Scientists discover cellular 'SOS' signal in response to UV skin damage

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New research from the University of North Carolina at Chapel Hill School of Medicine has identified two proteins that may help protect against skin cancer.

The study, which appears in the advance online edition of the journal Molecular and Cellular Biology, indicates that two proteins, named Timeless and Tipin, form a complex that regulates the rate at which DNA is replicated after exposure to ultraviolet radiation.

Ultraviolet radiation in sunlight damages the DNA in skin cells. If left unrepaired by the cell, this damage can turn into mutations that lead to cancer. Before cells divide, they must replicate, or copy, their DNA to form new daughter cells. If damage in the DNA is discovered even after the cell has given a "go-ahead" to replicate its DNA, the Timeless/Tipin complex sends a signal throughout the nucleus of the cell to slow the rate of replication. This slowdown may give the cell additional time to repair its DNA and potentially save itself from becoming cancerous or from dying in response to ultraviolet radiation.

"What we discovered here was that the cell can send out an additional SOS and slow DNA replication even after it has begun," said Dr. William Kaufmann, a professor of pathology and laboratory medicine and a member of the UNC Lineberger Comprehensive Cancer Center and Center for Environmental Health and Susceptibility.

"We've known for 25 years that a cell can stop DNA replication from

even starting when it detects damage in its own DNA – this gives the DNA repair mechanisms in the cell the time to find and repair the damage," he said.

Using an innovative new technique to visualize the replication of DNA strands exposed to ultraviolet radiation, Kaufmann and his co-authors noted a slowdown in DNA replication when Timeless and Tipin were present in the cell. Building blocks for DNA were labeled with fluorescent molecules so that tracks of newly synthesized DNA could be observed under the microscope and their lengths measured.

Though the study specifically examined only the Timless/Tipin response to ultraviolet radiation, Kaufmann speculates that this response may be relevant to other types of DNA damage as well – including those used as treatments for cancer.

"This protective response may make some cells more resistant to certain types of cancer therapies which work by inducing the cancer cell to die. If the cell, even if it is a cancer cell, is given this additional time to recover from treatment, it may be able to survive it, much to the detriment of the patient." Kaufmann said.

Ultraviolet radiation in sunlight causes at least one million cases of skin cancer in the U.S. annually and greater than fifty thousand cases of melanoma.

Source: University of North Carolina School of Medicine