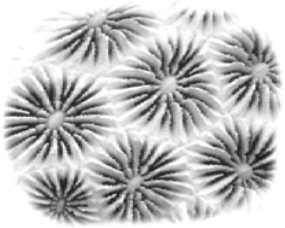
Biodiversity Bioinformatics

An introduction to biodiversity bioinformatics using

NMITA Neogene Marine Biota of Tropical America



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Lesson and materials developed by Ross Nehm, CUNY,
and Ann Budd, University of Iowa, 2004.

National Science Education Standards (National Research Council, 1996)	NMITA
Life Science	
CONTENT STANDARD C	**Life Science**
BIOLOGICAL EVOLUTION	BIOLOGICAL EVOLUTION
Species evolve over time. Evolution is the consequence of the interactions of (1) the potential for a species to increase its numbers, (2) the genetic variability of offspring due to mutation and recombination of genes, (3) a finite supply of the resources required for life, and (4) the ensuing selection by the environment of those offspring better able to survive and leave offspring.	Students gather data that demonstrate patterns of evolutionary change through time.
Natural selection and its evolutionary consequences provide a scientific explanation for the fossil record of ancient life forms, as well as for the striking molecular similarities observed among the diverse species of living organisms.	Students use the fossil record of ancient and living species and note their similarities and differences to develop biological hypotheses.
The millions of different species of plants, animals, and microorganisms that live on earth today are related by descent from common ancestors.	Students trace living species back through geological time.
Biological classifications are based on how organisms are related. Organisms are classified into a hierarchy of groups and subgroups based on similarities which reflect their evolutionary relationships. Species is the most fundamental unit of classification.	Students use taxonomic information that represents the evolutionary relationships of the corals in their samples.
THE INTERDEPENDENCE OF ORGANISMS	THE INTERDEPENDENCE OF ORGANISMS
Organisms both cooperate and compete in ecosystems. The interrelationships and interdependencies of these organisms may generate ecosystems that are stable for hundreds or thousands of years.	Students quantify changes in coral reef ecosystems over millions of years.
Human beings live within the world's ecosystems. Increasingly, humans modify ecosystems as a result of population growth, technology, and consumption. Human destruction of habitats through direct harvesting, pollution, atmospheric changes, and other factors is threatening current global stability, and if not addressed, ecosystems will be irreversibly affected.	Students compare species richness patterns in modern coral reef ecosystems to species richness patterns in ancient ecosystems in order to establish a baseline for assessing human impact.
Earth and Space Science	**Earth and Space Science**
CONTENT STANDARD D	
THE ORIGIN AND EVOLUTION OF THE EARTH SYSTEM	THE ORIGIN AND EVOLUTION OF THE EARTH SYSTEM
Geologic time can be estimated by observing rock sequences and using fossils to correlate the sequences at various locations. Current methods include using the known decay rates of radioactive isotopes present in rocks to measure the time since the rock was formed.	Students observe and use fossils from sedimentary rock layers of differing ages to establish evolutionary patterns.
Interactions among the solid earth, the oceans, the atmosphere, and organisms have resulted in the ongoing evolution of the earth system. We can observe some changes such as earthquakes and volcanic eruptions on a human time scale, but many processes such as mountain building and plate movements take place over hundreds of millions of years.	Students document patterns that take millions of years to occur.
Science and Technology	**Science and Technology**
CONTENT STANDARD E	
UNDERSTANDINGS ABOUT SCIENCE AND TECHNOLOGY	UNDERSTANDINGS ABOUT SCIENCE AND TECHNOLOGY
Science often advances with the introduction of new technologies. Solving technological problems often results in new scientific knowledge. New technologies often extend the current levels of scientific understanding and introduce new areas of research.	Students use new technologies to answer questions that could not be addressed previously without computer technology.
Technological knowledge is often not made public because of patents and the financial potential of the idea or invention. Scientific knowledge is made public through presentations at professional meetings and publications in scientific journals.	Students become aware that the scientific data in NMITA is for public access.
Science in Personal and Social Perspectives	**Science in Personal and Social Perspectives**
CONTENT STANDARD F	
SCIENCE AND TECHNOLOGY IN LOCAL, NATIONAL, AND GLOBAL CHALLENGES	SCIENCE AND TECHNOLOGY IN LOCAL, NATIONAL, AND GLOBAL CHALLENGES
Understanding basic concepts and principles of science and technology should precede active debate about the economics, policies, politics, and ethics of various science- and technology-related challenges. However, understanding science alone will not resolve local, national, or global challenges.	Students become aware that answering questions about human-induced changes in biodiversity require scientific knowledge of natural variation in ecosystems.

NMiTA Neogene Marine Biota of Tropical America

NYS Learning Standards employed in this lesson

New York State standards (Standard 1, Scientific Inquiry)
Key Idea: The central purpose of scientific inquiry is to develop explanations of natural phenomena in a continuing, creative process.
Performance indicator: Learn to ask "why" questions to seek greater understanding concerning objects and events they have observed and heard about
New York State standards (Standard 2, Information systems)
Key Idea: Information technology is used to retrieve, process, and communicate information and as a tool to enhance learning.
Performance indicator: Use a variety of equipment and software packages to enter, process, display and communicate information in different forms using text, pictures, and sound.
Performance indicator: Access needed information from media, electronic data bases and community resources.
New York State standards (Standard 4, Living Environment)
Key Idea 1: Living things are both similar to and different from each other and nonliving things.
Performance indicator: Explain how diversity of populations within ecosystems relates to the stability of ecosystems.
Key idea 3: Individual organisms and species change over time.
Performance indicator: Explain the mechanisms and patterns of evolution.
Key Idea 6: Plants and animals depend on each other and their physical environment. *Performance indicator*: Explain the importance of preserving diversity of species and habitats.
Performance indicator: Explain how the living and nonliving environments change over time and respond to disturbances.
Key idea 7: Human decisions and activities have had a profound impact on the physical and living environment.
Performance indicator: Describe the effects of environmental changes on humans and other populations.
Performance indicator: Explain the impact of technological development and growth in the human population on the living and nonliving environment
New York State standards (Standard 5, Computer technology)
Key Idea: Key Idea: Computers, as tools for design, modeling, information processing, communication, and system control, have greatly increased human productivity and knowledge.