



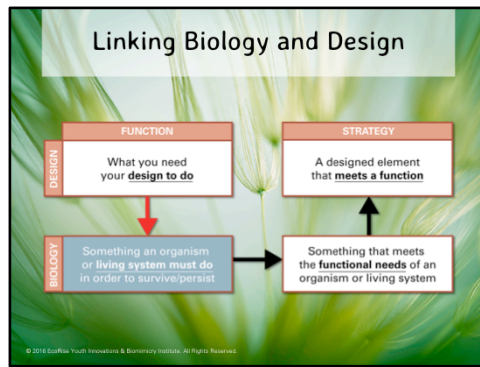
Biological strategies are inspiring on their own, but in order to apply them effectively and correctly to a design challenge it's helpful to evaluate and restate them in design terms. This presentation introduces the steps necessary to produce a design strategy from a biological strategy and walks students through the process with examples.

Presentation Objectives:

- Define “biological strategy” and “design strategy,” and provide examples of each.
- Translate biological strategies into actionable design insights.
- Analyze a biological strategy and isolate its key concepts.
- Translate biological strategy information into design terms.
- Compose a design strategy.

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Getty Images 83170683: sot: The hemisphere that trees come out



Objective:

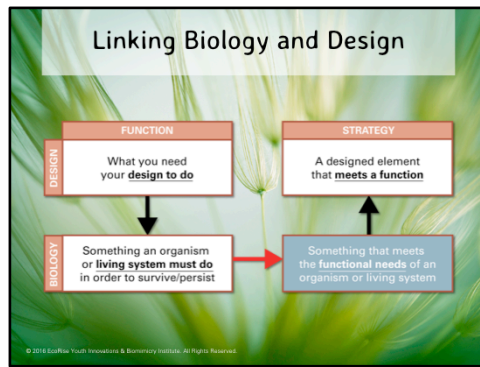
- Define “biological strategy” and “design strategy,” and provide examples of each.

Suggested Teaching Strategy:

Remind students that in the Explore step of the biomimicry process we biologized the design question, or re-stated design problems as biological functions. Then...
(Continued on next slide.)

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Getty Images 166044373: Jasmina: Wildflower abstract



Objective:

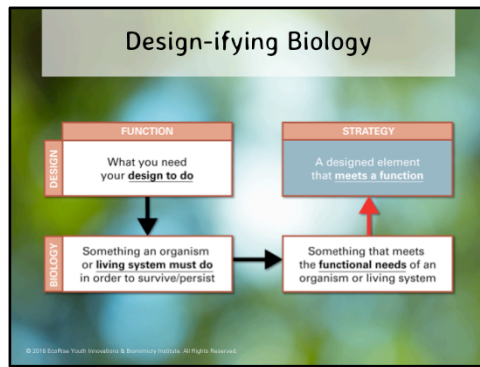
- Define “biological strategy” and “design strategy,” and provide examples of each.

Suggested Teaching Strategy:

(Continued from previous slide.) ...we used those biological functions to discover and learn about biological strategies that explain how nature meets those functions.

CREDIT:

Getty Images 166044373: Jasmina: Wildflower abstract



Objective:

- Define “biological strategy” and “design strategy,” and provide examples of each.

Suggested Teaching Strategy:

Tell students: In this next step we are taking the most promising biological strategies we’ve found and re-stating them in general (or design/engineering) terms, so they can be more easily and accurately applied. So, what we need to do is create a bio-inspired “design strategy” out of a “biological strategy.” Generally speaking, a design strategy is HOW a design meets it’s function. All designed objects have design strategies. BIOMIMETIC design strategies are strategies gleaned from and emulating biological strategies.

To create a biomimetic design strategy, we need to take the key relevant information from the biological strategy and describe it without using any biology-specific terms. It’s sort of the reverse of “biologizing” the design question. Instead, we are “design-ifying” the biological strategy. (Note: In biomimicry circles, this is sometimes called “abstracting” the design principles.)

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Getty Images 517861998: Panya_sealim: Vintage green blurred bokeh. Defocused background.

**Objective:**

- Define “biological strategy” and “design strategy,” and provide examples of each.

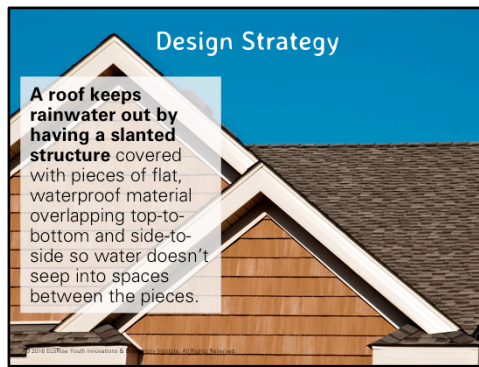
Suggested Teaching Strategy:

Tell students: To practice writing design strategies, let’s first try it with a human design that you are familiar with—the roof of a house.

Explain that one of the functions of a roof is to keep out rain. Ask: What is the design strategy behind HOW a roof keeps rainwater out? How would you describe this design strategy to someone who has never seen a roof? Write students’ answers on the board. Answers may vary based on the architecture in your area. Accept all plausible answers and discuss as needed. An example for a typical shingle roof is included on the next slide.

CREDIT:

Getty Images 157481582: Jennifer Byron: Gables and Roof



Objective:

- Define “biological strategy” and “design strategy,” and provide examples of each.

Suggested Teaching Strategy:

Tell students: Here’s one description of a roof’s design strategy. This description of the strategy has enough information that if someone wanted to keep rainwater out of a building, they could design a structure to do it.

CREDIT:

Getty Images 157481582: Jennifer Byron: Gables and Roof



Objectives:

- Define “biological strategy” and “design strategy,” and provide examples of each.
- Translate biological strategies into actionable design insights.

Suggested Teaching Strategy:

Tell students: Next, let’s look at how you could come up with a design strategy based on a **biological strategy**.

There are four important steps:

1. Summarize the biological strategy in a paragraph or two. In order to summarize a strategy, you have to really understand it, so be careful and make sure you get help if you need it. It can also be helpful to your understanding if you sketch or draw a diagram, even a simple one, that represents the biological strategy.
2. Next, identify the key words in the summary that are relevant to the strategy and how it meets the function. Pay attention to context and factors that are relevant to your challenge.
3. Translate those key words and concepts into general, non-biologic terms. How can you describe what is happening without referring to body parts or other biological structures or functions?
4. Last, use these concepts to help you write a design strategy statement that describes the strategy without using biology.

CREDIT:

Getty Images 105655598: GYRO PHOTOGRAPHY/amanaimagesRF: Sketch pad and color pencils



Objectives:

- Define “biological strategy” and “design strategy,” and provide examples of each.
- Translate biological strategies into actionable design insights.
- Analyze a biological strategy and isolate its key concepts.

Suggested Teaching Strategy:

Tell students: Let’s walk through this process together. Here is a biological strategy for temperature regulation in the jackrabbit. Ask for a volunteer to read the biological strategy shown here out loud.

Explain that this is a pretty good example of Step 1: Summarize the biological strategy. It includes context information that is helpful for making sure that when we create a design strategy we apply it correctly.

Next, we need to identify key words and concepts. Tell students to take a few minutes to read the strategy again and pick out the most important details relevant to regulating temperature and underline or highlight them in Question 4 of their Student Notes. After a few minutes, ask one or more volunteers to share their ideas. You may wish to write their responses on the board.

CREDITS:

Resource: Biomimicry Institute. (2016). Large ears used to cool off: Jackrabbit. Retrieved from <http://www.asknature.org/strategy/a250478ba7f69e68c71405d931c91d62>

Image: Getty Images sb10064500w-001: Bob Stefko: Jackrabbit (*Lepus californicus*) sitting in grass



Objective:

- Analyze a biological strategy and isolate its key concepts.

Suggested Teaching Strategy:

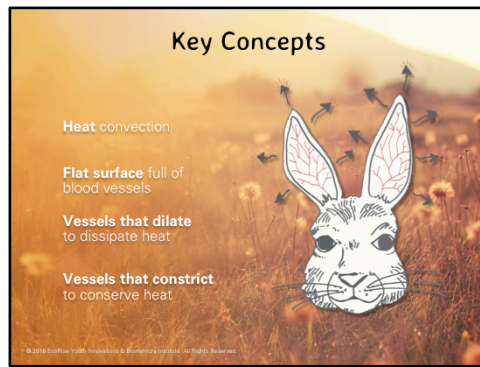
Tell students that the underlined words shown here are the primary key words. Note that there are references in these key words to context as well as function.

- Flat surface
- Heat convection
- Blood vessels dilate
- Dissipate heat
- Shed excess metabolic heat
- Cold
- Constrict blood flow

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Resource: Biomimicry Institute. (2016). Large ears used to cool off: Jackrabbit. Retrieved from <http://www.asknature.org/strategy/a250478ba7f69e68c71405d931c91d62>

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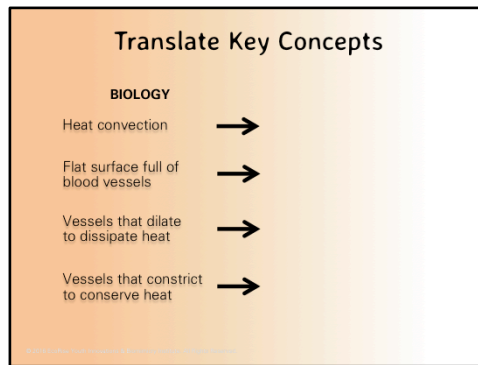
Suggested Teaching Strategy:

Tell students: Here are the key words again, isolated from the text and turned into phrases that describe what's happening. These are the key concepts of the biological strategy. It can also be very helpful at this stage to sketch or draw the strategy. This sketch shows the rabbit's ears radiating heat from the many blood vessels inside the ears.

CREDITS:

Drawing: Hannibal Xolani, K. EcoRise Youth Innovations. (2016). <http://ecorise.org>

Background: Getty Images 160474420: Andrej Godjevac: Autumn colored nature



Objectives:

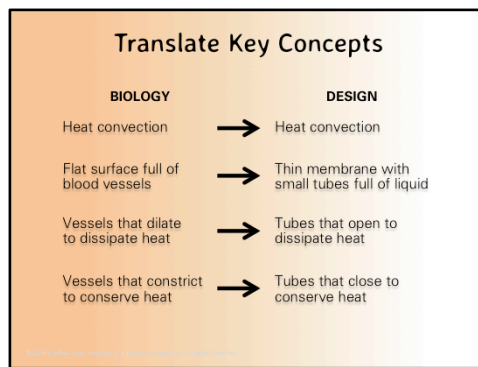
- Analyze a biological strategy and isolate its key concepts.
- Translate biological strategy information into design terms.

Suggested Teaching Strategy:

Tell students: Now that we have our key concepts, we need to make sure we can describe them without relying on biological terms. Ask: Do you see any biological terms in this list that need to be replaced? (*Sample answer: blood vessels*) How could you describe those terms in another way? Have students write their responses in Question 5 of their Student Notes. Discuss their suggestions.

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Getty Images 482140831: Dave and Les Jacobs: Close up of tall wheat stalks in field



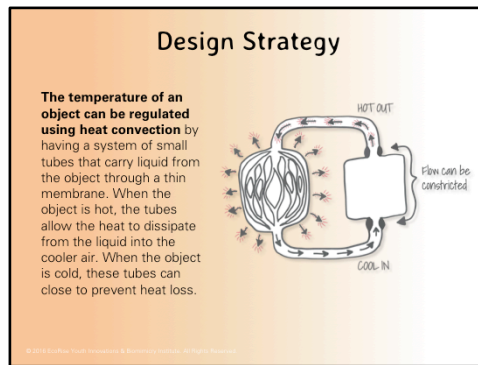
Objectives:

- Analyze a biological strategy and isolate its key concepts.
- Translate biological strategy information into design terms.
- Compose a design strategy.

Suggested Teaching Strategy:

Tell students: Here's one way to restate the key concepts in design terms—instead of “blood vessels,” we talk about “small tubes full of liquid” because we know that's what blood vessels are. Sometimes, you may have a biological strategy that uses biological terms you don't understand. In these cases, do further research or ask for help so that you understand and can translate the terms properly. (Note: “flat surface,” “dilate,” and “constrict” don't need to be changed, but the alternate terms are another way to describe what is going on based on what we know about the jackrabbit.)

Next, have students try using these concepts and phrases to develop a design strategy statement (Question 6 on their Student Notes). Ask for a volunteer to read his or her strategy aloud.



Objective:

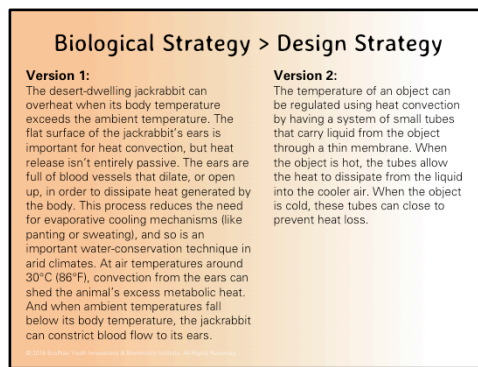
- Compose a design strategy.

Suggested Teaching Strategy:

Direct students' attention to this example of a summary statement that describes the biological strategy they've been analyzing without the biology. Point out that sketching is again helpful in this process. Encourage students to try drawing the strategy like an engineering diagram, without showing any biological parts (ears, body, etc.) Tell students to draw just the strategy—not how they think they will apply it to their design problem. That part comes later. Emphasize that what is important now is to make sure they have a clear description of how the strategy works.

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Suggested Teaching Strategy:

Tell students: Here are the two strategies side-by-side. Point out how the design strategy is simplified and no longer describes a biological system but, importantly, still includes the essential information about **how** the jackrabbit’s strategy works in its context. A well-written design strategy provides enough information that a designer or engineer can understand how to apply it, even without being familiar with its origin in biology.