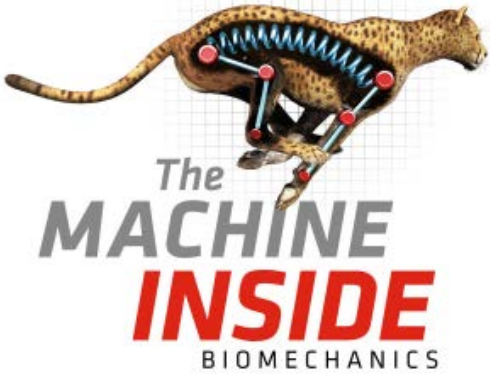

NOTE TO EDUCATOR/PARENT

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 date 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!
Thermoregulation

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 suggested 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

There is an array of animals that have evolved to have amazing ways to regulate their temperature in extreme environments such as the cold arctic and warm deserts. They do this without any reliance on air conditioners or central heating...that is without needing to generate massive amounts of energy to maintain a comfortable temperature. We humans can certainly learn something from these animals. Design a dwelling that can keep itself warm in the winter or stay cool in the summer in an eco-friendly way.

OTHER TOOLKIT RESOURCES: BERGMANN'S RULE ACTIVITY

NGSS ALIGNMENT:

- MS-PS1-6 Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy.
- MS-PS3-3 Apply scientific principles to design construct, and test a device that either minimizes or maximizes thermal energy transfer.

SPECIAL THANKS:

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