**Student Worksheet: Making Use of Nature’s Designs**

**Feather-Inspired Design**

Read the *Science News* article “[Feather-inspired airplane flaps could boost flight performance](https://www.sciencenews.org/article/feather-inspired-airplane-flaps)” and answer the questions on the associated student worksheet.

1. Why were engineers interested in incorporating covert feathers into their designs?

2. What was the difference between aircraft wings with and without the covert feather design?

3. Incorporating the structure of covert feathers into an engineered design is an example of bioinspired design. Define bioinspired design.

4. Some engineering solutions utilize living organisms in their final products. For example, scientists and engineers are currently working with a bacterium that can break down and digest plastic. They hope that this bacterium will be a solution to plastic pollution. Is this an example of bioinspired design? Why or why not?

5. Scientists are constantly discovering new species and learning new things about organisms. How can this influence the engineering design process?

6. Why should engineers look to nature’s designs? What natural processes might indicate that nature’s designs are, in general, highly effective? Explain your answer.

**Design Types: Part 1**

Form groups of three or four students and look at the engineered designs below. Research each design, identify whether it utilizes traditional design, biotechnology design, or bioinspired design, and explain your reasoning. These designs can be split into three different categories.

Slime Molds: Some engineers use slime molds to find the most efficient route for public transportation and build transportation systems based on the slime mold’s movement.

Omnidirectional Wheels: Engineers designed a movement system for robots and other machines that utilizes omnidirectional wheels. These wheels allow machines to move in any direction from any position.

Biofuel: Living organisms produce biomass, which can be burned or otherwise used to produce fuel.

Velcro: George de Mestral noticed that burrs caught on his clothes and his dog’s fur. From this observation, he designed a hook and loop system that worked as a fastener.

Sharkskin Swimsuit: Scientists observed that the dermal denticles on sharks’ skin enabled them to move faster. They then produced swimsuits covered in similar structures. These swimsuits have since been banned in the Olympics.

Helicopter Propeller: Helicopter propellers are based on the Archimedes screw. The Archimedes screw was designed to help move liquids.

**Design Types: Part 2**

Using what you learned from Design Types: Part 1, use the resources available to you to identify and describe an additional bioinspired design.

**Bioinspired Design**

With your group, create your own bioinspired designs.

Step 1: Identify a design characteristic to focus on. Design characteristics include agility, camouflage, speed, resilience, strength, defense, self-healing, streamlining, or elasticity.

Step 2: Identify and research an organism that you believe provides your design characteristic. Use the following search terms for guidance:

Organisms/Animals/Plants that are [design characteristic]

Nature’s best examples of [design characteristic]

[Species name] and [design characteristic]

Adaptations for [design characteristic]

Step 3: Use what you learned about your identified organism to adapt a design or create an original bioinspired design that utilizes your characteristic. Your design can range from simple designs, like straws, to complex designs, like boat propellers.

Step 4: Draw your design

Step 5: Prepare to present your design. During your presentation, you must describe your design focus, describe how the design characteristic is exemplified in your target organism, identify your product, and explain how the characteristic is used within your product. You must also explain the advantages of implementing your product.