



Fact Sheet - Expedition Overview

The Genesis of the Expedition

A scientific expedition of discovery that was inspired by the voyages of Darwin on the H.M.S. Beagle and Captain George Nares on the H.M.S. Challenger during the 19th Century. Following in their footsteps, The Sorcerer II Expedition circumnavigated the globe for more than two years, spanning nearly 32,000 nautical miles, visiting 23 different countries and island groups on four continents.

The scientific goals and ideas sprung from the sequencing and analysis of *Methanococcus jannaschii*, by Dr. J. Craig Venter and his research team after the organism was isolated from a hot, deep sea vent in the Pacific. *M. jannaschii* is from the Archeal branch of life and is also known as an autotroph, in that it makes all it needs for survival from carbon dioxide, nitrogen, and hydrogen in water. This stimulated Dr. Venter's thinking that there was obviously an unknown and unseen world in the oceans that could be vital to better understanding diversity on the planet, as well as potentially solving some of the planet's growing environmental issues, such as climate change.

Objective

The Expedition's goal is to evaluate the microbial diversity in the world's oceans using the tools and techniques developed to sequence the human and other organisms' genomes. With a better understanding of marine microbial biodiversity, scientists will be able to understand how ecosystems function and to discover new genes of ecological and evolutionary importance.

Pilot Study

In February and May 2003 a pilot project was conducted in Bermuda's Sargasso Sea. The study's sequencing and analysis results, published in the journal *Science* in April 2004, revealed unexpectedly high microbial diversity in a region that is relatively nutrient-poor and thus thought to have very low diversity of microbial life. More than 1.2 million new genes and more than 1,800 species were identified using a whole genome shotgun sequencing technique by which scientists clone (copy) random DNA fragments from the many microbes present in the sample.

Methodology for Water Sampling

Scientists take a 200 liter seawater sample approximately every 200 miles as the vessel circumnavigates the globe. In certain coastal areas, additional samples are taken to complement the ongoing studies of regional scientists. The collected water then passes through a series of progressively smaller filters to capture microorganisms of various sizes onto filter paper. The filtered samples are immediately frozen to prevent degradation and are shipped to the J. Craig Venter Institute (JCVI) laboratories in Rockville, MD., where scientists extract the microorganisms' genomic DNA, analyze it and store the information in computer databases. Using precise mathematical algorithms, researchers are able to reassemble by computer the DNA code of genes and large sections of genomes from the diverse microbial communities found in the ocean.

Expedition Route 2003-2005

After its launch in Halifax, Nova Scotia in August 2003, the *Sorcerer II* sailed south into the Gulf of Maine, then along the U.S. east coast sampling in the ecologically important Narragansett, Delaware and Chesapeake Bays. The vessel then passed Cape Hatteras and traveled around Florida into the Gulf of Mexico, through the Panama Canal and to Cocos Island and then onto the Galapagos Islands. The *Sorcerer II* then sampled across the central and south Pacific through French Polynesia, the Cook Islands, Tonga, Fiji, Vanuatu, New Caledonia, and in Australia, where the *Sorcerer* was based for approximately six months. From there, the *Sorcerer II* sampled across the Indian Ocean, toward Madagascar and around South Africa. The final leg of the Expedition included sampling across the South Atlantic. The initial voyage ended with a trip through the Eastern Caribbean and back to the East Coast of the United States.

Expedition 2007

The *Sorcerer II* set sail again in December 2006 leaving Virginia heading through the Chesapeake Bay, and then south along the East Coast of the United States. After a transit through the Panama Canal, the vessel headed north through Central America and on to Mexico. The Expedition will continue into the Sea of Cortez and up the West Coast of the U.S. into Alaska.

Bodies of Water Navigated

During its time at sea The *Sorcerer II* navigated 8 different bodies of water including the Caribbean Sea, Pacific Ocean, Koro Sea, Coral Sea, Gulf of Carpentaria, Arafura Sea, Timor Sea, and the Indian Ocean

Funding

The Gordon and Betty Moore Foundation granted \$4.25 million to the Expedition to sequence the DNA collected along the coast of North America. The Department of Energy Office of Science has awarded approximately \$12 million for sequencing associated with the Expedition, as well as for other projects within the JCVI's environmental genomics, synthetic biology and biological energy groups. The JCVI is funding the majority of expenses associated with the voyage itself.

Access to Data/Public Databases

Genomic DNA sequence data from samples generated from the *Sorcerer II* Expedition are publicly available to researchers worldwide through two sources on the internet-- GenBank, a data repository at the U.S. National Institutes of Health, and a new database for metagenomic data, CAMERA (Community Cyberinfrastructure for Advanced Marine Microbial Ecology Researcher and Analysis). CAMERA, funded by a grant of \$24.5 million over seven years from the Gordon and Betty Moore Foundation, is a state-of-the-art computational resource with software tools to decipher the genetic code of communities of microbial life in the world's oceans. The new resource will help scientists understand how microbes function in their natural ecosystems, enable studies on the effect humans are having on the environment, as well as permit insight into the evolution of life on Earth. This invaluable new resource has been developed by UC San Diego Division of the California Institute for Telecommunications and Information Technology (Calit2) who will lead the project in partnership with JCVI and UCSD's Center for Earth Observations and Applications (CEOA) at Scripps Institution of Oceanography.

No patents or other intellectual property rights will be sought by the Institute on genomic DNA sequence data.

Permits and MOUs

The JCVI/Expedition developed cooperative relationships with leading international researchers located in each sampling region. The collaborators consisted of representatives from 12 separate countries, as well as 36 different institutes, organizations, and universities. Additionally, the JCVI worked with collaborators or their Governments to develop memoranda of understanding (MOU). These MOUs are obtained in addition to research permits and sample export permits issued by the countries where sampling takes place and specify how the genetic resources may be used.

Collaborators

The Sorcerer II Expedition research team, led by Dr. Venter, is a multidisciplinary team of microbiologists, bioinformatics specialist, and DNA sequencing staff at the JCVI. In addition, host country collaborators in each region complement the expertise for sampling. Work was also performed in collaboration with researchers at various academic centers including: four campuses of the University of California--San Diego, Los Angeles, Davis, and Berkeley; University of Southern California, Salk Institute for Biological Studies, Burnham Institute, University of Hawaii, Brown University, Universidad Nacional Autonoma de Mexico, Bedford Institute of Oceanography, Smithsonian Tropical Research Institute, Universidad de Concepcion, Universidad de Costa Rica, and Rutgers University.

Sorcerer II Onboard Team

The Sorcerer II has a permanent professional sailing crew of four. Dr. Venter and at least one other JCVI scientist are onboard for important sampling passages. For the 2007 Expedition, onboard scientists have included: Doug Rusch, Yu Hui Rogers, Aaron Halpern, Jeff McQuaid, and the circumnavigation Expedition scientist, Jeff Hoffman. The Sorcerer II has a new sailing crew led by long-standing Captain Charlie Howard. Others include: Bruce Matheison, Sarah Renko, and Laura Blackwell.