Beyond the Biocube

Biocubes are a great way to introduce students to the natural world. Students choose an ecosystem and document biodiversity within a quantifiable space at a given time. Documenting the occurrence of species helps students begin to understand the function of biological systems, and also provides important information that can be used by the scientific community. It is possible for investigations to go deeper than the leaf litter, soil, and crevices found within a typical Biocube. Students can study biodiversity on the molecular level by using DNA barcoding techniques.

DNA barcoding is the process of identifying species based on short fragments of DNA. When taxonomic information about a species occurring within a Biocube is difficult to find, DNA barcoding can provide a useful alternative. Just like morphological characters can be used to identify species, the nucleotides that make up DNA can serve as alternative character sets for assistance in identification. DNA characters are a fundamental component of life and are universally found across the variety of forms seen in the natural world. Another benefit is the exposure students receive to current molecular techniques used by scientists around the world. The DNA sequences students generate can even be deposited in databases used to store DNA and can be accessed by scientists for future research.

DNA barcoding does require specific equipment not available in most school classrooms. However, there are options for mail-in kits. Here we provide general background resources introducing the concept of DNA barcoding, links to curriculum and protocols that will walk you through what is needed to implement DNA barcoding with your students, and classroom management software for DNA based projects.

We are working to integrate an explicit barcoding protocol for your biocube project. This includes protocols for groups with and without access to the required lab equipment. If you are interested in this barcoding component, please contact biocube@si.edu.

Curriculum and protocols for DNA barcoding


http://www.urbanbarcodeproject.org: example of DNA barcoding focused high school science fair competition. Includes protocols and example projects.

**DNA barcoding management software and analysis tools**

**BoldSystems - SDP - student data portal**
(http://www.boldsystems.org/index.php/SDP_Home): The BOLD Student Data Portal (BOLD-SDP) is a classroom-focused interface to the BOLD database. This platform provides instructors and students with the tools necessary to make contributions to the DNA barcode library used for identifying species.

**DNAsubway**
(http://dnasubway.iplantcollaborative.org/#): DNA Subway is an appealing and intuitive interface that uses the metaphor of a network of subway lines to guide users through the maze of analysis steps necessary to annotate and compare DNA sequences.

**Articles and information on DNA barcoding**

**DNA barcoding theory**


**Cautionary notes about DNA barcoding**


**DNA barcoding research**

