Introduction to Biomimicry
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Lecture - 13
Approaches to Biomimicry

Next, we are going to look at what is called approaches to biomimicry. An approach to biomimicry is how you get started doing biomimicry. And there are two approaches based on the starting point.

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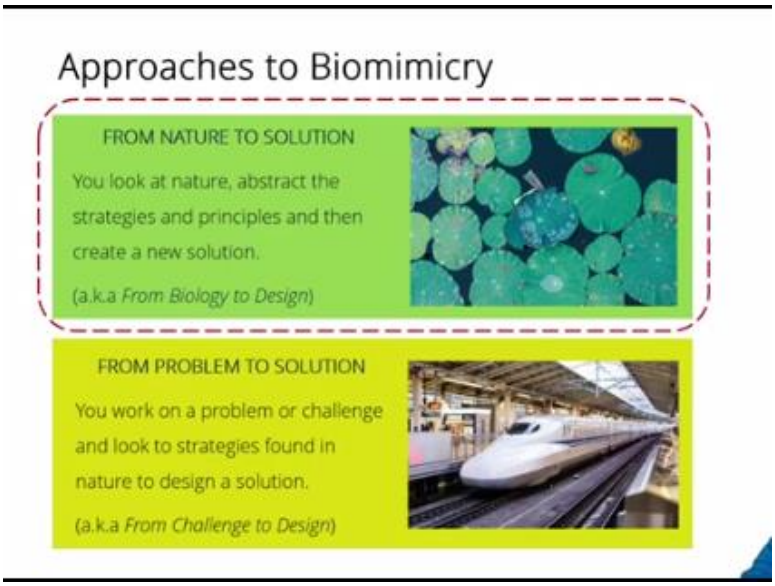

One is called ‘nature-to-solution’. ‘Nature-to-solution’ is when you start looking at nature, look at what nature does, extract that principle or strategy and use it in the human world to solve a problem. That is the ‘nature-to-solution’ approach. An example of that is, of course, the lotus leaf that you encountered earlier. You look at the lotus leaf, you see that it stays clean.

You find out how it stays clean, you use that principle of staying clean in order to solve a problem in the human world, which could be paints for the exteriors of buildings. So that is the ‘nature-to-solution’ approach. The other approach is the problem-to-solution approach. Now the ‘problem-to-solution’ is the regular problem-solving approach where you are confronted with a problem.

And then you ask yourself, how do I go about solving the problem, you look to nature, and find out if nature has a strategy or principle that you can use in order to solve the problem. An example of that is the bullet train that you encountered earlier. Now, the bullet train was making a huge noise when it passed through the tunnel. The engineers were wondering how to solve the problem.

So, they had a problem in front of them, that they did not know how to solve. They looked to nature, they saw the kingfisher and the kingfisher's beak that helps it do a splashless dive. And they use the same principle in order to solve the problem of the noise that the bullet train makes. So that is a 'problem-to-solution' approach. Let us look at the 'nature-to-solution' approach first.

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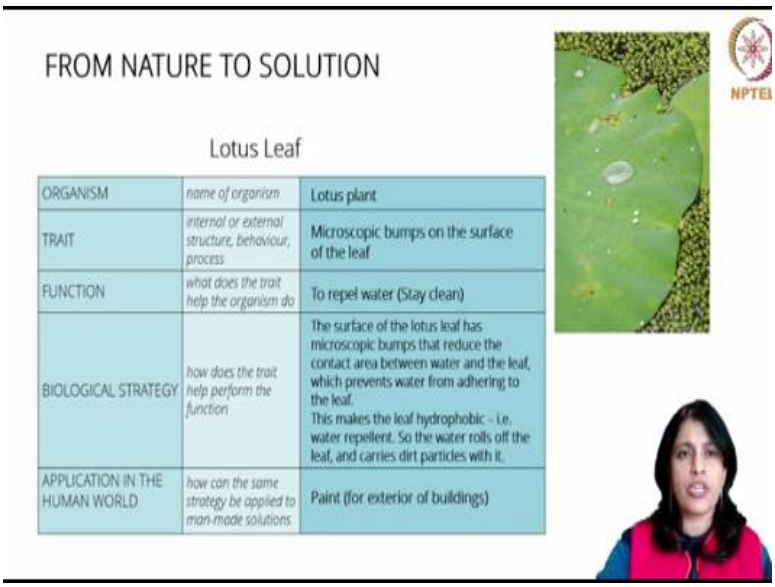

So, in the 'nature-to-solution' approach, I am going to use this example of the lotus leaf again and this table to kind of take you through the sequence of what happens. So, in the case of the lotus leaf, the organism is of course the lotus plant. What is the trait? The trait, what is the meaning of a trait? A trait is any characteristic or attribute or behavior or process that the organism exhibits.

If you notice, this is very closely linked to what you encountered earlier about mimicking. A trait is any internal or external structure, an attribute, or a characteristic that the organism has, that you can observe. So, in the case of the lotus leaf, the trait is the microscopic bumps on the surface of the leaf. What is the function of these bumps on the leaf? To repel water, could also say to stay clean.

And what is the strategy that it employs in order to accomplish that function? The strategy that is employed is the microscopic bumps reducing the contact area between water and the leaf, therefore, repelling water, and therefore the water rolling off the leaf and the dust and the dirt being washed away along with it. Briefly, that is the biological strategy that the lotus leaf uses in order to stay clean.

Remember we are doing 'nature-to-solution'. So, this is the principle. This is the principle or strategy that you have observed as part of observing the lotus leaf. And then you ask yourself- is there an application in the human world? and the application is of course paints. One of the applications is paints for the exteriors of buildings. And the company called Lotus and Paints has done that of course.

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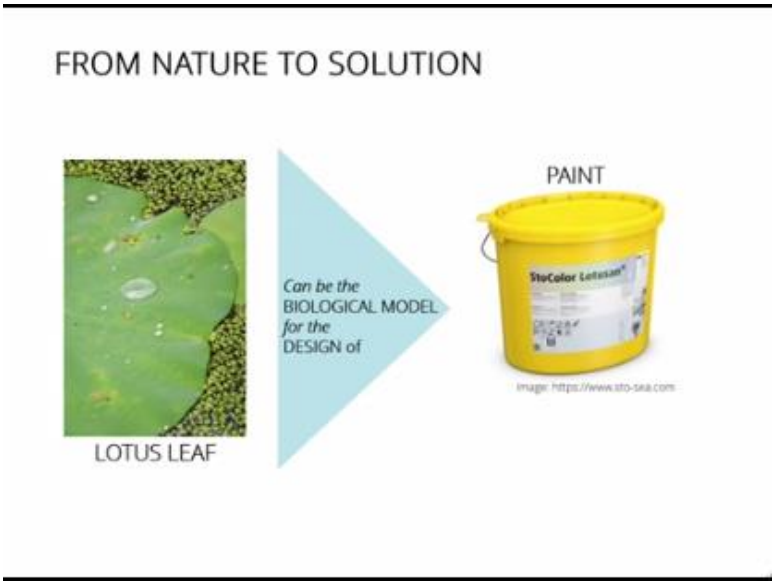

So, a summary of the 'nature-to-solution' approach could be that a lotus leaf can be the biological model for the design of paints. Let us understand 'nature-to-solution' with another example.

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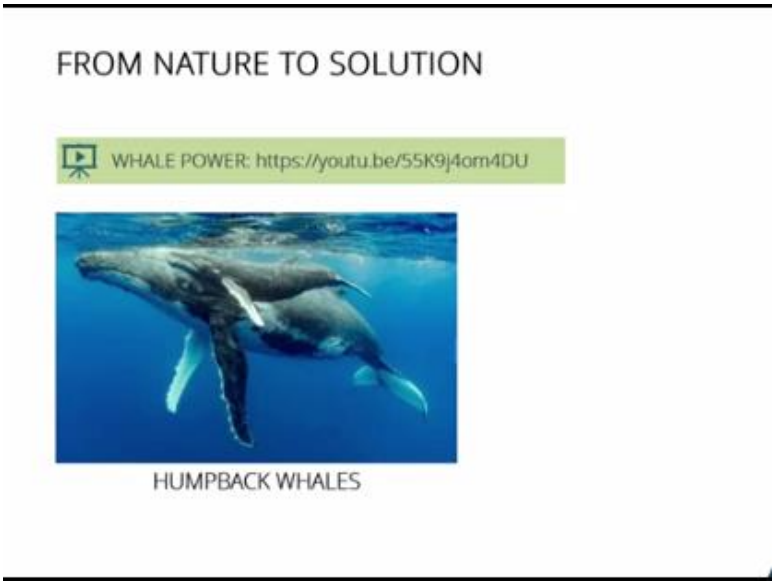

And for this, we are going to look at a video, first of a company called whale power. The link is posted below this recording so you can pause this recording and look at the video. The company whale power has used an interesting trait of humpback whales in order to do something and the video will tell you exactly what.

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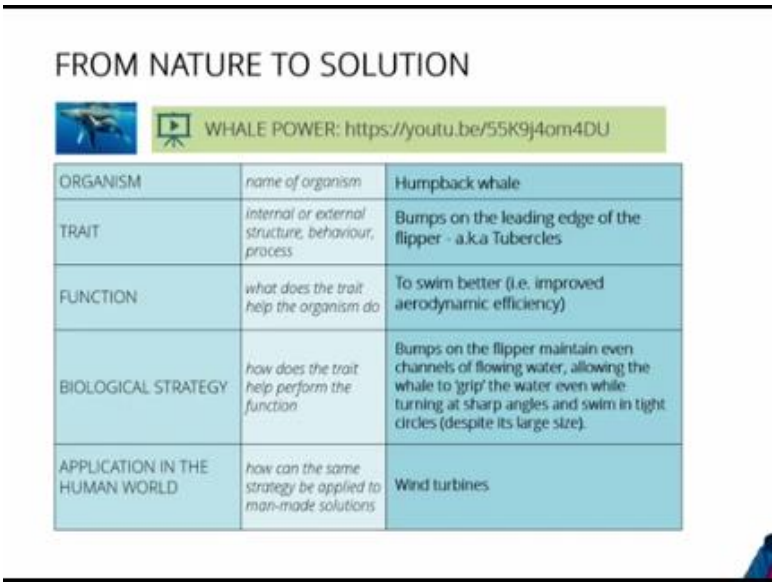

So how did ‘nature-to-solution’ work in the case of whale power? The organism of course was the humpback whale. The trait of the humpback whale that they looked at is the bumps on the leading edge of the flipper. On the front of the flipper of the humpback whales, there are these small bumps which are called tubercles. And what is the function of that trait? The function of the tubercles is to help the whale swim better.

What is the strategy therefore that is being employed here? Briefly, the strategy is to allow the whale to grip the water better. Using that strategy, looking at this trait and using that strategy, is there a problem that can be solved in the human world? Whale power decided that it could be wind turbines. So that is the 'nature-to-solution' approach, as whale power did it.

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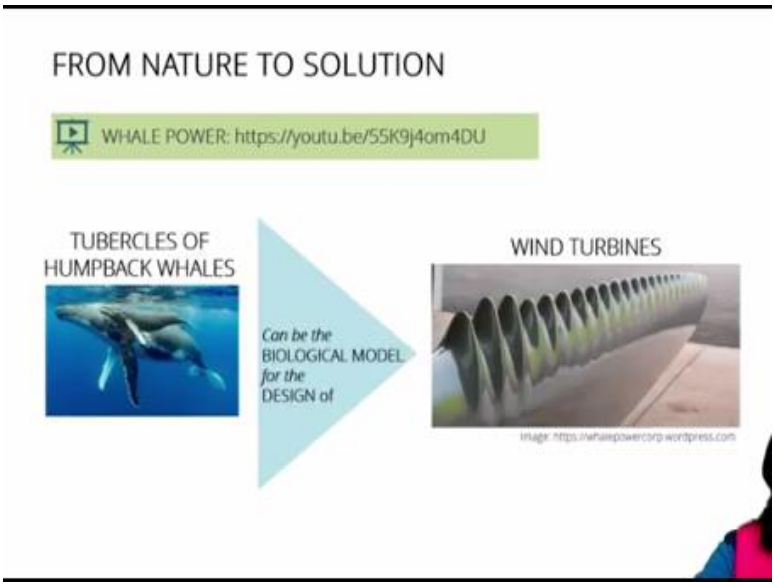

So, they use the tubercles as a biological model to create wind turbines. Then you can look at other examples to understand 'nature-to-solution' better.

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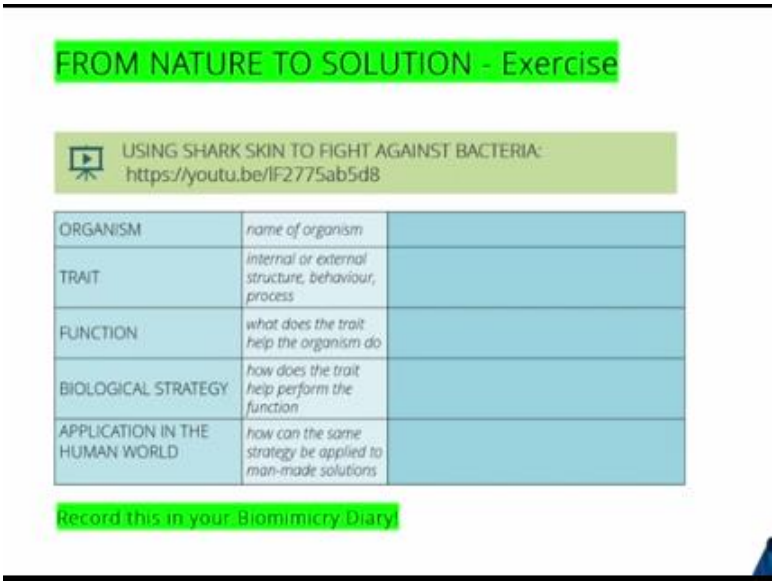

And to get you started, I am going to ask you to look at a video, a link to which is posted below this recording as well. Using shark skin to fight against bacteria. It is a very short video, but the intention is to help you understand the 'nature-to-solution'

approach better. So, look at the video and try and fill up this table according to what you saw earlier.

You can look at other examples as well, go ahead and record them in your biomimicry diary. So, you will start getting a hang of how this 'nature-to-solution' approach works.

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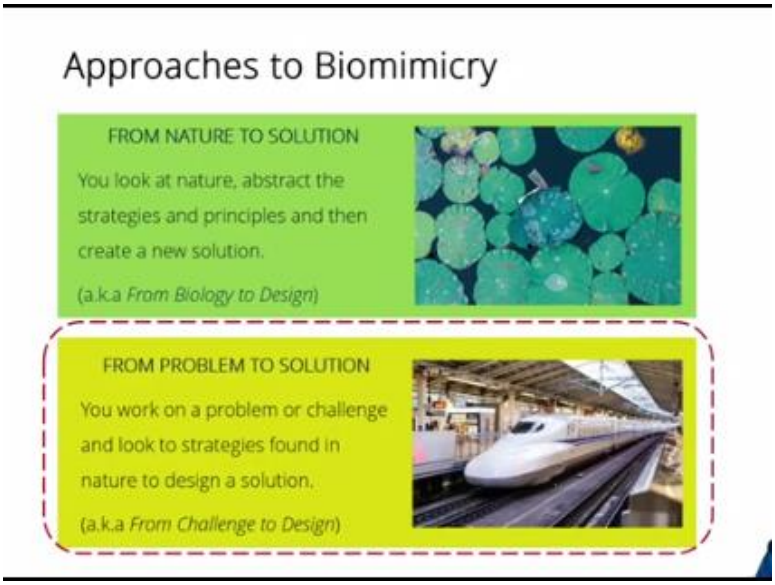

The second approach to biomimicry is the 'problem-to-solution' approach. As we saw, the classical approach to problem-solving, where you are faced with a problem, then you look to nature to see if you can solve this problem using a principle from nature. Now for the 'problem-to-solution' approach, the way that you can use the 'problem-to-solution' approach in biomimicry is by applying the biomimicry design spiral.

That is the biomimicry process, which you have been briefly introduced to earlier. You start with defining the problem. You look at it, go through a sequence of steps and come up with a solution. Of course, you may iterate through those steps, but you go through a sequence of steps, and you go through the process in order to arrive at a solution. So, you have a problem. You look to nature to solve it, and you come up with a solution.

That is the ‘problem-to-solution’ approach. Let us look at that with an example of how a student applied the biomimicry design process, the biomimicry design spiral in order to solve a problem.