

Resources
COSEE-West Workshop
3/26/2011

<http://www.darkenergybiosphere.org/>

The Center for Dark Energy Biosphere Investigations (C-DEBI) is a brand new National Science Foundation funded center that is committed to explore life beneath the seafloor in both sediment and oceanic crust. We are asking questions about which microbes are there, what they are doing, how they are doing it. We also want to know where they came from and how they travel, are they related to other microbes, and what are their limits? Our scientists travel aboard the JOIDES Resolution to core into the sediment and basement of the ocean as well as leave behind instruments that measure and become host to microbial communities.

Resources Posted:

1. Animation of drilling and installing a CORK
<http://www.youtube.com/watch?v=stqhtI-N7eg>
2. Two short films of CORKs and deployment
<http://www.darkenergybiosphere.org/resources/toolbox.html>
3. Design specifications of the FLOCS
<http://www.darkenergybiosphere.org/resources/toolbox.html>

The wide world of Microbes! (Resources about Microbes in general)

1. Two websites developed by the Comm Tech Lab & the Center for Microbial Ecology at Michigan State University
 - a. Digital Learning Center for Microbial Ecology " The goal of the DLC-ME project is to use computers and network technologies to help students and teachers learn about microbial ecology, and to help make educational resources concerning microbes readily available."
<http://commtechlab.msu.edu/sites/dlc-me/>
 - b. This website includes the following sections: Microbe of the Month, The Curious Microbe, Microbes in the News, Microbial Ecology Resources, Meet the Scientists The Microbe Zoo A look at the diversity of known microbes. This website includes: Dirtland, Animal Pavilion, Snack Bar, Space Adventure, Water World
<http://microbezoo.commtechlab.msu.edu/zoo/>
2. Infection Detection Protection, American Museum of Natural History This information is designed to "help students, families and teachers understand what causes infectious disease and what they can do to help prevent it", so this is focused on a subset of microbes that can negatively affect human health. This website includes the following sections: Meet The Microbes, Bacteria in the Cafeteria, Infection!, How Lou got the Flu, The Amazing Microbe Hunters, The Mixed-up Microbe Mystery, The Prevention Connection
<http://www.amnh.org/nationalcenter/infection/infectionindex.html>

3. Keep up on microbe news on ScienceDaily
http://www.sciencedaily.com/news/plants_animals/microbes_and_more/
4. JUST FOR FUN: GIANT Microbes (toys) <http://www.giantmicrobes.com/>

More resources for you to learn about microbes, the ocean, and scientific discovery!
<http://www.usc.edu/org/cosee-west/resources.html>

COSEE-West has posted resources for this workshop on their web site. There are also an abundance of other teaching tools and PD opportunities there. Bookmark this page!

<http://cmore.soest.hawaii.edu/education.htm>

A National Science Foundation site like C-DEBI, the Center for Microbial Oceanography: Research and Education (C-MORE) looks at microbial life in the water focuses on linking genetic similarity to similar environments. They have some wonderful resources on line such as:

1. Flip book “What microbe am I?” Elementary and High School
<http://cmore.soest.hawaii.edu/education/teachers/index.htm>
2. Grants for K-12 public school teachers to foster awareness in microbial science
<http://cmore.soest.hawaii.edu/education/teachers/index.htm>
3. Kids activities <http://cmore.soest.hawaii.edu/education/kidskorner/index.htm>

<http://www.oceanleadership.org/education/deep-earth-academy/educators/classroom-activities/>

Deep Earth Academy develops curriculum and other materials in conjunction with scientists on drilling expeditions via the JOIDES Resolution. They have a wealth of opportunities, including for teachers to go to sea on the ship. Here are a few examples of lessons that relate to today’s topics:

1. What is a core? <http://www.oceanleadership.org/education/deep-earth-academy/educators/classroom-activities/grades-9-12/what-is-a-core/>
2. A “Bit” of engineering <http://www.oceanleadership.org/education/deep-earth-academy/educators/classroom-activities/grades-5-8/a-bit-of-engineering/>
3. Impact craters and the K/T Boundary
<http://www.oceanleadership.org/education/deep-earth-academy/educators/classroom-activities/grades-9-12/impact-craters-and-the-kt-boundary/>
4. HardCORE writing—Leg 171 pencil
<http://www.oceanleadership.org/education/deep-earth-academy/educators/classroom-activities/grades-5-8/hardcore-writing-leg-171-pencil/>
5. It’s not just the core that tells the story
<http://www.oceanleadership.org/education/deep-earth->

- [academy/educators/classroom-activities/grades-9-12/its-not-just-the-core-that-tells-the-story/](http://www.oceanleadership.org/education/deep-earth-academy/educators/classroom-activities/grades-9-12/its-not-just-the-core-that-tells-the-story/)
6. Ocean Science Careers <http://www.oceanleadership.org/education/deep-earth-academy/educators/classroom-activities/grades-5-8/exploring-ocean-science-careers-2/>
 7. A World of Physics <http://www.oceanleadership.org/education/deep-earth-academy/educators/classroom-activities/grades-9-12/a-world-of-physics-extracting-physics-from-the-earth-and-sea/>
 8. How to Access Scientific Ocean Drilling Data & Publications (on <http://www.oceanleadership.org/education/deep-earth-academy/> but scroll down to highlights section “Looking for ocean drilling data?”)

<http://science.nasa.gov/earth-science/>

NASA is usually thought of in conjunction with space exploration. But they also focus on understanding earth systems and their relationships to one another. If you scroll down the left side of the page, you will see NASA oceanography. Click that link and you will find:

1. For a general list of learning materials and links to them <http://science.nasa.gov/earth-science/oceanography/learning-resources/>
2. Earth Data Visualization Tool (HS); OceanAGE (Career choices); Ocean Motion (HS) <http://science.nasa.gov/earth-science/oceanography/oceans-interactive/>
3. Ocean and Earth Systems—Look at the big picture <http://science.nasa.gov/earth-science/oceanography/ocean-earth-system/>
4. Physical Ocean—surface topography, temperatures, winds, salinity, currents, sea ice <http://science.nasa.gov/earth-science/oceanography/physical-ocean/>
5. Living Ocean—color and microbial loop <http://science.nasa.gov/earth-science/oceanography/living-ocean/>

<http://www-odp.tamu.edu/publications/tnotes/tn31/jr/jr.htm>

This page is part of the Ocean Drilling Programs’ web site and overviews the technical details of the ship. On the right side of the page are pictures of equipment and the drawings of the ship and derrick enclosed in this packet.

<http://joidesresolution.org/>

This main web site to a host of resources:

1. A “Introductory Presentation” that overviews the ship (top paragraphs) <http://joidesresolution.org/node/46>
2. Two levels of vocabulary for the ship and science <http://joidesresolution.org/node/46>

3. What is a core <http://joidesresolution.org/node/266> (Note: On this page is a link to a document The Earth Scientist: Summer 2005. This contains a wealth of activities and background information regarding scientific drilling.
4. Timeline of drilling expeditions
<http://joidesresolution.org/sites/default/files/timeline.jpg>
5. Fun stuff like models, graphic novel, and coloring sheets (scroll down toward end of page) <http://joidesresolution.org/node/46>
6. Posters available for your classroom (scroll down a little further)
<http://joidesresolution.org/node/46>
7. “Adopt a Microbe” project that has been run with several expeditions and is anticipated to run again this year.
http://adoptamicrobe329.blogspot.com/p/adoption-center_18.html
8. There are also blogs where scientists and educators talk about various topics.
<http://joidesresolution.org/blog>

<http://mitworld.mit.edu/video/421>

This is a lecture and Q&A by Dr. Sallie (Penny) Chisholm who explains the role of a family of microbes called phytoplanktons not only in the creation of the oxygen in the atmosphere but in the overall metabolism of the planet. The program runs an hour, but her 15 minute talk has enough information to keep you thinking for days.

For an overview of Sediment/Crust Biosphere Investigations:

1. NSF press release 10-161 **Subseafloor Observatories Installed to Run Dynamic Experiments**
http://www.nsf.gov/news/news_summ.jsp?cntn_id=117649
2. Scroll down the page to **The Magic of Microbes** <http://whyfiles.org/2010/life-in-the-oceans/>
3. Meet the Intraterrestrials. Olivia Judson. New York Times Blog
<http://opinionator.blogs.nytimes.com/2008/06/10/meet-the-intraterrestrials/>
4. **Probing the depths of the biosphere** by Heather Olins
http://scienceblogs.com/webeasties/2010/11/rarely_do_i_read_papers.php?utm_source=sbhomepage&utm_medium=link&utm_content=channellink
5. **World of Virus** from the Sound Print Media Center Inc, featuring Dr. Anand Patel and Dr. Jed Fuhrman
http://soundprint.org/radio/display_show/ID/800/name/The+Bucket

For those of you that want to delve into the science papers, consider these:

1. The colonization of subsurface microbial observatories deployed in young ocean crust. Authors: Beth N. Orcutt, Wolfgang Bach, Keir Becker, Andres T. Fisher, Michael Hentscher, Brandy M. Toner, C Geoffrey Wheat and Katrina J Edwards
<http://www.nature.com/ismej/journal/vaop/ncurrent/full/ismej2010157a.html>
2. Virus and prokaryote enumeration from planktonic aquatic environments by epifluorescence microscopy with SYBR Green 1. Anand Patel, Rachel T. Noble, Joshua A Steele, Michael S Schwalbach, Ian Hewson & Jed A Fuhrman
<http://www.nature.com/nprot/journal/v2/n2/full/nprot.2007.6.html>