Dankesrede

von

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Es gilt das gesprochene Wort.

Chromosome Ends and Diseases of Aging

The genetic information in the many trillions of cells in our bodies exists is packaged into 46 chromosomes. Every chromosome contains a long linear DNA molecule, with ends that must be protected. Telomeres are the structures that protect and stabilize the ends of chromosomes, ensuring genomic stability both within an organism and for future generations of that organism. Telomeres consist of simple repetitive DNA sequences, which bind cellular protein factors and make a "cap", thus securing each end of every chromosome. Without telomeric DNA and its special mode of replicating, chromosome ends gradually would shorten because their telomeric DNA erodes, eventually causing cells stop dividing altogether. For humans to live a long life, this dwindling down has to be counteracted.

Cells have an enzyme called telomerase that replenishes telomeres, and protects them. Can the understanding of telomeres and telomerase be exploited to combat cancer and improve health? New results suggest this is possible.

In the setting of cancer cells, which are very different from normal cells in many respects, high telomerase activity is common. As most human cancers progress, their telomerase becomes hyperactive and the high telomerase promotes cancer. However, telomerase in humans has another, more benevolent face – telomerase is naturally present in a great many of the normal cells in human adults, although often in only low amounts. Throughout human life a minimal level of telomerase is required for replenishment of tissues, such as the immune system. Telomerase activity partly counteracts the dwindling down of telomeres throughout the human life span. The effectiveness of the maintenance of telomeres by telomerase is certainly influenced by genes, but it can apparently also be altered by non-genetic factors. Indeed, our recent collaborative studies showed that the amount of telomerase activity in certain white blood cells of the body is diminished by chronic psychological stress: in caregivers of a chronically ill family member, the more years the care-giving situation has lasted, and the worse the perceived stress, the lower the amount of telomerase activity in white blood cells (vital components of the immune system), and the shorter their telomeres. Furthermore, low telomerase was associated with six of the known major risk factors – including chronic psychological stress – for cardiovascular disease in people.

The challenge now is to develop the emerging molecular and cellular information about telomeres and telomerase into rational approaches that can be used to improve human health.