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I explored AskNature.org and browse examples of biological strategies or bio-inspired designs and chose one natural process or organism that fascinates me and that is coral reefs and learned how it solves a challenge in its ecosystem.

Natural Process: Coral Reefs

Challenge Solved: Maintaining Structural Integrity and Coastal Protection

The primary challenge coral reefs face is physical damage from severe storms (like hurricanes and typhoons), vessel groundings, or bioerosion. In their ecosystem, a damaged reef loses its ability to:

- **Protect the Coastline:** They are natural breakwaters that absorb wave energy.
- **Provide Habitat:** They are the foundation of a biodiverse marine environment.

The Coral's Solution: Self-Repair and Rapid Growth

The AskNature article highlights that coral's own healing properties have inspired restoration techniques. The natural solution involves two key biological processes:

- **Regeneration (Healing):** When a coral colony is partially damaged or fragmented (a common occurrence during a storm), the remaining polyps and tissue have the incredible ability to regenerate and cover the exposed skeleton. This healing process is crucial because exposed coral skeleton is quickly colonized by algae, which prevents new coral from settling and can kill the remaining live tissue. By rapidly healing, the coral is closing the wound to prevent infection and colonization by competitors.
- **Asexual Reproduction (Fragmentation):** If a piece of coral breaks off—a process called fragmentation—it doesn't necessarily die. Instead, this piece can be swept away and reattach to a new, suitable substrate, starting an entirely new colony. This effectively allows the coral to reproduce and spread in response to physical disturbance, turning damage into a dispersal opportunity.

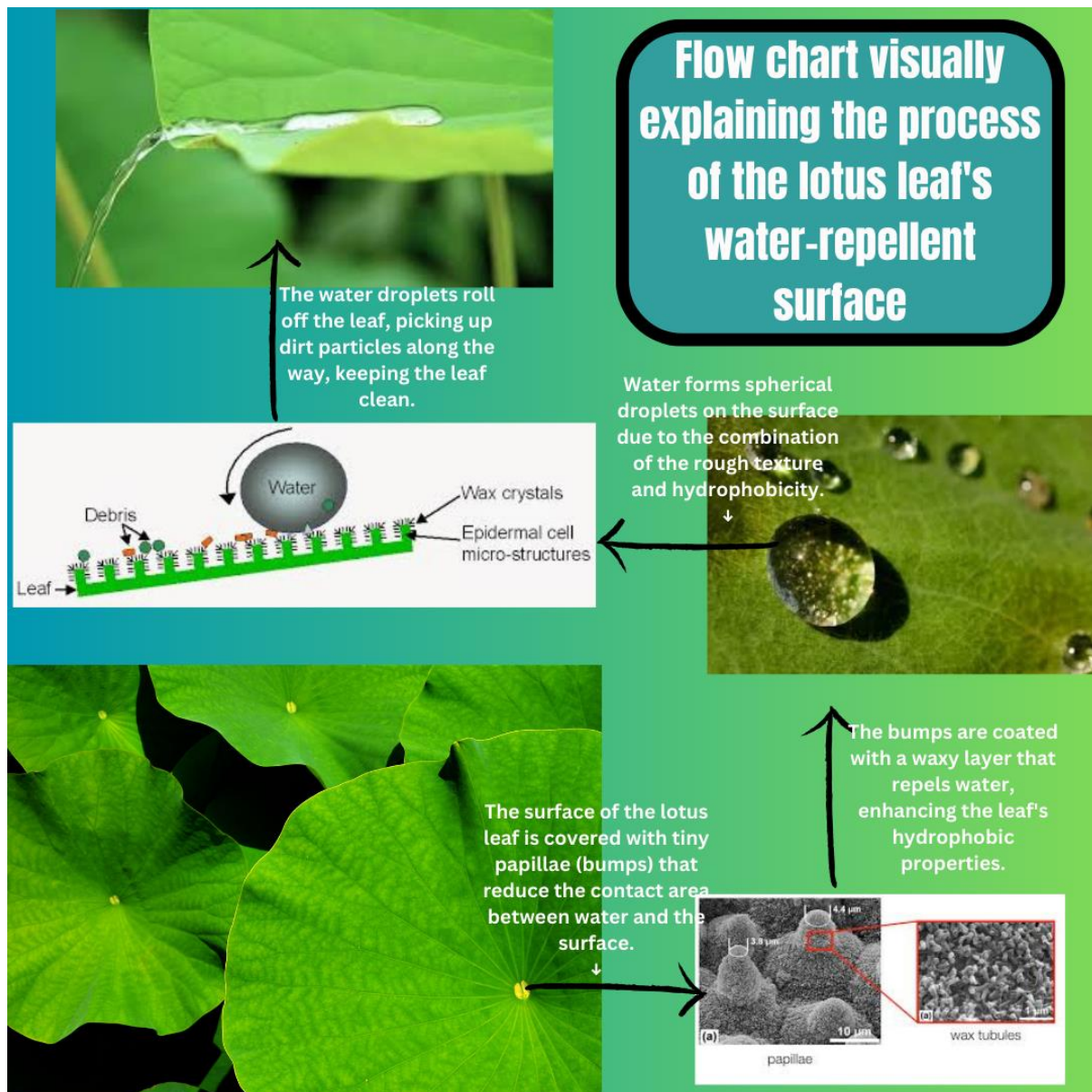
This natural ability to heal and use broken pieces to start new life forms the basis for modern coral gardening or micro-fragmentation restoration techniques, where scientists deliberately break corals into small pieces, grow them in nurseries, and then outplant them to damaged reefs

to accelerate recovery. In essence, the coral's ability to self-repair and propagate from fragments is its key to solving the challenge of rebuilding its own essential structure after physical trauma.

From the following of Greener challenge of today, this is the place of my Jahangirnagar University campus. Whenever I don't have nothing to do, then I always come here to spend time with the nature and see the lotus. I see the lotus and the water body today too like every day but in different way. That means I noticed the "LOTUS EFFECT". That means the lotus leaf's water repellent surface.



Then, I created my own bio-inspired solution from this place for a real-world problem in our daily life:



Then thinking that this system can inspire the products like water-repellent fabrics, such as, hydrophobic coatings for fabrics could reduce the need for frequent cleaning and making them ideal for applications like windows, outdoor gear, or even clothing in wet climates.

Applications that are inspired by the Lotus Leaf:

- 🔧 **Self-cleaning surfaces:** The lotus leaf's capability to stay clean and free from debris can apply into self-cleaning coatings for glass and windows. This will make them ideal for solar panels, and even smartphone screens.

- ✚ **Water-repellent fabrics:** Hydrophobic fabrics can mimic the water-shedding properties of the lotus leaf, and thus can keep the clothing, tents, and outdoor gear dry in wet conditions. These fabrics can frequently used in rain jackets, sportswear, and outdoor equipment.
- ✚ **Anti-fouling materials:** Inspired by the lotus leaf, surfaces coated with materials are used in industries in where the dirt, water, or other substances could affect with operations.
- ✚ **Sustainable cleaning solutions:** Products that are incorporating hydrophobic coatings can reduce the need for often cleaning and harsh chemical use and support eco-friendly practices by lowering the need for detergents and water.
- ✚ **Electronics and gadgets:** Hydrophobic coatings can protect the electronic devices from water damage and that can provide an extra layer of security for gadgets which are used in wet or outdoor environments.

Here is my thinking diagram of this:



This system has inspired products like self-cleaning surfaces and water-repellent fabrics. For example, hydrophobic coatings for glass or fabrics could reduce the need for frequent cleaning, making them ideal for applications like windows, outdoor gear, or even clothing in wet climates.

Here is the link of my Instagram post:

https://www.instagram.com/p/DQJjs_gCZpR/?igsh=ZDN0dTrRZWZremZw

Here are the screenshots of my Instagram post:

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clodysky2025

My mind was blown by the incredible Lotus Leaf Effect! 🌸 Nature has perfected the self-cleaning surface: the combination of tiny bumps and a waxy coating makes water droplets roll off, picking up dirt and debris along the way (swipe to see the flow chart! 📄). This natural process of hydrophobicity inspired me to design a simple solution for a huge local problem: maintaining hygiene and cleanliness in public transport or workspaces. My idea is a biomimetic spray-on coating based on this self-cleaning principle. Applied to surfaces like bus seats, public tables, or hospital equipment, this coating could drastically reduce the need for frequent, chemical-heavy cleaning and minimize the spread of dirt and germs, keeping public spaces cleaner and healthier with less effort. It's amazing how the wisdom of a single leaf can lead to better public health solutions! 💧🌿🌟

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Flow chart visually explaining the process of the lotus leaf's water-repellent surface

The water droplets roll off the leaf, picking up dirt particles along the way, keeping the leaf clean.

Water forms spherical droplets on the surface due to the combination of the rough texture and hydrophobicity.

The bumps are coated with a waxy layer that repels water, enhancing the leaf's hydrophobic properties.

The surface of the lotus leaf is covered with tiny papillae (bumps) that reduce the contact area between water and the surface.

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