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Bioeconomy BW

“Road trip” to the Lake Constance

American scientists from the J. Craig Venter Institute (JCVI) have recently visited the Institute of Limnology at the University of Constance at Lake Constance. The visit was part of the Sorcerer II Expedition, which is a unique global mission to sample and discover the diversity of microorganisms and their role in global substance flows.

Dr. Jeff Hoffman and Dr. David Schleheck removing microorganism samples from a filtration system.

It is estimated that microorganisms constitute around half of the earth's total biomass and control important global processes in the conversion of carbon compounds such as the greenhouse gas carbon dioxide. Unfortunately, microorganisms are difficult to investigate. Only about one per cent of all microorganism species can be cultivated in the laboratory using traditional microbial

techniques. Following the completion of the sequencing of the human genome, J. Craig Venter and his team now hope to uncover and analyse the remaining 99 per cent of microorganisms.

The American researchers are using the modern tools of molecular genetics, including metagenome sequencing, and have been undertaking test voyages on the world's oceans since 2003. The expedition on their sailboat Sorcerer II has so far taken them across the Atlantic, the Pacific and the Indian Ocean. The 2009 expedition brings the researchers to Europe, including the North and Baltic Seas, and will continue in 2010 in the Mediterranean and the Black Sea.

In order to guarantee the international comparability of the results, the Sorcerer's crew members use standardised methods to withdraw samples from the oceans. Using a filtration system consisting of sequentially fine filters, the researchers collect microorganisms from the water, i.e. bacteria and viruses, and send them to the USA for sequencing. In their pilot study, the JCVI scientists have discovered more than 1.2 million new genes and 1,800 new species using their specific analysis method. The non-commercial genome project is designed to enable the American scientists to work in close cooperation with scientists of the respective bordering nations. As in previous expeditions, the sequence data of the new expedition are deposited in a public environmental gene database.

The expedition has recently undertaken a "road trip" to Lake Constance. For this shore leave, the American research team packed the filtration system on a pick-up truck and travelled from England to Lake Constance in order to sample freshwater microorganisms. The research vessel of the University of Constance, with the American scientists on board, set sail from Friedrichshafen harbour and set about pumping 200 l water onto the ship from different depths of Lake Constance and filtering the water using their standardised filtration system.

The researchers at the Institute of Limnology at the University of Constance have carried out detailed investigations of Lake Constance for many years. From a sampling site at the Überlinger See area of Lake Constance, the researchers are investigating the different water layers of the lake for their physical and chemical parameters and for the composition of the plankton community. They have been doing this at weekly intervals for around 30 years. In addition, the Constance researchers record details of the annual cycle of plankton growth. They have found that bacteria have a key role in recycling the nutrients available for algae growth. But so far the bacteria have not been investigated to a great extent in terms of species composition.

"This kind of census of microorganism populations in Lake Constance water gives us unique opportunities to discover new organisms and deduce their function in the lake based on their genome sequence," explains Dr. David Schleheck from the "Microbial Ecology" work group at the University of Constance. "We were able to convince our colleagues at the J. Craig Venter Institute to include Lake Constance samples in the 2009 sequencing programme by providing them with excellent data on the Lake Constance ecosystem, obtained through the long-term and assiduous work of the Institute of Limnology at the University of Constance and other research institutes around Lake Constance," said David Schleheck. "Maybe, the JCVI team will come to visit us on other occasions so that they can look at the entire yearly cycle."

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Press release

09-Sep-2009
Source: Uni Konstanz (01.09.09)