**Extremophyte Clustered Regularly Interspaced Short Palindromic Repeats (CRISPR)**

CRISPR (Clustered Regularly Interspaced Short Palindromic Repeats) is a genetic editing scientific technique that can be used to increase, decrease, insert or remove genes from organisms. Exploring its application in plants could be helpful for understanding plants' stress responses in microgravity that could translate to improved agricultural practices on Earth, in space, or or other terrestrial bodies on exploration missions. In this TÜBİTAK UZAY-sponsored project "Extreme Salt Stress and CRISPR Gene Editing Efficiency in Plants Under Microgravity" (Extremophyte CRISPR), researchers will investigate the downregulation via the CRISPR technique of three genes involved in the stress response of Arabidopsis thaliana (thale cress, a member of the mustard family). The second aim will evaluate the salt stress tolerance of two plants - one salt-sensitive and one salt-tolerant - that will be germinated and grown in the International Space Station (ISS). This work builds on previous microgravity investigations showing how microgravity affects the growth, movement and genetics of this plant, and could provide valuable insights into plant adaptation to extreme environments and help develop more resilient crops for agriculture.

**Innovative Research on Novel Space Alloys (UYNA)**

The UYNA experiment will investigate novel medium entropy and high entropy alloys (MEAs and HEAs, respectively). These types of metal alloys are characterized by their high strength, toughness, and resistance to corrosion and are of interest for potential applications in many industries, including space, aviation, automotive, energy, and medicine. The data from this experiment will help to improve the understanding of the formation and properties of MEA/HEA alloys, which could lead to the development of new and improved materials for a variety of applications.

**Microgravity effects on metal particles’ dynamics in fluids (gMETAL)**

The microgravity effects on metal particles dynamics in fluids (gMETAL) project from TÜBİTAK UZAY will investigate how the lack of gravity impacts the mixing of solid particles in a gas (two-phase mixture formation) within a contained environment. This mixing is important to understand how metal particles and an oxidizing gas can react in a combustion chamber for efficient combustion and maximum heat release. Applications for this research include the development of zero-carbon energy generation technologies on Earth by burning metal particles in air; or for development of propulsion systems or energy generation on Mars, for example, by reacting metal particles with CO2 collected from the Martian atmosphere.

**\*MESSAGE (Microgravity Associated Genetics Research Group)**

**The MESSAGE**\*
(Microgravity Associated Genetics Research Group) project from the TÜBİTAK UZAY portfolio on Ax-3 is interested in assessing microgravity-associated changes in gene expression in human immune system T-cells collected from an astronaut. After flight, the project will use CRISPR gene editing technologies to knock out genes in T-cells found to be upregulated by space travel. The researchers will also aim to produce immune cells with the observed microgravity-associated gene changes by using an acoustic levitation device on the ground to mimic microgravity and explore the cells' changes in proliferation, survival, and stress responses at a cellular level. By better understanding the response of the immune system to the stress of microgravity, the project aims to identify potential space travelers who may be more suited to long duration spaceflight missions due to the resilience of their immune system.

**Metabolom**

Spaceflight can be a stressful experience for the human body to adapt to changes in microgravity, such as physical demands, nutritional changes, and lack of sleep. The physiological changes can be monitored by profiling the "'omics" of the body — the changes in gene expression (genomics), protein expression (proteomics) or metabolites (metabolomics). A better understanding of these changes in an individual's response to spaceflight can help to develop personalized countermeasure procedures that can optimize the safety and performance of each astronaut. This project aims to gather data to better understand omics changes seen after spaceflight and inform Turkish researchers working on gravitational physiology, aviation, and space medicine on best practices for astronaut care, as part of Türkiye’s rapidly developing national space program.

**Pranet Algal**

Propolis extract is a natural product from bees called "bee glue" used for hive construction and maintenance, which has the potential to be characterized as an antioxidant and anti-inflammatory agent. This project is a STEM project led by 13–14-year-old students aiming to investigate the effect of propolis extract on bacteria in microgravity. If the experiments prove that propolis extract can exhibit anti-microbial properties in space, it could open avenues for future research on new and natural product-based cleaning agents for future spaceflight applications.

**Uzman**Algae have many properties that make them ideal organisms to support humans during long-duration spaceflight missions. Not only could they serve as a nutritional source included in astronaut menus, algae could also remove carbon dioxide and produce oxygen for spacecraft environmental control systems, help regulate spacecraft temperatures, recycle certain wastes, and even act as a source of fuel. The data generated from this experiment will be used to advance the development of microalgal life support systems for space missions and could impact the design of future carbon dioxide capture, oxygen conversion, wastewater treatment systems, and provide fertilizer options for other agricultural crops grown in space.

**Vokalkord**

The Vokalkord experiment will focus on developing an artificial intelligence system to detect over 70 types of disease by analyzing respiratory, speaking, and cough sounds. This project further develops the software for use on Earth as a tool to identify and diagnose lung cancers, voice and vocal cord diseases, infectious diseases, and even cardiovascular and eye disease.