Radioactivity muddles the alphabet of DNA

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Curtin University researchers have shown natural radioactivity within DNA can alter chemical compounds, providing a new pathway for genetic mutation.

The research, recently published in *Biochimica et Biophysica Acta-General Subjects*, for the first time looked at natural radioactivity within human DNA on the atomic-scale.

While radioactivity occurs naturally in our bodies as well as in every living organism across the planet, it was never before thought to affect our DNA in such a direct way.

Using high-performance computers, the research team from Curtin and Los Alamos National Laboratory were able to show radioactivity could alter molecular structures which encode genetic information, creating new molecules that do not belong to the four-letter alphabet of DNA.

Professor Nigel Marks from Curtin's Discipline of Physics and Astronomy and Curtin's Nanochemistry Research Institute said the new molecules may well generate mutations by confusing the replication mechanisms in DNA.

"This work takes an entirely new direction on research into natural radioactivity in biology and raises important questions about genetic mutation," Professor Marks said.

"We have discovered a subtle process that could easily be overlooked by

the standard cell repair mechanisms in the body, potentially creating a new pathway for mutations to occur."

Professor Marks said the work was both exciting and unexpected, emerging as a spin-off from an Australian Research Council funded project on nuclear waste.

"As part of the project between Curtin and Los Alamos we developed a suite of computational tools to examine deliberate radioactivity in crystalline solids, only to later realise that the same methods could be applied to natural radioactivity in molecules," he said.

"This direction was an unplanned outcome of our research program – just the way blue skies research should be."

The natural radioactivity in focus involved the decay of carbon atoms, Carbon-14, turning into nitrogen atoms, Nitrogen-14.

Professor Marks said this was one of the most abundant forms of radioactive decay occurring in biological systems. Over a human lifetime, around 50 billion Carbon-14 decays occur within our DNA.

"While it is still not obvious how DNA replication is affected by the presence of chemical compounds that are different to the four-letter alphabet of DNA, it is quite remarkable to consider that Carbon-14 could be a source of genetic mutation that would be impossible to avoid due to the universal presence of radiocarbon in the environment," Professor Marks said.

More information: The research paper, Carbon-14 decay as a source of non-canonical bases in DNA, is available at www.sciencedirect.com/science/ … ii/S0304416513004431

Provided by Curtin University