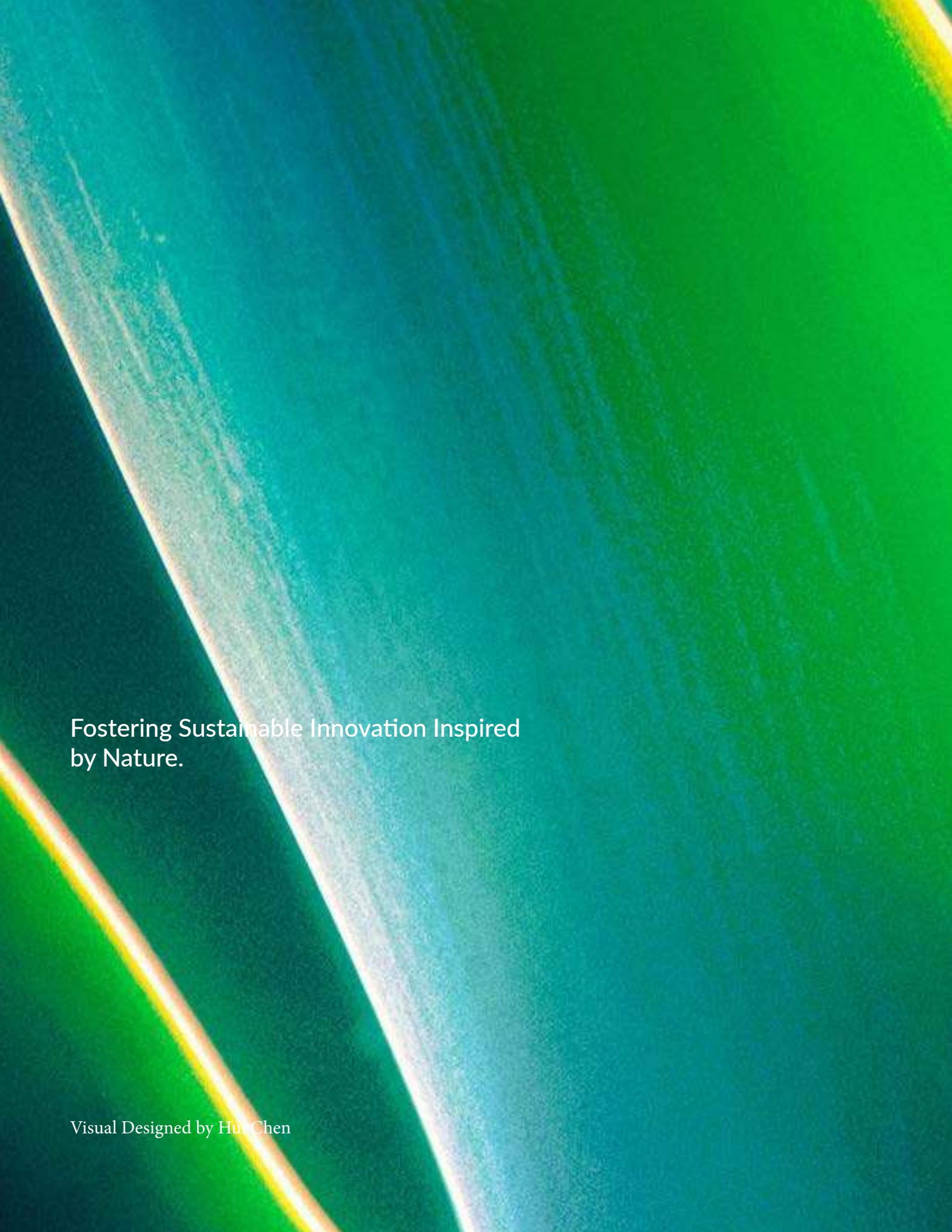
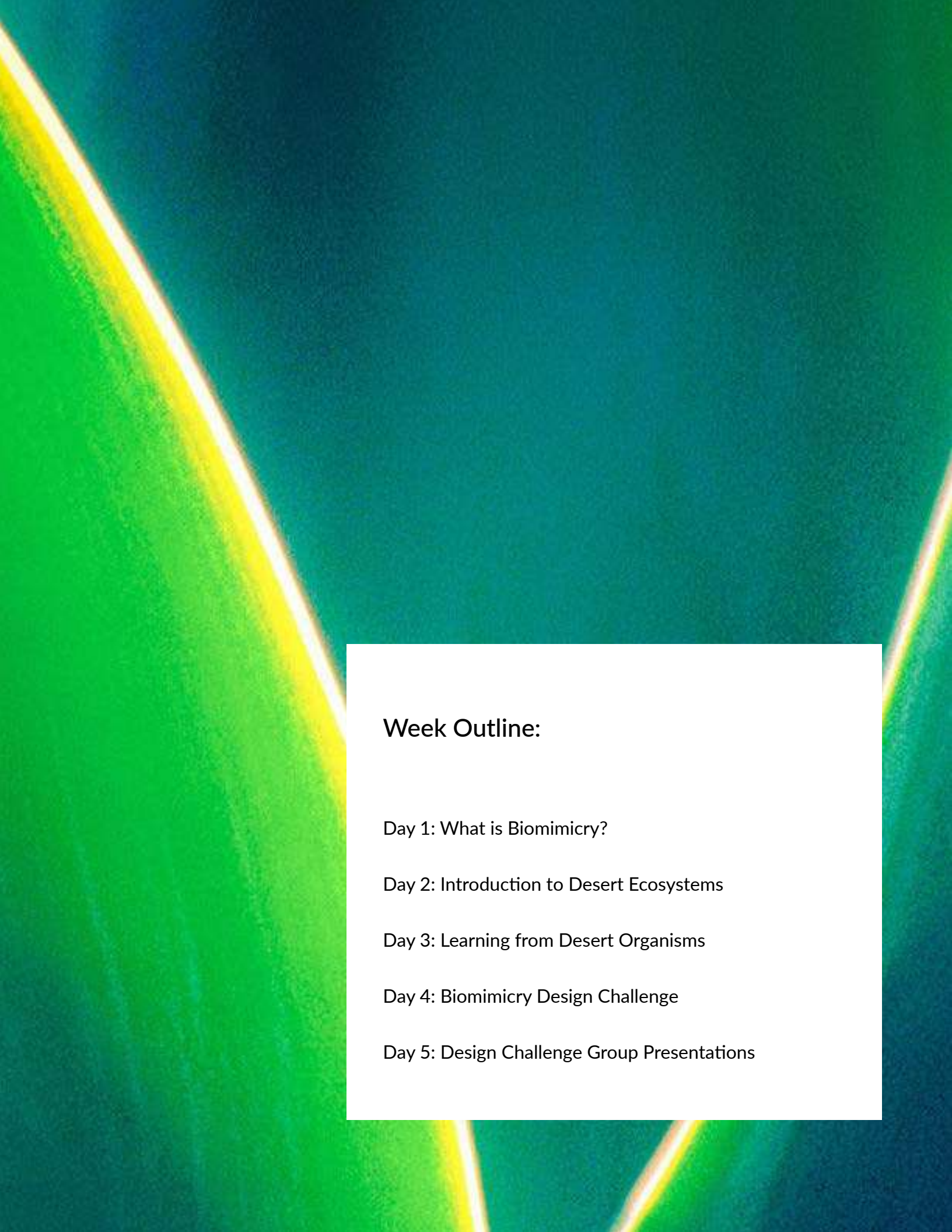
BIOCONNECT

Lesson Plans


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 sometimes 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 actually 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.). **Bio-utilization** involves directly taking a natural or biological organism and using it in a design (i.e., bacteria, fungus, etc.). **Bio-assisted** means that a design did have the help of a biological organism, but it doesn't make up the entire design (i.e., water filtration using wetland plants/soil). **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*
7.L1U1.11- Construct an explanation for how organisms maintain internal stability and evaluate the effect of the external factors on organisms' internal stability.	**7.W.2**- Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. a. Introduce a topic clearly, previewing what is to follow; organize ideas, concepts, and information, using strategies such as definition, classification, comparison/contrast, and cause/effect; include formatting (e.g., headings), graphics (e.g., charts, tables), and multimedia when useful to aiding comprehension.

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, biomorphic, bio-assisted, and bio-utilized 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:

- Biomimicry, biomorphic, bio-assisted, bio-utilized examples print out
- Biomimicry Case Studies: namib beetle
- 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 (15 mins)

Biomimicry Intro: using the continuum (bio-morphic → bio-utilized → Bio-assisted → biomimicry). Discuss idea of biomimicry continuum, other fields that sound similar: biomorphism, etc. Mention that biomimicry is an ancient practice and new practice (as we encounter more problems and more life-friendly solutions).

- Use print-outs of picture examples for each term, have students guess which "bio" it is.

3 (15 mins)

Introduce Biomimicry Case Study- Namib Beetle

- Read out loud to class. Discuss after: was this biomimicry? If so, what organism inspired the design? What were the designers trying to "mimic"?

4 (5 mins)

Optional Overview design discussion- Ask students if they can name a few designs that they use in their everyday lives. Is there a design that you think works really well, and one that perhaps is not as useful or well-designed? What makes a good design? (no right or wrong answer here)

- Talk through what we will be looking for in the end project for this week.

Resources:

AskNature Namib Beetle Case Study:
https://asknature.org/innovation/lightweight-water-collection-system-inspired-by-darkling-beetles/

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.

Overview: *(Vocabulary in bold)*

The desert is a harsh environment. Deserts are classified by scientists as extremely dry areas that receive very little rain (**arid**). **Humidity**—water vapor in the air—is near zero in most deserts. Light rains often **evaporate** (transition from liquid state to vapor/gas state) in the dry air, never reaching the ground. Rainstorms sometimes come as violent cloudbursts. A cloudburst may bring as much as 25 centimeters (10 inches) of rain in a single hour—the only rain the desert gets all year (Source: National Geographic). 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. In this lesson, we will explore a few animals that have learned to live in the desert and have really efficient **strategies** for dealing with the scarce water availability.

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. One main factor in the desert that affects what organisms (plants and animals) can survive there is the soil. Plants rely on soil for water absorption and nutrients, and animals rely on these plants. Soil is composed of **inorganic materials** (rock and minerals) and **organic materials**, which is partially decayed plant and animal matter (aka humus). The other main component of soil is space, which can be filled with air or water. **Percolation** is the ability of water to drip or go into soil. Many factors affect the space in soils. The size of the particles in the soil, the amount of compaction of the soil, and the proportion of organic to inorganic material can all affect how much water soil can hold. We will learn about a few "**champion organisms**" today -- animals that have adapted and lived in this harsh climate for many years.

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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…

- Understand and explain the environmental factors that make the desert unique
- Gain an understanding of the challenges of living in the desert
- Explore organisms that have survived in the desert, and learn what strategies make their survival possible

Materials:

- BioConnect videos from the Phoenix Zoo of the following organisms: desert tortoise, camel
- Paper
- Pencils
- 4 metal cylinders (cookie cutters) for group activity
- Nature Research Journal

Procedure

1 (30 mins)

Outside Activity: Defining a Desert and connection to water absorption in soil. This activity develops students' abilities to compare, contrast, collect, record and interpret data.
Background - Soil is composed of inorganic materials (rock and minerals) and or organic materials (humus), which is partially decayed plant and animal matter. The other main component of soil is space, which can be filled with air or water. Percolation is the ability of water to drip or go into soil.

- This is an activity about soil- create a few different "sites" where the metal cylinder (cookie cutter) is placed on the ground, in sandy soil, dirt/mulch, and grass - pushed in so that it will be stable when water is poured in the center. Record how long it takes for ½ cup to 1 cup of water to be absorbed at each location. Make sure each group uses the same amount of water. In small groups, have students use calculators to convert the time in seconds to decimal equivalents (30 sec = .5 min; 15 sec = .25 min), rounding to the nearest quarter of a minute.
- Have students collect a tablespoon of desert soil/sand. Use the magnifying lens (jeweler's loupe) to look at the sample of soil, combined with water.
- Discuss why soils might absorb water at different rates. How would this impact the living organisms that survive in this ecosystem?
- Explain some common features of a desert, focusing on rainfall and lack of water. Ask students if they know how any of their favorite desert animals get their water. How might different kinds of soil affect what organisms can live there?

2 (10 mins)

Return to the classroom and show Zoo videos about champion organisms: tortoise and camel.

- *Do these organisms drink water from the ground, eat it in their food, or can they absorb it into their body?* Think about this question for tomorrow.

Assessment:

Can use as an exit ticket for in-person or virtual poll (insert virtual tool here).

1. What is the definition of a desert? What environmental factors does the Sonoran Desert have?
2. What are 3 factors that make living in a desert environment so difficult for animals?
3. Imagine you are a camel, lizard, or tortoise. Write a short story describing how you would survive a hot summer in the desert. Hint: make sure to describe both day and night!

At-Home Activity (Extension Activity):

- 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. This activity is just to begin the process of learning to observe the natural world.

Links/Resources:

https://www.nationalgeographic.org/encyclopedia/desert/

https://www.desertmuseum.org/desert/sonora.php

https://www.desertmuseum.org/center/edu/docs/k-2_TIP_adaptation.pdf

PROJECT 2061 (Soil Activity):
http://www.project2061.org/research/goals.htm

Overview: *(Vocabulary in bold)*

A crucial component to surviving in the desert is the ability to get and store water (as well as survive with little water). There are many skilled animals and plants in the Sonoran that do this efficiently, after millions of years of practice. Because there is very little available standing water (like lakes and rivers), organisms in the desert have **evolved** many different ways in which to gather and store water from every source including rain, fog, or **condensation** (the process of water vapor/air becoming liquid).

Today we will be exploring a few **champion organisms** that have efficient water collection and storage mechanisms. The Saguaro cactus is able to rapidly **absorb** rainwater in a monsoon storm, and it's ridges expand to store that water in tissue inside the plant. The Namib (Darkling) beetle can drink fog in the desert of Namibia by **condensing** water droplets on it's back. Rattlesnakes in the Sonoran Desert have recently been observed catching and drinking rainwater on their backs during a storm. All of these organisms can survive in the extreme environment of the desert because of their unique ability to gather the limited water available to them. Let's take a deeper dive into these mechanisms and explore more about how they work.

AZ State Standards:

Science	*English Language Arts*
7.L1U1.11- Construct an explanation for how organisms maintain internal stability and evaluate the effect of the external factors on organisms' internal stability.	**7.SI.1**- Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 7 topics, texts, and issues, building on others' ideas and expressing their own clearly. a. Come to discussions prepared having read or researched material under study; 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, track progress toward specific goals and deadlines, and define individual roles as needed. c. Pose questions that elicit elaboration and respond to others' questions and comments with relevant observations and ideas that bring the discussion back on topic as needed. d. Acknowledge new information expressed by others and, when warranted, modify their own views
Supports Math Standard	

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…

- Learn about how specific desert animals and plants manage with such limited water
- Describe the strategy and mechanisms used by plants and animals to tolerate temporary drought and flooding
- Explain the difference between a positive and negative feedback loop

Materials:

- Inquiry Cards: saguaro, nami beetle, rattlesnake
- BioConnect 3D models: saguaro and namib beetle
- Natural artifacts: Rattlesnake skin
- Case study printouts: Namib beetle, Rattlesnake research
- Spray bottle
- Poster paper
- Pens/markers

Procedure

1 (30 mins)

A Preoccupation with Precipitation": Activity- biomimicry kit stations. Have students break into three groups and rotate through the biomimicry kit stations (10 minutes per station). During their time at a station, the group should explore the model- *how does it work? What is the organism strategy and mechanism for capturing or storing water?*

- **Saguaro Plant:** This 3D model shows a before and after cross-section of a saguaro plant when it receives water. The ridges expand and definition decreases when it receives rain. Pull out the middle component and observe how the ridges between each section are different (one shows before a rainstorm, and the other shows after a rainstorm). Read the Inquiry Card as a group.
  Math Connection- One mature saguaro can hold 1500 gallons of water. A gallon of water weighs 8.32 pounds. If your saguaro receives 1.5 gallons of water, how many pounds would that be? Check and explain your reasoning with your centermates.

- **Namib Beetle:** This model shows the structure of a Namib beetle back. The ridges and valleys are arranged in the way that directs water towards its mouth- using both hydrophobic (water-repelling) hydrophilic (water-attracting) properties.
  Inquiry Question-Water is highly cohesive, meaning that it tends to "bunch" together. What works best to move water? Is it a "push" or "pull" that moves water along most efficiently? Discuss this question before reading the inquiry card and doing the activity. Afterward, lightly spray the model and observe what happens.

- **Rattlesnake Skin Artifact:** (Please note, these skins have been ethically sourced) This is a section of genuine rattlesnake skin, paired with the research being done on how the skin captures rainwater. Students can look through the jeweler's loupe to see the scales and explore the surface of the snake skin.
  Bio-Debate-In biomimicry we move from learning about organisms to learning from organisms. After looking at the skin, take 60 seconds to think of an innovative idea using what you've learned. Place your idea on the Bio-Continuum and discuss how you've made that determination.

Links/Resources:

https://study.com/academy/lesson/water-absorption-movement-in-plants.html#transcriptHeader

https://organismalbio.biosci.gatech.edu/nutrition-transport-and-homeostasis/plant-and-animal-responses-to-the-environment

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.
- Break students into small groups (no more than 4 students) and have them choose a champion organism from the ones we have just explored.
- 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.

At-Home Activity (Extension Activity):

Students will find another spot to journal, can be the same as yesterday. They should spend some time observing, then write down one animal/organism that they see (can be a bird, insect, etc). What is the organism doing? Can you see any behavior that is related to capturing or drinking water? Depending on the weather, will the organism behavior be any different?

Assessment:

Rubric for Poster, review of Nature Research Journal from previous day

Overview: *(Vocabulary in bold)*

Biomimetic designers ("biomimics") focus on understanding, learning from, and **emulating** 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 (design. 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, and finding inspiration for solutions in nature. 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!

AZ State Standards:

Science	*English Language Arts*
7.L1U1.11- Construct an explanation for how organisms maintain internal stability and evaluate the effect of the external factors on organisms' internal stability.	**7.RI.4** - Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze the impact of specific word choices on meaning and tone.
	7.W.4 - Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience

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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…

- Explore what it means to be a designer and biomimic
- Learn about and practice crafting 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

Procedure

1 (10 mins)

Present biomimicry challenge and process for group work. Break students into groups that they will reconvene in tomorrow (cluster tables to make this more intuitive).

- Challenge: New invention for water collection/storage, and maintaining homeostasis in desert.
- Optional: students can choose a "job" or "role" - engineer, architect, designer

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?

Links/Resources:

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

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)**. 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 may LP's are addressed in each design? Or how could designs work to include more LPs?

AZ State Standards:

Science	*English Language Arts*
7.L1U1.11- Construct an explanation for how organisms maintain internal stability and evaluate the effect of the external factors on organisms' internal stability.	**7.SL.4** - Present claims and findings, emphasizing salient points in a focused, coherent manner with pertinent descriptions, appropriate vocabulary, facts, details, and examples; use appropriate eye contact, adequate volume, and clear pronunciation.

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Objectives:
The students will be able to…
- Synthesize learnings from entire week
- Create presentation about these learnings to present to their classmates
- 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

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, review Research Journals from the week
OPTIONAL: Biomimicry Design Challenge

Resources:

Life's Principles Page

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.

Fostering Sustainable Innovation Inspired by Nature.

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