DksA polices the intersection of replication and transcription

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DNA replication, the process by which a strand of DNA is copied during cell proliferation , and DNA transcription, the process by which the message in the DNA is translated into messenger RNA, involve the same "track" or DNA template. What happens when the two mechanisms are on the same track at the same time? Baylor College of Medicine researchers have identified the director -- the transcription factor DksA. A report appears in the current issue of the journal Cell.

Dr. Jue D. (Jade) Wang, assistant professor of molecular and human genetics at Baylor College of Medicine, focuses her attention on replication - the process by which a strand of DNA is copied during cell proliferation (growth and division).

Dr. Christophe Herman, also an assistant professor of molecular and human genetics at BCM, zeroes in on transcription - the process by which the message in the DNA is translated into messenger RNA and ultimately the proteins that are workhorses of the cell.

Scientists in the two fields rarely communicate, but the two processes involve the same "track" or DNA template.

"What happens when two machines are on the same track but going in opposite directions?" said Wang. "These two processes are happening at the same time and use the same template."

The two laboratories combined their skills to answer that question and

came up with a director -- the transcription factor DksA. A transcription factor is a protein that helps regulates expression (or the level) of gene activity, the researchers

A report on their work appears in the current issue of the journal *Cell*.

"We think this factor is one of the reason there are not more traffic jams," said Wang. "It is there to make sure that the traffic flows."

Their experiments show that DksA acts on the process of transcription directly to prevent conflict between transcription and replication.

"The factor began our collaboration," said Herman. "We saw that it was regulating the process of transcription. It also tags along with RNA polymerase (the enzyme that prompts the process of making a strand of RNA from the DNA strand)."

When it sees the DNA polymerase (an enzyme critical to replication) come along, "it removes the RNA polymerase from the track," said Herman. That allows replication to take place and prevents the two "machines" from colliding.

The two did their work in a form of Escherichia coli (E. coli), a bacterium often used as a model organism in the laboratory. When DksA was not present in the bacteria, the cell was unstable, prompting a DNA damage response from halted replication.

"Stress can promote endogenous DNA damage," said Herman. Starvation is one method of such stress, he said. When DksA is present, it prevents disruption of replication and maintains the integrity of the DNA.

Previously, it was thought that the DNA polymerase simply knocked the

RNA polymerase out of the way, said Herman.

"That is not the case. You need to have specific factors to remove the RNA polymerase," he said.

The findings raise as many questions as they answer, said Wang. Does the factor work before or after the enzymes collide?

"We don't know the mechanism yet," she said.

More information: www.cell.com/

Provided by Baylor College of Medicine