

research highlights

PHYSIOLOGY

Understanding the effects of spaceflight

Science **364**, eaau8650 (2019)



Credit: NASA/Science Source

Long-term spaceflight of roughly a year induces physiological changes, some of which are unchanged after 6 months.

The effects of long-term spaceflight on human physiology are not known, and but an understanding is needed to increase preparedness for space exploration, such as to Mars.

Researchers from the National Aeronautics and Space Administration (NASA) and collaborating institutes took a large panel of genome-wide genetic and physiology measurements from various cell types and tissues in a set of identical twins, one of which was on the International Space Station for a period of 341 days, while the other remained

on Earth for that period. Studying twins reduced any changes due to genetics.

The large majority of changes that seemed to be the result of spaceflight (and, hence, lack of gravity, radiation exposure and stress upon returning to earth, among other factors) were reversible adaptations. Some changes, such as cognitive performance, did not return to baseline after 6 months and could represent challenges for future missions. HS

<https://doi.org/10.1038/s41591-019-0455-x>

IN VITRO FERTILIZATION

Cancer risk

JAMA Pediatr. <https://doi.org/10.1001/jamapediatrics.2019.0392> (2019)

Children conceived by in vitro fertilization are at a marginally higher risk of developing childhood cancers than those conceived naturally.

IVF is associated with an increased incidence of birth defects and imprinting disorders that are also known to predispose to childhood cancer, yet the link between childhood cancers and IVF is unknown.

Researchers in the United States carried out a retrospective analysis of birth and cancer registries in 14 states and analyzed 275,686 children conceived via IVF and ten times that many who were conceived naturally.

IVF was found to be associated with cancers of early childhood, and this

warrants additional monitoring of infants conceived by IVF. HS

<https://doi.org/10.1038/s41591-019-0452-0>

CANCER

Evading the immune system

Nature **567**, 479–485 (2019)

The local immune microenvironment of a tumor shapes that tumor's route of immune escape.

The extent to which local tumor-infiltrating lymphocytes influence the evolution of a cancer through immune editing of neoantigens is not known.

Researchers from the TRACER-x consortium based in the United Kingdom analyzed 258 regions from 88 early-stage, untreated non-small-cell lung cancers and identified the immune cells, cancer mutations and epigenetic marks in these regions. They found the patterns of evolution of the tumor regions were highly localized depending on immune environment and took no one set route. The routes to immune evasion also could be used to make a prognosis prediction. HS

<https://doi.org/10.1038/s41591-019-0453-z>

INFECTIOUS DISEASE

Therapeutic selfies

Lancet **393**, 1216–24 (2019)

A randomized controlled trial shows that video observed treatment (VOT) of tuberculosis (TB) therapy via use of a smartphone by patients results in better adherence to a therapeutic regime than directly observed treatment (DOT).

DOT, in which a patient with TB is observed taking their medication by a healthcare or lay worker, is recommended in the United Kingdom for individuals with TB who are at high risk of poor adherence. VOT relies on the patient using a smartphone app to record themselves taking their medication and sending it to a healthcare worker for review.

In a randomized control trial of 226 participants based in the United Kingdom, VOT was a more effective approach for treatment of TB than DOT and also resulted in a rate of reporting of adverse effects similar to that of DOT. HS

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NEUROLOGY

Improving cognition

Cell **177**, 256–271, (2019)

Declines in cognition that manifest as working-memory deficits in aging humans can be ameliorated by noninvasive stimulation, as can cognitive deficits in mouse models of Alzheimer's disease.

Aging is associated with a decline in cognitive function and dementia, and Alzheimer's disease is a pathological version of this. The understanding of the molecular mechanisms of both of these types of impairment will lead to therapies, particularly much-needed nonpharmacological interventions.

Scientists in Boston, Massachusetts, used electrophysiological measurements to pinpoint the circuits and brain regions involved in working-memory deficits and were able to improve working-memory performance by noninvasive stimulation.

Scientists in Cambridge, Massachusetts, were able to alleviate Alzheimer's pathology and related cognitive impairments in mouse models of the disease using a noninvasive light-flicker stimulus.

Both studies pave the way for these nonpharmacological approaches for therapies for cognitive decline. HS

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