# Genetics in the Cosmic Context

Genetics · Practice Test · 20 Questions

**1. During the 2016 NASA Twins Study, which specific type of DNA modification was measured in Scott Kelly to determine the effects of long-duration spaceflight on the human epigenome?**

A) Histone acetylation
B) DNA methylation
C) ATP-binding
D) Protein phosphorylation

**2. In the 'Bion-M1' mission, which organism was primarily used to study the genetic expression changes caused by cosmic radiation and microgravity over 30 days in orbit?**

A) Mus musculus (House mouse)
B) Drosophila melanogaster
C) Caenorhabditis elegans
D) Arabidopsis thaliana

**3. What is the primary genetic phenomenon observed in the plant 'Arabidopsis thaliana' when grown aboard the International Space Station compared to terrestrial controls?**

A) Complete silence of all metabolic genes
B) Significant downregulation of cell wall-related genes
C) Hyper-mutation of nuclear DNA
D) Permanent loss of chlorophyll production

**4. Research on the International Space Station regarding 'T-cell' genetic expression revealed that microgravity suppresses the activation of which specific transcription factor?**

A) NF-kappaB
B) HIF-1alpha
C) FOXP3
D) MYC

**5. The experiment 'Micro-11' on the ISS studied the genetic and physiological factors of which human process in microgravity?**

A) Neurogenesis
B) Sperm motility and fertilization
C) Cardiac muscle regeneration
D) Synaptic pruning

**6. Which genetic sequencing tool was the first to successfully identify unknown microbes on the ISS without returning samples to Earth?**

A) Ion Torrent PGM
B) MinION Nanopore Sequencer
C) PacBio Sequel
D) Illumina HiSeq

**7. What genetic effect has been observed in 'Caenorhabditis elegans' (nematodes) subjected to prolonged spaceflight?**

A) Increased longevity via DAF-16 pathway
B) Complete suppression of reproduction
C) Instant apoptosis of neurons
D) Inversion of chromosomes 1 and 2

**8. In studies of 'space-exposed' bacteria like Bacillus subtilis, which genetic mechanism is frequently upregulated to survive the vacuum of space?**

A) Enhanced DNA repair systems
B) Production of cellulose fibers
C) Rapid mitochondrial division
D) Increased viral lysis

**9. NASA's 'Rodent Research' missions have documented that spaceflight induces a significant shift in the expression of genes related to which biological system?**

A) Circadian rhythm and bone density
B) The production of bile
C) The maturation of hair follicles
D) The synthesis of Vitamin K

**10. What specific genetic observation in the 'Twins Study' regarding telomere length was unexpected upon Scott Kelly's return to Earth?**

A) They completely disappeared
B) They significantly lengthened
C) They remained constant
D) They fragmented into RNA

**11. The 'GeneLab' database aggregates omics data from space experiments; which 'omics' field focuses on the study of the entire set of proteins expressed by a genome in space?**

A) Transcriptomics
B) Proteomics
C) Metabolomics
D) Epigenomics

**12. In experiments involving 'Drosophila' in orbit, which genetic pathway was identified as being altered, affecting the fly's immune response?**

A) IMD pathway
B) Wnt signaling
C) Notch pathway
D) Hedgehog pathway

**13. What is the primary concern for genetic stability in humans exposed to high-LET (Linear Energy Transfer) cosmic radiation in deep space?**

A) Increased frequency of double-strand DNA breaks
B) Accelerated production of ribosomes
C) Inhibition of histone methylation
D) Immediate degradation of mRNA

**14. Studies on the ISS regarding 'yeast' (Saccharomyces cerevisiae) genetics in microgravity focused on which cellular function?**

A) Mitochondrial inheritance
B) DNA segregation during mitosis
C) Protein folding in the endoplasmic reticulum
D) Oxidative stress response

**15. Which genetic molecule is used as a biomarker for cellular stress in astronauts measured via the 'Biomolecule Sequencer' on the ISS?**

A) mRNA
B) rRNA
C) tRNA
D) siRNA

**16. The experiment 'Plant Gravity Sensing' (PGS) on the ISS explored the genetic basis of which tropism?**

A) Phototropism
B) Chemotropism
C) Gravitropism
D) Thigmotropism

**17. What was the result of the 'Mouse Epigenetics' study concerning the sperm of mice exposed to spaceflight?**

A) Full sterility observed
B) Altered gene expression profiles in offspring
C) Increased birth weight
D) Total loss of XY chromosomes

**18. In the study of 'E. coli' in microgravity, which genetic response was observed to increase its antibiotic resistance?**

A) Increased expression of multidrug efflux pumps
B) Deletion of the ribosomal RNA genes
C) Enhanced conjugation rate
D) Decreased metabolic rate

**19. Which genetic technique is most commonly used in space biology to analyze differential gene expression in limited samples?**

A) RNA-Seq
B) Sanger Sequencing
C) Southern Blotting
D) Karyotyping

**20. The 'NASA Twins Study' showed that spaceflight led to the 'un-silencing' of which type of genetic elements, potentially causing genomic instability?**

A) Transposable elements (LINE-1)
B) Introns
C) Pseudogenes
D) Centromeric repeats