Universal microarrays for the evaluation of fresh-water quality based on detection of pathogens and their toxins

Results in Brief

New universal microarray for freshwater pathogen testing

A large proportion of Europeans do not have access to safe drinking water. Furthermore, the health of the entire European population is at risk from pathogenic organisms and toxins found in lakes, rivers and reservoirs used to supply drinking water and for recreation.

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Most pathogens are small and occur in low numbers, making them very difficult to measure directly. Moreover, climate change and mass migration from Africa and Asia are expected to alter the ecological balance, likely causing the re-emergence of water-related pathogens. To cope with the changing situation, Europe needs to implement a reliable system for the sensitive, early detection of waterborne pathogens and toxins.

The EU-funded µAQUA (Universal microarrays for the evaluation of fresh-water quality based on detection of pathogens and their toxins) project developed a universal microarray chip to detect microbes, including bacteria, viruses, protozoa

and cyanobacteria. Water quality was assessed using certain diatoms as bioindicators of ecological status.

The designed molecular probes were spotted on microchips that were subjected to several rounds of hybridisation experiments using fluorescently labelled nucleic acids obtained from pure cultures of the target microorganisms. These were either RNA directly extracted from the microorganisms or DNA amplicons obtained after amplification by polymerase chain reaction in the case of DNA.

Valid probers were retained and spotted on the so-called generation-3 microarray. This microarray was used for the analysis of the RNA extracted from environmental samples collected from fresh, brackish, marine and drinking water from different locations in six countries (Bulgaria, France, Germany, Ireland, Italy and Turkey).

Traditional methods for detecting them are time consuming and labour intensive, and require a highly trained work force. µAQUA responded to this challenge by developing a very sensitive, cost-efficient and simple to use universal microchip array for detecting microbes and toxins.

Accurate and efficient water testing will enable a rapid response by water management authorities and producers, thereby improving the quality and safety of European water supplies. In addition, the large body of data obtained will yield important information regarding gene flow and distribution of pathogenic species.

Keywords

Microarray | freshwater | pathogen | drinking water | toxins | bioindicators

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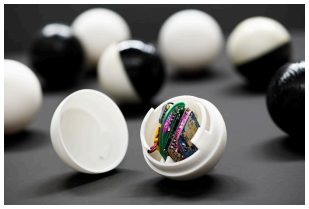

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MAQUA

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