Introduction to Biomimicry
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Lecture – 19
Step 3: Discover Strategies in Nature: The Biomimicry Design Spiral

So next we are going to look at step 3 of the biomimicry design spiral. Now, though we are saying step 1, step 2, step 3; remember that these are not just linear sequential steps. you will be iterating through them if required which means that you will be going back and forth between the steps as and when required. So, coming back to step 3, in step 1 you defined the problem statement, you created the design question: How might we? Then in step 2, you look at biologizing the question which means you ask the question how does nature do what I want to accomplish?

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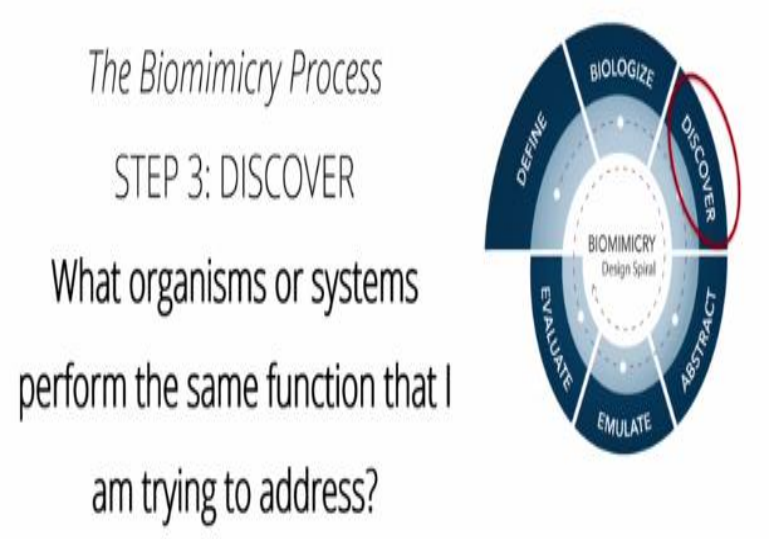

The next step is the discover where you look at what organisms perform the same function that I am trying to address. You biologized the question in step 2, you came up with a how does nature question with a function. Now you look for which are the organisms that perform that function and that is what we are going to do in the discover step. Let us see how we do that.

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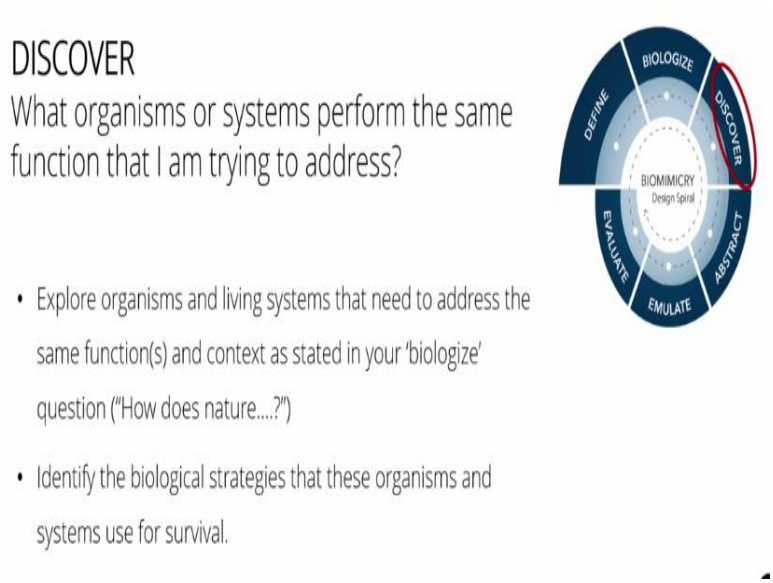

A couple of things to remember as you start this step 'discover'. You are going to be looking at organisms and living systems that are doing the same function of course and you are going to look at the associated strategies that they use for performing that function what is called the biological strategies. You have heard this term before. So, you are going to look for organisms and the associated biological strategies as you go through the discover step.

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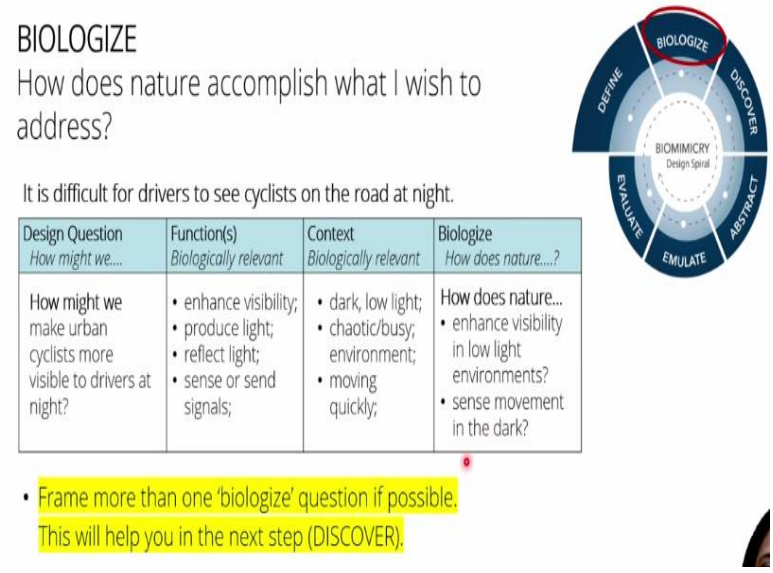

Let us pick up the same example that we used in 'biologize'. You will remember this example of how might we make urban cyclists more visible to drivers at night- that was the define question. You biologized the function and context. Let me just get the laser pointer here. So, this is the define question, you biologized the function and context. And you came up with a 'how does nature' question which said how does nature enhance visibility in low light environments?

And how does nature sense movement in the dark? Now, if you recall at that point in time we had said that you should frame more than one biologized question to help you in your next step. And now that we are at the next step, let us see how that helps us. So now you have a biologized question in front of you how does nature enhance visibility in low light environments?

And how does nature sense movement in the dark? You are going to discover organisms that perform the same function that you want to look for. What is the function? Organisms that enhanced visibility in low light environments and organisms that sense movement in the dark.
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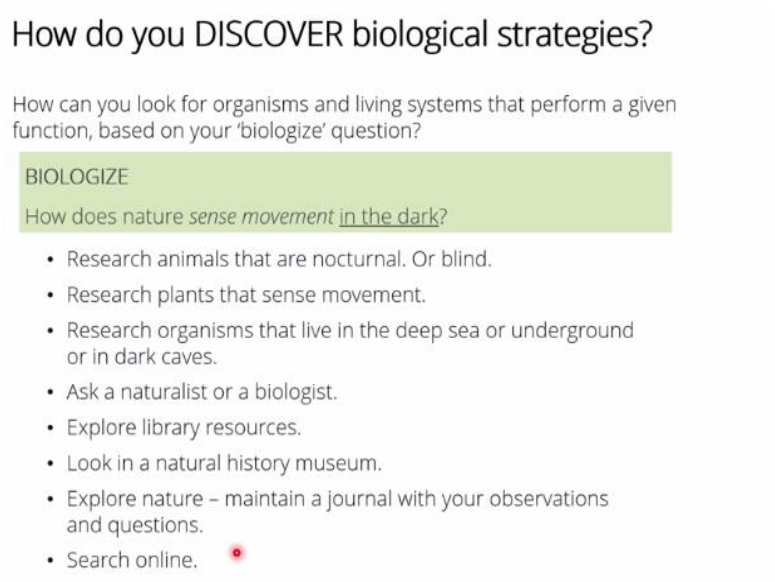

So how do you actually go about looking for such organisms? Any guesses? How would you go about looking for organisms that sense movement in the dark? How do you discover these organisms? How do you discover their biological strategies? Of course, you could research animals that are nocturnal or blind. You can start looking for animals that have these characteristics. Again, you know when we say organisms we always think only of animals.

Do not forget that plants are also organisms. Also, there are living systems which means an entire system of living beings that can also be considered in order to look for functions. So, you could look for plants that sense movement. You could look for organisms that live in the deep sea or the underground or in dark caves. You could ask someone who is an expert or naturalist or a biologist to find out organisms that sense movement in the dark.

You could also of course explore library resources, look in a National History Museum, and look for it yourself. Remember this is biomimicry, going out in nature is something that you will be expected to do, you could actually go out to nature and start looking for organisms and of course search online as well. So, you can do all of these in order to discover organisms that perform the same function that you are looking for in your biologize question. And you can go through each of these to do that.

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However, for the purposes of this course, we are suggesting that you use AskNature. You are of course welcome to try other ways as well. But AskNature is the most direct way of looking for organisms and looking for associated strategies. Last time or rather in the last video, I introduced you how to use AskNature to look for a function and an associated strategy. So, you could employ that in order to look for an organism that is the most direct way.

You can also use the biomimicry toolbox which has a pretty extensive references section. So, you can look at those sources in order to look for organisms as well. Asking an expert is, of course, an option. There is an online service available from Arizona State University where you can email a question to your biologist and they try to answer those questions as much as they can. So that is something you can do as well.

Remember, you are trying to look for organisms that perform a certain function and the associated strategy they use to perform that function. And you could use these ways to arrive at those organisms.

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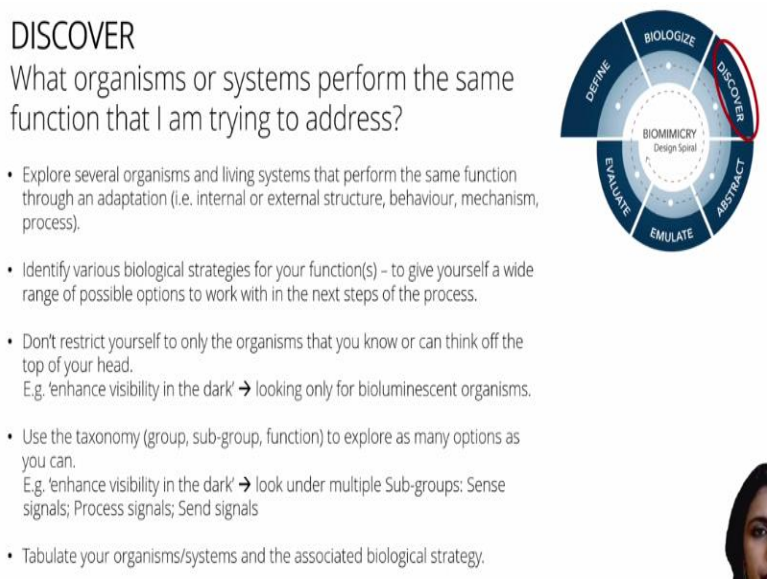

A couple of tips to help you do this step of discovering organisms. One is to explore multiple organisms and living systems that are doing the same function. This also gives you multiple biological strategies for those functions that you can look at for your solution in the next step that is. Again, this is something that you would have noticed as a tip even in the previous two steps, define and biologize. In define, we told you to not just frame one question and say this is my problem statement.

Do not just frame three questions and say one is broad, one is narrow, one is just right and move forward with it that is not how it works. Frame multiple define questions. Classify them as broad, narrow, and just right. Pick up your just right questions, and find out which you want to proceed with. Similarly, in biologize look for multiple functions that are related to the define question and explore each of them as you do the biologize step.

Similarly, in discover do not just restrict yourself to one organism that performs a function, look for multiple organisms. And you have the resources available. We just spoke about what all you could do to discover organisms. For the purpose of this course, you can look at AskNature. Again, AskNature has almost 1700 plus organisms, so you do not have a dearth of choices there. So do not just restrict yourself to one organism or two organisms.

The other one is not to restrict yourself to only organisms that you know because we have students who think of designating that they already know the organism. Enhancing visibility in the dark, you look only for bioluminescent organisms. So, I look at fireflies because fireflies enhance visibility in the dark, do not do that. Go with the process. Do not just stick to

what you know and what you think you know. Go with the process, and trust the resources available to you in order to proceed.

And use the taxonomy fully. You have 160 specific functions that you can use to frame your biologize questions and to look for associated organisms and strategies. Use that effectively. Look for functions under multiple subgroups. Look for functions that are synonyms, look for functions that are opposite, just gives you a fresh perspective of the way in which you are looking at your problem. And once you have done that, do tabulate your entire findings.

Now this is something that is important because it is easy to get caught up in the research and look at multiple organisms and multiple functions and multiple strategies, but do tabulate them and say here is the organism I discovered, this is the function, this is the strategy. So do that in a systematic way because this will help you in your next stage. And when you look at the biological strategy, do not just copy it from the source that you looked at it from.

Read it and explain it in your own words. Explain it in your own words and even draw a rough sketch of the strategy if you can because this will help you understand the strategy better. And it will only help you as you go to the next step of abstracting the strategy and actually using it to create a new solution. Now that we have looked at how ‘discover’ is done, I am going to show you a way of doing that using the AskNature website. So let me do that.

Pick up one example and do that. So given the ‘biologize’ question of how nature senses movement in the dark, let us take that as an example to see how you can discover organisms using AskNature. **(Video Starts: 11:00)** So you go to the biological strategies section right here and go to search strategies because you have a very specific function that you want to look for. You are not just simply exploring.

So, you could just search here by typing your query, you could say sense, movement or dark, etc. So, you could use some keywords to actually do that. I am not going to do that because I have a specific function that I am looking at. So, therefore, I am going to say how does nature sense movement in the dark? What function group do I look for? Sensing movement is processing information. So, I can process information.

Again, if you do not know this, it is fine. You can use the search box here in order to do that. So, processing information and I look at sensing movement. So, sensing signals let us say. And in sensing signals, you have multiple ways of sensing and there is sensing motion which is sensing movement. So, 14 organisms are curated here for sensing movement. You could look at each one of them.

So, you have the water strider, you have spiders, you have red harvester ants. Look at each one of them, you can open up each of these pages, look at the strategy, look at the function, and how they perform it using a strategy. Find out more about that specific function tabulated in your findings. So, you have multiple organisms to work with here for sensing movement. You could also look pick up the dark part in the night.

So, sensing light, sensing light in the visible spectrum or the non-visible spectrum, you can even look at organisms that do that in this context, try and see if that expands your range of organisms and strategies that you can look for. So that is what you do as part of the discover organisms step. You are looking at discovering as many organisms as you can that perform the function. Do not be restricted to just one function in one organism. Look for multiple functions, multiple organisms, using the tips that I gave you earlier. **(Video Ends: 13:22)**

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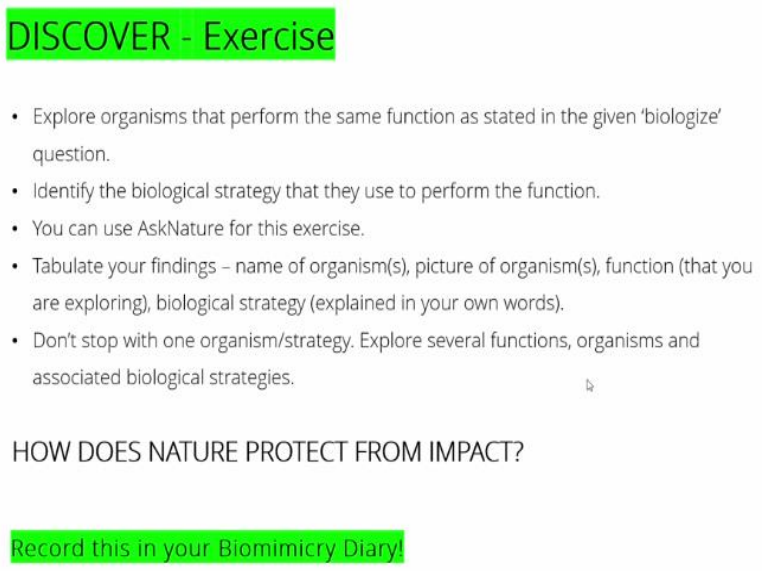

Now that we have looked at how to discover organisms using AskNature, I am going to ask you to do it on your own because there is no better way to learn than practicing on your own. So, I will give you a 'biologize' question: how does nature protect from impact? Take up this

question, identify the biological strategies, identify the organisms that perform this function, identify the biological strategies that they use to perform this function.

For this, you can use AskNature, you do not have to use all the other ways in which to look for it like researching on your own, etc. You can just check to AskNature for this. Tabulate your findings systematically as explained here the name of the organism, what is the function and explain the biological strategy in your own words. Do not just copy-paste it from AskNature. Write it in your own words.

Draw a simple diagram if you like to explain that strategy in your own words. And do not stop with just one organism or one strategy. Explore several organisms and strategies. So, this is the exercise that you can use. Do not forget to record it in your diary because this will also help you see how you are progressing in your application of the biomimicry spiral.