
Introduction to
Insect Nano Lab
NASA
HUNCH
ACADEMY

Introduction to NASA HUNCH video.

Mission Statement: Empowering Elementary School Students in STEM through NASA HUNCH Academy

At NASA HUNCH Academy, our mission is to ignite a passion for STEM (Science, Technology, Engineering, and Mathematics) among elementary school students by providing an immersive and innovative educational experience inspired by NASA HUNCH. We strive to cultivate curiosity, critical thinking, and creativity, laying the foundation for future leaders in space exploration and technology.

Vision Statement: Fostering a Generation of Young Explorers and Innovators

Our vision at NASA HUNCH Academy is to create a dynamic learning environment where elementary school students can thrive in STEM fields. We envision a future where every child is equipped with the knowledge, skills, and inspiration needed to contribute to space exploration and technological advancements. Through hands-on experiences, collaboration, and mentorship, we aim to nurture a community of young explorers and innovators who will boldly shape the future of science and technology.

Introduction to NASA HUNCH Insect NANO LAB video

Tips:

- Study up on the bug you want to grow.
- It would be a good idea to grow some of the bugs you think would go to space and observe their life cycle. This will give you ideas of how you might grow them in micro gravity.
  - Example – meal worms typically are fed loose leaves or grains, that won't be very possible in micro-g.
    - Can they be fed on some kind of grains on a stick or could the grains/leaves be held in a cloth bag?
    - Do they generate a lot of particles when they eat that might cause a problem?
  - When molting their skin, some insects require gravity for hanging and removing their old skin. Are there structures they would need for latching onto?
- Once we learn if bugs can be grown in space, we will also have to figure out how to separate out the bugs that are ready to be eaten from left over food, the bugs that are too young or too old.

Objective

Read over the NASA HUNCH powerpoint, visit the websites and watch the videos for information.
https://www.hunchdesign.com/uploads/2/2/0/9/22093000/insect_nanolab.pdf
Develop, design and build a prototype Nanolab for growing 5 or more of one kind of insect for 30 days in micro-g. You are trying to develop the inside of the box that could be used for many experiments. NASA's long term goal is to find out how insects would live out their life cycle in microgravity so that in the future the data gathered could influence how that insect could be grown as a fresh source of food for long duration space missions. We need to develop structures that allow insects to grow, feed and mature from different stages of their lifespan. This structure should also allow for good lighting and camera views of the insects. Keep in mind that investigators will want to record data from inside the NANOLAB and video activity during the experiment. The chamber that houses insects must have adequate space for sustaining at least one more generation of your insect. The chamber must also have source of nutrients (food) and water. Water must be contained to prevent it from contacting electrical hardware and wiring. The NANO LABS needs to be lightweight. It cost $1.2 million per pound to send material into space. NANOLAB must fit within a 4 inches wide x 4 inches high x 8 inches long NanoLab. First start out by drawing a basic NANOLAB that you want to create on paper. Make a 3D drawing of your Insect NANO LAB. Then take your blueprint and make it on tinkercad. Once you have your basic design we will do research to choose which insects we want to use for this project. Then we will make modifications to our NANOLAB design to properly house our insect. Have fun and be creative.

Discussion Questions

What kind of insect are safe for people to eat?
Which insect are the most protein/ healthy to eat?
At what stage of life can the insect be eaten?
What stage of the insect's life cycle would you send up?
How long is their lifecycle?
What kind of food do they need to eat?
Do they need water besides what is in the food?
Do they like light?
What kind of humidity does the bug need?
What temperature range do they grow in?
How much oxygen do they need?
How much space do they need to survive?
How long will they live in the space of a NanoLab?
What kind of a structure do they need to crawl on?
Can the food they are eating also be the structure they are crawling on?
How do you keep the waste products from floating everywhere?
How will you contain the food and water in the nanolab?

Websites that will help

What is Gravity

https://spaceplace.nasa.gov/what-is-gravity/en/

https://www.coolkidfacts.com/gravity/

https://www.generationgenius.com/videolessons/gravity-pulls-things-down-video-for-kids/

Insects

https://a-z-animals.com/blog/what-do-insects-eat/

https://kids.earth.org/life-on-land/eating-bugs/

https://www.webmd.com/food-recipes/ss/slideshow-bugs-you-can-eat

https://www.farmersalmanac.com/10-edible-bugs-and-how-to-eat-them-24150

https://www.pbs.org/video/case-eating-bugs-hpx3x2/

Videos about insects

2- 4 NGSS Science standards covered.

2-LS2-1. Plan and conduct an investigation to determine if plants need sunlight and water to grow.

K-2-TS1-1.E. Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.

K-2-ETS1-2.Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.

K-2-ETS1-3.Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs

.3-LS1-1.Develop models to describe that organisms have unique and diverse life cycles but all have in common birth, growth, reproduction, and death.

LS1.B: Growth and Development of Organisms. Reproduction is essential to the continued existence of every kind of organism. Plants and animals have unique and diverse life cycles.

3-LS2-1.Construct an argument that some animals form groups that help members survive.

LS3.B: Variation of Traits. The environment also affects the traits that an organism develops.

3-LS3-2. Use evidence to support the explanation that traits can be influenced by the environment.

3-LS4-2.Use evidence to construct an explanation for how the variations in characteristics among individuals of the same species may provide advantages in surviving, finding mates, and reproducing.

3-LS4-3. Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all.

LS2.C: Ecosystem Dynamics, Functioning, and Resilience- When the environment changes in ways that affect a place's physical characteristics, temperature, or availability of resources, some organisms survive and reproduce, others move to new locations, yet others move into the transformed environment, and some die. *(secondary)*

LS4.D: Biodiversity and Humans- Populations live in a variety of habitats, and change in those habitats affects the organisms living there.

4-LS1-1.Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.

4-LS1-2.Use a model to describe that animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways.

4-8 NGSS Science standards covered.

5-PS3-1.Use models to describe that energy in animals' food (used for body repair, growth, and motion and to maintain body warmth) was once energy from the sun.

PS3.D: Energy in Chemical Processes and Everyday Life-The energy released [from] food was once energy from the sun that was captured by plants in the chemical process that forms plant matter (from air and water).

LS1.C: Organization for Matter and Energy Flow in Organisms-Food provides animals with the materials they need for body repair and growth and the energy they need to maintain body warmth and for motion. *(secondary)*

5-LS2-1.Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.

3-5-ETS1-3.Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

Elementary Math Standards for Georgia

MGSE2.MD.1 Measure the length of an object by selecting and using appropriate tools such as rulers, yardsticks, meter sticks, and measuring tapes.

MGSE2.MD.2 Measure the length of an object twice, using length units of different lengths for the two measurements; describe how the two measurements relate to the size of the unit chosen. Understand the relative size of units in different systems of measurement. For example, an inch is longer than a centimeter. (Students are not expected to convert between systems of measurement.)

MGSE2.MD.3 Estimate lengths using units of inches, feet, centimeters, and meters.

MGSE2.MD.4 Measure to determine how much longer one object is than another, expressing the length difference in terms of a standard-length unit.

MGSE3.MD.4 Generate measurement data by measuring lengths using rulers marked with halves and fourths of an inch. Show the data by making a line plot, where the horizontal scale is marked off in appropriate units – whole numbers, halves, or quarters.

MGSE4.MD.1 Know relative sizes of measurement units within one system of units including km, m, cm; kg, g; lb, oz.; l, ml; hr, min, sec. a. Understand the relationship between gallons, cups, quarts, and pints. b. Express larger units in terms of smaller units within the same measurement system. c. Record measurement equivalents in a two-column table.

MGSE4.MD.2. Use the four operations to solve word problems involving distances, intervals of time, liquid volumes, masses of objects, and money, including problems involving simple fractions or decimals, and problems that require expressing measurements given in a larger unit in terms of a smaller unit. Represent measurement quantities using diagrams such as number line diagrams that feature a measurement scale.

MGSE5.MD.1 Convert among different-sized standard measurement units (mass, weight, length, time, etc.) within a given measurement system (customary and metric) (e.g., convert 5cm to 0.05m), and use these conversions in solving multi-step, real word problems.

Elementary Science standards

SKL1. Obtain, evaluate, and communicate information about how organisms (alive and not alive) and non-living objects are grouped. SKL2. Obtain, evaluate, and communicate information to compare the similarities and differences in groups of organisms.
S1L1. Obtain, evaluate, and communicate information about the basic needs of plants and animals.
S2E3. Obtain, evaluate, and communicate information about how weather, plants, animals, and humans cause changes to the environment.S2L1. Obtain, evaluate, and communicate information about the life cycles of different living organisms. a. Ask questions to determine the sequence of the life cycle of common animals in your area: a mammal such as a cat, dog or classroom pet, a bird such as a chicken, an amphibian such as a frog, and an insect such as a butterfly. b. Plan and carry out an investigation of the life cycle of a plant by growing a plant from a seed and by recording changes over a period of time. c. Construct an explanation of an animal's role in dispersing seeds or in the pollination of plants. d. Develop models to illustrate the unique and diverse life cycles of organisms other than humans.
S3L2. Obtain, evaluate, and communicate information about the effects of pollution (air, land, and water) and humans on the environment. a. Ask questions to collect information and create records of sources and effects of pollution on the plants and animals. b. Explore, research, and communicate solutions, such as conservation of resources and recycling of materials, to protect plants and animals.
S4L1. Obtain, evaluate, and communicate information about the roles of organisms and the flow of energy within an ecosystem. a. Develop a model to describe the roles of producers, consumers, and decomposers in a community. b. Develop simple models to illustrate the flow of energy through a food web/food chain beginning with sunlight and including producers, consumers, and decomposers. c. Design a scenario to demonstrate the effect of a change on an ecosystem d. Use printed and digital data to develop a model illustrating and describing changes to the flow of energy in an ecosystem when plants or animals become scarce, extinct or overabundant.
S5L1. Obtain, evaluate, and communicate information to group organisms using scientific classification procedures. a. Develop a model that illustrates how animals are sorted into groups (vertebrate and invertebrate) and how vertebrates are sorted into groups (fish, amphibian, reptile, bird, and mammal) using data from multiple sources. S5L4. Obtain, evaluate, and communicate information about how microorganisms benefit or harm larger organisms. (Clarification statement: Possible microorganisms could include Tardigrades, Lactobacillus, Probiotics, Rotifers, Salmonella, Clostridium botulinum (Botox), E-coli, Algae, etc. Students are not expected to know these specific microorganisms. The list is provided to give teachers examples.) a. Construct an argument using scientific evidence to support a claim that some microorganisms are beneficial. b. Construct an argument using scientific evidence to support a claim that some microorganisms are harmful.