



NOTE TO EDUCATOR/PARENT

The design challenges are meant to fit into your curriculum as a project for students to complete related to their study of biomechanics. Each design challenge connects to The Field Museum traveling exhibition *The Machine Inside: Biomechanics*. The exhibition can be a great resource to help inspire your students, and the challenges can act as a post-visit activity. However, you can also easily use these challenges on their own by having students investigate ideas online.

Top tips for teaching through design include:

- Holding multiple feedback sessions for your students to present their ideas to you and their peers for refinement,
- Encouraging students to take on the perspective of a particular stakeholder to help focus their ideas,
- Having students take a devil's advocate position to their own ideas in order to improve their design.

We also encourage educators to check out <http://www.designlearning.us/> for more information on teaching through design.

When your students have completed their designs, we encourage them to submit a photo or a video to us with a written explanation of their design, which problem it solves, and how nature was an inspiration. They can submit their projects here:

<http://fieldmuseum.fluidsurveys.com/surveys/fieldmuseum/biomechanics-education-design-challenge/>

If they submit we may choose their design to be featured on our Biomechanics tumblr site. Check out what others have done or see if your student's design has been published here:

<http://biomimicrytfm.tumblr.com>

NGSS Alignment

- MS-ETS1-1 Define criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment.
- MS-ETS1-4 Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.
- HSETS1-1 Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.
- HS-ETS1-2 Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.



BE A BIOMECHANIC!

Forces

THE TASK

Humans can live under a diverse set of circumstances, largely because we are able to create tools and technology that help us do so. Throughout the rest of nature, animals and plants have adapted to have a particular set of unique traits that take advantage of physics and allows survival in the most extreme environments. Scientists often get inspiration for new technologies by observing and copying animals in a field called *biomimicry*. Now it's your turn! Use what you can find in nature to design something that can help humans continue to thrive and leave a better tomorrow for future generations.

THE PROCEDURE

Use video resources provided to inspire you and start brainstorming ideas. Sketch out a design or build a prototype or model of what you propose. Gather feedback from teachers, peers, parents, siblings, or anyone else who will listen to help refine your ideas.

THE CHALLENGE

When objects collide with one another and one breaks, there is force generated that transfers enough energy to break that object. Animals and plants have evolved to withstand incredible forces from the environment, including predators to the wind. Design something for humans to use that can reduce the force felt and/or energy absorbed by objects. This can be a vehicle that protects humans during car crashes or a new helmet for kids to wear while riding their bike.

OTHER TOOLKIT RESOURCES: LEVERS ACTIVITY, DOME STRENGTH ACTIVITY

NGSS ALIGNMENT:

- MS-PS2-1 Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.

SPECIAL THANKS:

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