Scientists announce world's most sensitive cancer test

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A new way of testing cells for cancer can both diagnose and determine the stage of cancer with just 50 tumour cells

Speaking at the Institute of Physics conference Physics 2005 in Warwick today, scientists will reveal a new test for cancer, more sensitive than any existing technique and capable of predicting for the first time whether a tumour has spread.

Unlike existing techniques which rely on expert visual assessment or unreliable biochemical measurements, the "optical stretcher" tests the physical strength of each cell and can give a diagnosis using as few as 50 cells, allowing doctors to test for cancer where traditional biopsies are dangerous or even impossible. The ability to measure the progress of a cancer by examining only the primary tumour should reduce the number of unnecessary and traumatic mastectomies in women with breast cancer.

Professor Josef Кдs and Dr Jochen Guck from the University of Leipzig have been developing the new procedure for several years and today described how the system is being tested, both to screen for oral cancers and in the "staging" of breast cancer tumours.

Professor Кдs' technique for the first time uses a physical characteristic of each cell – its stretchiness or elasticity – instead of its biological make-up, to decide whether or not it's cancerous. Cancer cells tend to de-differentiate, losing the special characteristics of the organ where they

started life. Because of this, they no longer need the rigid cytoskeleton which holds them in shape, making them stretchier than normal cells.

Kдs and Guck's machine uses a powerful beam of infrared laser light to stretch and measure cells one by one. His optical stretcher differs from an existing tool known as optical tweezers in which the light is focused to a sharp point to grab hold of a cell. In contrast, the optical stretcher doesn't use focused light. This allows laser beams strong enough to detect stretching to be used without killing the cell.

"Of all the physical properties of a cell," explains Professor Kдs, "elasticity is the one which varies most dramatically between normal and cancerous cells." This makes stretching the most sensitive method known for identifying cancer. Just 50 tumour cells are needed in a sample for the optical stretcher to diagnose cancer, contrasting with traditional methods which need 10,000 to 100,000 cells. With such small samples, diagnoses can be made even before solid tumours develop, or where a traditional biopsy is problematic.

More importantly, the optical stretcher can yield crucial information on the spread of cancer. The softer the cancer cells, the more likely they are to travel through the body and produce secondary tumours (known as metastases). Traditionally, doctors have had to check nearby lymph nodes for cancer cells. However, the optical stretcher can determine, just by measuring cells from the primary tumour, whether or not the cancer will spread. This is the first time that anyone has been able to diagnose metastasis without locating the secondary tumours.

Secondary tumours can be difficult to find, and women with breast cancer often undergo precautionary mastectomy or whole-body chemotherapy. The optical stretcher will allow many women to avoid the emotional and physical side-effects of such unnecessary treatment.

The optical stretcher can test as many as 3,600 cells per minute, so is already fast enough to be useful in clinical diagnosis of cancer. Professor Kдs believes that this high speed and the equipment's low cost could even herald a shift towards cancer prevention. Dentists, for example, could swab their patients for mouth cancer cells even before a solid tumour develops. Pre-clinical trials are already underway in Germany, and Professor Kдs is keen for an industrial partner to see his prototype machine through to full clinical testing.

Professor Josef Kдs is Director of the Institute for Soft Matter Physics at the University of Leipzig, Germany.

Source: Institute of Physics