Researchers successfully map fountain of youth

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In collaboration with an international research team, University of Copenhagen researchers have for the first time mapped telomerase, an enzyme which has a kind of rejuvenating effect on normal cell ageing. The findings have just been published in *Nature Genetics* and are a step forward in the fight against cancer.

Mapping the cellular fountain of youth – telomerase. This is one of the results of a major research project involving more than 1,000 researchers worldwide, four years of hard work, DKK 55 million from the EU and blood samples from more than 200,000 people. This is the largest collaboration project ever to be conducted within cancer genetics.

Stig E. Bojesen, a researcher at the Faculty of Health and Medicial Sciences, University of Copenhagen, and staff specialist at the Department of Clinical Biochemistry, Copenhagen University Hospital, Herlev, has headed the efforts to map telomerase – an enzyme capable of creating new ends on cellular chromosomes, the so-called telomeres. In other words, a kind of cellular fountain of youth.

"We have discovered that differences in the telomeric gene are associated both with the risk of various cancers and with the length of the telomeres. The surprising finding was that the variants that caused the diseases were not the same as the ones which changed the length of the telomeres. This suggests that telomerase plays a far more complex role than previously assumed" says Stig E. Bojesen.

The mapping of telomerase is an important discovery, because telomerase is one of the very basic enzymes in cell biology. It relengthens the telomeres so that they get the same length as before embarking on cell division.

-The mapping of telomerase may, among other things, boost our knowledge of cancers and their treatment, and with the new findings the genetic correlation between cancer and telomere length has been thoroughly illustrated for the first time, says Stig E. Bojesen.

Telomeres a cellular 'multi-ride ticket'

The human body consists of 50,000,000,000,000 or fifty trillion cells, and each cell has 46 chromosomes which are the structures in the nucleus containing our hereditary material, the DNA. The ends of all chromosomes are protected by so-called telomeres. The telomeres serve to protect the chromosomes in much the same way as the plastic sheath on the end of a shoelace. But each time a cell divides, the telomeres become a little bit shorter and eventually end up being too short to protect the chromosomes.

Popularly speaking, each cell has a multi-ride ticket, and each time the cell divides, the telomeres (the chromosome ends) will use up one ride. Once there are no more rides left, the cell will not divide any more, and will, so to speak, retire. But some special cells in the body can activate telomerase, which again can elongate the telomeres.

Sex cells, or other stem cells which must be able to divide more than normal cells, have this feature. Unfortunately, cancer cells have discovered the trick, and it is known that they also produce telomerase and thus keep themselves artificially young. The telomerase gene therefore plays an important role in cancer biology, and it is precisely by identifying cancer genes that the researchers imagine that you can

improve the identification rate and the treatment.

"A gene is like a country. As you map it, you can see what is going on in the various cities. One of the cities in what could be called Telomerase Land determines whether you develop breast cancer or ovarian cancer, while other parts of the gene determine the length of the telomeres. Mapping telomerase is therefore an important step towards being able to predict the risk of developing different cancers. In summary, our findings are very surprising and point in many directions. But as is the case with all good research, our work provides many answers but leaves even more questions" says Stig E. Bojesen.

The international collaboration

The large-scale COGS research collaboration has so far resulted in 14 articles which will be published simultaneously. Six of the articles will be published in the same issue of *Nature Genetics* and the remaining eight in other journals. All the articles from the many researchers involved in the project focus on the correlation between the environment, genetics and cancer, in particular breast cancer, ovarian cancer and prostate cancer.

Provided by University of Copenhagen