

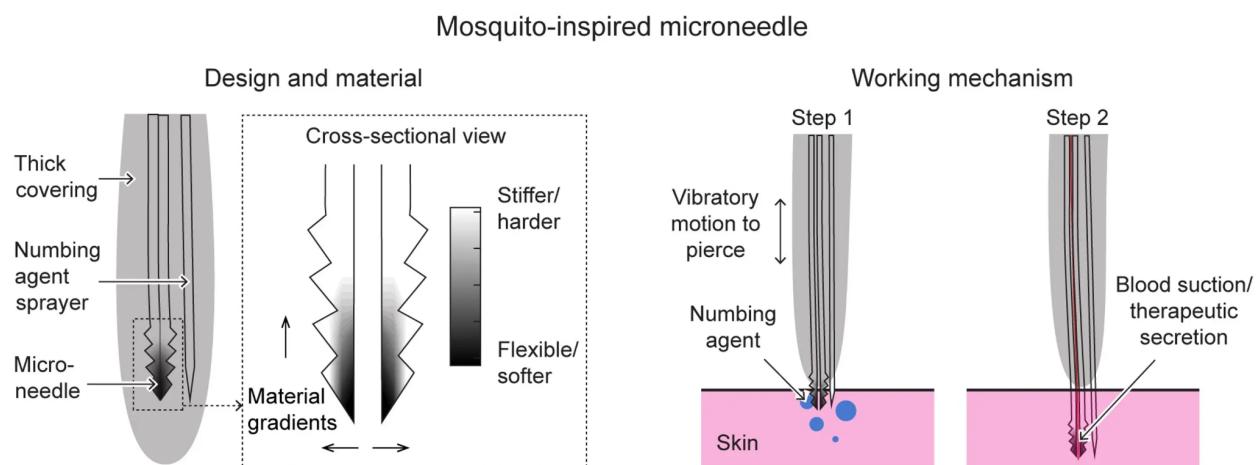
Assignment 01 : Biomimetics in Home & Around Daily Life;

Biomimicry Examples Inspired By Nature

Mosquitos inspire pain-free micro-needle:

A new, completely painless, hypodermic microneedle has been developed by engineers in India and Japan. The unique micro-electro-mechanical based suction system has a design that is based on the female mosquito.

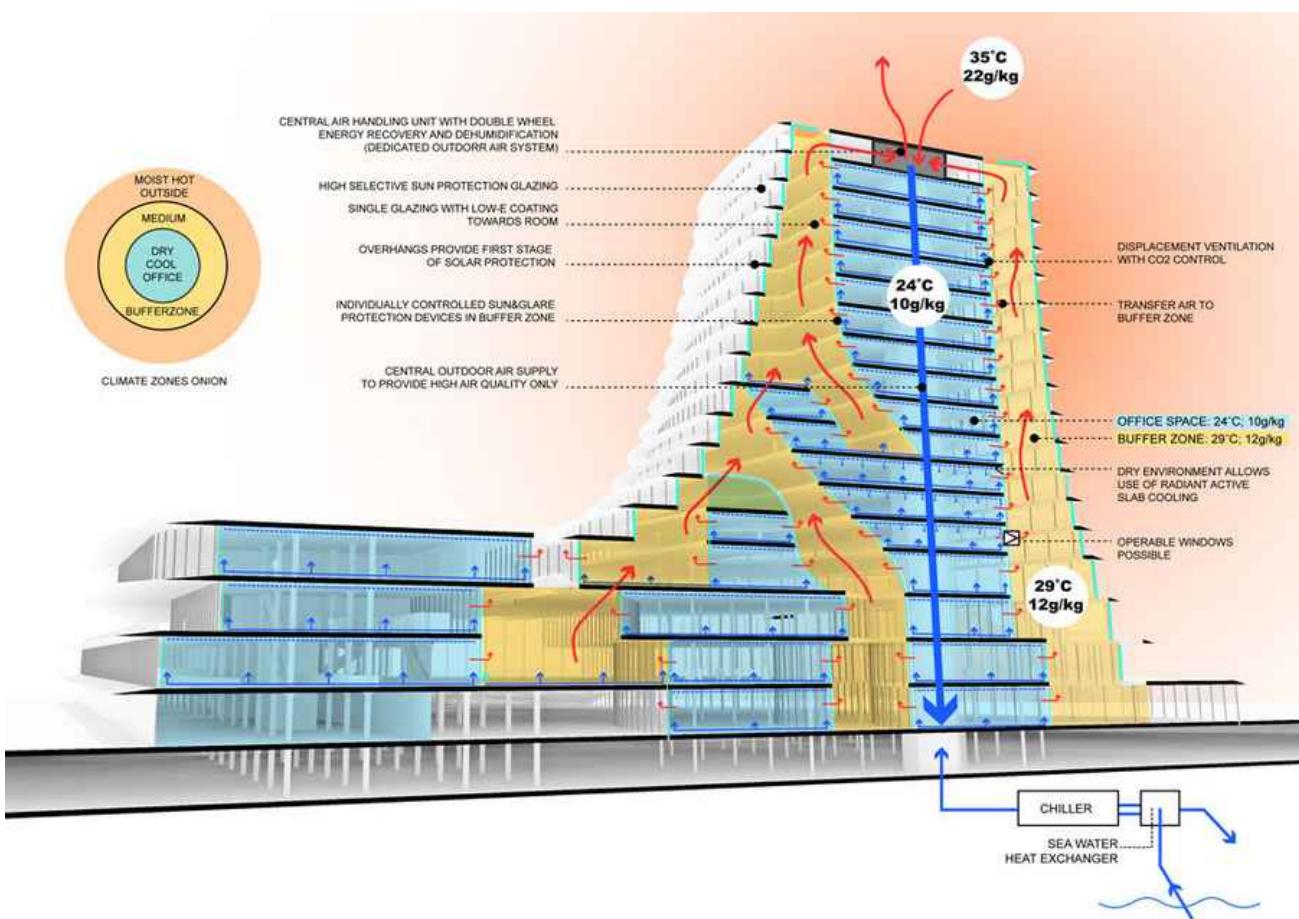
The system uses a sucking motion to draw up blood, similar to the ritual of a mosquito. The needle could be used for various procedures such as drawing blood, injecting drugs and monitoring glucose levels for diabetics.



The needle is strong enough to penetrate as far as 3 millimeters into the skin and reach capillary blood vessels. It has been calculated that this needle can extract 5 microliters of blood per second. Regular needles have a diameter of about 900 microns while this new needle only has a 60 micron diameter.

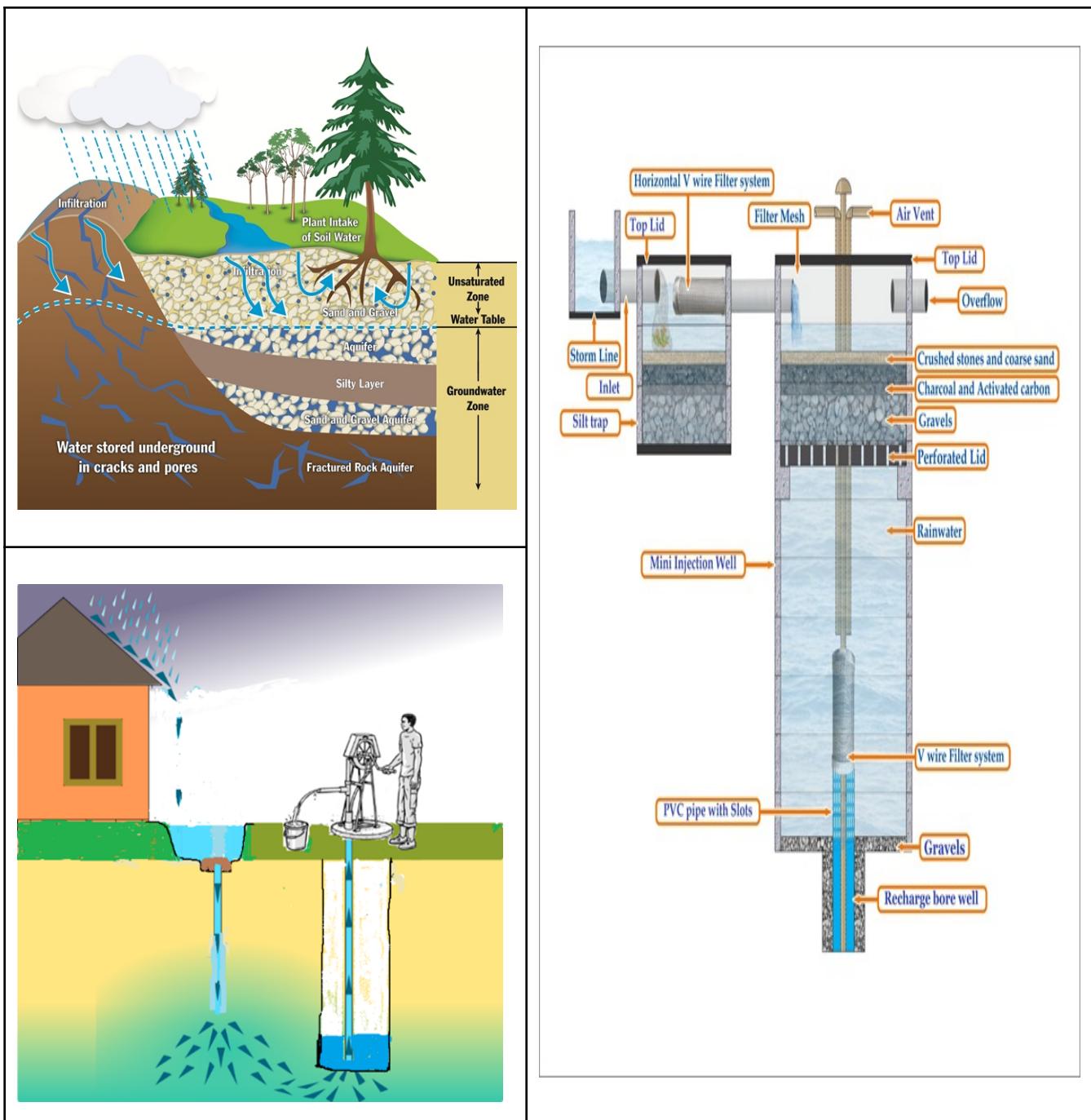
Termites-inspired Ventilation System:

Termites are often considered harmful due to their destructive properties. However, they are known for creating the most elaborate ventilation system for cooling on the planet. Utilizing an intricate network of air pockets, the mounds create a natural ventilation system using convection. The convection system also uses 35% less energy than traditional air-conditioned facilities.



Rainwater Harvesting & Artificial Ground-Water Recharge:

Nature uses the water cycle and rain water to store and carry water to the various places over the soil, also recharge and store water underground. This has been going on for thousands of years. Modern water management systems in rural or urban areas also utilize rainwater harvesting and groundwater recharge by borewell recharge technology to store and use the easily available storm/rain water.



Armadillo Backpacks and Vests:

The armadillo has a hide, which is highly rigid and flexible. The hide protects the animal, while enabling it to be agile. Backpacks have been made as people got inspired by this biomimicry. They joined recycled rubber inner tubes around a central axis to make backpacks more adaptable and durable.

Armadillo outer Shell inspired Vest or Protective Armor is also being developed. Greater flexibility and comfort is their advantage. They also provide substantial protection from blunt force trauma, Lightweight and easy access.



Efficient and Quiet Fan Blades Inspired By Whales or Bird wings:

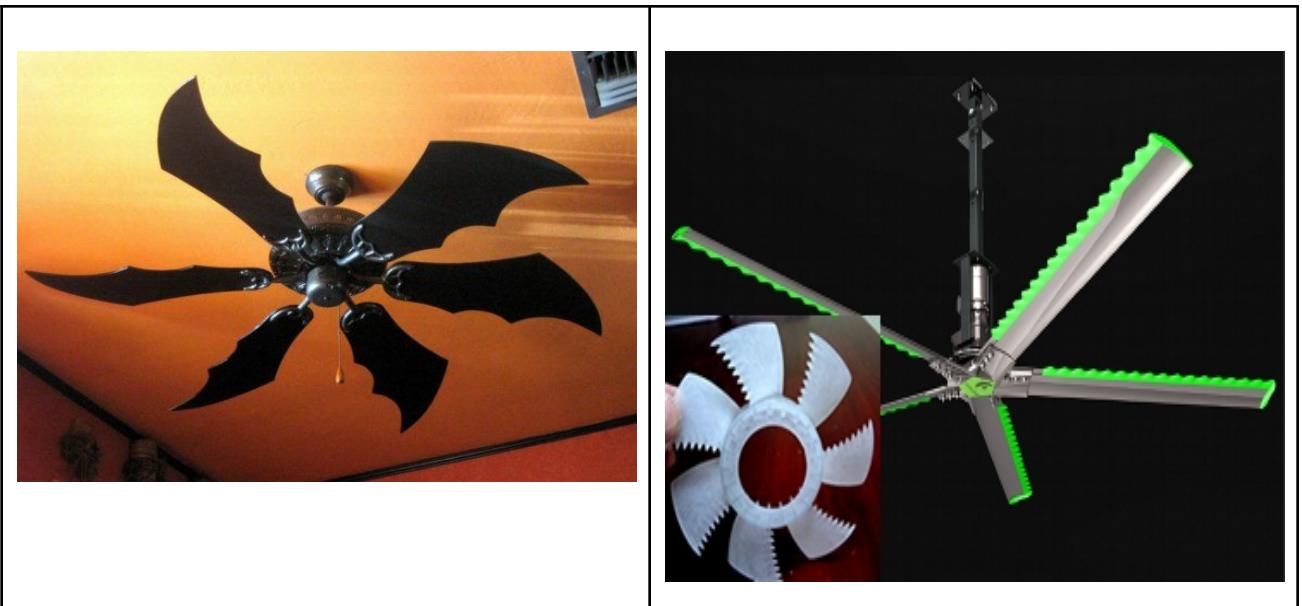
The humpback whale weighs an astonishing 36 tonnes, yet it is one of the most elegant swimmers, divers and jumpers in the sea. Whales have been swimming in the ocean water since its existence. They can dive hundreds of feet beneath the water and remain there for hours. Their fins help them move from one place to the other. As first researched by Frank Fish, a biomechanic, these aerodynamic abilities are greatly attributed to the bumpy protrusions on the front of its fins, called tubercles. The scientists discovered that the bumps at the front end of the whale help them increase the efficiency, reduce the drag by 32% and increase the lift by 8%. Companies are now trying to apply this idea to the wind turbine and propellers.

Similar to the processes of aircraft wings, whales use their fins at different steepening angles to increase their lift. Too much tilt though, and the opposite will occur and they'll stall – a loss of

lift due to current turbulence and the formation of eddies in the water. By comparing bumpy blades to smooth-edged ones, Fish and colleagues found that stalling occurs at a much higher angle with tubercles – an increase by nearly 40 per cent.



Owls are able to approach their prey silently at high speed by managing turbulence. Most of the noise that occurs as an object moves through the air originates at the trailing edge, as air flowing above and below the object meets. This can also increase drag. Many owls have a flexible fringe on the trailing edge of their wing feathers which serves to minimize that noise-generating turbulence.



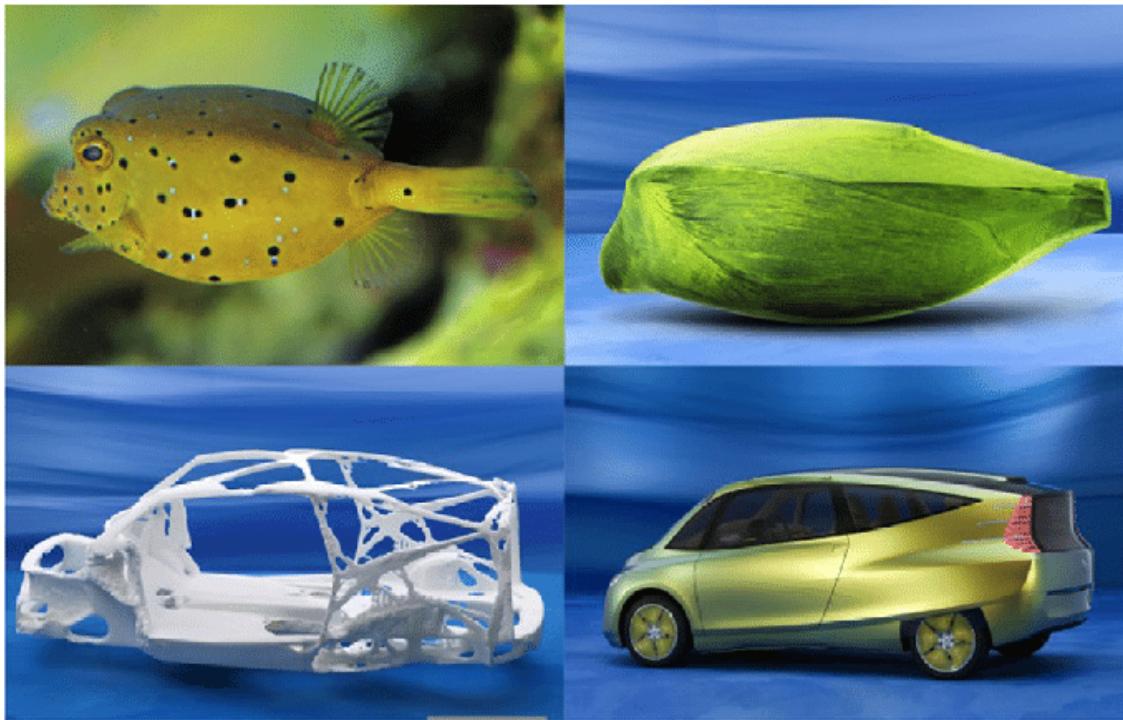
Bird-safe glass:

It is estimated that 100 million birds die every year as a result of flying into glass, and the reason is obvious - they simply do not recognise the transparent structure as a physical barrier. To address this problem, a company developed biomimetic Ornilux Birdsafe Glass, drawing inspiration from the UV reflective strands in spider webs, which birds see and therefore avoid. This is a clear mutual benefit for both species, and so Ornilux sought to replicate this with their criss-crossing UV glass.



Box fish and the Bionic car:

Despite the cumbersome appearance of the boxfish, it has a low flow resistance and a drag coefficient of an astounding 0.06. In comparison, penguins swimming through water have a coefficient of 0.19. In 2005, inspired by the great structural strength and low mass of the boxfish, Mercedes Benz developed the Bionic Car, which reported to reduce drag, have great rigidity, low weight and a significantly lower fuel consumption than traditional cars. Of course just because something seems like the perfect design in the natural world, doesn't necessarily mean it works out that way in industrial design. You might have noticed the distinct lack of Bionic Car-shaped vehicles on the road, which is probably because a 2015 study found that the shape of the boxfish didn't reduce drag at all and actually made it more unstable - great for a box fish with 50 million years of evolution to perfect the art of being a boxfish, less good for a people carrier.



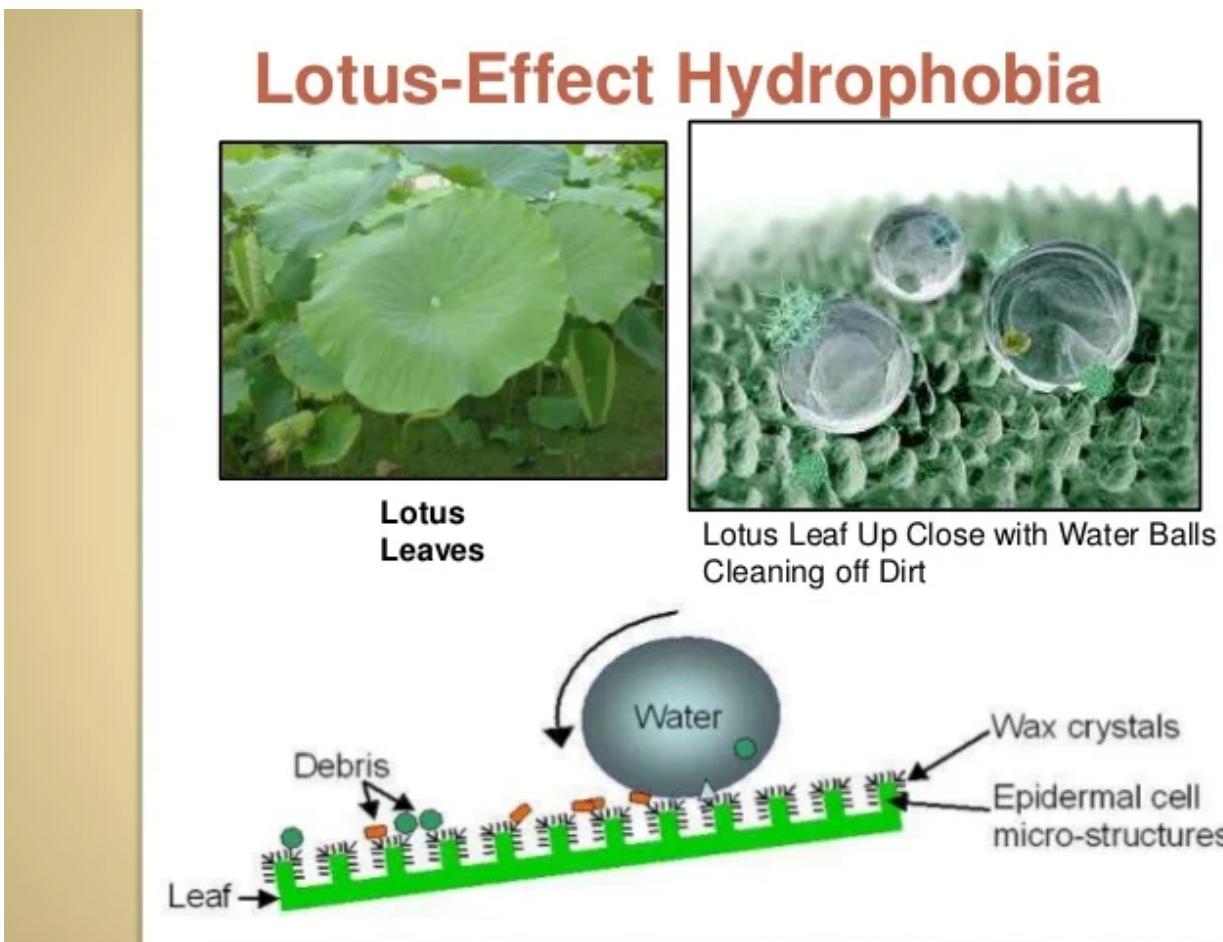
Velcro:

George de Mestral was inspired to invent Velcro after noticing how easy it was for burrs to stick to his dog's hair. Upon studying them under a microscope, he noticed the simple design of tiny hooks at the end of the burr's spines. These were able to catch anything with a loop, such as fur and fabric, and he went on to replicate this synthetically. His two-part velcro fastening system uses a strip of loosely looping nylon opposite a strip of tiny hooks, and has since been prolific in its range of applications and popularity.



Lotus-inspired hydrophobia:

The lotus effect, otherwise known as superhydrophobicity, is the effect seen on the leaves of the Lotus flower, where water is not able to wet the surface and simply rolls off. This high repellency is due to the nanostructure of the plane, where micro-protrusions coated in waxy hydrophobic materials repel the water. This is also a self-cleaning mechanism as dirt particles also stick to the water molecule. Copying this process, CeNano developed nanitol - a hydrophobic (water-repelling), lipophobic (fat-repelling), and oleophobic (oil-repelling) sealant that can be sprayed to substances to create their own superhydrophobicity.

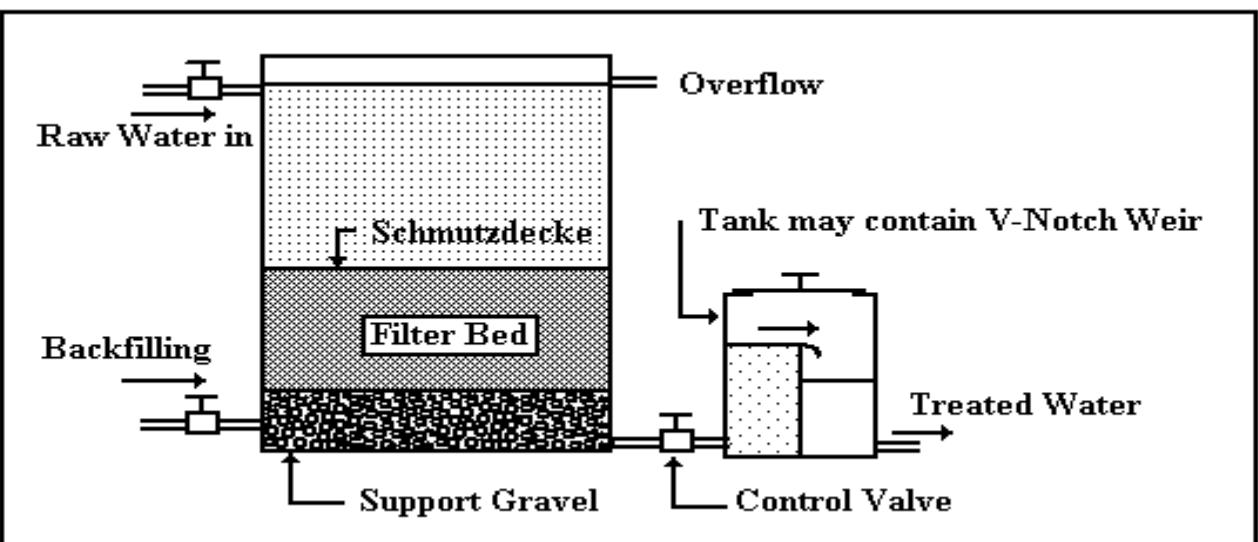
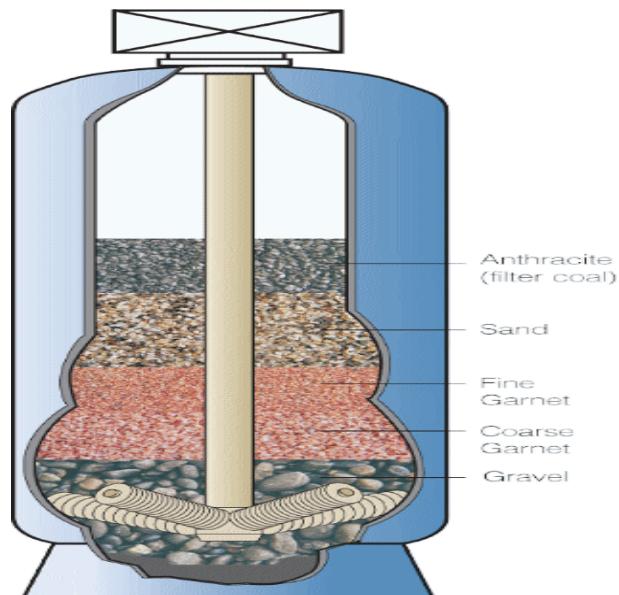


Lotus flower like paint to repel dust:

The lotus flower is sort of like the sharkskin of dry land. The flower's micro-rough surface naturally repels dust and dirt particles, keeping its petals sparkling clean. If you've ever looked at a lotus leaf under a microscope, you've seen a sea of tiny nail-like protuberances that can fend off specks of dust. When water rolls over a lotus leaf, it collects anything on the surface, leaving a clean leaf behind. A German company, Ispo, spent four years researching this phenomenon and has developed a paint with similar properties. The micro-rough surface of the paint pushes away dust and dirt, diminishing the need to wash the outside of a house.

Water purification by nature-inspired membrane or Sand, gravel etc :

Nature purifies water by filtering water through soil, sand, gravel etc. Modern water treatment plants/ filters also use sands, gravel, coal etc natural material for water purification.

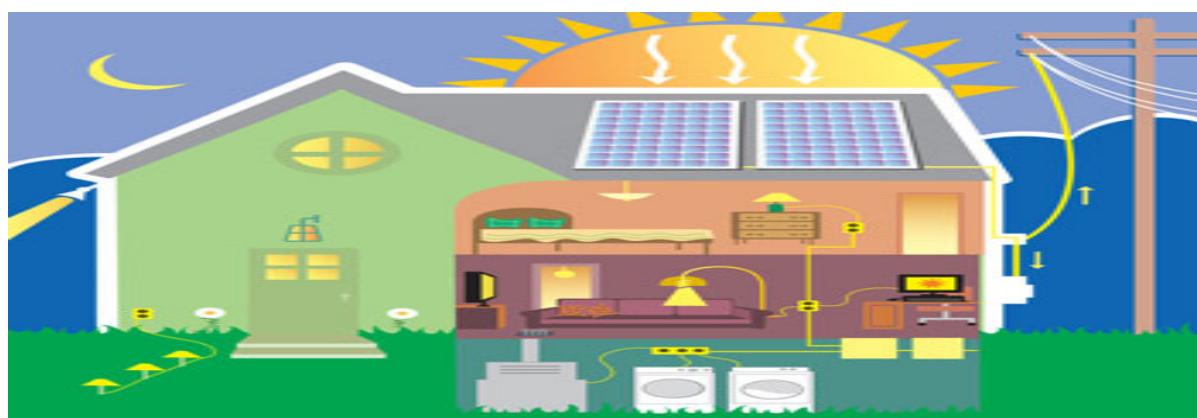


Preservation by freezing or drying:

	<p>Ice in nature can preserve substances for a very very long time. So, we also refrigerate many things to be preserved for very long time, in the fridge.</p>
	<p>Nature can also preserve things when dried under sunlight. Fish , Meat , Fruits can be preserved when properly dried.</p>

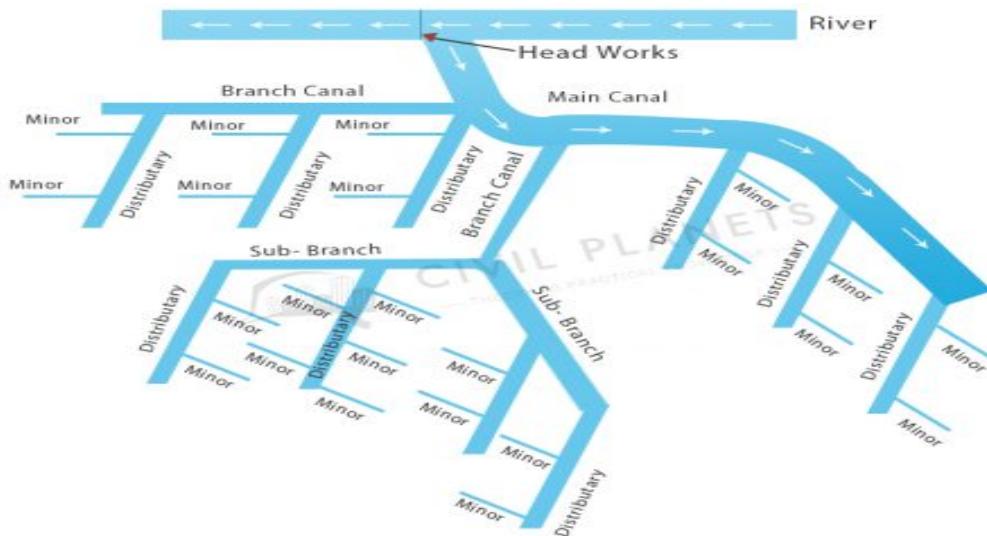
Solar Power Harvesting:

From trees to animals to germs -the natural world uses sunlight for most of its needs. Human civilizations are also trying to use solar energy for most of our energy needs - from electric power production to agriculture and in domestic use.

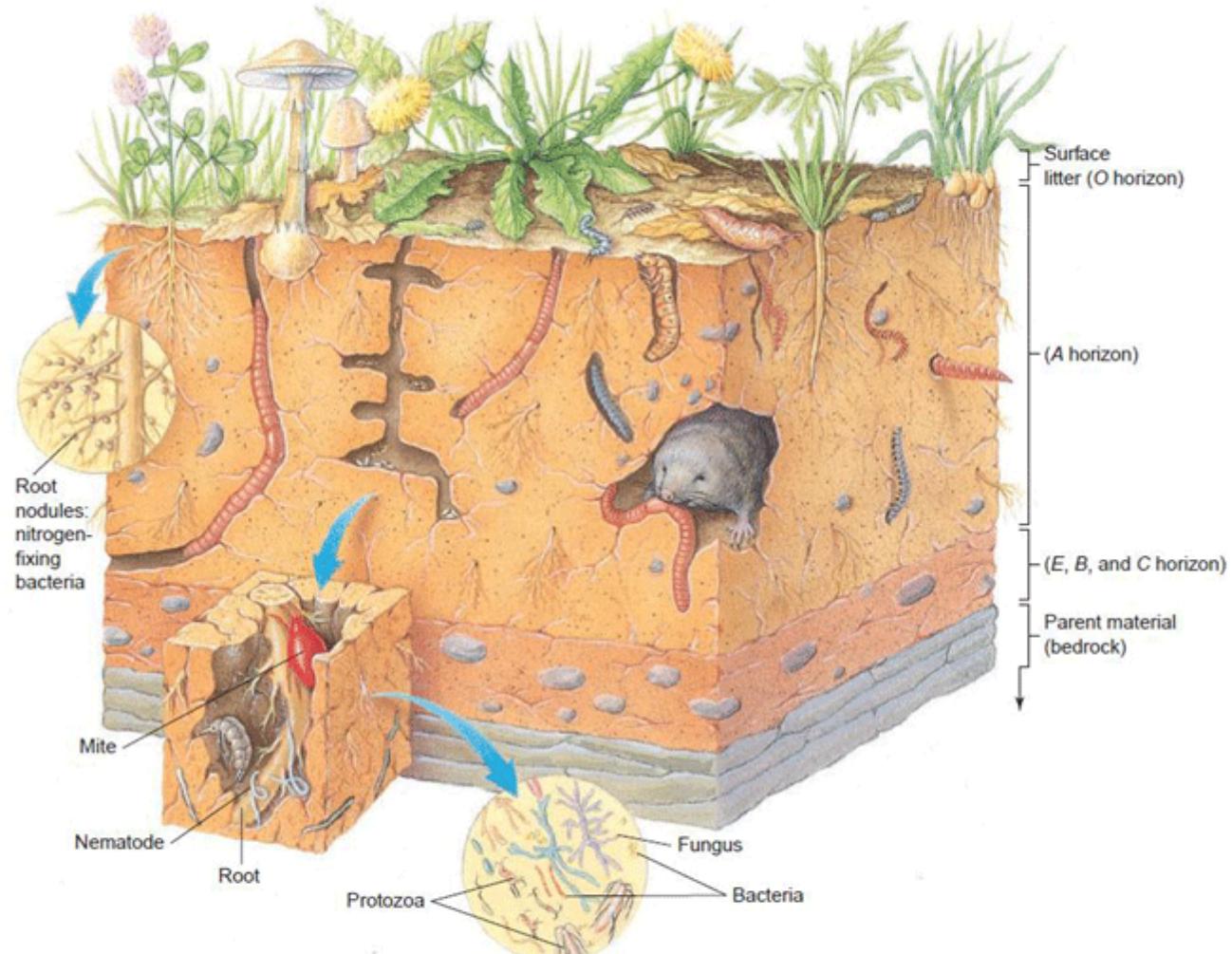


Carrying water by canals:

Nature uses rivers, canals and waterways to carry water. We humans also carry irrigation water, raw water for treatment, drainage water by canals or culverts. Artificial canals can also be used as water storage facilities . They can also serve as water ways for communication, as natural canals do.



Natural soil Fertilization:



10.15 Soil organisms

The diversity of life in fertile soil includes plants, algae, fungi, earthworms, flatworms, roundworms, insects, spiders and mites, bacteria, and burrowing animals such as moles and groundhogs. Soil horizons are not drawn to scale.

Scientists are now advocating using worms, plants, algae, composted waste to make the soil fertile like nature.

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