

## Speedy tests target newborn health in India

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A team of Simon Fraser University engineering science researchers, in collaboration with two research institutes in India, The Raman Research Institute, Bangalore, and The Centre for Biotechnology, Anna University, Chennai, India, has created a simple and expedient way to determine the correct type of antibiotics required for curing newborn infants infected by bacterial pathogens in rural India – and potentially save many young lives in the process.

Working together with researchers in India, professor Ash Parameswaran and a trio of graduate students have developed a class of plastic microfluidic chips that can test up to five samples and eight different antibiotics– and determine the right antibiotic quickly – within a few hours - with the aid of a simple LED light source.

The microfluidic chip consists of tiny chambers and in each of the tiny chambers we include the bacteria (via a feces sample) along with a food mixture, containing the antibiotic and a dye material, for the bacteria to consume. The bacteria consume the food in presence of the antibiotic and the digestion byproduct can be seen using the fluorescence technique. If the bacteria are able to live, in spite of the antibiotic, then that sample glows green. If the antibiotic is effective then the bacteria dies and that sample does not glow. This is a simple text book approach called "Antibiogram", which has been implemented on a small and compact microfluidic chip.

Dr. Parameswaran, during his vacation trip to India in 2008, gave a series of talks to local Indian institutions on the developments and capabilities of SFU, Engineering Science's microfabrication research and his group's plastic microfluidics technology. During the question answer period a brain storm ensued and the idea of developing a low-cost antibiotic susceptibility chip was born.



Prof. Parameswaran explaining the microfluidic device to Dr. A. P. J. Abdul Kalam



Dr. Kalam, Prof. Parameswaran's research group and Mr. Ashok Das, Consul General of India

There are about 8 different antibiotics available to address the infantile diarrhea in developing countries. It is a well known fact that the doctors have to administer the correct antibiotic for the type of bacteria that has infected the infant. In a resource limited environment, the doctors either have to take the sample and send it to a centralized testing facility to determine the correct antibiotic, which can take anywhere between 3 days to a week, or make an educated judgment and administer an antibiotic cocktail. Both of these techniques have serious negative consequences, the infant will suffer, and occasionally face fatality. The researchers in India wondered if the microfluidics technology can be put to a rapid testing protocol, addressing the needs of developing countries in terms of manufacturing technology as well as the cost of the system.

Interestingly enough, the plastic microfluidics technology developed by the researchers at the School of Engineering Science, SFU, specifically addressed the ultra low cost production of plastic microfluidic chips, and this found a natural fit for the antibiogram process which India and other developing countries need. This formed an ideal research collaboration between SFU and India. Dr. Parameswaran and his collaborators' research proposal was reviewed by the Shastri Indo-Canadian Institute and they awarded a seed grant to accelerate this collaborative research. Two graduate students from Dr. Parameswaran's group, Ms. Mona Rahbar and Ms. Suman Chhina worked on this project initially and developed the first set of prototypes which were tested in Indian laboratory and a comprehensive feedback was given last summer. With the help of the seed funding given by Shastri Institute, the researchers from India visited SFU and they spent two weeks working with the graduate students and performing tests using non-pathogenic bacterial strains, graciously provided by Dr. Fiona Brinkman and her research laboratory at SFU. The prototype chips were then tested in India using the real bacterial strains and the test results helped formulate the next generation microfluidic chips. The graduate students at SFU have developed the next generation microfluidic chips and they have been sent to India for more detailed testing and possibly move on to field trial. The present chips can perform the antibiotic susceptibility tests within 2 to 3 hours giving the potential ability of the field hospitals in India to determine the correct antibiotic for the infantile diarrhea problem in a timely manner.



Graduate students Ms. Suman Chhina, Ms. Mona Rahbar and Ms. Avneet Bajwa displaying the microfluidic chips developed for this research.

Dr. Parameswaran and his research group recently showcased this research at a meeting with former President of India, Dr. A.P.J. Abdul Kalam, who also happens to be the scientific director of India's Department of Science and Technology. "He was impressed by the promise of this research and the outcome so far", says Parameswaran. "Dr. Kalam couldn't wait for the formal 5 minute presentation by Dr. Parameswaran to see the microfluidic chip samples we have displayed. He walked over so briskly toward the display table and asked so many questions about the technology" remarks Suman, the graduate student who explained the aspects of Technology to Dr. Kalam. Dr. Kalam gave his best wishes to the research group and Dr. Kalam's personal assistants, Dr. V. Ponraj and Mr. R. K. Prasad, have asked Dr. Parameswaran and his research group to keep Dr. Kalam's office posted on the research progress.

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