THE TIMES
Section: null
Edition: 02
Date: 28 March 2008
Page: 36
Circulation: 635653
Source: ABC August 2007
pressdata

Phone scientist solving riddle of how to hang up on cancer

Telecom network maths is helping fight disease. **Mike Wade** reports

Computer science which was developed to iron out the most irritating failed "call on hold" functions of telephone networks is being used to help understand cancer and heart disease.

A team based at the University of Glasgow has already achieved "tangible results" in research that predicted healthy and unhealthy pathways within human cells, and their insights are already being applied in cancer research and by the British Heart Foundation, in the fight against cardiovascular disease.

More intensive studies would lead to a new generation of drug treatments, said Muffy Calder, who has been leading the research. She added: "I wouldn't want to oversell, but this is really exciting."

Professor Calder, who formerly worked with telephone networks, said that the same scientific reasoning that applies to telecommunications network problems may be applied to chemical pathways inside human cells.

"It boils down to the question, does your system do what you think it does? The biologists are asking for models and there are synergies between cells and phones. For computer scientists, this is familiar territory. There are a whole number of things happening concurrently, it is random, there's message-passing. These are things we know about and which we can model," said Professor Calder, who was speaking at the Edinburgh International Science Festival.

Working alongside specialists at the Beatson Institute for Cancer Research, Professor Calder is investigating the biochemical pathways along which signals pass from the membrane of cells into their nucleus. These pathways are constructed of a series of chemical reactions in which different protein molecules are created and destroyed.

In telephone networks, when a single function — such as "call on hold" — crashes, the effectiveness of the entire system breaks down. When similar blockages occur in cells, the results can be the growth of cancers, or in the case of heart disease, the constriction of blood vessels.

For years biologists have been striving for a better understanding of this communication process, so they can predict the way these reactions are affected by drugs. Until now, the pathways have usually been modelled using complex maths to simulate the processes involved, allowing virtual experiments to be done on the computer instead of on real cells.

Professor Calder realised that the diagrams that were being employed by biochemists to illustrate the reactions inside cells were well known to computer scientists as "producer-consumer" networks. Her idea was to transfer the methodology behind phone networks into molecular biology.

It was at this point that her knowledge of the chaos caused by the failure of "call forwarding" and "call on hold" facilities became useful, she said.

"What happens if your call forwarding and call waiting are busy when you get another call? Computer scientists have to find out what's going on. We formalise properties about individual features, check them, and then put all the features together and find out which ones get satisfied.

"In telecommunications we have the idea and came up with the artefact. In biochemistry, it is the same thing, but in reverse: I have the artefact and I'm trying to figure out the idea. Why? Because we want to figure out where we should make an intervention."

The end result, Professor Calder added, would be drug targeting at specific problems.

Professor Calder described herself as "a sort of out-of-work, not very good mathematician". She said: "I like to think about what a computer can do and use mathematics to reason about software. You can apply that kind of reasoning in other spheres, and it gets really exciting when you ask how computing interacts with other sciences."

Curriculum vitae

Born

Quebec, Canada, Mefanwy (Muffy) Calder, is the daughter of a Spanish father and a Norwegian mother

Education

She spent her late teens working in a Dominican convent in Bodø, Norway, the most northerly convent in the world, before pursuing her interest in mathematics and computing. Studied at Stirling and St Andrews universities

Career

Until last August the head of the University of Glasgow's department of computing science

Interests

She may be the only fellow of the Royal Society of Edinburgh to be a keen hill runner

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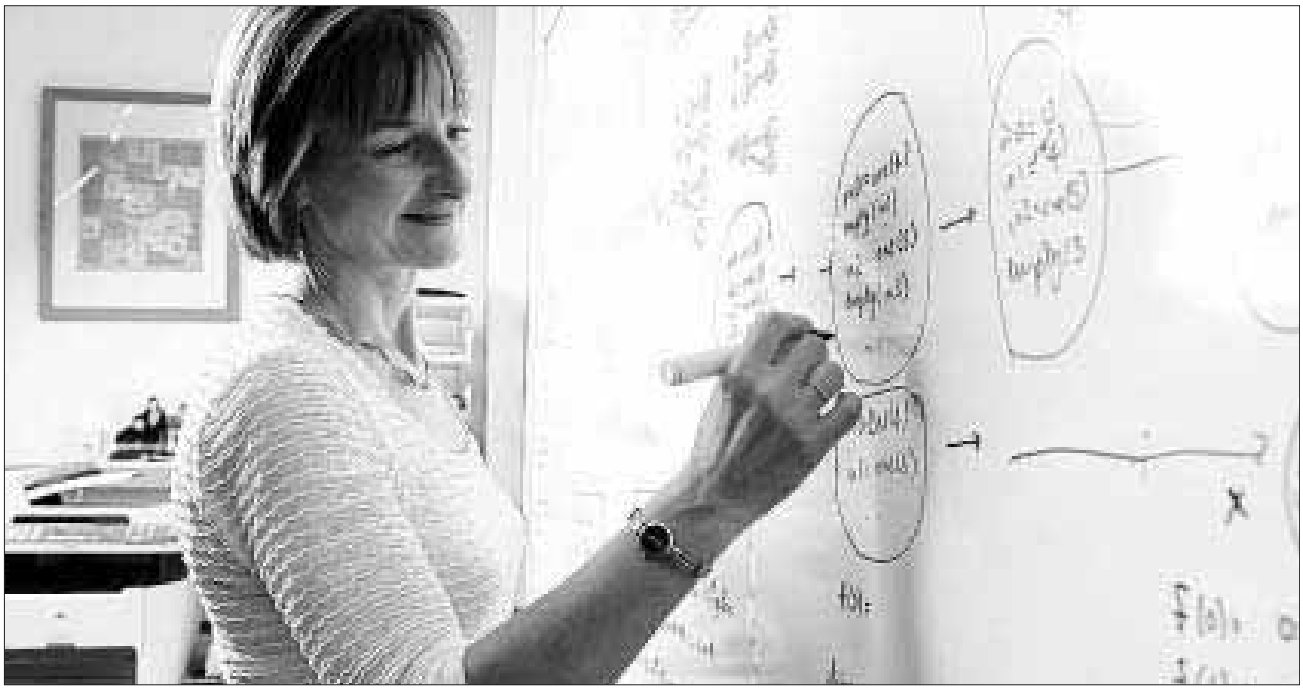

Muffy Calder realised that the mathematical models used by biologists to simulate reactions within cells were similar to those used by computer scientists

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