein
- Hercules Incorporated and Columbia Forest Products
- PureBond™
- 50-90% reduction in emission of toxic products like HCHO
- Greener Synthetic Pathways Award for Li in 2007

Quiet flows the blood, until...



Clot formation

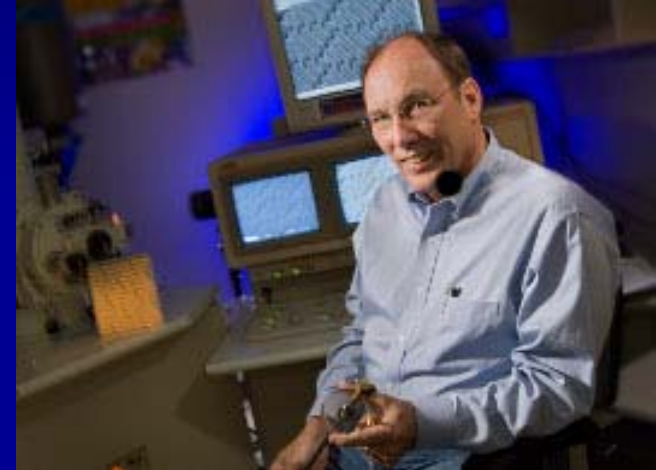
Platelet™...



- Brinker technologies (Aberdeen, UK)
- Sealing of leaks in small bore pipelines, including deep sea ones.
- Also possible to deduce where the leak has occurred (radioactive tracers or pressure transients)

No Chip-Chip . . .

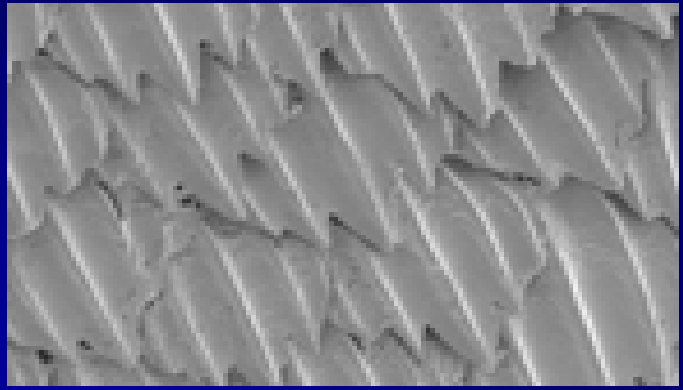
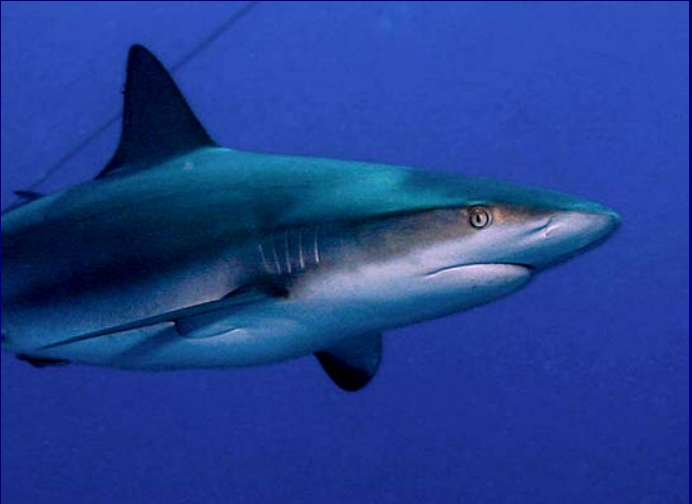
Foul play...



Biofouling

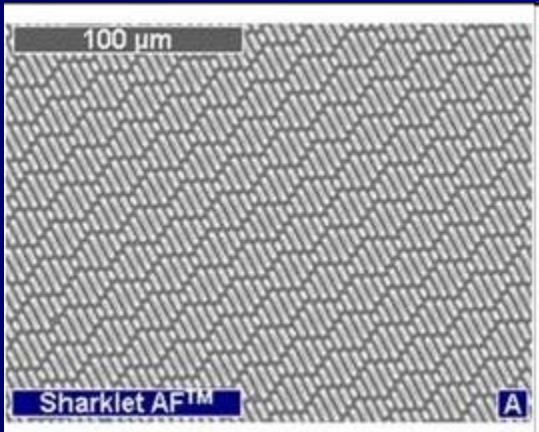
Antony Brennan
University of Florida, USA

Sharklet™...

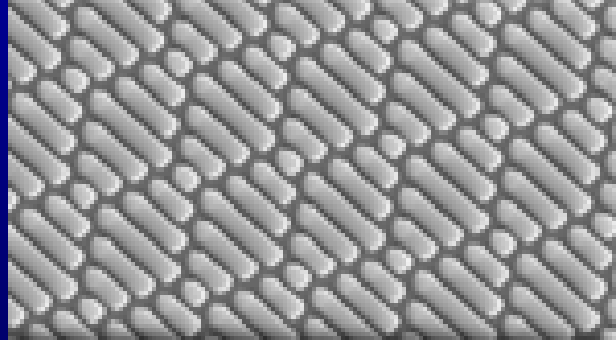


Details of shark-skin

Sharks never face bio-fouling

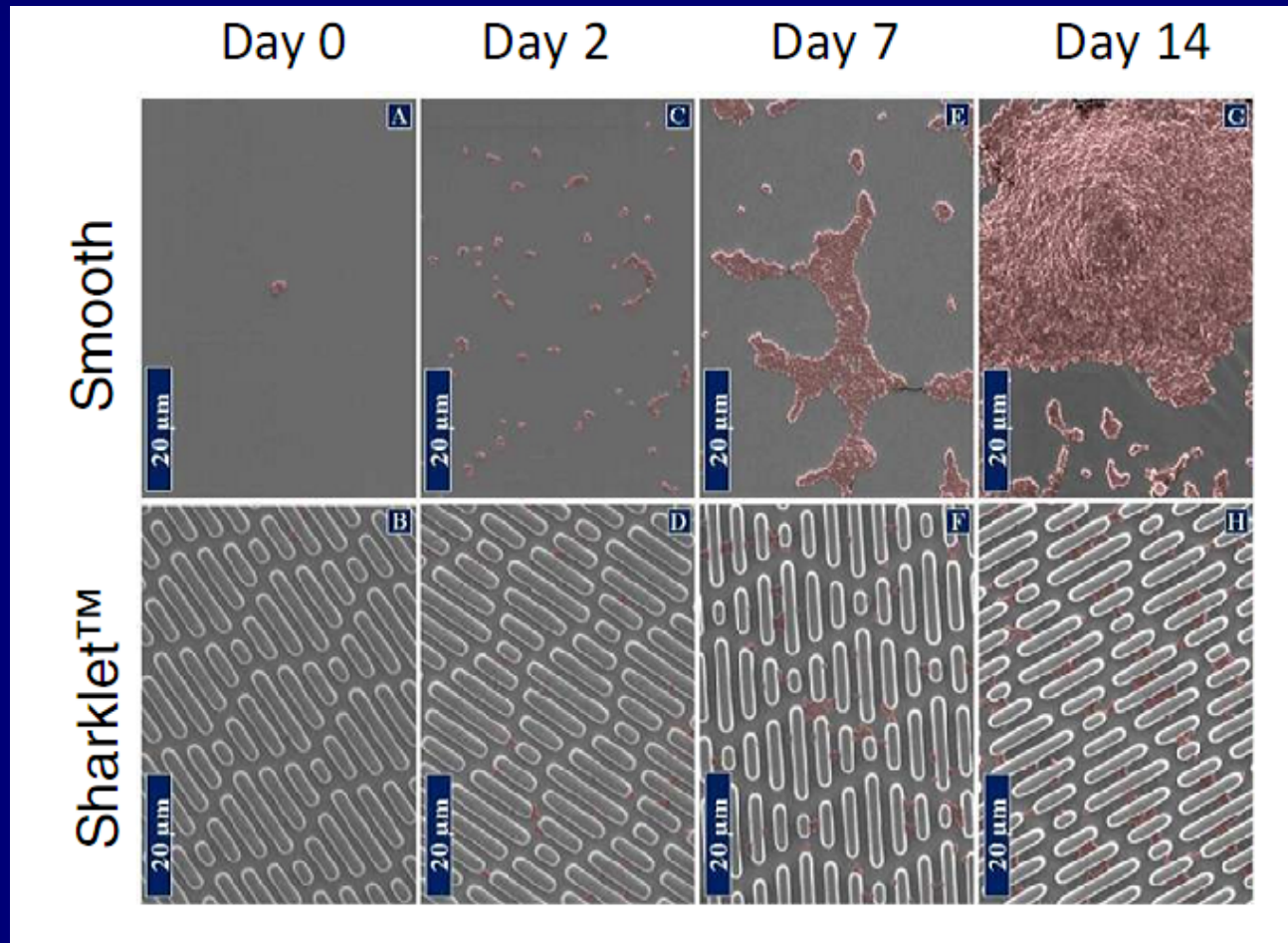


Sharklet AF™



Details

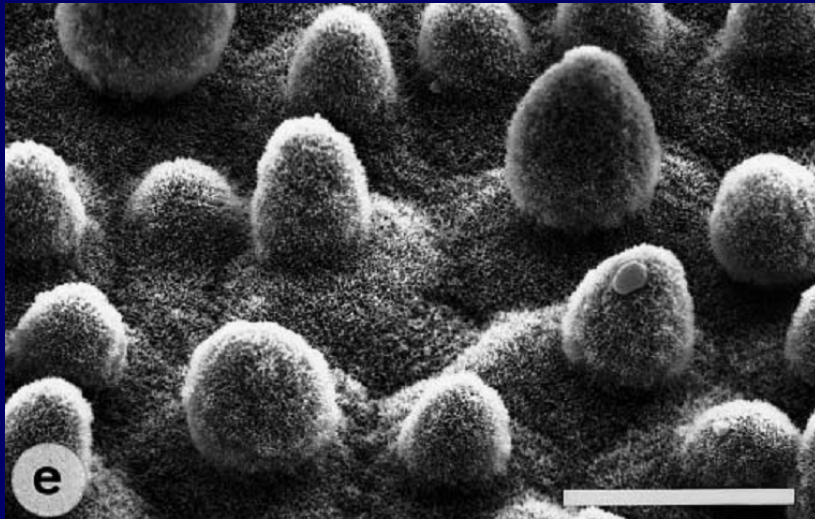
Diamonds are forever...



- Sharklet surface does not allow bacteria to settle down
- Hospital products like catheters, needles etc.

Tears of a lotus...





SEM structure of lotus leaf

Microstructures



**Layer of air b/w
surface and water**



**↓ surface for
adsorption**



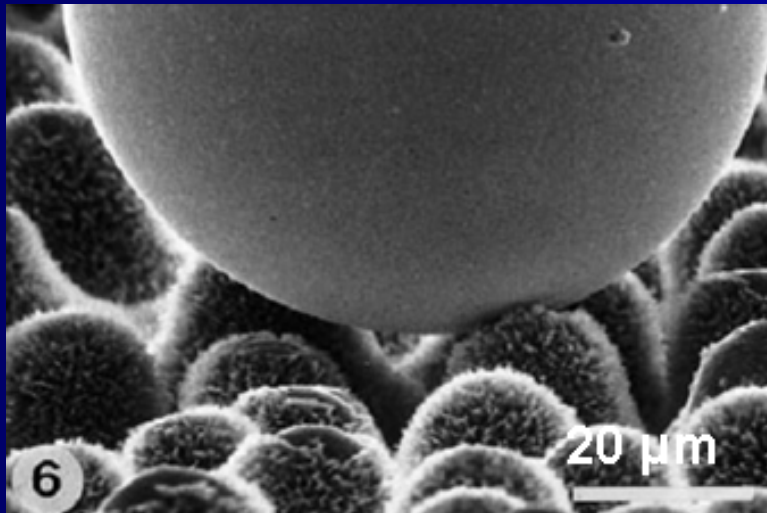
↓ energy



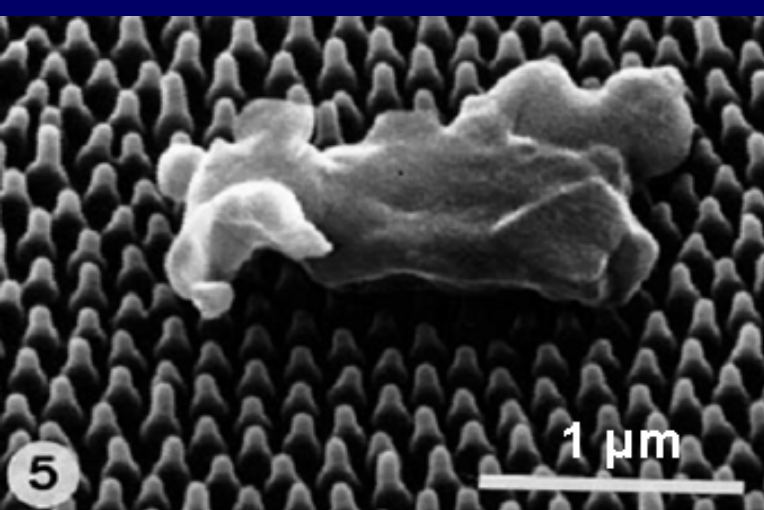
↓ spreading of water



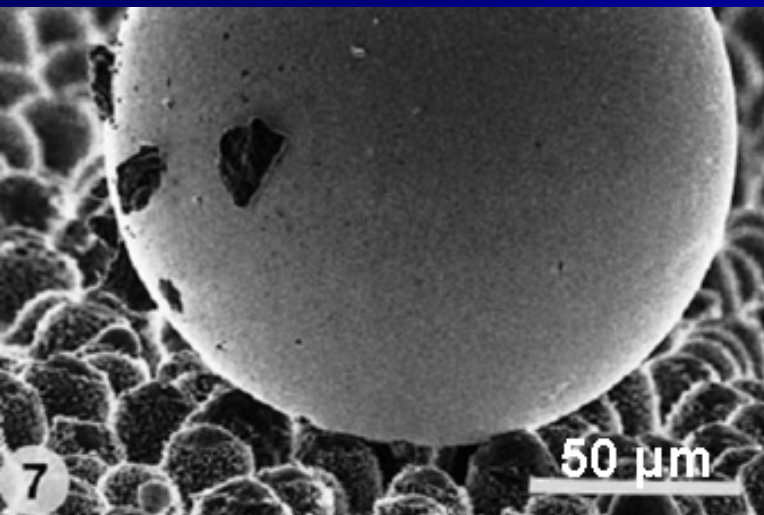
**Formation of
spherical droplets**



**Formation of spherical droplets
on the surface of lotus leaf**



Contaminant on a sculptured surface



Particles clinging to liquid droplets

Water rolls on the particles



↑ adsorption ⇒ ↑ energy



Contaminants cling to water surface

Contaminants rest on tips



↓ contact with surface

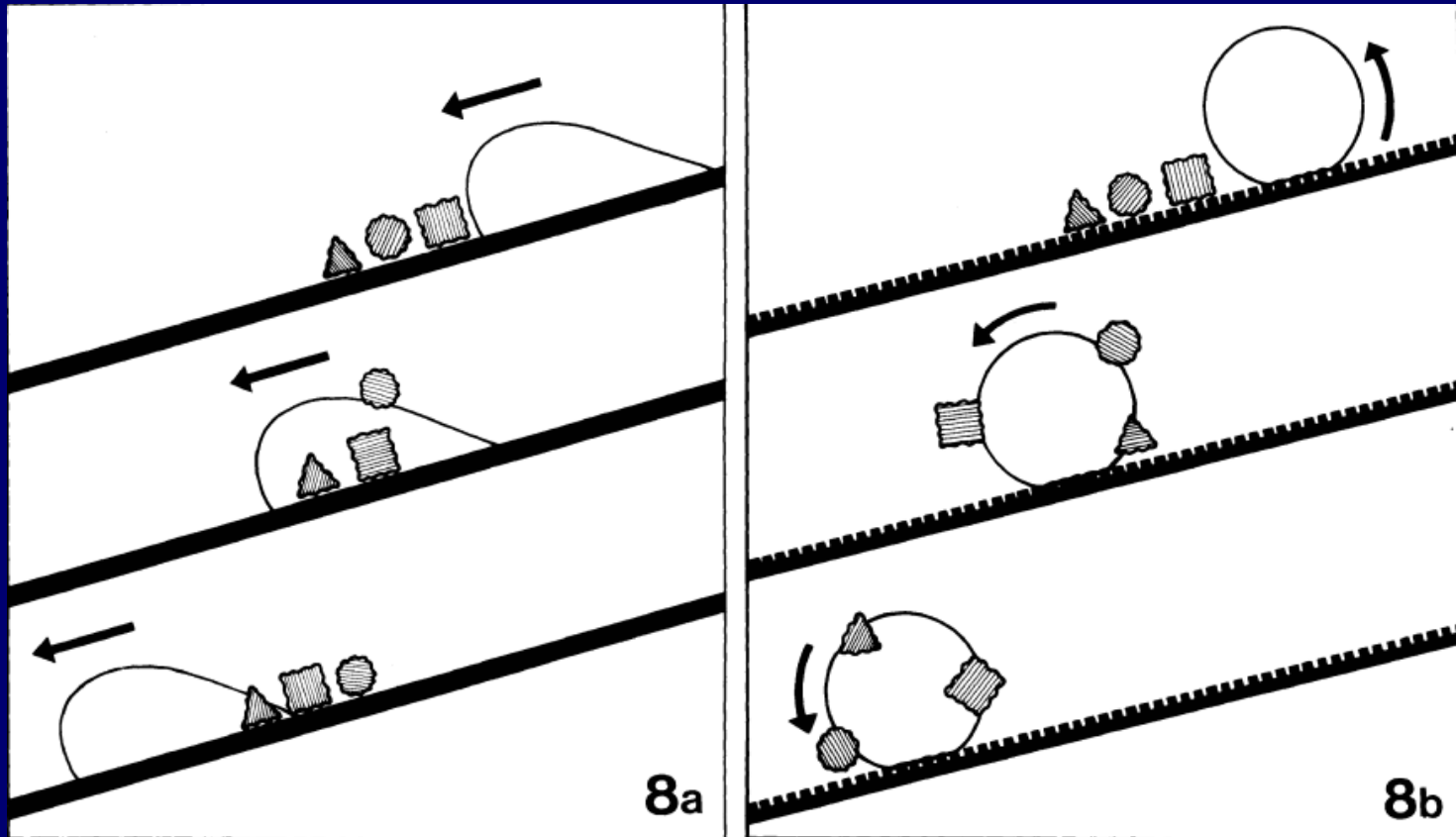


↓ adhesion with surface



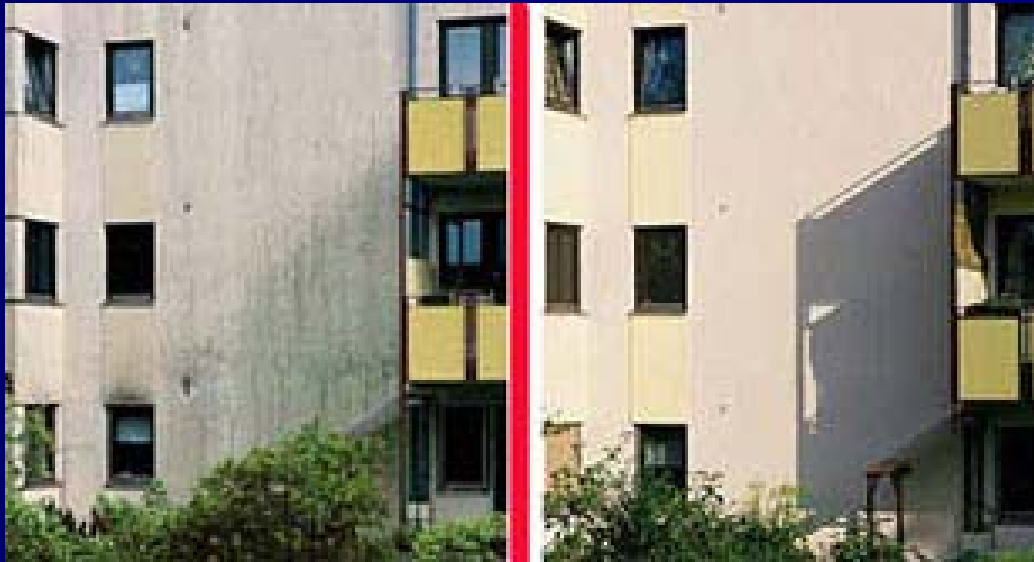
Particles roll away with the water droplets

Lotus-effect



Particles cling to liquids on rough surfaces but not on smooth surfaces

Lotusan®...



[Movie](#)

- Self-cleaning paint
- Developed by Prof. Wilhelm Barthlott, University of Bonn, Germany
- Manufactured by Sto Corporation, Germany
- Claimed to prevent algae and microbes

Dirt collector...



Bacteria in Dental Plaque (Magnified 30000 times)



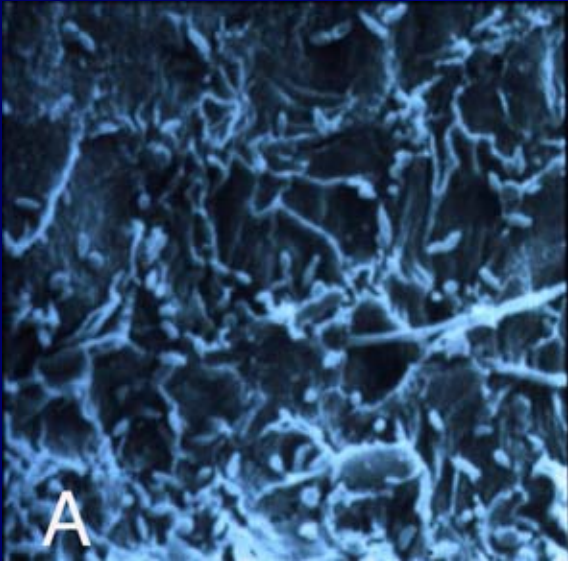
Professor Staffan Kjelleberg
University of Göteborg (Sweden)

Professor Peter Steinberg
University of New South Wales (Australia)

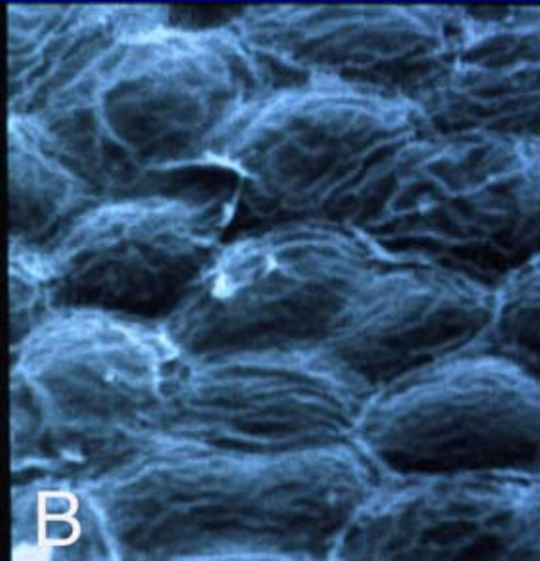


Red alga
Delisea pulchra

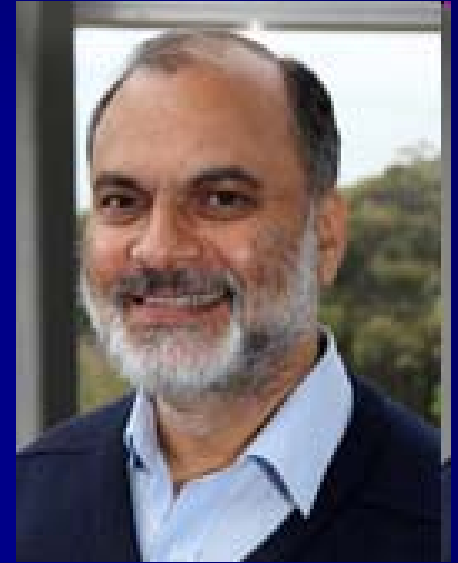
Biosignal™



Sargassum sp.

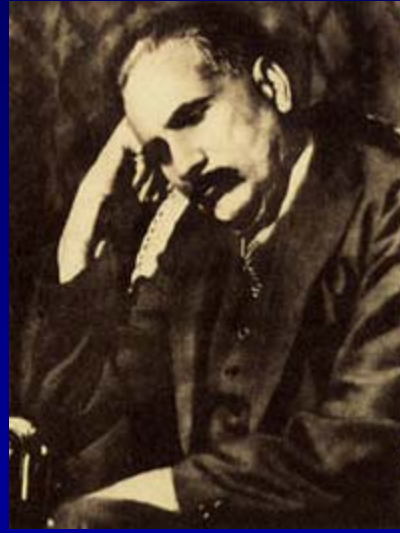


Delisea pulchra



Dr Naresh Kumar
University of New
South Wales (Australia)

MOVIE



guftand jahaan-e-maa, aayaa ba too mee saazad
guftam ke namee saazad, guftand ke barham zan

*"God asked me if I did find
his universe to my liking and taste
When I said no, then he replied,
create your own and lay this waste"*