



BIO-MACHINE:

*Pollinator-inspired
Design*

SNAPSHOTS

Quick Look at
Pollinator Inspiration Species



POLLINATOR SNAPSHOT

The Pollinator Snapshot is intended to make connections between the Pollinator theme with biomimetics or nature inspired design. For further information on nature inspired design, biomimicry and pollinators role in biodiversity search the [bioSTEAM Wiki](#). The biomimicry curriculum methodology is derived from and in consultation with Ana MacArthur. The Pollinator Concentrator installation by Ana MacArthur inspired and informed the [Pollinator Concentrator Project](#). Visit [Ana MacArthur](#) website to learn more.

BioSTEAM WIKI KEYWORDS

light
polarization
electromagnetic spectrum
optics
pollinators
bees
butterflies
bats
hummingbirds
solar navigation
ecoservices

Rio Fernando Park is a living ecology laboratory. The park has rich and diverse habitats that host a wealth of biodiversity, and demonstrates positive human impact through their land restoration work and community programming. Your backyard or school garden can also be a living laboratory for biodiversity.

The Pollinator Concentrator art installation by Ana MacArthur, uses technology or human tools to reveal hidden relationships between pollinators, local ecology and global interconnectedness. Tools like the sun dial and bat detectors are technologies that extend the human senses to “see invisible” relationships in the living world, like our relationship to the sun. UV sensors detect and respond to bats ultrasonic sound revealing the hidden relationships of nocturnal biodiversity. While unseen water catchment nourishes the pollinator garden extending hydration to native plants that feed pollinators. Pollinator Concentrator tiles highlight different species of pollinators including bees, butterflies, moths, wasps, hummingbirds and bats.

There are hundreds of thousands of pollinator species, with new ones discovered everyday by researchers and citizen scientists. Pollinators facilitate the reproduction of 90% of flowering species of plants and are important to our food supply. Human impact, climate change and biodiversity loss threatens the lives of pollinators and our interdependent relationship on their ecoservices.

Pollinators play an important role in our environment and have evolved amazing adaptations over time. Nature Inspired Design is a term for when we use the lessons all around us provided by nature to create innovative design processes and products. For example: Pollinators see the world in a unique way. They can see wavelengths and qualities of light the human eye can't. In order to see the invisible relationships between ourselves and our environment humans have developed technological tools from sundials to polarizers to take in the information in our environment.

SENSING THE INVISIBLE: land, space + time tools

What strategies might we learn from the pollinators highlighted in Pollinator Concentrator?

How might we use our human bodies as tools to collect data about our environment?

How do pollinators collect or process data in their environment?

What invisible pollinator relationships are we taking for granted or do not see?

What tools might we develop to help us see and show those relationships?

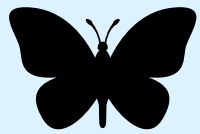
Pollinator Strategy/ Inspiration

Pollinators have developed unique adaptations to survive including:



BEEES

- hives and hexagons
- nest building
- social strategy
- electrostatic hair
- signal detection
- buzz pollination
- compound eye



BUTTERFLIES+
MOTHS

- multifunctional wing scales
- cocoon building
- thermoregulation
- structural color
- aerodynamics
- internal compass
- flight patterns



WASPS

- nest building
- waterproof fiber
- parasitic relationships
- vortex lift
- solar pigments
- antifreeze blood



HUMMINGBIRDS

- hover mechanisms
- rotating joints
- torpor
- efficient tongue pump
- microstructure feathers
- electrostatic pollination



BATS

- biosonar
- unique immunity
- social strategy
- thermoregulation
- internal magnetic compass
- flight maneuverability

Biomimetic Innovation

Pollinators have inspired the creation of cutting edge design including:

Bee strategies have inspired numerous innovations in technology including building materials, swarm inspired technology like drones and software, and compound camera lenses.

Butterfly and **moth** strategies have inspired transformations in fabrics, solar cells, acoustic camouflage, biophotonic implants and airplane wings.

Wasp strategies have inspired composite building materials, novel solar cells, micro air vehicles, drones and steerable needles.

Hummingbird strategies have inspired innovation in drones, wind turbines, and AI robots.

Bat Strategies have inspired a sonar cane for the visual impaired, robots, drones, ultrasonic image reconstruction Radar, Lidar and other sonar based systems.



BAT SNAPSHOT

The Bat snapshot is intended to make connections between the Pollinator theme with biomimetics or nature inspired design. For further information on nature inspired design, echolocation and the bats role in biodiversity search the bioSTEAM Wiki.

Bats provide an important role in our ecosystems, providing ecosystem services like pest control and even night pollination of important crops like chocolate and agave. Nature Inspired Design uses the lessons all around us provided by nature to create innovative design processes and products. Bat species as a group represent interesting biological strategies that scientists, artists and engineers are mimicking to design new technologies to address the complex challenges we face.



21 species of (non-pollinating) bats have been identified at the Rio Fernando Park. Bats species can be found all over the world and in most climates. They are the only flying mammal and have unique biological adaptations that motivate nature inspired designers.

The most famous bat adaptation is echolocation which has inspired sonar systems like radar, lidar and other sound applications like a walking cane that uses echolocation to aid the visually impaired. Other adaptations like their wing structure inspire flexible flight maneuverability for drones and other robots.

Bats have a unique immunity that evolved over time. This immune response protects them from infection while the bat becomes a carrier for multiple disease called zoonoses- or disease that are passed between animals to humans. COVID-19 is one of these diseases. As biodiversity loss and habitat encroachment brings humans and bats closer together the risk of novel zoonotic disease spreading to humans is high. New solutions will need to be developed in conjunction with environmental protections to prevent devastating consequences of disease and to protect bats from ecological destruction.

BioSTEAM WIKI KEYWORDS

sound
bioacoustics
echolocation
ultrasonic sound
waves
sensors
navigation
sensors
bats

SENSING THE INVISIBLE: land, space + time tools

Bats use specialized sensing to navigate their environment. Their physical being and survival strategies express unique adaptations to place.

What is unique about bats? What inspiration can we draw from bats that might solve a current or future problem?

What can we learn about ecological communication and relationships from bats, or other local species?

How might we collect data on local ecologies? Why does it matter?

What strategies might we develop to help us see and show ecological relationships?

SKETCH PAD

Design Journal/Notes:

Name:

School: