

BIOCONNECT



Teacher Workshop



Today We Hope You...



Feel confident using the BioConnect kit materials and lesson plans



Feel confident teaching STEM concepts and STEM-related skills



Understand the Biomimicry Design process



Clarify your understanding of any difficult or challenging concepts related to the kit



Collaborate with colleagues



Engage in rich discussion



Apply what you've learned to your classroom

Agenda

- Part 1:
 - Welcome
 - Desert Activities
 - Intro to the Design Challenge
- Part 2:
 - Champion organisms + inquiry strategies
 - Observation
 - Start Design Challenge Process
- Part 3:
 - ADP Process
 - Finish and Discuss Design Challenge
- Part 4:
 - Individual and Team Time



Part 1

- Welcome!
- Story Harvesting
- Challenges of Desert Ecosystems
- Outdoor Stations



Tell Us What
You Already
Know...



A hand is placing a yellow paper cutout of a castle onto an open book. The book's cover features a night sky illustration with a large yellow moon, birds, and a castle. The book is open to two blank pages, and the entire scene is set on a wooden surface.

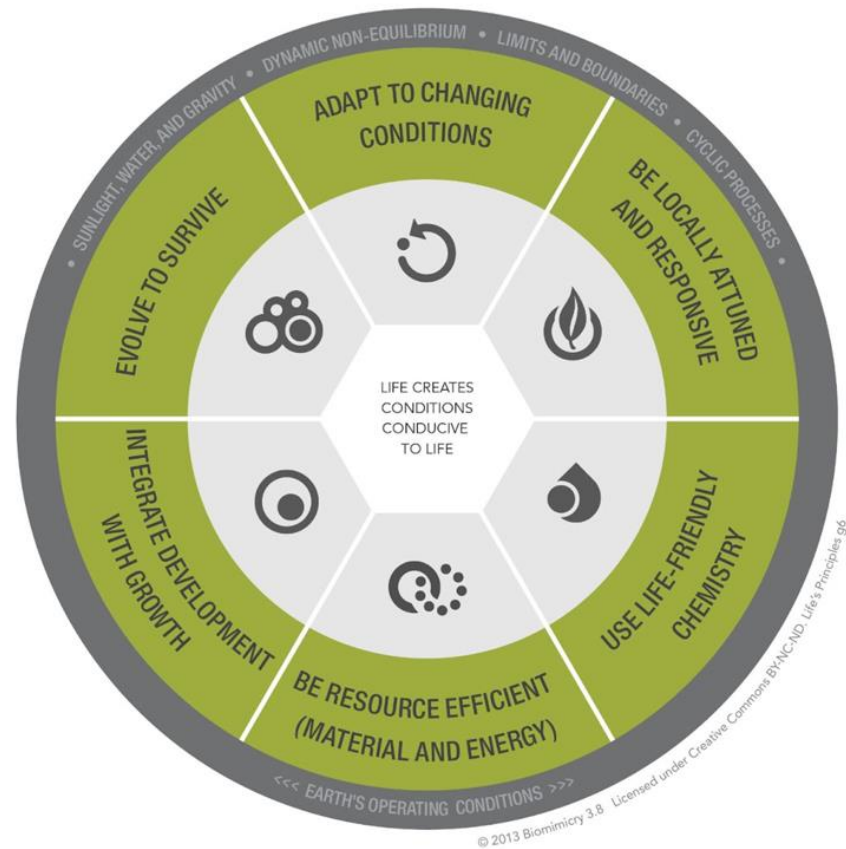
Story Harvesting Roles

- **Teller:** tells a story about a STEM activity that they did with their students (could be successful or not)
- **Questioner:** What questions arise from the story that applies to other STEM experiences?
- **Process:** What processes, applications, discoveries happened?
- **Pivotal Points:** When did breakthroughs occur, what was the learning?
- **Emotional:** How did the story make you feel?
- **Connection:** How do your experiences connect to the story? Have you experienced something similar or different?

BioConnect Challenge:

Create a new invention, inspired by a desert organism (champion), to help people survive in the desert. Can focus on heat management or water conservation.





LIFE'S PRINCIPLES

Biomimicry DesignLens

Let's Go
Outside!













Why PBL?

- Integrates science, technology, engineering and math into one learning experience
- Reinforces real-world applications
- Prepares students for complex careers
- Develops student skills, knowledge and processes
- Learning retention
- Deeper understanding
- Builds confidence in both teachers and students
- Enhanced engagement and motivation

(And it's fun!)

Gold Standard PBL

Seven Essential Project
Design Elements



Outdoor Stations

- Soil
- Evaporation
- Human Impact





Break Time!

Part 2

- Reflection
- Desert Champion Animal
- Rattlesnake Case Study
- 3D Model Stations
- At-home Observation Activity
- Start Design Process



Reflection: Triangle Circle Square



Triangle: 3 important points



Circle: What's circling around in your head?

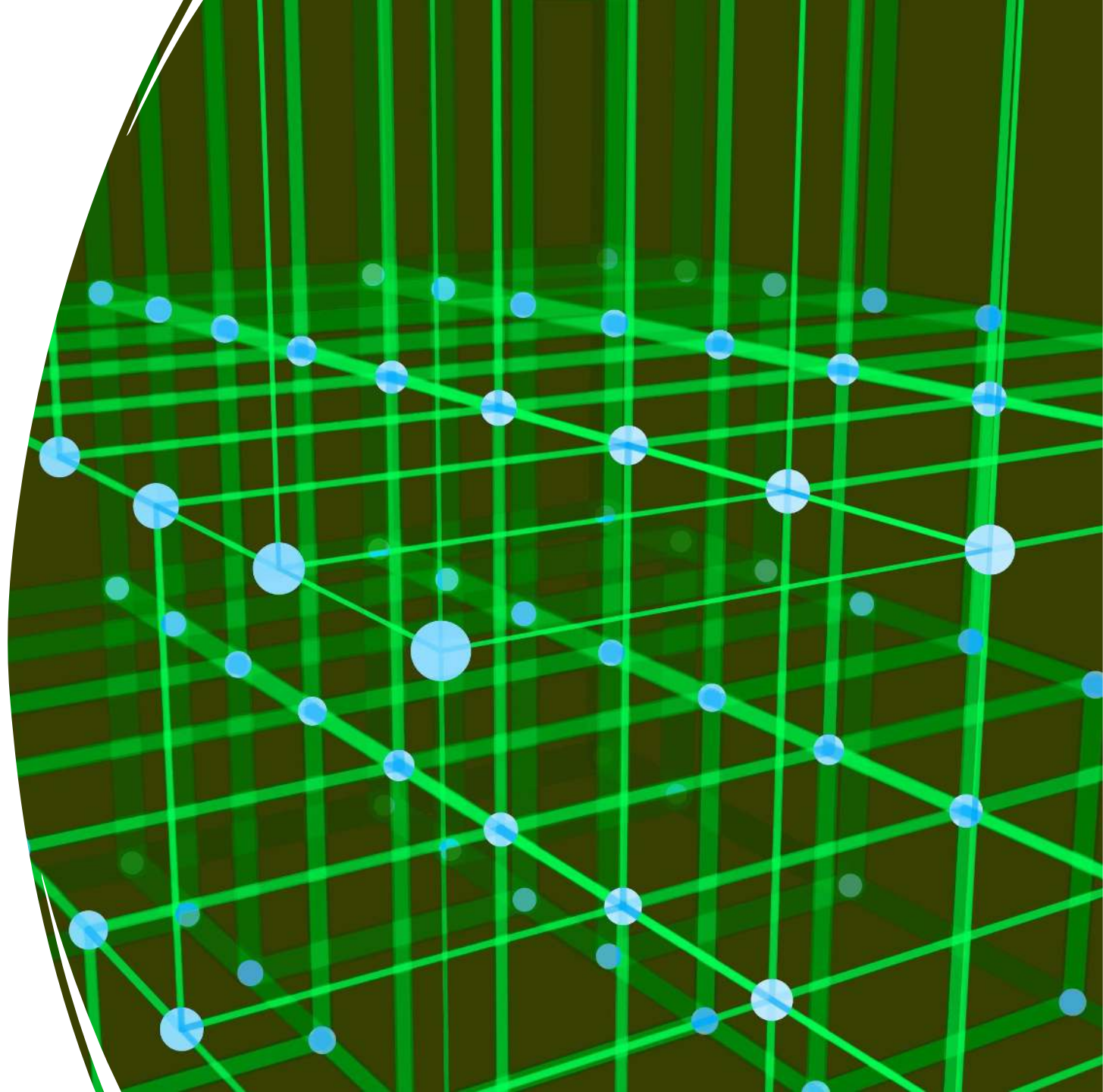


Square: Something that "squares" with your way of looking at the world

Function and Strategy

Function = What
Strategy = How

A biological strategy is a characteristic, mechanism, or process that an organism or ecosystem exhibits to meet a function.



A close-up photograph of a rattlesnake coiled on a rocky, uneven surface. The snake's scales are a mix of light tan and brown, with a distinct diamond pattern. Its head is raised, showing a dark eye and a small, dark, horn-like structure. A semi-transparent white text box is overlaid on the lower half of the image, containing the title and a question. The background consists of grey and brown rocks.

Rattlesnake Skin Case Study

What do you notice? What questions does it inspire?

WHAT is the
snake doing
and HOW is
it doing
that?

<https://www.youtube.com/watch?v=R3T7PQ2IRhg>



How to collect rainwater

(if you're a western diamondback rattlesnake)

Step 1

Wait for rain

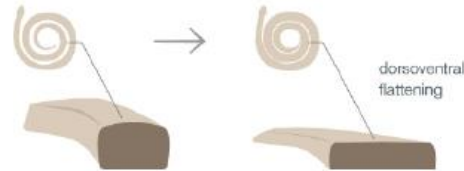
This might take a while in the desert.



Step 2

Expand your surface area

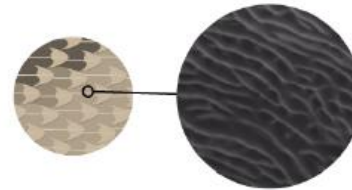
Flatten yourself into rain-harvesting posture.



Step 3

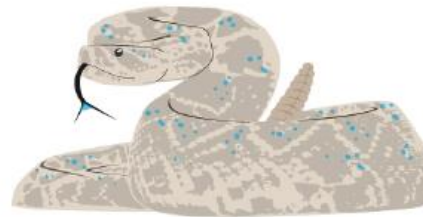
Collect water drops

Use the nanochannels in your scales to bead and hold raindrops as they land on you.



Step 4

Drink up!



3D Model Stations

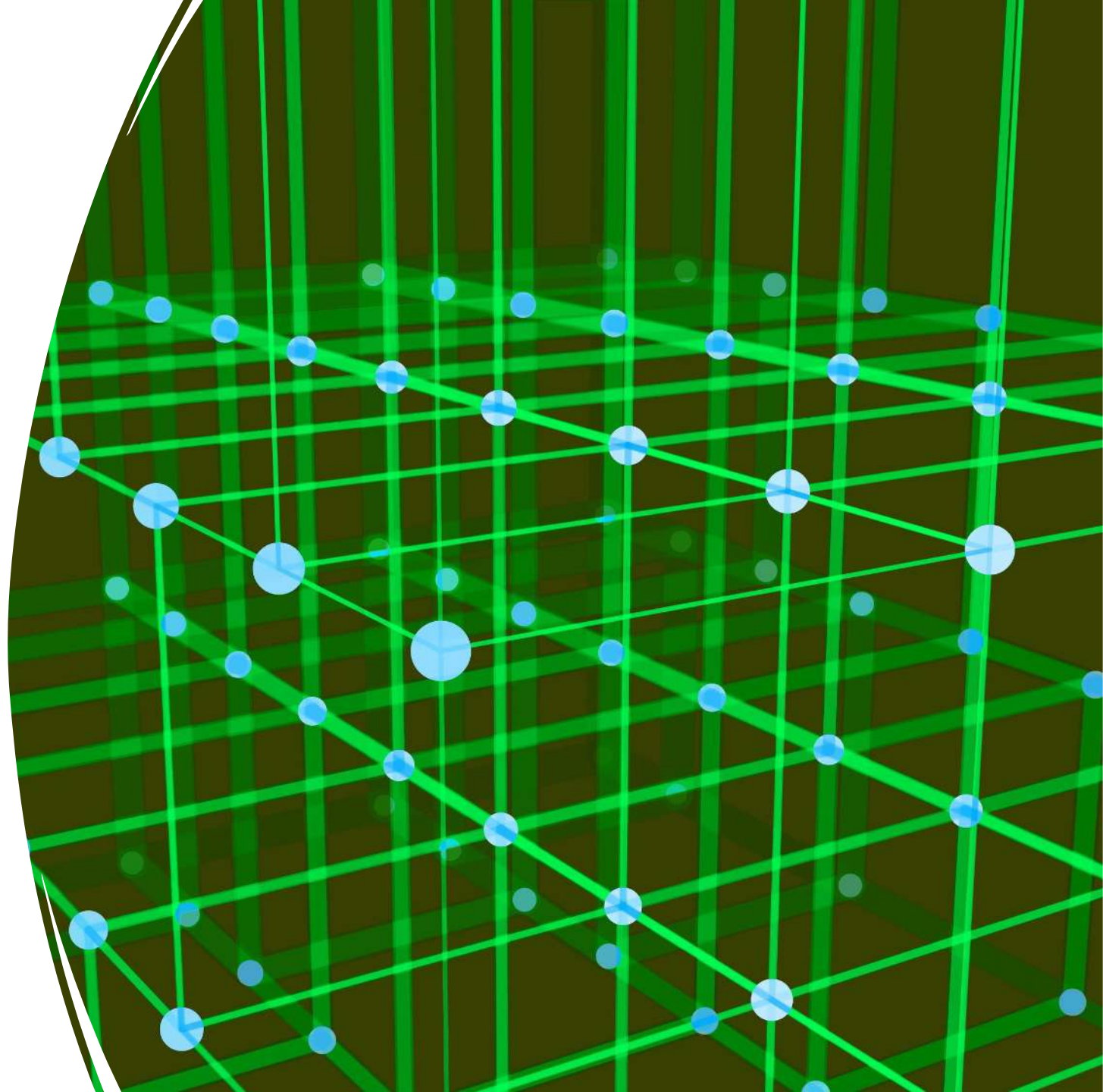
- Rabbit
- Namib beetle
- Saguaro
- Camel
- Coyote
- Rattlesnake



Function and Strategy

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Lunch Break!

Part 3

- Reflection
- Biotic and Abiotic
- ADP
- Discuss/Assess Ideas
- Feedback
- Finish Design
- Present
- Final Reflection





Reflection: Rose, Bud, Thorn

- **Rose:** A positive experience or something you learned so far
- **Bud:** Something you are looking forward to doing with your students
- **Thorn:** Something you need help with or are not looking forward to

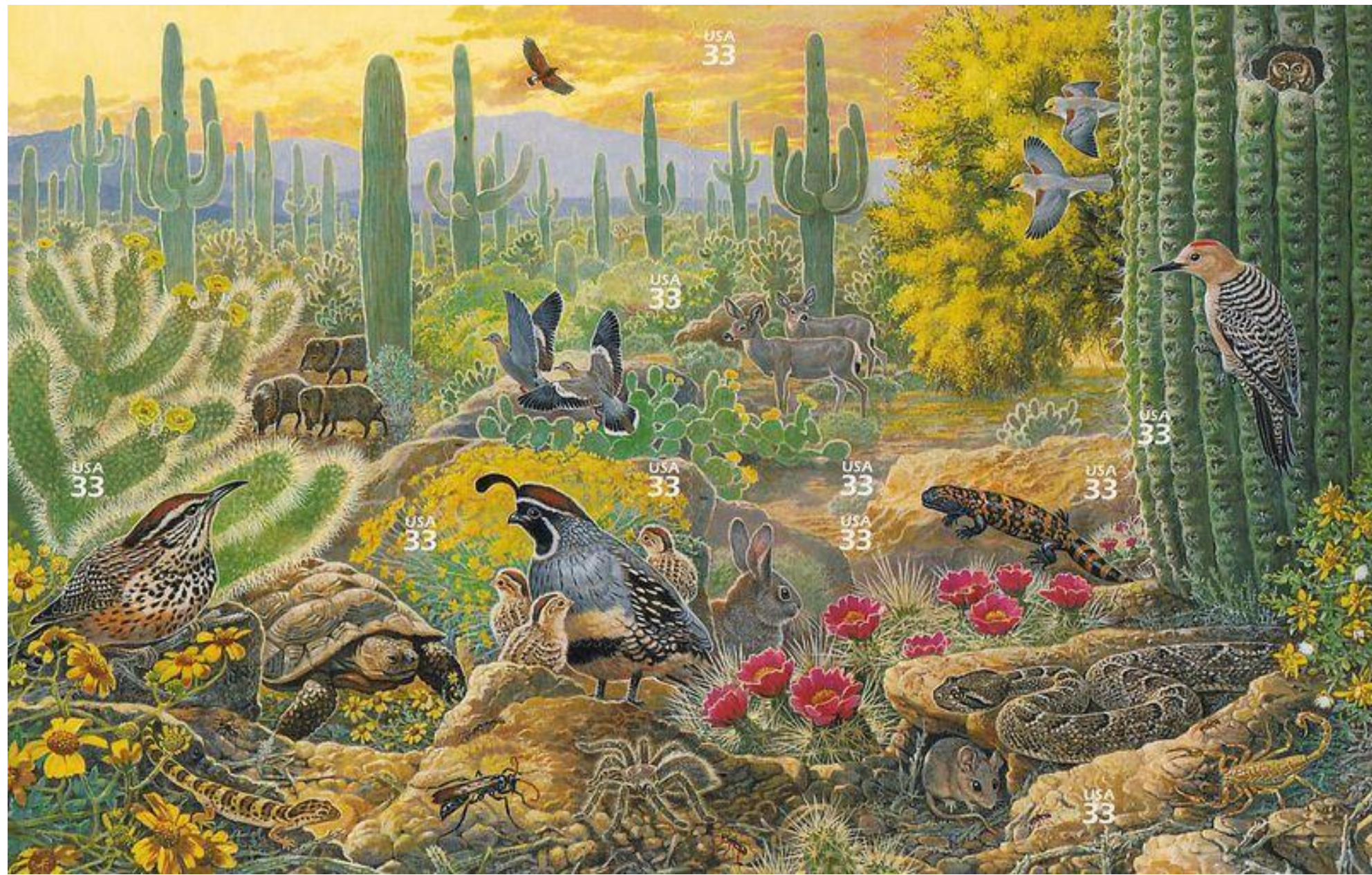
Biotic vs. Abiotic Factors

- Living
- Examples
 - Plants
 - Animals
 - Fungi
 - Bacteria



- Non-Living
- Examples
 - Water
 - Sunlight
 - Soil
 - Air
 - Temperature

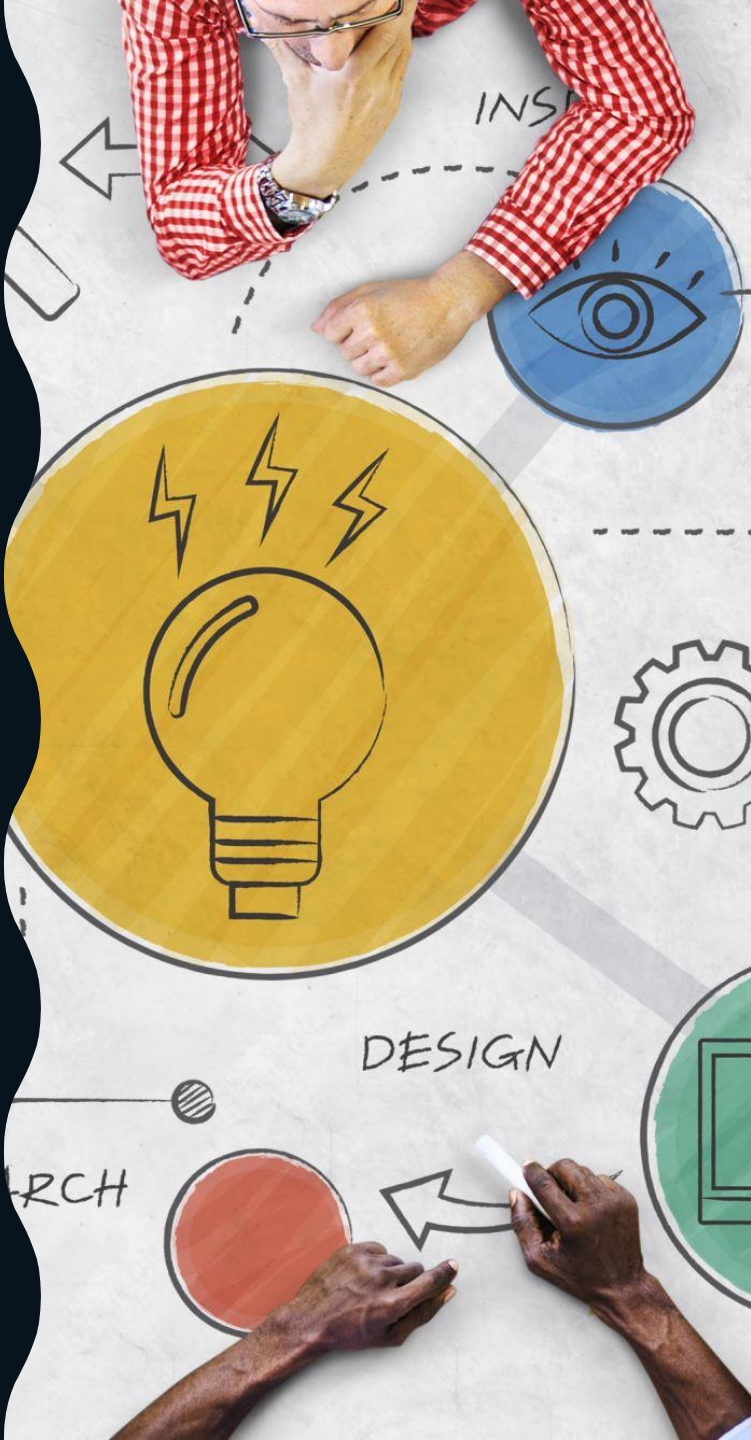




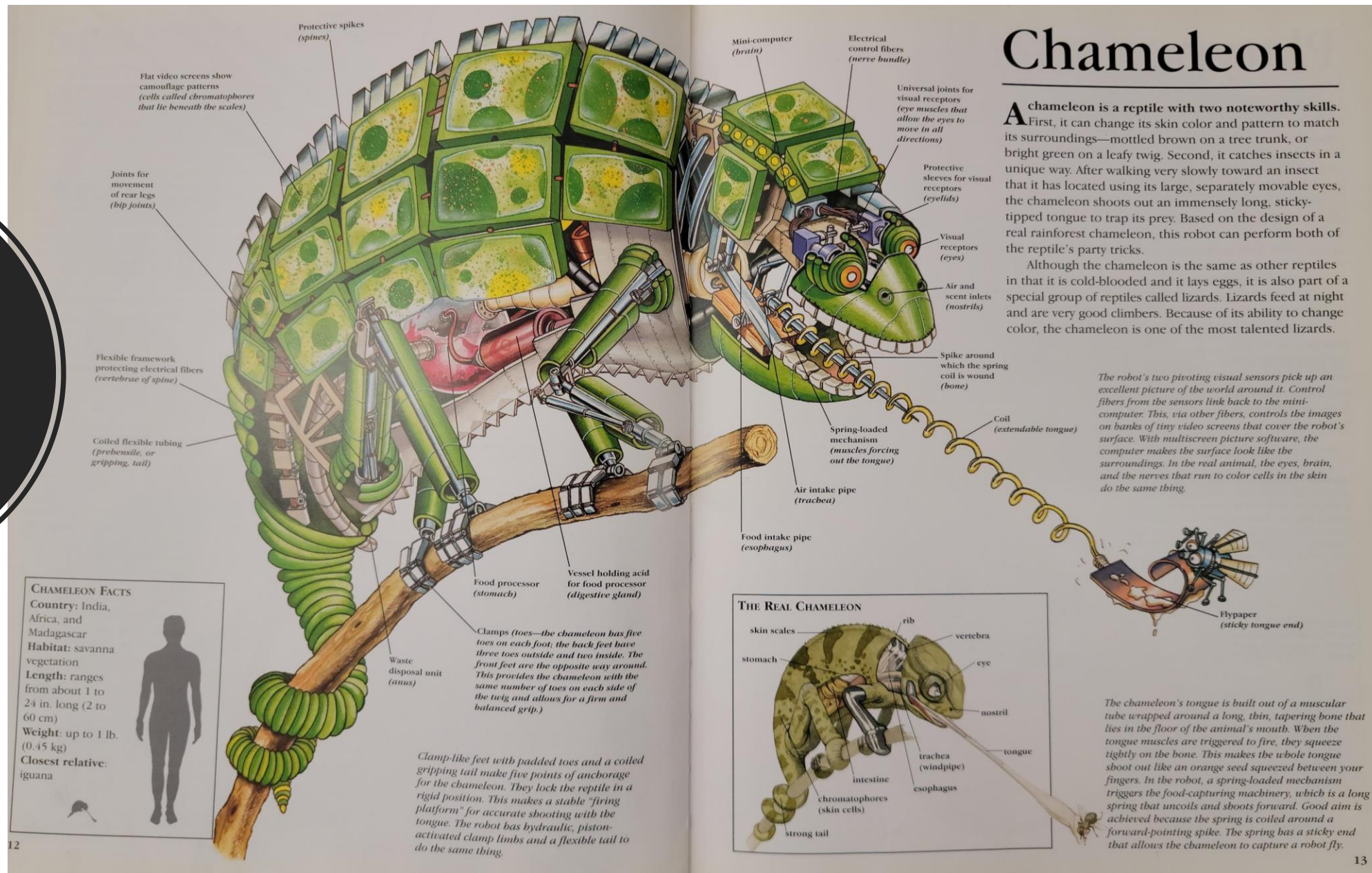
Abstract Design Principle

- Think like an engineer. Imagine the strategy as a mechanical system or process diagram in order to draw it without depicting biological parts.
- Carefully study the essential features or mechanisms that make the biological strategies successful. Use plain language to write down your understanding of how the features work, using sketches to ensure accurate comprehension.
- Abstracting design strategies is one of the most difficult steps in biomimicry. So don't be discouraged if you stumble at first. With practice it will become second nature.

Taken from: [Abstract Design Strategies - Biomimicry Toolbox](#)



The Robot Zoo by John Kelly



Chameleon

A chameleon is a reptile with two noteworthy skills.

First, it can change its skin color and pattern to match its surroundings—mottled brown on a tree trunk, or bright green on a leafy twig. Second, it catches insects in a unique way. After walking very slowly toward an insect that it has located using its large, separately movable eyes, the chameleon shoots out an immensely long, sticky-tipped tongue to trap its prey. Based on the design of a real rainforest chameleon, this robot can perform both of the reptile's party tricks.

Although the chameleon is the same as other reptiles in that it is cold-blooded and it lays eggs, it is also part of a special group of reptiles called lizards. Lizards feed at night and are very good climbers. Because of its ability to change color, the chameleon is one of the most talented lizards.

The robot's two pivoting visual sensors pick up an excellent picture of the world around it. Control fibers from the sensors link back to the mini-computer. This, via other fibers, controls the images on banks of tiny video screens that cover the robot's surface. With multiscreen picture software, the computer makes the surface look like the surroundings. In the real animal, the eyes, brain, and the nerves that run to color cells in the skin do the same thing.

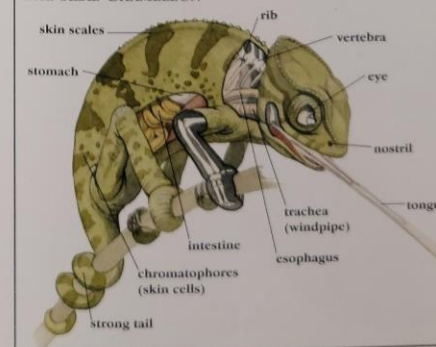
CHAMELEON FACTS

Country: India, Africa, and Madagascar
Habitat: savanna vegetation
Length: ranges from about 1 to 24 in. long (2 to 60 cm)
Weight: up to 1 lb. (0.45 kg)
Closest relative: iguana

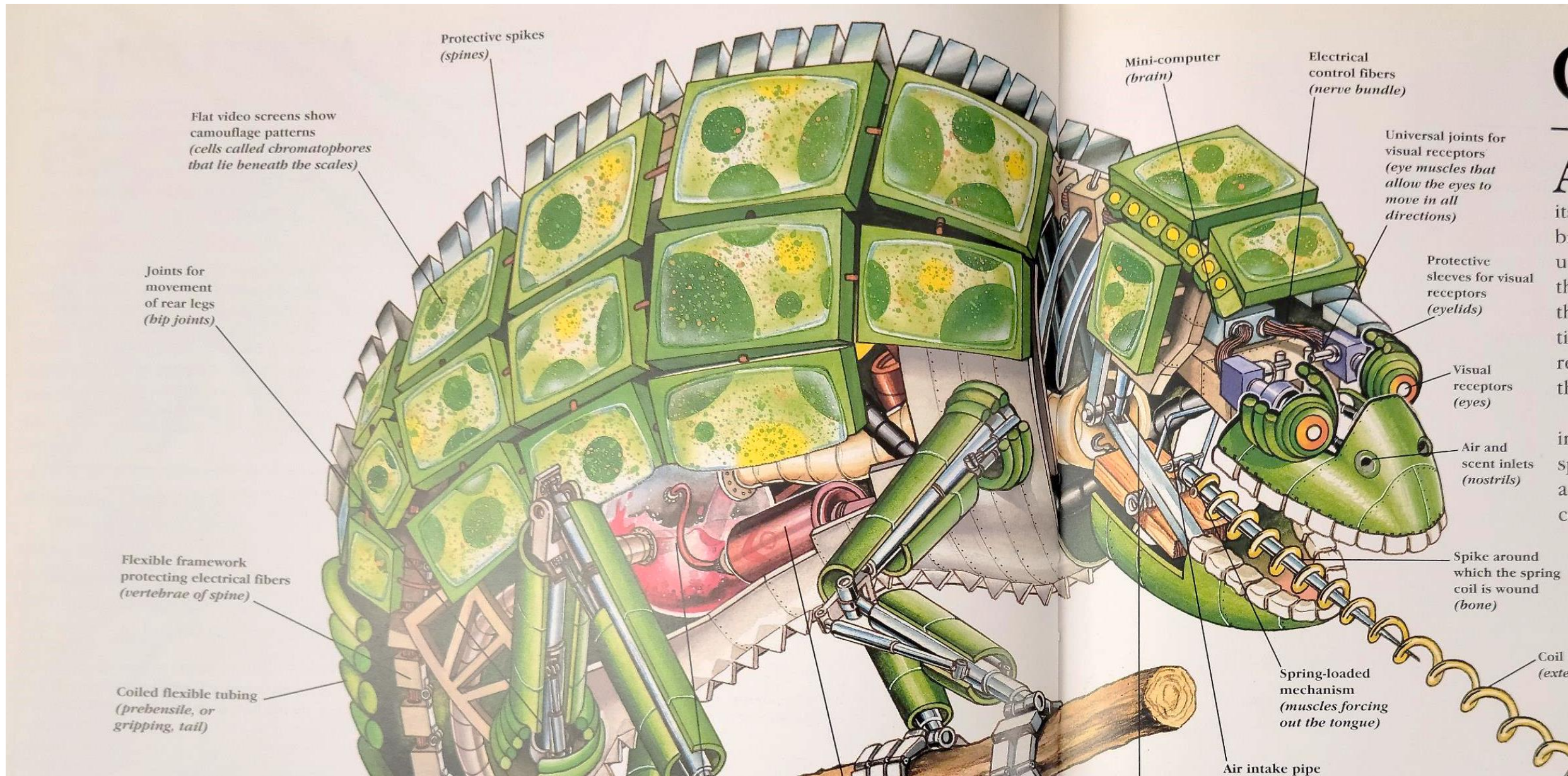


Clamp-like feet with padded toes and a coiled gripping tail make five points of anchorage for the chameleon. They lock the reptile in a rigid position. This makes a stable "firing platform" for accurate shooting with the tongue. The robot has hydraulic, piston-activated clamp limbs and a flexible tail to do the same thing.

THE REAL CHAMELEON



The chameleon's tongue is built out of a muscular tube wrapped around a long, thin, tapering bone that lies in the floor of the animal's mouth. When the tongue muscles are triggered to fire, they squeeze tightly on the bone. This makes the whole tongue shoot out like an orange seed squeezed between your fingers. In the robot, a spring-loaded mechanism triggers the food-capturing machinery, which is a long spring that uncoils and shoots forward. Good aim is achieved because the spring is coiled around a forward-pointing spike. The spring has a sticky end that allows the chameleon to capture a robot fly.



Let's Go
Outside!



What are some techniques you can use with a group?

- Encourage them talk to each other!
 - Think-Pair-Share
 - Sticky notes
 - Inside-Outside Circle or Parallel Lines
 - Speaker-Listener or Speaker-Scribe Roles
 - Gallery Walks
 - Question Stems and Sentence Frames
- Use phrases like...
 - To add to what ____ said
 - In my experience ____
 - Say more about ____
 - I wonder ____



Feedback Sentence Stems



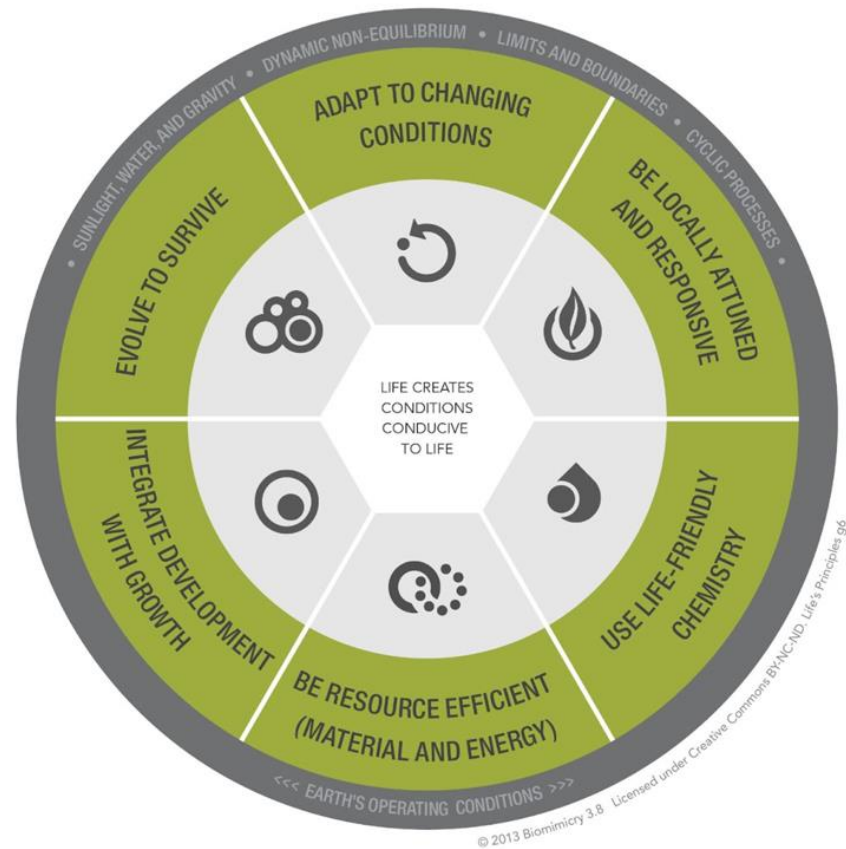
ONE THING I LIKE IS...



ONE SUGGESTION I HAVE
IS...



ONE QUESTION I HAVE
IS...



LIFE'S PRINCIPLES

Biomimicry DesignLens

Reflection



What was easy and difficult?



Where could you see your students needing guidance or more structure?



Are there any questions about the process?

Glow & Grow

- One thing that makes them “glow” (i.e. something you are proud of doing or learning today)
- One thing that you want to “grow” (i.e. do more of or learn more about)



In the Future, We Hope You...

1

Complete the
BioConnect kit with
your classroom

2

Help or train at
least one colleague
on how to use the
BioConnect kit

3

Provide feedback
on your experience
teaching the kits

4

Use the Phoenix
Zoo and Biomimicry
Center resources in
the future

Next Steps...



How to sign up for the kits



How you'll receive the stipend




Any questions or additional feedback?



outreach@phoenixzoo.org or lbell@phoenixzoo.org

Ordering a Bioconnect Kit for Mesa Public Schools



BioConnect Science Kit Order Form (Gr. 6-8)

Please fill out the form below to order the BioConnect kit for you class(es). Only ten kits are available for the district, so please return yours promptly at the end of 3 weeks. Due to limited availability, the kit orders are first come-first serve.

For secondary teachers, all materials will need to be shared each class/period, except for student notebooks and extension pages. Those will be provided for each student, and an order form to order more will be available in the class canvas. Thank you!

majames@mpsaz.org [Switch account](#)

* Indicates required question

- Order using this Google form:
[Bioconnect Kit Order Form](#)
- May keep the kit for 3 weeks-if needed longer, exceptions are made :-)
- Kits are delivered from and returned to MPS Science Dept.
- We only have 10 available so be flexible with your dates when ordering

Tell Us What You
Think Now...



Part 4

It's up to you...

- How can you modify activities to fit your group's needs?
- Time to ask questions
- Make notes and reflect on your learning

