Nature Masterminds™

The Nature Masterminds series from the Caroline Kramer Faust Foundation is a one-of-a-kind biomimicry program that turns students in grades K through 8 into Nature Masterminds. With five individual modules, the program can be customized to meet the needs of teachers, parents, science centers, zoos, natural history museums and other institutions that are looking for a fun and innovative STEAM-based program to fill curriculum needs and interests. The program can be adapted for a variety of grade levels and can be tailored for wherever students live and learn.

To reach the largest audience, we made our program turnkey. Each lesson is taught by experienced educators and includes video recordings of the lessons and activities, a list of materials needed, numbered activity steps and supplemental materials. Our program can be offered online or in person. In our inaugural launch in 2021, the Great Lakes Science Center provided our program to 150 students in grades K-8 throughout the Greater Cleveland area.

Nature Masterminds: Take Flight

It's a bird... it's a plane… it's the biomimicry of flight! Nature Masterminds: Take Flight is the second program in the Nature Masterminds series. We have partnered with the Great Lakes Science Center and the Cornell Lab of Ornithology to provide a summer camp for 130 students from grades K-6. Students will study birds, insects, and other flying animals and how they inspired people to make flying objects such as airplanes, drones, and winged flight suits! Students will discover how bird bodies are designed from the inside out for flight and how that information is used in flying aircraft. Students will determine how to overcome flight obstacles such as balance, lift, and drag. They will get to fly their own mini drone as they learn about hovering. Students will marry art and science when they dissect an owl pellet. They will observe and explore the inside of a real bird specimen, focusing on the flight muscles and wings. Students will learn what special adaptations water birds have and how humans have used that knowledge in biomimicry designs such as diving aircraft, construction vehicles, and filtering tools. Every module has hands-on STEAM learning activities, biomimicry applications based on flight, and an outside activity of the day.

Curriculum Outline

Below is an outline of the five modules in the Nature Masterminds: Take Flight curriculum:

I. Bird Bodies Module

1. Designed to Fly: Anatomy: Intro to internal bird anatomy for flight © Cornell Lab of Ornithology.
2. Designed to Fly: Diet-In and Out: Birds high energy diet + excrete waste = parallel to fuel use vs weight in aircraft
3. Wings and Feathers: Flight feathers used to reduce noise in turbine blades
4. V Formation: The tip of the V uses most energy, the back uses least. Military jets mimic this formation to reduce fuel use.
5. Swarming: The group protects the center from harm. Idea to make autonomous flying fertilizers.
6. Sight and Sound ID: Use app on iPad/phone to identify birds by sight and sound © Cornell Lab of Ornithology

II. Soaring Seabirds Module

1. Waterproofing: Feathers and Fabric: Bird preening and waterproof fabric
2. Diving Falcon: Peregrine Falcon adaptations and diving aircraft
3. Filtering Fish: Pelican's ability to filter rocks from fish and filtering tools
4. Searching for Prey: Water bird beaks and long necks to search in water and use in construction vehicles
5. Warmth: Your Turn: How water birds stay warm and biomimicry applications.

III. Flight Control Module

1. Hovering: Hummingbirds and moths hover while feeding used in helicopter vertical takeoff/landing
2. Drag Relay Races: The Kingfisher improved the bullet train and concord plane
3. Sensors and Coding: Insects used as models for tiny search and rescue robots
4. Gyroscope/Balance: Flies have tiny hindwings. Used as gyroscopes like balance controls on planes
5. Aerodynamics and Lift: Create an aerodynamic bird that will fly through the target

IV. Avian Art Module

1. Owl Drawing: Learn to draw a perched owl and owl in flight; includes biomimicry coloring page
2. Preservation Education: Adaptations to different habitats like planes must prepare for different weather conditions. Specimens provided courtesy of © Cornell Lab of Ornithology Museum of Vertebrates
3. Owl Pellet Dissection and Collage: Bird bones can be found inside owl pellets. Learn how hollow structure are used in plane wing design
4. Dissection: Pigeon and Plane. Cut open a pigeon to see its flight muscles and wings and watch a video to see inside an airplane
5. Bird and Airplane Origami: Learn to fold a paper duck and paper airplane

V. Catching Air Module

1. Flying Mammals Inspire Sails: When spread out, bat wings are good models for sails on boats.
2. Flying Mammals and Flight Suits: Flying squirrels glide just like a person in a flight suit!
3. Flying Fish Scales Reduce Drag: Fish scales on planes? Think of a biomimicry idea using flying fish as a model.
4. The Lotus Effect: Nanotechnology waterproofing products all began with a plant called the lotus leaf
5. Maple Seed Helicopters: Maple seeds spinning in the air inspired tiny robots, helicopter propellers and turbines
6. Bird Silhouette: Can you match the name of the bird with its shadow? © Cornell Lab of Ornithology.