

## How is the genome protected and passed on to the next generation?

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A genome is the complete genetic information possessed by an organism. For example, when we speak of the human genome, we refer to all of the DNA sequence information containing the human genes. The genome is the blueprint that determines the design of an organism, and it would not be an exaggeration to say that it is the most important "information" on earth. However, the material equivalent to the paper on which this information is written, DNA, is a long, thin thread and is vulnerable to radiation and chemical substances from outside the cell. In addition, DNA is damaged by reactive oxygen species generated inside the cell and errors made during DNA replication, and the genome is gradually destroyed. Genomic damage can also cause cancer and other diseases by distorting information in the form of mutations.

During the course of evolution, organisms have acquired the ability to repair and rebuild their DNA and mechanisms to pass on as healthy a genome as possible to their offspring. We have discovered that "cellular senescence" plays an essential role in one of these mechanisms. Cellular senescence actively stops the proliferation of "slightly dangerous cells" that have gradually accumulated damage after escaping the DNA repair mechanism and eventually removes them from the tissue. We have discovered that the most fragile region of the genome, the "ribosomal RNA repetitive gene cluster," acts as the senescence switch. Interestingly, when the senescence switch is artificially manipulated and left OFF, the lifespan of cells is extended by about 60%. In terms of human age, this is equivalent to extending the lifespan of an 80-year-old to 120 years. We are currently trying to identify the senescence signal emitted from the senescence switch.

Maintaining genomic stability is critical to the continuity of life. How did life originate, inherit, and evolve on this planet? And where is it headed in the future? We will scientifically approach these questions.

