Common weed could provide clues on aging and cancer

October 26 2009

A common weed and human cancer cells could provide some very uncommon details about DNA structure and its relationship with telomeres and how they affect cellular aging and cancer, according to a team led by scientists from Texas A&M University and the University of Cincinnati.

For the study, the multi-institutional team examined the telomeres of Arabidopsis, a plant found throughout the world, and discovered a new set of essential telomere proteins. The team then identified the human counterpart, a discovery that could be beneficial in understanding human cancers and cellular aging. Their work is published in the current issue of the journal "Molecular Cell" and was funded by the National Institutes of Health.

Dorothy Shippen, professor of biophysics and biochemistry at Texas A&M, and Carolyn Price, professor of cancer and cell biology at the UC College of Medicine, served as co-corresponding authors of the study.

Telomeres are located at each end of a chromosome and are composed of DNA and protein. Their main function is to protect the ends of the chromosome, but they also play a key role in cell division. Researchers also believe they play a key role in cellular lifespan.

"We found that removal of the plant telomere proteins caused rampant end-to-end joining of chromosomes and dramatic defects in plant development," explains Shippen.

"The Cincinnati team then showed that removal of one of the human proteins from human cancer cells caused wide-spread DNA damage and complete loss of some telomeres."

Price adds, "We know that telomeres act as a protective cap for chromosomes and these caps are needed to stop chromosome fusions. We also know that telomere length determines how many times a cell can divide.

"However, we still don't fully understand how the cap structure prevents chromosome joining or regulates telomere length. This is important because problems in telomere maintenance lead to diseases such as cancer, premature aging syndromes, aplastic anemia and pulmonary fibrosis. The discovery of a new protein complex that is required to maintain the protective telomere cap is very exciting and should open up new research avenues related to human disease."

The Arabidopsis plant is found worldwide and is related to the cabbage, radish and mustard plant family. Because of its genetic makeup, it has been used for decades as a model organism for studies in the cellular and molecular biology of flowering plants.

The multi-institutional research team says these findings open up new doors on several fronts, leading to an "evolutionary bridge" in current work on telomeres.

"At the very least, it will give us a better understanding of the fundamental composition of telomeres and how they function," Shippen notes.

"This could give us a new window in defining the role or roles telomeres play in safeguarding our DNA."

"It could also give us new insight into how damaged telomeres block cell division," Price adds. "These new proteins seem to function in replication of DNA at the chromosome end, so further study may also give clues into how the protective caps work when a cell divides.

"These are all questions that we need to be answered if we are to fully understand the role of telomeres in human health."

Source: Texas A&M University