

The guardians of the genome protect DNA to increase seed lifespan

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New research has identified crucial biological sensors that determine seed longevity and control germination. ATM and ATR proteins sense DNA damage in seeds and are essential factors that help plants retain correct genetic information stored in the seeds.

The study, led by Dr. Chris West from the Centre for Plant Sciences at the University of Leeds along with colleagues from University of Warwick and University of Manchester, found that ATM and ATR act as crucial checkpoints to ensure that seeds only germinate after any damage to the genome has been repaired. The findings are published in the leading scientific journal *Proceedings of the National Academy of Science (PNAS)*.

Dr West said, "Most of the food we eat is produced directly from seeds, and seeds are also used for crop production and animal feed, so they really are central to agriculture. For the plant, seeds represent an important stage of their life cycle—even though a seed is tiny compared to a mature plant, it still packs in the same amount of genetic information, which must be passed on from one generation to another."

"The problem is that seeds endure more DNA damage before germination than during any other stage in the plant's life cycle. DNA damage can often introduce genetic mutations, which in humans can cause cancer, and in plants can lead to poor growth. So a good quality control is required preserve accurate genetic information in the seed. ATM and ATR are 'the guardians of the genome' that safeguard the

[genetic information](#) in seeds," Dr. West continued.

This discovery has the potential to enable the production of seeds with improved resistance to the environmental stresses that they are exposed to during storage, and therefore improve germination of crop plants.

Dr. Wanda Waterworth, the first author of the publication said, "Previous work in our lab enabled this discovery. What we've also found is that removing ATM from the plant genome speeds up germination, but the resulting plant accumulates a lot of extreme DNA damage. This would compromise plant growth, significantly affecting yield."

Dr Waterworth added, "High temperature and humidity decrease seed longevity during seed storage, which is a huge problem in the developing world. Likewise, climate change and environmental stress are also affecting crop productivity in Europe and the USA. Our next action is to use the information gained from this research to identify more factors that control germination. This may potentially allow us to design improved, more productive [seeds](#) in the future."

More information: Wanda M. Waterworth et al. DNA damage checkpoint kinase ATM regulates germination and maintains genome stability in seeds, *Proceedings of the National Academy of Sciences* (2016). [DOI: 10.1073/pnas.1608829113](https://doi.org/10.1073/pnas.1608829113)

Provided by Rupesh Paudyal

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