Connect Webinar

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Biomimetic processes in the development of new materials

Ideaport is a TGV program.

Unlike the processes used by today's engineering, the nature develops genuine materials through bottom-up and more energy efficient processes. The nature is capable of synthesizing such materials that are not toxic, multi-functional and responsive (sensitive) to the environment.

Biomimetic materials are synthetic (man-made) materials that imitate the nature or follow such a design pattern derived with inspiration from the nature.[1]

Biomimetic processes have the potential for use in a number of different areas:

- Developing design and production technologies
- Developing energy conversion and storage technologies
- Developing signalling and information processing technologies
- Developing communication technologies
- Developing sensing, imaging and monitoring technologies
- Developing robotics and navigation technologies[7]
- Developing structural material technologies

Different Areas of Application for Biomimetic Materials:

- **Developing Optical Materials:** Sensors, Diagnostic and Warning Systems, Electronic Displays
- **Changing the Surface Topography:** Anti-corrosion (antifouling) applications in the energy industry
- **Changing the Surface Chemistry:** Self-cleaning materials, self-healing materials, Structural materials with improved surface properties
- **Developing Complex and Hierarchical Structures:** Sorting and Filtering Systems, Controlled distribution systems

Nanocrystals and nanofibers can be made of **nanocellulose** and these advanced materials can be used for a number of different purposes today:

Biomimetic Design Spiral[2,3]:

Biomimetic processes do not proceed linear!

01 DETERMINE
Set one or more functions that you wish your design to realize.

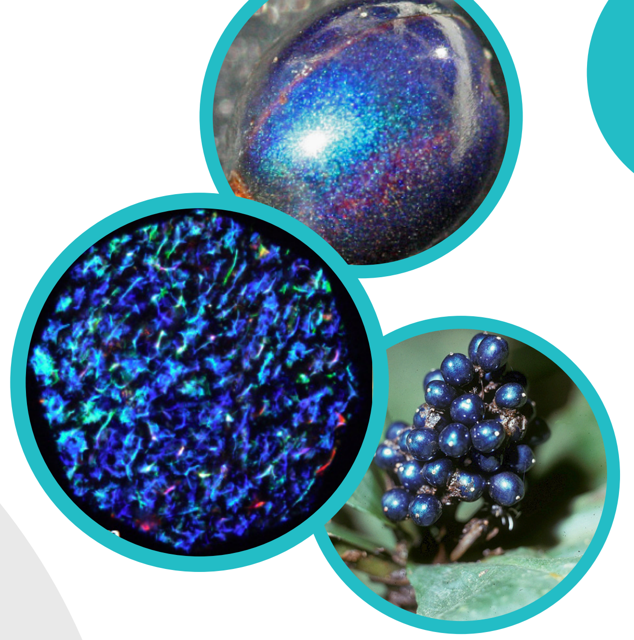
02 TRANSFORM TO BIOLOGICAL TERMS
Transform these terms into biological terms

03 DISCOVER
Discover the strategies the nature uses in order to fulfil these functions.

04 SUMMARY
Summarize these strategies and transform them into technical terms again.

05 IMITATE
Try to imitate these strategies and use them in your design solutions

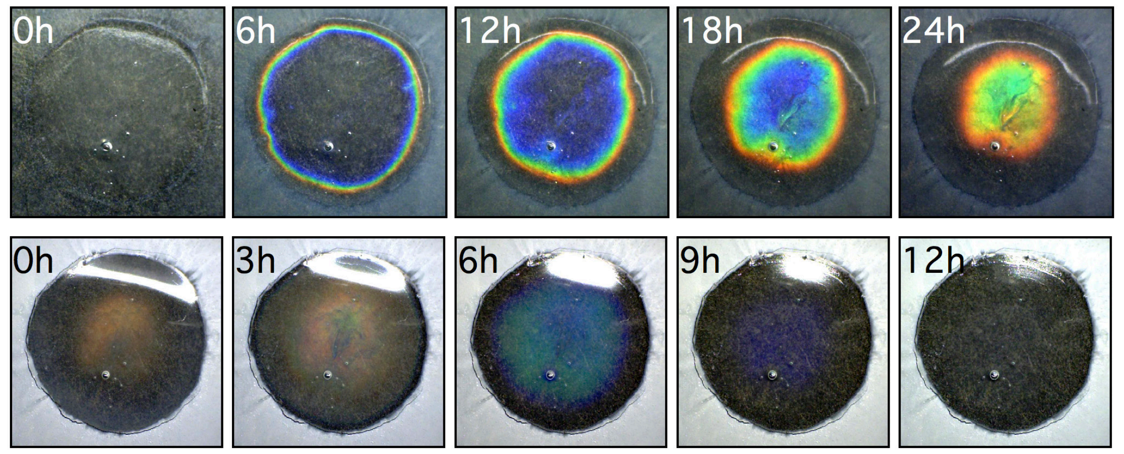
06 EVALUATE
Evaluate your design based on your own design summary and living principles and then decide how you wish to use the next round.



Chitin that can be considered the evolutionary equivalent of cellulose is the second most abundant polymer -after the cellulose- in the nature, which is produced from the crustaceans such as crab and shrimp.

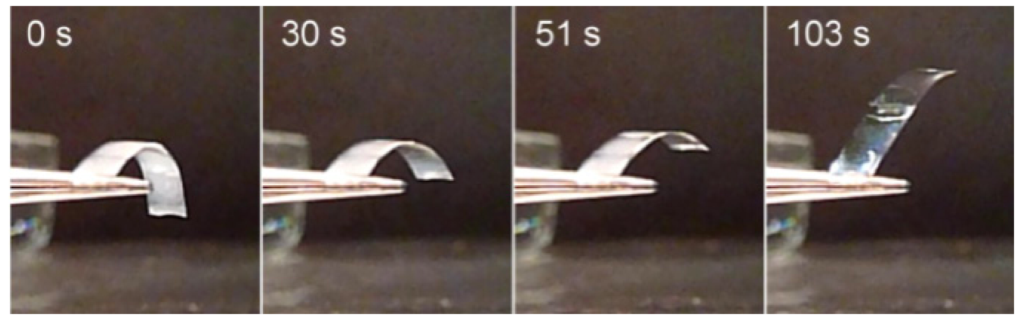
Sensors:

The berries known as marble berry or "Pollia condensate" get their bright blue color entirely due to the cellulose strands in their composition. By breaking the cellulose into nanocrystals through chemical means and then ensuring its self-structuring, it was possible to produce **the strain sensors*** that change color as they detect the pressure whenever touched.[4] Besides, special film-coating practices have been developed with the use of cellulose in a similar way, which can detect that the active ingredient is no longer good and tell the time it loses its function, thanks to the renewable **colorimetric sensors**** that can be used in pharmacology and pharmaceutical industry.



Shape Memory Photonic Films:

Likewise, with the nanocrystals obtained from cellulose, light-sensitive films that can change their shape, and also change colour as it changes shape can be developed[5]. These films are a good fit for especially a wide range of biomedical applications.



Smart Packaging and Packing Systems:

It is possible to manufacture **bioplastic packaging systems** made from chitin with a much lower carbon footprint as opposed to plastics, which can help us understand that food is no good to consume as it changes colour during the storage of the foodstuff[6].

All visuals and contents in this infographic were developed by Ahu Gumrah Parry.
The comments and narrations in this infographic are made by using Ahu Gumrah Parry's webinar presentation

References

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