BIOMIMICRY
YOUTH DESIGN CHALLENGE

COMMUNICATE

MOTIVATE  INVESTIGATE  MATCH  INNOVATE  COMMUNICATE

COMMUNICATE

BIOMIMICRY INSTITUTE
Dear Educators,

The Biomimicry Youth Design Challenge (YDC) is an authentic STEM learning experience that empowers learners to pursue project-based-learning skills needed to solve real-world problems. Working with an adult coach, learners explore biomimicry and apply their new understanding to create biomimicry solutions to global and local sustainability problems. For additional details, visit the Youth Challenge Home Page.

Designing a nature inspired solution to a sustainability problem requires students to connect:
• Biomimicry  • Sustainability Problem  • Designed Solutions

The YDC guides learners through the creation of a biomimetic design using the MIMIC Instructional Approach. Each 5E instructional segment is one in the five phased MIMIC series.

**M MOTIVATE** Get inspired! Motivate your team by exploring biomimicry. Discover how the unique abilities of organisms help them to survive and thrive, and how people have been inspired by them to design solutions to challenging problems.

**INVESTIGATE** Investigate the causes and effects of a sustainability problem you would like to solve. Identify the impact your solution will need to have to address the problem effectively.

**M MATCH** Explore how nature has solved problems similar to yours by matching what you need your design to do with organisms that have similar abilities. Examine the features of these organisms and why they have those abilities, and determine which organisms could inspire your solution.

**INNOVATE** Create a biomimicry innovation that would help solve your selected problem. Refine your innovation after evaluating its strengths and weaknesses.

**C COMMUNICATE** Use evidence to explain how your biomimicry design solves the selected problem and how nature has inspired it.

Youth Education at the Biomimicry Institute
YOUTH DESIGN CHALLENGE STORYLINE

The Earth is facing a number of large, shared ecologic and economic problems. The UN has established 17 sustainability goals that will help the people of the planet move towards a better future. As we look for solutions to the problems we face, people can leverage the strength of nature's designs. When we study and use nature as inspiration in our solutions, we are doing biomimicry. Using biomimicry to address human problems is not a new idea. Indigenous cultures and current businesses have used biomimicry to find creative ways to solve the problems they have been faced with. These problems might be world-scale issues or local issues. Some biological structures or behaviors can be more helpful than others when solving specific problems. To derive the best solution to a problem, the structures of many natural systems should be investigated and the most useful ones should be incorporated into the design of the solution. Solutions have strengths and weaknesses. It is important to test the solutions, and iterate them in order to increase the likelihood of their success. By implementing successful local solutions, we can contribute to the UN sustainability goals for the planet.

- **Anchor Phenomenon:** Nature solves its problems with well-adapted designs, life friendly chemistry and smart material and energy use.
- **Driving Question:** How can learning from nature help us solve local and global sustainability problems?

Science Standards

Forty-four states (representing 71% of U.S. students) have education standards influenced by the Framework for K-12 Science Education and/or the Next Generation Science Standards.

Foundational biomimicry, climate change, and design challenge alignments are shown in the table below. Alignment strength will depend on lesson choice, depth of instruction, and problem choice. Additional specific physical, earth, and life science standards can be selected by choosing a particular Sustainable Development Goal as the focus for the design challenge.
The foundational biomimicry, climate change, and design challenge alignments are shown in the table below. Alignment strength will depend on lesson choice, depth of instruction, and problem choice. Additional specific physical, earth, and life science standards can be selected by choosing a particular Sustainable Development Goal as the focus for the design challenge.

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<td>MS, HS - ESS3.D: Global Climate Change</td>
<td>• Asking Questions and Defining Problems Analyzing and Interpreting Data</td>
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<td>MS, HS - ESS3.C: Human Impacts on Earth Systems</td>
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**ADDITIONAL PHYSICAL, EARTH, AND LIFE SCIENCE STANDARDS**

Choose a Sustainable Development Goal that matches your class or program content as the focus for the design challenge. Refer to the document, UN Sustainable Development Goals Aligned to NGSS, for suggested alignments.
The Communicate section of The Biomimicry Institute’s Youth Design Challenge (YDC) begins with student reflection and sharing what they have learned about biomimetic designs, processing how it can be effectively communicated to others. In this section, learners present their designs with clear language around the problem that was solved, the inspiration for their design solution, and what their design accomplishes. Students will gather the information from their biomimetic design project and create a Project Portfolio. After a classroom review, three top design projects can be submitted to the YDC.

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<th>Goal</th>
<th>Question Aligned to the Storyline</th>
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<td>Explain how your design solves the selected problem, how it was inspired by nature, and how you created a design in real life.</td>
<td>What did you learn about biomimicry and how can you communicate the process of designing with nature in mind?</td>
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**ENGAGE**

Engage Questions:

- How did this process help you in understanding more about nature? Did your design help solve the identified problem?

*Note for the educator/coach: A limit of 3 projects per coach / educator is accepted for YDC submission. Please use the steps below to select the strongest 3 projects to submit to YDC.

**PROCEDURE**

1. Tell students that communicating scientific and engineering discoveries is essential to stakeholders understanding the importance of the project. Have students revisit the Design Brief prior to submitting their projects to YDC. Students should be told that the strongest projects are those that are most aligned to the Design Brief and the Biomimicry Project Rubric.

2. Ask students to reflect on how their perspective changed from the beginning to now.

**EXPLORE**

Explore Questions:

- Which biomimicry projects are most aligned to the overall goals?

*Note for the educator/coach: The YDC submission portal is accessed here. Complete all of these steps for all student projects, the last phase will help you determine which of the projects to submit. The submission form has 5 sections: Project Overview, Video Pitch, Project Portfolio, Project Image and Team Photo.

Supply each student with the Project Portfolio Checklist so they can keep track of their communication process.

**PROCEDURE:**

1. Project Overview: Save these responses for the YDC Submission Portal and/ or for grading
   
   Have students write an answer to each of the three questions. The answers will be the first thing judges will read about the project, so make sure they are complete and well-written.
This response is limited to 100 words.

What is the problem your team solved for this challenge?
- What is the problem addressed?
- How is the problem connected to the selected SDG?

This response is limited to 100 words.

How was your solution inspired by nature?
- What (at least two) organisms did you learn from?
- How effectively did you combine the biological strategies for the final design?

This response is limited to 100 words.

What does your design solution do?
- How does it solve or mitigate the problem you selected?
- How did what you learn inform your design?

2. Two-Minute Video Pitch:
   This connection to Visual and Performing Arts, may take place during art/drama/after school programming, asynchronously, etc.

   A video pitch is the second requirement for submission to YDC. The video pitch is an engaging overview of the design project and convinces viewers that the idea has merit. For additional suggestions and resources here is this Video Pitch Tips. Be sure to include the following in the Two-Minute Video Pitch:
   a. How the empathy interview or research was carried out with the results about what was learned.
   b. Clearly explain the project that will be seen and how it relates to the selected SDG.
   c. How it is inspired by nature.
   d. Communicate key discoveries or insights from the design process.

3. Project Portfolio:
   These must be a pdf for submission to YDC

   A Project Portfolio is a document or presentation that combines narrative and images to tell the story of your team’s biomimicry design and process for developing it. The portfolio should illustrate how your team approached selecting a specific problem, how you researched biological models, and how you developed the bio-inspired design solution, including testing ideas and getting feedback from others.

   - **Slide 1: Title Page** - Project Name, Coach Name, Team Members, School or Organization, Grade Level, and Project Photo (optional)
   - **Slide 2: Meet the Team** - Team Photo (with coach if possible), Names, Ages and General Info
   - **Slide 3: Project Abstract** - Problem that SDG Addressed, Biological Models used as Mentors, Criteria and Constraints listed (summary of the project in 75 words or less)
   - **Slide 4: Innovate** - Problem is defined with a proposed solution that defines who needs the design, what is needed in the design, and why the design is needed.
   - **Slide 5: Inspiration/Match** - The biological models that were used for the design, including the abstracted design principle (ADP).
   - **Slide 6 & 7: Iterations/Process** - The process of developing the designs along the way. Show all of the “design failures” that have occurred. Annotate the models to show the strengths and limitations of the designs.
- **Slide 8: Final Project Image** - image with labels of design features, include how the 3 essential elements of biomimicry were used in the design.

- **Slide 9 & 10: References and Works Cited** - for all sources, image credits, and experts consulted. Include any AskNature website pages used. *(If image credits are provided within captions, there is no need to provide additional citations in the references list.)*

### 4. Project Image:

*Top and side view of the project*

The project image is a drawing, diagram, or photograph that clearly portrays your team’s design solution. *JPG file format. No smaller than 1500px by 1000px.*

Include an image caption *(entered separately in the submission form).*

### 5. Team Photo:

This may be the same photo from the Project Portfolio *(entered separately in the submission form).* *JPG file format No smaller than 750px by 500px.*

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**EXPLAIN (Vocabulary)**

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<td>Rubric</td>
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**Explain Question:**

- How do we decide which of our design projects to submit to the Biomimicry Institute’s YDC?

**PROCEDURE:**

Tell students that a lot of great work has taken place and they must now work as a community to get the strongest design project to YDC (the one that is most aligned to the sustainability criteria, Design Brief, and three essential components of Biomimicry).

**Options for Selecting 3 Projects (using the Design Brief and Rubric)**

- These projects may be displayed and / or judged for STEM Fairs, science fairs, Open House, parent conferences, etc.

- Hold a biomimicry design fair in your classroom, requiring students to give their video pitches in person to small groups. Allow students to use the rubrics to judge the top three.

- Hold a biomimicry design fair in your classroom, allow staff and parents to use the rubric to judge the top three. This will require training on biomimicry (to discuss the biomimicry components, above and beyond a science fair), and can be used to spark community discussions and continue the conversation beyond the YDC deadline.

- Have students choose 2 of the projects that will move forward and the educator chooses 1. Suggestion: the YDC Rubric can be used to assess mastery and convert student work into a score/letter grade. You could use this scoring to pick the top three teams (or if students are voting, use the team with the highest score that was not selected by their peers).

- Invite a guest panel of science professionals to judge the projects.
**ELABORATE/EXTEND**

**Elaborate/Extend Question:**
- How can you share what you learned and experienced so others recognize biomimicry as a sustainable design practice?

**PROCEDURE:**
1. Invite the selected teams (and any other teams who would like) to share how their biomimicry journey has impacted their understanding of global issues.
2. Have students think about how they can take their designs further. Are there other organisms that students might have missed that could have helped in their design?
3. Submit the three selected projects to the YDC.

**EVALUATE**
- Give students a high five that they shared their project and that they are taking steps in learning about how biomimicry is helping to solve global issues!