

National Research Council Canada

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DNA quick to defuse radiation harm - It took the most precise timing equipment there is to show how a molecule converts dangerous UV energy into harmless heat, Tom Spears reports.

Your genes are faster than you thought. Just how fast, Albert Stolow has only begun to show: Pieces of your DNA can react to harmful radiation in only about 100 billionth of a millionth of a second. And it's possible that all life on Earth -- from seaweed to dinosaurs to people -- can thank DNA for evolving with this ability more than three billion years ago.

Mr. Stolow's team at the National Research Council has found that DNA converts harmful UV radiation -- which can make genes mutate -- into harmless heat energy in the shortest time-frame that humans can measure.

They began with a problem. The ozone layer protects us from the sun's radiation. Yet Earth hasn't always had an ozone layer.

So how, they wondered, did early life survive the constant radiation bath?

The conventional answer is that it began deep in the sea, where water blocked the radiation. Mr. Stolow wasn't convinced. Water deep enough to shield from radiation would also block most of the light that early plant life needed.

He wondered whether DNA could have a defence mechanism of its own.

The Stolow lab at the Steacie Institute for Molecular Sciences is all about speed -- events that happen in femtoseconds, the shortest units of time anyone can measure.

"The number of femtoseconds in a minute is about the same as the number of minutes in the history of the universe," he says.

Now he has shown that pieces of a DNA molecule can react in this brief time. He studies adenine, one of the four chemicals that form DNA when they join in a chain.

UV radiation is a threat because it adds energy to the adenine molecules.

Adding energy makes a molecule more likely to react, either breaking apart or bonding with other molecules, and destroying the original molecule either way.

This would disrupt the whole DNA chain. Our genes would mutate.

But when he shot UV light at adenine in a vacuum, an odd thing happened: Instead of becoming more energetic, the little molecules changed the radiation into heat, a form of energy that can just dissipate into the cell and cause no harm.

"If you didn't do that conversion of light to heat fast enough, then the adenine molecule would have time to do something else nasty ... and that would be a damage in the DNA, and that's bad," he said.

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His paper was published this month in the Proceedings of the National Academy of Sciences, a major science journal.

One outside expert who reviewed his findings concluded that "the debate is probably not over yet," he said. "But that's fine, because scientific research is a debate."

ILLUS: Colour Photo: Ashley Fraser, The Ottawa Citizen / Albert Stolow's work on DNA and radiation came out of a question about the early life on Earth: How did it survive the constant radiation bath it was exposed to before the protective ozone layer developed?

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