



IJSEP Experiment Guide: Recommended Materials

The list presented in this document gives examples of materials that have been safely used in space experiments.

They are grouped by scientific area to help teams design ideas for their IJSEP experiment.

All samples are considered **non-toxic or low-risk** for use in the Fluids Mixing Enclosure (FME) minilab.

 **Important:** Always check with the IJSEP Science Team when choosing your materials.

 **Note:** The examples below are just suggestions - they're meant to inspire your creativity! The possibilities for experiments and sample combinations are not limited to this list. Feel free to explore new ideas, as long as they follow the IJSEP safety and materials guidelines.

List of Recommended Materials:

1. Cell Biology and Bioactive Molecules

Goal: To explore how biological products and purified molecules behave in microgravity.

Possible Materials:

- **Secretome from mesenchymal stem cells (lyophilized)** - a mixture of bioactive proteins, lipids, nucleic acids, and extracellular vesicles.
- **Purified proteins and peptides** such as collagen type I, albumin (BSA), lysozyme, and growth factors (e.g., VEGF, TGF- β).
- **Protein stabilizers or preservation agents** such as trehalose, glycerol, sorbitol, or mannitol.

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- **Solutions for reconstitution and preservation**, such as phosphate-buffered saline (PBS), HEPES buffer, or Ringer's lactate solution.
- **Analytical standards**: glucose, sodium pyruvate, beta-glycerophosphate (for biochemical reactions).
- **RNA stabilization solution** (e.g., RNA Later) for preserving nucleic acids.

💡 *Note: Live cells, tissues, or microorganisms are not permitted in IJSEP experiments. Only cell-free biological components (like secretome or purified proteins) may be used.*

2. Protein Crystal Growth

Goal: To study how crystals form in microgravity and compare them to crystals grown on Earth.

Possible Materials:

- Lysozyme (from egg white)
- Aldolase protein
- Urokinase protein
- Bence-Jones protein
- Ammonium sulfate
- Sodium acetate, sodium phosphate, sodium chloride (NaCl)
- Tris-HCl, HEPES, MES buffer
- MPD (2-Methyl-2,4-pentanediol)
- Glycerol water
- Food dye (various colors)

3. Inorganic Crystal Growth

Goal: To grow "perfect" inorganic crystals and analyze their shapes and sizes.

Possible Materials:

- Sodium metasilicate (Na_2SiO_3)
- Potassium aluminum sulfate

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- Monoammonium phosphate or sulfate
- Zinc chloride (ZnCl_2)
- Metal filaments (no beryllium, cadmium, or magnets)

4. Bacteria and Microorganisms

Goal: To study how bacteria grow and behave in microgravity.

Possible Organisms:

- *E. coli* (K-12 or B strain, non-pathogenic)
- *Bacillus subtilis*, *Bacillus safensis*, *Lactobacillus acidophilus*
- *Deinococcus radiodurans*
- *Pseudomonas aeruginosa* (research strain)
- *Staphylococcus aureus* (research strain)

Growth Media:

- Agar (plain, nutrient, or tryptic soy)
- Luria Broth (LB), R2A Broth
- Yeast extract

5. Seeds and Plant Growth

Goal: To see how plants germinate and grow roots and stems in microgravity.

Possible Samples:

- Seeds: radish, wheat, tomato, alfalfa, cowpea, strawberry
- *Arabidopsis thaliana* (model plant)
- Soil (sterilized), rockwool, OASIS substrate
- Distilled water, gibberellic acid (growth promoter)



6. Food Products

Goal: To test how foods or ingredients behave in microgravity and their potential for astronaut nutrition.

Possible Materials:

- Milk, yogurt, cheese
- Honey, peanut butter, sugar, starch, tofu
- Vegetable oils (olive, sunflower, canola)
- Vitamins A, B, C, D
- Tea leaves, corn powder
- Yeast

7. Fluid Diffusion and Materials

Goal: To study how liquids mix or spread in microgravity.

Possible Materials:

- Colored water or food dye
- Honey or glycerol
- Polystyrene microbeads
- Modeling clay or small metal pieces (non-magnetic)

8. Biological Fixatives and Preservatives

Goal: To stop or slow biological growth after the experiment ends (for sample preservation).

Possible Materials:

- 10% neutral buffered formalin
- Puromycin (low concentration)
- Rifampicin and cephalexin (for bacteria)
- Sugars (trehalose, others)
- Water

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Remember:

- Avoid toxic, flammable, or corrosive materials.
- When using living samples, confirm they are **safe and non-pathogenic**.
- Check that all materials fit within the FME tube and can be safely mixed.
- If unsure, ask the IJSEP Science Team for approval before including a material.