# Next Generation Science Standards Alignment for the Biomimicry Youth Design Challenge | High School

The foundational biomimicry, climate change, and the 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 targeted by choosing a particular type of problem for the design challenge.

## Biomimicry

| NGSS Disciplinary Core Idea | Science & Engineering Practices | Crosscutting Concepts |
|---|---|---|
| **HS-LS1.A: Structure and Function**<br>• Systems of specialized cells within organisms help them perform the essential functions of life.<br>• Multicellular organisms have a hierarchical structural organization, in which any one system is made up of numerous parts and is itself a component of the next level.<br><br>**HS-LS4.C: Adaptation**<br>• Natural selection leads to adaptation, that is, to a population dominated by organisms that are anatomically, behaviorally, and physiologically well suited to survive and reproduce in a specific environment. That is, the differential survival and reproduction of organisms in a population that have an advantageous heritable trait leads to an increase in the proportion of individuals in future generations that have the trait and to a decrease in the proportion of individuals that do not. | Developing and Using Models<br><br>Constructing Explanations and Designing Solutions | Structure & Function<br><br>Systems & System Models<br><br>Patterns<br><br>Cause & Effect |

## Solving a problem that affects climate change

The Biomimicry Youth Design Challenge asks students to develop innovations that address climate change. Additional standards can be demonstrated by having students focus on a particular type of climate-related problem (e.g,. water, energy) or create a solution with particular features.

| NGSS Disciplinary Core Idea | Science & Engineering Practices | Crosscutting Concepts |
|---|---|---|
| **HS-ESS3.C: Human Impacts on Earth Systems**<br>• The sustainability of human societies and the biodiversity that supports them requires responsible management of natural resources.<br>• Scientists and engineers can make major contributions by developing technologies that produce less pollution and waste and that preclude ecosystem degradation.<br><br>**HS-ESS3.D: Global Climate Change**<br>• Though the magnitudes of human impacts are greater than they have ever been, so too are human abilities to model, predict, and manage current and future impacts.<br>• Through computer simulations and other studies, important discoveries are still being made about how the ocean, the atmosphere, and the biosphere interact and are modified in response to human activities. | Constructing Explanations and Designing Solutions<br><br>Developing and Using Models<br><br>Analyzing and Interpreting Information | Stability & Change<br><br>Cause & Effect |
| **Additional physical, earth, and life science alignments can be made by selecting a specific NGSS-aligned UN Sustainable Development Goal as the focus of the problem investigation and students solution.** Student design teams would then identify a problem that addresses this SDG and demonstrate their understanding of the relevant concepts and practices when they design a biomimicry solution. Refer to the YDC resource: *UN Sustainable Development Goals Aligned to NGSS.* | | |

## Engineering Design Process

| Disciplinary Core Idea | Performance Expectations | Science & Engineering Practices | Crosscutting Concepts |
|---|---|---|---|
| **HS-ETS1.A: Defining and Delimiting Engineering Problems**<br>• Criteria and constraints also include satisfying any requirements set by society, such as taking issues of risk mitigation into account, and they should be quantified to the extent possible and stated in such a way that one can tell if a given design meets them. (HS-ETS1-1)<br>• Humanity faces major global challenges today, such as the need for supplies of clean water and food or for energy sources that minimize pollution, which can be addressed through engineering. These global challenges also may have manifestations in local communities. (HS-ETS1-1)<br><br>**HS-ETS1.B: Developing Possible Solutions**<br>• When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts. (HS-ETS1-3)<br>• Both physical models and computers can be used in various ways to aid in the engineering design process. Computers are useful for a variety of purposes, such as running simulations to test different ways of solving a problem or to see which one is most efficient or economical; and in making a persuasive presentation to a client about how a given design will meet his or her needs. (HS-ETS1-4)<br><br>**HS-ETS1.C: Optimizing the Design Solution**<br>• Criteria may need to be broken down into simpler ones that can be approached systematically, and decisions about the priority of certain criteria over others (trade-offs) may be needed. (HSETS1-2) | **HS-ETS1-1.** Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.<br><br>**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.<br><br>**HS-ETS1-3.** Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.<br><br>**HS-ETS1-4.** Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem. [*Physical models or diagrams can also be created for the YDC.*] | Asking Questions and Defining Problems<br><br>Developing and Using Models<br><br>Analyzing and Interpreting Data<br><br>Constructing Explanations and Designing Solutions<br><br>Engaging in Argument from Evidence<br><br>Obtaining, Evaluating and Communicating Information | Influence of Engineering, Technology, and Science on Society and the Natural World<br><br>Systems and System Modeling<br><br>Structure & Function |