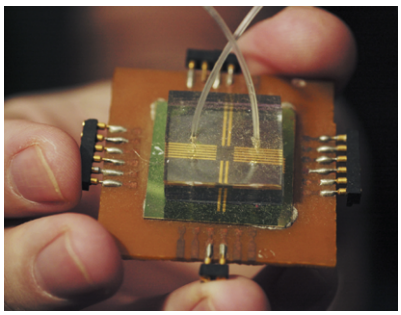
Nanowires show potential as virus detectors

Ultra-thin silicon wires, dubbed nanowires, can electrically detect the presence of specific viruses in near-real time, report scientists from Harvard University (Cambridge, MA, USA). The new detectors "could usher in a new era for diagnostics, biosafety, and response to viral outbreaks", enthuses lead author Charles Lieber.

Lieber and his colleagues coated semiconducting nanowires with silicon oxide and antibody receptors for specific viruses—for example, agglutinin in the influenza A virus. They then exposed the nanowires to various unpurified virus samples. Specific binding of a single virus—such as influenza A—to the receptor on the nanowire produced a conductance change characteristic of that particular virus; unbinding of the virus caused conductance to return to baseline. Simultaneous electrical and optical measurements with a fluorescently labelled virus (a more conventional method) confirmed that the conductance changes seen on the nanowires indeed corresponded to binding and unbinding of the influenza A virus from the nanowire.

Subsequent tests with nanowire arrays containing receptors specific to paramyxovirus and adenovirus showed that the arrays could differentiate among the viruses both because of the receptors used to bind them and because each virus binds to its receptor for a specific length of time before dislodging (*Proc Natl Acad Sci USA* 2004; **101:** 14017–22).

"We're using the same kind of chemistry that people are using in biology for array screening on chips, but the advantage is that you don't need labels to transduce an optical signal", explains Lieber. "Our nanowire device is label-free—a direct electrical measurement. This means you can simply take body fluid or blood serum, put it into the device, and see immediately whether a species of interest is present. You don't have to do any other chemistry, as you do in an immunoassay where you send a sample to a lab to be analysed." The high sensitivity of the nanowire arrays means they can detect viral infection at very early stages, and treatment can therefore be started sooner. Lieber envisions a front-end display to the device that is comparable to that of a glucose monitor, which would be easy for clinicians to read.



Jon Chase/Harvard University

Prototype nanowire detector

Nanowire arrays are unlikely to supplant the "very entrenched" conventional assays used by biologists doing basic research, he concedes. But it could have a powerful effect in the clinic, "where you need something done and don't want to wait". Another advantage to the nanowire device is that it can detect different diagnostic variables simultaneously. "You can tests for additional disease markers with little or no additional cost", says Lieber, "and to me, that's very exciting for the future of medicine".

Marilynn Larkin

Europe set to tackle zoonotic infections

On Sept 2, 2004, more than 300 of Europe's top scientists in 16 institutes and organisations in ten European countries came together to launch "Med-Vet-Net", a new "virtual institute" that will deal with prevention and control of zoonotic diseases. "The virtual institute will, at last, create the critical mass of European scientists needed to attack the problems caused by zoonosis", says Diane Newell, scientific coordinator of the project in the Veterinary Laboratories Agency, Surrey, UK.

Nearly two-thirds of all known human pathogens are zoonotic, and events such as severe acute respiratory syndrome (SARS) have shown that the public-health risks can be serious. New zoonotic diseases are constantly emerging as a result of global travel, changes in livestock production and trade, growing contact between man and exotic animals, and shifts in human eating and food preparation habits. At the same time, people are becoming more susceptible while the organisms themselves are mutating, becoming more virulent, and developing new transmission routes.

Food supply is a global industry, and because many zoonotic agents are food-borne or have reservoirs in livestock, the microbiological safety of food is now recognised as a major public-health concern for the European Union (EU), and one that must be addressed from "farm to fork". The EU has now identified 23 zoonotic agents, which need to be monitored by Member States in both humans and animals.

"Research on zoonotic agents in Europe has been highly fragmented", says Newell. To address this issue, the EU 6th Framework Programme has provided financial support (€14·4 million) for 5 years to develop Med-Vet-Net (Network of Excellence for Integrated Research on the Prevention and Control of Zoonoses).

The new virtual centre will provide the appropriate environment for scientists from a range of specialties to share and enhance their knowledge and skills, develop collaborative projects, and present joint research within and outside the network.

Arie Havelaar, whose National Institute for Public Health and the Environment in Bilthoven, Netherlands, is one of the partners of the network, says that Med-Vet-Net is "a very good possibility to improve multidisciplinary cooperation since it links national institutes with responsibilities in research and control of zoonoses, and aims to provide durable integration".

Xavier Bosch