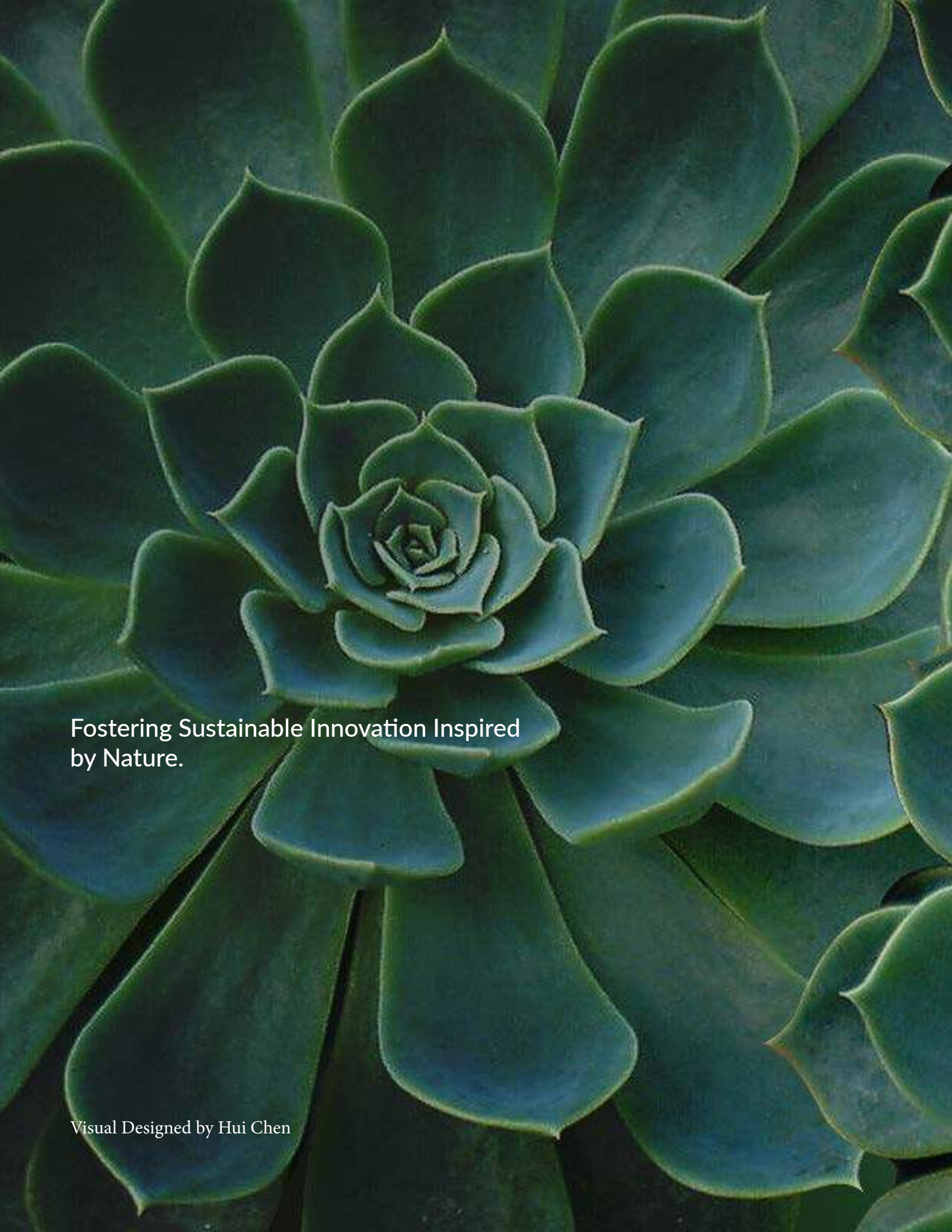
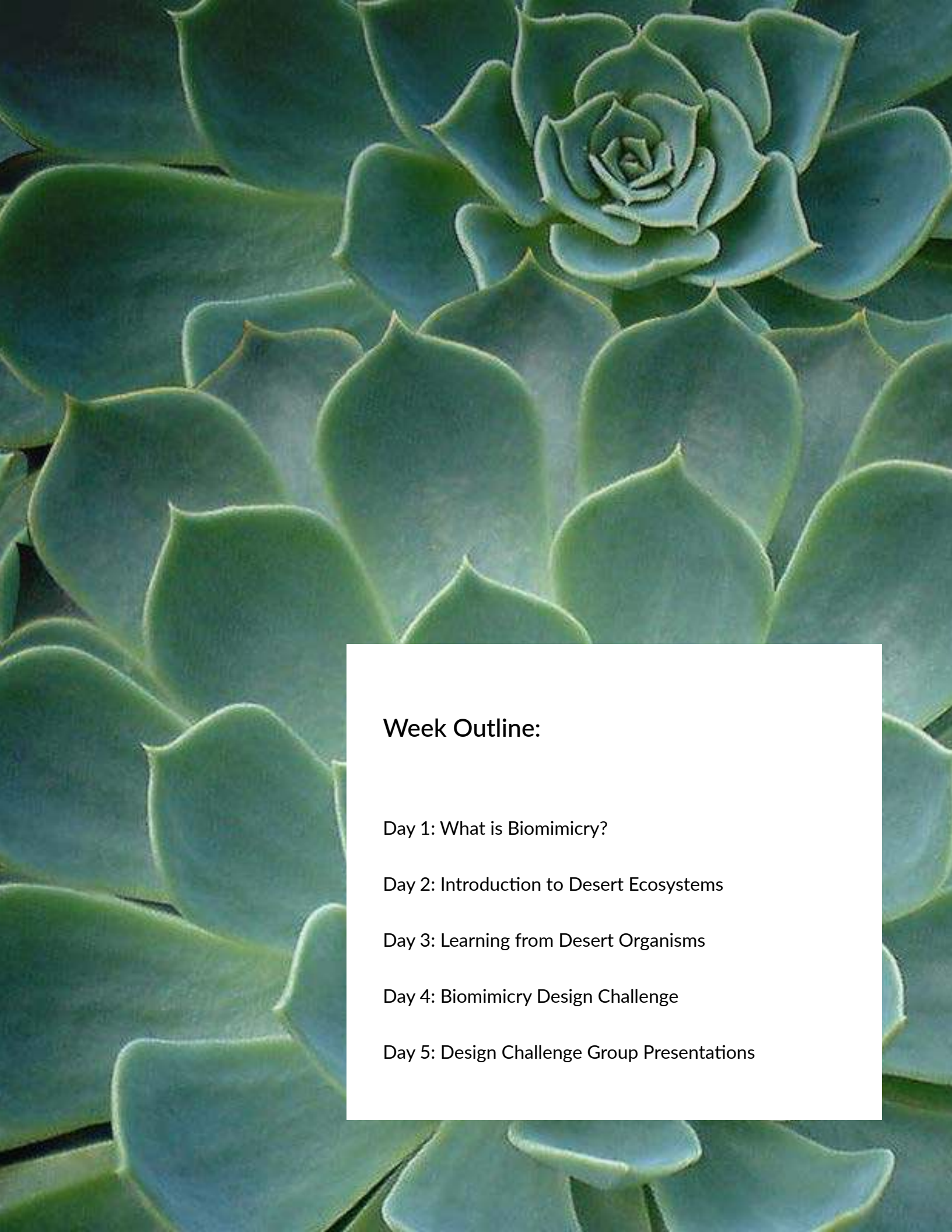
BIOCONNECT

Lesson Plans 6


Fostering Sustainable Innovation Inspired
by Nature.
Visual Designed by Hui Chen



Week Outline:

Day 1: What is Biomimicry?

Day 2: Introduction to Desert Ecosystems

Day 3: Learning from Desert Organisms

Day 4: Biomimicry Design Challenge

Day 5: Design Challenge Group Presentations

Overview: *(Vocabulary in bold)*

The natural world is an incredible place filled with millions of different organisms that have inhabited our planet for much longer than humans. Many indigenous communities survived off the land for thousands of years by learning from other organisms in their habitat. The practice of looking to nature to survive and create new designs is ancient. Only in the last twenty years have we named this approach "**biomimicry**" and integrated looking to nature into formal design and academic spaces (although many tribal communities and indigenous cultures have never forgotten how to learn from nature). Biomimicry offers a new way to apply lessons from nature to the **invention** of healthier, more life-friendly technologies for people. We will be exploring this topic this week, and you will even have a chance to create your own design based on something we learn about from nature!

Biomimicry can be confused with some other terms that are used to describe different design approaches- and each of these practices is along what we call the "**biomimicry continuum**" (none are inherently "bad", but can be misinterpreted or not ultimately very life-friendly). **Bio-morphic** refers to the practice of creating a design/structure that only looks like something in nature (i.e,. a leaf, a tree, etc.). **Biomimicry** is a deeper practice that requires that we learn about how natural organisms or systems function and translate these ideas into a final product-- but this approach does not take or use nature directly in the design. One of the tools that **biomimics** (people who practice biomimicry) use is the framework of **Life's Principles**: a set of 26 total principles that govern life on our planet (see Life's Principles page in kit). A group of scientists from around the world created this set of guiding principles that every living thing needs to do in order to survive. We can use these principles to guide our designs and evaluate how "life-friendly" they are. For example, does the design evolve to survive, adapt to changing conditions, or use low-energy processes?

AZ State Standards:

Science	*English Language Arts*
6.L2U3.11- Use evidence to construct an argument regarding the impact of human activities on the environment and how they positively and negatively affect the competition for energy and resources in ecosystems	**6.SL.1**- Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 6 topics, texts, and issues, building on others' ideas and expressing their own clearly. a. Come to discussions prepared having read or studied required material; explicitly draw on that preparation by referring to evidence on the topic, text, or issue to probe and reflect on ideas under discussion. b. Follow rules for collegial discussions, set specific goals and deadlines, and define individual roles as needed. c. Pose and respond to specific questions with elaboration and detail by making comments that contribute to the topic, text, or issue under discussion. d. Review the key ideas expressed, draw conclusions, and demonstrate understanding of multiple perspectives through reflection and paraphrasing.
6.L2U1.13 - Develop and use models to demonstrate the interdependence of organisms and their environment including biotic and abiotic factors	

Next Generation Science Standards:

Growth and Development of Organisms
Animals engage in characteristic behaviors that increase the odds of reproduction **(MS-LS1-4)**.
Adaptation
Adaptation by natural selection acting over generations is one important process by which species change over time in response to changes in environmental conditions. Traits that support successful survival and reproduction in the new environment become more common; those that do not become less common. Thus, the distribution of traits in a population changes. **(MS-LS4-6)**
Structure and Function
Complex and microscopic structures and systems can be visualized, modeled, and used to describe how their function depends on the relationships among its parts, therefore complex natural structures/systems can be analyzed to determine how they function **(MS-LS1-2)**

Objectives:

The students will be able to…

- Understand how the concept of biomimicry and biomorphic designs are different
- Explore the topic of learning from the natural world
- Understand how biomimicry can be used in human design
- Explore the topic of Life's Principles and how this tool is used in biomimicry

Materials:

- Biomorphic examples
- Biomimicry Case Studies: termite inspired building
- Biomimicry and biomorphic laminated pages/images
- Unlined paper (white and colored)
- Stapler
- Pens/Markers/stickers

Prior to Beginning Instruction:
Consider capturing student work and thoughts in their current science journals or prompt students to make a research journal. (15 min) Make Research Journal: have students create a booklet with 10 pieces of white unlined paper folded in half and stapled at the crease, with a color page folded for the cover/back. Students can write a title like "NAME's Nature Research Journal YEAR", and decorate with drawings/stickers/etc. This journal will be used for at-home thoughts and reflections throughout the week.

Procedure

1 (10 mins)

"What do you notice, what do you wonder?" Group Activity: Give the Life's Principles pdf to each student and ask them to spend 5 minutes observing the document and come up with one thing they notice and one thing they wonder. After giving students the student time to notice and wonder, have them each share one notice or one wonder as time permits. Post the wonder on one side of a T chart and the notice on the other side.

- Sentence Stem: "I notice..." and "I wonder...?"

2 (20 mins)

Biomimicry Intro: (bio-morphic vs biomimicry) Discuss idea of biomimicry continuum, other fields that sound similar: biomorphism. Mention that biomimicry is an ancient practice and new practice (as we encounter more problems and more sustainable solutions). Show images of a few examples for both biomorphic and biomimicry (hiding the title) and have students guess which it is- informal discussion.

3 (15 mins)

Introduce Case Studies: termite-inspired construction

- Present students with biomimetic designer observations. What do you notice? What questions does it inspire?
- Explain what a biomimetic designer observed. What do you think they did with this information?
- Explain what a biomimetic designer created. Do you think this design was effective or not?

Discuss pros and cons of the current design and any plans to change it.

Resources:

Termite inspired Eastgate building:
https://asknature.org/innovation/passively-cooled-building-inspired-by-termite-mounds/

Biomimicry Institute:
Sharing Biomimicry with Young People - This document provides an orientation to biomimicry for K-12 educators, describing the what and why of biomimicry with teaching suggestions for several core concepts. It is available to download from

AskNature.
AskNature: Resources - A diverse library of resources for teaching and learning about biomimicry. The collection can be filtered by resource type and audience.

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Overview:

The desert is a harsh environment. **Deserts** are classified by scientists as extremely dry areas that receive very little rain. **Humidity**—water vapor in the air—is near zero in most deserts. Light rains often **evaporate** (turn from liquid to a gas/air) in the dry air, never reaching the ground. Rainstorms sometimes come as violent cloudbursts. A cloudburst may bring as much as 10 inches of rain in a single hour—the only rain the desert gets all year. The Sonoran Desert -- which covers a lot of the lower part of our state -- is a unique desert in that it receives both a winter rainy season and a summer rainy season, known as the **monsoon**. This bi-seasonal rainfall pattern has allowed the Sonoran Desert to be home to a huge variety of plant and animal species. We will learn about a few "**champion organisms**" today -- animals that have adapted and lived in this harsh climate for many years.

Deserts are found on every continent and cover about one-fifth of Earth's land area. They are home to around 1 billion people—one-sixth of the Earth's population (Source: National Geographic). People have adapted to life in the desert for thousands of years. In Arizona, our largest city is located in the desert. Phoenix is also known to have a really high **ozone** level- a gas that is caused by human activity like driving and industry pollution. This ozone layer can be seen sometimes when gasses and dust collect in the atmosphere around Phoenix, and looks like haze or smog covering over the city. Because we live in a place where resources like water are **scarce (very limited)**, we need to be more aware of our own **impact** in this ecosystem. Our impact on the desert includes everything from how much waste ends up in our landfill, how much water we use, and how much our housing developments encroach on wildlife habitat.

AZ State Standards:

Science	*English Language Arts*
6.L2U3.11- Use evidence to construct an argument regarding the impact of human activities on the environment and how they positively and negatively affect the competition for energy and resources in ecosystems	**6.W.3 -** Write narratives to develop real or imagined experiences or events using effective technique, relevant descriptive details, and well-structured event sequences.
6.L2U1.13 - Develop and use models to demonstrate the interdependence of organisms and their environment including biotic and abiotic factors	**6.W.10 -** Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.

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NGSS HUMAN IMPACT ESS

Objectives:

The students will be able to…

- Define deserts, and understand what makes the Sonoran Desert unique
- Identify the challenges of living in a desert environment
- Explain some of the impacts humans have on the desert environment

Materials:

- Elephant Zoo video
- Fennec fox Zoo video
- "What is a desert?" slides
- Student nature research journal
- Large piece of poster board or butcher paper for each group

Procedure

1 (15 mins)

PowerPoint Activity - Start by showing the first 4 slides of the PowerPoint (photos of the desert). Ask students to vote whether this photo is a desert or not.

- Explain that all of the photos are a desert!
- Ask students: What do they all have in common?
  - Show Slide 5: They all have a limited amount of precipitation.

- Have students brainstorm what challenges animals and people face when living in a desert.
  Emphasize:
  - Limited water
  - Extreme temperatures, especially heat during the summer
  - Limited shade from plants
  - Human development and population growth causes temperatures to rise and less resources to be available
- Show Slide 6 and discuss what they see in the photo(s) of the Sonoran Desert.
  - Discussion questions:
    - What is unique about the Sonoran Desert compared to other types of deserts?
    - What biotic factors do you see pictured?
    - What abiotic factors are pictured?
    - How do you adapt (or behave differently) when it's really hot outside during the summer?

2 (20 mins)

Human Impact Experiment- Go outside and set up a heat lamp (or in a sunny area, if available) over an area with grass, an area with concrete, and sand. Place a thermometer on the ground underneath the heat lamp. (Optional: Do this experiment again, but with heat lamps over painted concrete, dirt, asphalt, or other student suggestions. Compare results).

- Discussion questions: Which has the highest temperature? What does that tell you about humans' impact on the desert?Ask students: What do they all have in common?
- What are some negative AND positive effects humans have on the desert environment? Record thoughts in Research Journal

3 (10 mins)

Show Phoenix Zoo fennec fox and elephant video

- How do these animals survive in the desert? Think about the question for tomorrow.

Assessment:

Can use as an exit ticket for in-person or virtual poll.

- What is the definition of a desert?
- What are 3 factors that make living in a desert environment so difficult for animals?
- Imagine you are a fennec fox or an elephant. Write a short story describing how you would survive a hot summer's day. Hint: make sure to describe both day and night!

At-Home Activity (Extension Opportunity):

- Explain that the at-home activities are meant to begin the process of learning to observe the natural world.
- Have students sit quietly outside near their house and observe for 10-15 minutes.
- They should write down what they see, smell, and feel: What is the weather like? What plants or animals do they see? What is the ecosystem like? Do they notice anything weird or cool? Option to include a drawing as well.

Resources:

Effect of Urbanization on Sonoran Desert:
https://www.ag.arizona.edu/OALS/urbanization/evaluating.html

Overview of Ozone:
https://www.epa.gov/ground-level-ozone-pollution/ground-level-ozone-basics

Overview: *(Vocabulary in bold)*

A crucial component to surviving in the desert is the ability to cool down quickly or heat up quickly. In the Sonoran desert, during the middle of the day temperatures can rise above 110 degrees fahrenheit; but these temperatures can then drop to near freezing at night. There are many skilled animals and plants in the Sonoran that can maintain **homeostasis**, or manage their temperature efficiently, after millions of years of practice. **Biotic** and **abiotic factors** can affect an organism's ability to survive. Abiotic factors refer to the nonliving factors in an environment, such as temperature or rainfall. Biotic factors include the living components in an environment, like predators.

Today we will be exploring a few different examples of how animals in the desert manage heat (**thermoregulation**), and maintain their internal body temperature (**homeostasis**). Many mammals use **evaporative cooling**. This mechanism occurs when water **evaporates** (changes from liquid state to a gas: like water to air) from the surface of their skin, either through sweat, saliva, or an external source like water splashed from a stream. When in a shaded area, blood vessels near the surface of their skin **dilate** -- or are made wider - and cools blood down, which then cools the body down when the blood is then circulated. Likewise, when the animal is in the direct sun, they **constrict** the blood vessels to limit the amount of heat that can enter their body through blood circulation. When a coyote (or your dog) pants -- heavy breathing with tongue out -- in the heat, they are using evaporative cooling near their mouth to lower the temperature of their body. This is the same mechanism that the Mexican Gray Wolf uses when it sweats: even under that full **insulating** fur coat, this water evaporates on their skin and cools the blood near the surface which then circulates throughout their body. Today we will be learning more about what these organisms are doing (**strategy**) and how they are accomplishing these strategies (**mechanism**).

AZ State Standards:

Science	*English Language Arts*
6.L2U3.11- Use evidence to construct an argument regarding the impact of human activities on the environment and how they positively and negatively affect the competition for energy and resources in ecosystems	**6.RI.7 -** Integrate information presented in different media or formats (e.g., visually, quantitatively) as well as in words to develop a coherent understanding of a topic or issue.
6.L2U1.13 - Develop and use models to demonstrate the interdependence of organisms and their environment including biotic and abiotic factors	

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Structure and Function
Complex and microscopic structures and systems can be visualized, modeled, and used to describe how their function depends on the relationships among its parts, therefore complex natural structures/systems can be analyzed to determine how they function **(MS-LS1-2)**

Objectives:

The students will be able to…

- Explain common adaptations of desert animals
- Investigate biotic and abiotic factors that contribute to heat management
- Understand biology mechanism and strategy
- Compare and contrast their findings for desert organisms mechanism and strategy with other group's results

Materials:

- Inquiry cards for rabbit ears, and coyote fur
- Natural artifact: Coyote fur in wooden box
- BioConnect 3D model: Jackrabbit Ears
- 2 heat lamps
- 2 thermometers
- Student nature research journal

Procedure

1 (30 mins)

(10 minutes per station)

Biomimicry kit stations-- Have students break into two groups and rotate through the biomimicry kit stations. During their time at a station, the group should explore the model and discuss: ***How does it work? What is the organism doing to manage heat?***

- Coyote fur artifact: Place coyote fur box under heat lamp. After 5 minutes, with your hand and the thermometer, test to see how hot it has become (it's a little different than when in nature, as the animal would be sweating). Explore the fur with the jeweler's loupe to see how dense the fur is. Would you think that this fur helps the organism keep cool? Why or why not?
  - Once students have explored the artifact, read the Inquiry Card together to understand more about how their fur helps to regulate the temperature of the organism.
  - Discussion questions: Can you name other desert animals that have this fur color? Do you think dark color fur or light color fur would be better in the desert? What might this coat color or density tell us about abiotic or biotic factors the coyote deals with in the desert?
- Camel fur 3D model: Place camel model with cover under heat lamp. After 1 minute, observe how the inside has changed color, and record the temperature. Then, take off the cover and place it back under the heat lamp. Record the temperature at 30 seconds and 1 minute, and observe how the inside changes color quicker.
  - Discussion questions: Which version became hotter quicker? Does the fur (cover) help to manage the temperature? Why do you think that a thick layer of fur would be useful in the desert? What might this fur density tell us about abiotic or biotic factors the camel deals with in the desert?
- Rabbit ears 3D model: Place model under heat lamp and observe how the ears change color (they have a temperature changing paint on them). When the ears are not under the heat, what color are they? When you place them under the lamp, what color do they change to? Record how long it takes the ears to change colors.
  - Once students have explored the artifact, read the Inquiry Card together to understand more about how their fur helps to regulate the temperature of the organism.
  - Discussion questions: Why is this adaptation so important for desert animals? What might the rabbit ear adaptation tell us about the abiotic or biotic factors they deal with in the desert?

2 (20 mins)

Organism Poster (Group Activity)

- Review the vocabulary terms: strategy and mechanism. Emphasize that strategy focuses on WHAT and mechanism focuses on HOW.
  - *Strategy= WHAT the organism does (ex: keeps cool, maintains homeostasis, etc)*
  - *Mechanism= HOW the organism accomplishes strategy (ex: network of blood vessels near surface use evaporative cooling, dense fur insulates and prevents moisture loss, etc).*
- Break students into small groups (no more than 4 students) and have them choose a champion organism from the ones we have just explored (fennec fox, elephant, jackrabbit, coyote).
- Give students a large piece of poster board or butcher paper. Have them divide the poster into 4 equal sections, with a circle in the middle (connecting to all sections) for general biology/drawing. Explain that they will be adding to this poster each day of the project. Today, they will be filling in the middle and first two boxes.
- Middle section-- Student teams should add the organism name, their own drawing, and summarized biology (sentence or two) to the middle section of their poster.
- For the first box, have students write out the **Strategy**: WHAT the organism is doing.
  - *Use this sentence frame: "The ____ (Organism) _____ (Strategy - ex: stays cool, manages heat)"*
  - TIP- The strategy should be a few words (i.e. cools or decreases its body temperature)
- For the second box, have students write out the **Mechanism**: HOW does the organism accomplish the strategy (with specific body part).
  - *Use this sentence frame: "The ___'s (**Organism**; ex- fennec fox) ___ (**Body part**; ex- large ears) ____ (**function**; ex-disperse heat) ___ because of/and or through (**structure of body part**; ex-have large surface area with thin skin that exposes blood vessels) ______ (add **any other details**).*
  - Add a sketch to this box too- can be a quick and simple drawing or diagram. Drawing at the same time you write a biological strategy will help you visualize and then verbalize the strategy.
  - TIP- Mechanism should be a sentence or two, explaining in detail how the strategy works.

Assessment:

Review the strategy and mechanism written on the students' posters. They will need to have a clear understanding of those concepts for their champion organism before moving on to complete their project.

At-Home Activity (Extension Opportunity):

- Students will find another spot to journal for 10-15 minutes. It can be the same spot as yesterday.
- They should spend some time observing, then write down one animal that they see (can be a bird, insect, etc). What is the organism doing (strategy)? How do you think it is doing that (mechanism)?

Resources:

Evaporative cooling in desert organisms:
https://www.desertmuseum.org/books/nhsd_adaptations_birds.php#:~:text=The%20primary%20method%20for%20cooling,and%20these%20surfaces%20are%20cooled.

https://www.scientificamerican.com/article/chilling-science-evaporative-cooling-with-liquids/#:~:text=The%20necessary%20heat%20of%20evaporation,when%20it%20gets%20too%20hot.

Overview: *(Vocabulary in bold)*

Biomimetic designers ("**biomimics**") focus on understanding, learning from, and **emulating** (mimicking) the strategies used by living things, with the intention of creating designs and technologies that are life-friendly. The products of **design** are all around us. Every human-made thing you use and service or system you interact with was designed by someone (Source: Biomimicry Toolbox).

Today we will all be "biomimics" and "designers", and will work in teams to create something inspired by one of our **champion organisms** that students have explored the past few days. In each group, we will walk through the biomimicry design process: starting with a challenge, finding inspiration for solutions in nature, and creating our own invention that addresses the challenge. One of the key parts of translating biological information to a design idea is a term called the **"Abstracted Design Principle" (ADP)**. For this, we will go through a process together to re-write the biological mechanism and strategy into a new statement that does not include biology and can be used in a variety of spaces (engineering, architecture, design, medical, etc.). This ADP is a crucial component to practicing biomimicry: it is the bridge between biology and design. As biomimics, we must understand the biology well enough to create an accurate statement that can be applied to a more general audience. It can be really tricky getting this part right, which is why we will practice today step-by-step together. The more practice you have creating ADP's the better biomimic you will be!

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Structure and Function
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Objectives:

The students will…

- Explore what it means to be a designer and biomimic
- Learn how to craft an abstracted design principle
- Practice brainstorming and group decision-making
- Begin to develop their own design based on a desert organisms strategy and mechanism

Materials:

- Paper
- Pens
- Poster board (1 for each group)- from yesterday's activity
- Biomimicry Taxonomy
- Abstracted Design Principle Cheat Sheet (for instructor)

Procedure

1 (5 mins)

Present the Biomimicry Challenge and process for group work. Break students into the same groups as yesterday.

- Challenge: *Create a new invention for people to stay cool in extreme environments based on what you learned about your champion organism.*
- Optional: students can choose a "job" or "role" - engineer, architect, designer, builder, etc.

2 (30 mins)

Create "Abstracted Design Principle": *Give only the instructions for one section one bullet at a time, then wait for students to complete that task before giving the next instruction (not all at once). Review strategy and mechanism with groups as needed based on their posters.*

- Give example of well-written ADP (included in ADP Cheat Sheet)
- STEP 1- Once strategy and mechanism is written students should go through and underline each word that is related to biology (i.e. "water", "cell", "leaf").
- STEP 2- Replace all the biology words from the above step with words that are similar, yet do not include biological context. Students can use a thesaurus to find alternative words (i.e. water= fluid, hair=small tubes, etc).
- STEP 3- Finalize by re-writing strategy and mechanism, but without any biology words (using replaced words from above step). Write this in Box 3 of their poster. This is your "Abstracted Design Principle".

3 (15 mins)

Brainstorm: Groups should brainstorm about 5-10 ideas for what they could design based on their written Abstracted Design Principle.

- Explain Brainstorming Framework: Don't worry about feasibility right now - anything is possible and think outside the box. Do not put down another's ideas. Have fun!
- Students should make a list of about 5-10 potential ideas/ innovations of where this design principle could be used in our built environment (agriculture, building, transportation, textiles, etc.)
- Assess the ideas you brainstormed by discussing them openly and ranking them as a group (or voting for favorites). Explain that just because the group doesn't pick the one you came up with doesn't mean your idea is "bad". Be open to others' ideas/feedback and what will be best for the group during this project.
  - Discuss: *Which one is most feasible/practical for your group? Which one is most effective for helping people stay cool in extreme environments? Which one are you most interested in creating?*
  - If your group hasn't picked one based on discussion, have each person choose their top 3 ideas for this project and put a star next to those 3 ideas. This can be done anonymously if needed. The idea with the most stars wins.

Assessment:

Check for understanding for ADP on Poster: Does it correctly translate the biology to a design concept? Are there components missing or mis-interpreted?

At-Home Activity (Extension Opportunity):

- Students will find another spot to journal for 10-15 minutes. It can be the same throughout the week.
- They should spend some time observing, then write down one organism that they see (can be a bird, insect, plant etc). What is the organism doing (strategy)? How do you think it is doing that (mechanism)? Change the strategy and mechanism you just identified to an ADP by replacing the biotic words with abiotic ones.

Resources:

1. Tips for writing an ADP: https://toolbox.biomimicry.org/methods/abstract/
2. https://toolbox.biomimicry.org/

Overview:*(Vocabulary in bold)*

Today, students will finalize their projects and present to each other. This will be the culminating day for the past week, and an opportunity for students to showcase their learnings with each other. An important component of biomimicry is the ability to **translate** and communicate biology information and design ideas. For their final day, each student team will finish creating their idea, illustrate and describe the **invention**, and present a poster with all relevant information. They will then do a "gallery" walk, and view other's posters, provide feedback, and reflect on their experiences.

Students will be asked to reflect on other project's use of **Life's Principles (LP's)**. If there was a design that addressed a LP really well, or if a LP could have been addressed more. This offers some connection to our first day exploring the LP's and their connection to every biomimicry design. Now we get to see it in action! How many LP's are addressed in each design? Or how could designs work to include more LPs?

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Adaptation by natural selection acting over generations is one important process by which species change over time in response to changes in environmental conditions. Traits that support successful survival and reproduction in the new environment become more common; those that do not become less common. Thus, the distribution of traits in a population changes. **(MS-LS4-6)**
Structure and Function
Complex and microscopic structures and systems can be visualized, modeled, and used to describe how their function depends on the relationships among its parts, therefore complex natural structures/systems can be analyzed to determine how they function **(MS-LS1-2)**

Objectives:

The students will be able to…

- Synthesize learnings from entire week in poster
- Create poster about these learnings with invention idea for gallery walk
- Be able to explain the biology, strategy, and mechanism of their chosen champion organism
- Discuss their unique design idea
- Provide feedback for classmates given their understanding of biomimicry and Life's Principles

Materials:

- Poster (from previous two days)
- Markers/pens/pencils
- Nature Research Journal (to turn in)

Procedure

1 (15 mins)

Finalize Group Work: Each group will finish up their design idea and draw it out in the last box of the poster board. Teams should give their design a name, short description, label sketch, and decide where it would be best used.

- *Poster now includes: strategy, mechanism, ADP, ADP Drawing, and new invention idea with drawing/diagram*

2 (20 mins)

Gallery walk for all inventions
Set up a "Gallery Walk" where students silently move around the room, reviewing each group's poster with emphasis on assessing each new invention.
Students should provide written feedback to at least one other group. Provide each student with post-it notes where they can write their reflections and post near each poster. Provide feedback sentence stems for students such as:

- One question I have about your project is...
- One suggestion I have for your project is...
- One thing I like about your project is...

3 (15 mins)

Reflections and comments: Groups should provide verbal feedback to one another and record thoughts on paper for the following questions-

- What is the most exciting thing you learned from this project?
- What was your favorite part of this project?
- What Life's Principles does this project or design address clearly?
- What Life's Principles could this project or design include?

Assessment:

Rubric for Poster
Reflections activity questions
Nature Research Journals from the week

The lessons in BioConnect will support your students in the Biomimicry Youth Design Challenge (YDC). The YDC introduces middle and high school students to the rapidly growing field of bioinspired design while acting as a bridge from core concepts to advanced project-focused STEM. YDC empowers students to access the teachings of nature while learning 21st century skills.

Sign up to access the YDC curriculum at https://youthchallenge.biomimicry.org.

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View and download digital files
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