Cancer is colour-blind

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We may look different on the outside, but inside we are all the same - so much has been scientifically proven. Research at the University of Bergen has shown that the pathways that lead to cancer are similar, no matter where you come from.

At any rate, there are remarkable genetic similarities among cancer tumours from Norway, Sudan, Sri Lanka, India, the UK and Sweden.

"We had actually expected to find a greater range of variation," says post-doctoral fellow Salah Osman Ibrahim of the University's Department of Biomedicine. He is first author of an article that has been published in the prestigious American journal "Clinical Cancer Research". The article is the product of collaboration among several departments and units at the University of Bergen, Western Norway Regional Health Trust and a number of national and international scientists.

The researchers compared patients in Norway and Sudan with head and neck squamous cell carcinomas (HNSCC). There are wide variations in the global incidence of HNSCC, which is a form of cancer that seems to be more common in developing countries than in our art of the world. The aim of the study, therefore, was to find out whether differences in life-style, diet or ethnic background could explains these variations.

The scientists used cDNA micro-matrix studies to compare patterns of gene expression in cancerous cells and cells from healthy tissue, in order to determine which genes had been switched on or off in the tumours.

"We looked at a total of 15,000 genes in each patient," explains Ibrahim. It turned out that out of these, 136 genes are expressed differently in tumours and normal cells in Sudanese patients and 154 in Norwegian patients. Seventy-three of these genes are common to both groups.

The same pathways lead to cancer

But what may be even more important is that several of these genes are found in particular patterns that are related to cancer. The scientists talk of biological pathways: particular genes that create a particular mechanism or lead to a given alteration in the cells. Just how cells divide is an example of a biological pathway. Alterations in individual pathways of this sort may lead to cancer.

In this study, Ibrahim has found three such common pathways that occur in cancer patients in Sudan and Norway and which appear to exist independently of the patients' background and life-style.

The results also showed that the anatomical location of HNSCC tumours in Norwegian tissue samples and the use of a type of chewing tobacco known as toombak in tissue samples from Sudan play an important role in patterns of gene expression. This was particularly the case when cancers have arisen where tissue has been in contact with chewing tobacco. There are differences from one country to another in where these tumours occur in the mouth, but these variations appear to be related to where users put the tobacco in their mouths.

Lethal chewing tobacco

"Chewing tobacco may not be so common in Norway, but it is more common in countries in which HNSCC occurs frequently," explains Ibrahim. In Sudan, the variant of snuff known as Toombak has become

increasingly popular as an alternative to smoking tobacco. Toombak has a higher concentration of nitrosamines, which are well known for their carcinogenic properties.

HNSCC, which is assumed to be related to the use of toombak, is also a much more common type of cancer in Sudan than in Norway, where it accounts for only one or two percent of all cancers. In Sudan, no less than 17 percent of cancer patients have HNSCC, while in Asian countries such as India it is estimated that more than half of all cancers are HNSCC.

"The use of chewing tobacco is also very common in India," says Ibrahim, who is currently leading a new multinational study, whose preliminary results appear to support the previous findings.

Could save more lives in developing countries

Now, there is hope that the knowledge produced by the project can be used for early diagnosis and as part of the treatment process.

"Our aim is to identify biomarkers that can be used in the field, particularly in regions where access to primary health services is poor," says Ibrahim. If we can easily find out when the genes that are associated with this type of cancer are switched off or on, we can start treatment early and save more lives.

Cancers of this sort are often extremely aggressive. When they have been diagnosed it is often already too late to do anything about them," he explains.

Post-doctoral fellow Salah Osman Ibrahim of the Department of Biomedicine and his colleagues have identified 73 genes that are activated in cancerous tumours in both Sudan and Norway. Now, they

are continuing the hunt in tumours from other parts of the world.

DNA micro-matrices

DNA micro-matrix studies are used to look at alterations in genetic activity under given conditions, for example after treatment with various drugs, in order to generate new knowledge of how such medications operate. One way of using the technique is to culture a particular type of cell and divide the culture into two parts. One sample is subjected to a given treatment while the other acts as a control group. After treatment, RNA is isolated from the two samples.

The treated sample is stained red, while the control sample is stained green and the two samples are mixed and placed in a DNA micro-matrix together with several thousand gene fragments, with each human gene being represented by a point on the matrix. RNA from both samples finds its way back to its own genes. When the matrix is illuminated with light emitted by a laser at a particular wavelength, the genes that have been activated by the treatment appear as points of red and those that were switched off show up as green, while genes that were not affected by the treatment will be yellow.

Source: University of Bergen