List of Archived ISS Publications

Oct. 1, 2021 - Sept. 30, 2022

BIOLOGY AND BIOTECHNOLOGY

Analysis of a Novel Sensory Mechanism in Root Phototropism (Tropi) — Correll MJ, Pyle TP, Millar KD, Sun Y, Yao J, et al. Transcriptome analyses of Arabidopsis thaliana seedlings grown in space: Implications for gravity-responsive genes. *Planta*. 2013 June 15; 238(3): 519-533. DOI: 10.1007/s00425-013-1909-x. *

Biological Research In Canisters (BRIC) — Nicholson WL, Fajardo-Cavazos P, Turner CC, Currie TM, Gregory G, et al. Design and validation of a device for mitigating fluid microgravity effects in Biological Research in Canister spaceflight hardware. *Frontiers in Space Technologies*. 2021; 2: 13. DOI: 10.3389/frspt.2021.797518.

Biological Research In Canisters-24 (BRIC-24) — Wang M, Danz K, Ly V, Rojas-Pierce M. Microgravity enhances the phenotype of Arabidopsis zigzag-1 and reduces the Wortmannin-induced vacuole fusion in root cells. *npj Microgravity*. 2022 September 6; 8(1): 38. DOI: 10.1038/s41526-022-00226-3.

Biomass Production System (BPS) — Morrow RC, Crabb TM, Iverson JT, Frank JG. Science accommodations in the biomass production system. *SAE Technical Paper*. 2001 July 9; 2001-01-2231: DOI: 10.4271/2001-01-2231. *

Biomass Production System/ Photosynthesis Experiment and System Testing and Operation (BPS/PESTO) — Stryjewski EC, Peterson BV, Stutte GW, Wells HW. Long-term storage of wheat plants for light microscopy. *SAE Technical Paper*. 2000 July; 2000-01-2231: 7. DOI: 10.4271/2000-01-2231. *

BioScience-4 (STaARS BioScience-4) — Biancotti JC, Carpo N, Zamudio J, Vergnes L, Espinosa-Jeffrey A. Profiling the secretome of space traveler human neural stem cells. *Journal of Stem Cells Research, Development & Therapy*. 2022 June 10; 8(1): 1-12. DOI: 10.24966/SRDT-2060/100094.

BioScience-4 (STaARS BioScience-4) — Tran V, Carpo N, Shaka S, Zamudio J, Choi SY, et al. Delayed Maturation of Oligodendrocyte Progenitors by Microgravity: Implications for Multiple Sclerosis and Space Flight. *Life*. 2022 May 27; 12(6): 797. DOI: 10.3390/life12060797.

Characterization of Biofilm Formation, Growth, and Gene Expression on Different Materials and Environmental Conditions in Microgravity (Space Biofilms) — Flores P, Schauer R, McBride SA, Luo J, Hoehn CV, et al. Preparation for and performance of a Pseudomonas aeruginosa biofilm experiment on board the International Space Station. *Acta Astronautica*. 2022 July 14; 25pp. DOI: 10.1016/j.actaastro.2022.07.015.

Commercial Biomedical Test Module – 2 (CBTM-2) — Ortega AM, Bateman TA, Livingston EW, Paietta RC, Gonzalez SM, et al. Spaceflight related changes in structure and strength of mouse trabecular and cortical bone from the STS-118 space shuttle mission. *ASME 2013 Summer Bioengineering Conference*, Sunriver, Oregon; 2013 June 26-29. V01AT08A005. DOI: 10.1115/SBC2013-14785. *

Crystalization of Biological Macromolecules and Generation of Biocrystal Film in the Conditions of Microgravity (Kristallizator) — Eistrikh-Heller PA, Rubinsky SV, Samygina VR, Gabdulkhakov AG, Kovalchuk MV, et al. Crystallization in microgravity and the atomic-resolution structure of uridine phosphorylase from Vibrio cholerae. *Crystallography Reports*. 2021 September 1; 66(5): 777-785. DOI: 10.1134/S1063774521050059. *

List of Archived ISS Publications

Oct. 1, 2021 - Sept. 30, 2022

Crystalization of Biological Macromolecules and Generation of Biocrystal Film in the Conditions of Microgravity (Kristallizator) — Timofeev VI, Abramchik YA, Muravyova TI, Zhukhlistova NE, Esipov RS, et al. Three-dimensional structure of recombinant thermophilic ribokinase from Thermus species 2.9 in complex with adenosine diphosphate. *Crystallography Reports*. 2021 September 1; 66(5): 769-776. DOI: 10.1134/S1063774521050205. *

Effects of Microgravity on Cerebral Arterial, Venous and Lymphatic Function: Implications for Elevated Intracranial Pressure (Delp Intracranial Pressure) — Holley JM, Stanbouly S, Pecaut MJ, Willey JS, Delp MD, et al. Characterization of gene expression profiles in the mouse brain after 35 days of spaceflight mission. *npj Microgravity*. 2022 August 10; 8(1): 1-10. DOI: 10.1038/s41526-022-00217-4.

Effects of Microgravity on Stem Cell-Derived Heart Cells (Heart Cells) — Cao X, Weil MM, Wu JC. Clinical trial in a dish for space radiation countermeasure discovery. *Life Sciences in Space Research*. 2022 May; DOI: 10.1016/j.lssr.2022.05.006.

Epigenetic change in Arabidopsis thaliana in response to spaceflight - differential cytosine DNA methylation of plants on the ISS/Biological Research In Canisters/Molecular Biology of Plant Development in the Space Flight Environment (APEX-04/BRIC/CARA/Seeding Growth-1/2/3) — Manzano A, Carnero-Diaz E, Herranz R, Medina F. Recent transcriptomic studies to elucidate the plant adaptive response to spaceflight and to simulated space environments. *iScience*. 2022 June 30; DOI: 10.1016/j.isci.2022.104687. †

Epigenetic change in Arabidopsis thaliana in response to spaceflight - differential cytosine DNA methylation of plants on the ISS (APEX-04) — Paul AL, Haveman NJ, Califar B, Ferl RJ. Epigenomic regulators elongator complex subunit 2 and methyltransferase 1 differentially condition the spaceflight response in Arabidopsis. *Frontiers in Plant Science*. 2021 September 13; 12: 691790. DOI: 10.3389/fpls.2021.691790. *

Evaluation of Radiotrophic Fungi as a Potential Radiation Barrier (Evaluation of Radiotrophic Fungi as a Potential Radiation Barrier) — Averesch NJ, Shunk GK, Kern C. Cultivation of the dematiaceous fungus Cladosporium sphaerospermum aboard the International Space Station and effects of ionizing radiation. *Frontiers in Microbiology.* 2022; 13: DOI: 10.3389/fmicb.2022.877625.

EuTEF-Expose-Protect — Waters SM, Ledford SM, Wacker A, Verma S, Serda B, et al. Long-read sequencing reveals increased occurrence of genomic variants and adenosine methylation in Bacillus pumilus SAFR-032 after long-duration flight exposure onboard the International Space Station. *International Journal of Astrobiology*. 2021 December; 20(6): 435-444. DOI: 10.1017/S1473550421000343.

Exercise Countermeasures for Knee and Hip Joint Degeneration during Spaceflight (Willey Gait) — Willey JS, Aunon-Chancellor SM, Miles LA, Moore JE, Mao XW, et al. aKlotho decreases after reduced weight-bearing from both spaceflight and hindlimb unloading. *npj Microgravity*. 2022 June 2; 8(1): 18. DOI: 10.1038/s41526-022-00203-w.

GeneLAB — Manian V, Orozco-Sandoval J, Diaz-Martinez V. An integrative network science and artificial intelligence drug repurposing approach for muscle atrophy in spaceflight microgravity. *Frontiers in Cell and Developmental Biology*. 2021; 9: 732370. DOI: 10.3389/fcell.2021.732370. *

List of Archived ISS Publications

Oct. 1, 2021 - Sept. 30, 2022

GeneLAB — Manian V, Orozco-Sandoval J, Diaz-Martinez V, Janwa H, Agrinsoni C. Detection of target genes for drug repurposing to treat skeletal muscle atrophy in mice flown in spaceflight. *Genes*. 2022 March; 13(3): 473. DOI: 10.3390/genes13030473.

Generation of Cardiomyocytes from Human Induced Pluripotent Stem Cell-derived Cardiac Progenitors Expanded in Microgravity (MVP Cell-03) — Rampoldi A, Forghani P, Li D, Hwang H, Armand LC, et al. Space microgravity improves proliferation of human iPSC-derived cardiomyocytes. *Stem Cell Reports*. 2022 August 7; S2213-6711(22)00416-7. DOI: 10.1016/j.stemcr.2022.08.007.

Growth of Large, Perfect Protein Crystals for Neutron Crystallography (Perfect Crystals) — Azadmanesh J, Lutz WE, Coates L, Weiss KL, Borgstahl GE. Cryotrapping peroxide in the active site of human mitochondrial manganese superoxide dismutase crystals for neutron diffraction. *Acta Crystallographica Section F: Structural Biology Communications*. 2022 January 1; 78(1): DOI: 10.1107/S2053230X21012413.

Identifying the Genetic Features Determining Individual differences in the Resilience of Biological Objects to Long-term Spaceflight Factors Studies with the Fruit Fly Drosophila melanogaster (Poligen (Polygene)) — Ogneva IV, Zhdankina YS, Kotov OV. Sperm of fruit fly Drosophila melanogaster under space flight. *International Journal of Molecular Sciences*. 2022 July 6; 23(14): 7498. DOI: 10.3390/ijms23147498.

International Space Station-Microbial Observatory of Pathogenic Viruses, Bacteria, and Fungi (ISS-MOP) Project (Microbial Tracking-2) — Madrigal P, Singh NK, Wood JM, Gaudioso E, Hernandez-del-Olmo F, et al. Machine learning algorithm to characterize antimicrobial resistance associated with the International Space Station surface microbiome. *Microbiome.* 2022 August 24; 10(1): 134. DOI: 10.1186/s40168-022-01332-w.

International Space Station-Microbial Observatory of Pathogenic Viruses, Bacteria, and Fungi (ISS-MOP) Project (Microbial Tracking-2) — Simpson AC, Urbaniak C, Bateh JR, Singh NK, Wood JM, et al. Draft genome sequences of fungi isolated from the International Space Station during the Microbial Tracking-2 experiment. *Microbiology Resource Announcements*. 2021 September 16; 10(37): e00751-21. DOI: 10.1128/MRA.00751-21. *

International Space Station-Microbial Observatory of Pathogenic Viruses, Bacteria, and Fungi (ISS-MOP) Project (Microbial Tracking-2) — Urbaniak C, Morrison MD, Thissen J, Karouia F, Smith DJ, et al. Microbial Tracking-2, a metagenomics analysis of bacteria and fungi onboard the International Space Station. *Microbiome*. 2022 June 29; 10(1): 100. DOI: 10.1186/s40168-022-01293-0.

International Space Station Summary of Research Performed (ISS Summary of Research) — Alekseev VR, Hwang J, Levinskikh MA. Effect of space flight factor on dormant stages in aquatic organisms: A review of International Space Station and terrestrial experiments. *Life.* 2022 January; 12(1): 47. DOI: 10.3390/life12010047.

International Space Station Summary of Research Performed (ISS Summary of Research) — Goldsmith M, Crooks SD, Condon SF, Willie BM, Komarova SV. Bone strength and composition in spacefaring rodents: systematic review and meta-analysis. *npj Microgravity*. 2022 April 13; 8(1): 1-14. DOI: 10.1038/s41526-022-00195-7.

International Space Station Summary of Research Performed (ISS Summary of Research) — Paul AL, Wheeler RM, Levine HG, Ferl RJ. Fundamental plant biology enabled by the space shuttle. *American Journal of Botany*. 2013 January 1; 100(1): 226-234. DOI: 10.3732/ajb.1200338. *

International Space Station Summary of Research Performed (ISS Summary of Research) — Pavletic B, Runzheimer K, Siems K, Koch S, Cortesao M, et al. Spaceflight virology: What do we know about viral threats in the spaceflight environment? *Astrobiology*. 2022 January 3; 22(2): ast.2021.0009. DOI: 10.1089/ast.2021.0009.

Investigation of the Osteoclastic and Osteoblastic Responses to Microgravity Using Goldfish Scales (Fish Scales) — Yamamoto T, Ikegame M, Furusawa Y, Tabuchi Y, Hatano K, et al. Osteoclastic and osteoblastic responses to hypergravity and microgravity: Analysis using goldfish scales as a bone model. *Zoological Science*. 2022 April; 39(4): 9pp. DOI: 10.2108/zs210107.

Investigation of the Osteoclastic and Osteoblastic Responses to Microgravity Using Goldfish Scales (Fish Scales) — Yano S. Preparation and overview of Fish Scales experiment. *Space Utilization Research*; 2011 March. 213-216.

Japan Aerospace Exploration Agency Protein Crystallization Growth / High Quality Protein Crystal Growth (JAXA PCG/PCG Kristallizator) — Boyko KM, Gorbacheva MA, Rakitina TV, Korzhenevskiy DA, Dorovatovsky PV, et al. Identification of the ligand in the structure of the protein with unknown function STM4435 from Salmonella typhimurium*. Doklady Biochemistry and Biophysics*. 2014 July; 457(1): 121-124. DOI: 10.1134/S1607672914040012. *

Japan Aerospace Exploration Agency Protein Crystallization Growth/ Japan Aerospace and Exploration Agency - Granada Crystallization Facility High Quality Protein Crystallization Project (JAXA PCG/ JAXA-GCF) — Obita T, Inaka K, Kohda D, Maita N. Crystal structure of the PX domain of Vps17p from Saccharomyces cerevisiae. *Acta Crystallographica Section F: Structural Biology Communications*. 2022 May 1; 78(5): 210-216. DOI: 10.1107/S2053230X22004472.

Japan Aerospace Exploration Agency Protein Crystallization Growth (JAXA PCG) — Rahman RN, Ali MS, Sugiyama S, Leow AT, Inoue T, et al. A comparative analysis of microgravity and Earth grown thermostable T1 lipase crystals using HDPCG apparatus. *Protein and Peptide Letters*. 2015 February; 22(2): 173-179. DOI: 10.2174/09298665216661410191 93604. *

JAXA Mouse Habitat Unit (JAXA Mouse Habitat Unit) — Ohira T, Ino Y, Kimura Y, Nakai Y, Kimura A, et al. Effects of microgravity exposure and fructo-oligosaccharide ingestion on the proteome of soleus and extensor digitorum longus muscles in developing mice. *npj Microgravity*. 2021 September 17; 7(1): 1-11. DOI: 10.1038/s41526-021-00164-6. DOI:10.1038/s41526-021-00164-6 *

Mechanisms of Gravity Resistance in Plants From Signal Transformation and Transduction to Response (Resist Tubule) — Kato S, Murakami M, Saika R, Soga K, Wakabayashi K, et al. Suppression of cortical microtubule reorientation and stimulation of cell elongation in Arabidopsis hypocotyls under microgravity conditions in space. *Plants*. 2022 January; 11(3): 465. DOI: 10.3390/plants11030465.

List of Archived ISS Publications

Oct. 1, 2021 - Sept. 30, 2022

Mechanisms of Gravity Resistance in Plants From Signal Transformation and Transduction to Response (Resist Tubule) — Tanimura Y, Mabuchi A, Soga K, Wakabayashi K, Hashimoto H, et al. Suppression of secondary wall formation in the basal supporting region of Arabidopsis inflorescence stems under microgravity conditions in space. *Biological Sciences in Space*. 2022; 36: 1-8. DOI: 10.2187/bss.36.1.

Mice Drawer System (MDS) — Ishihara A, Nagatomo F, Fujino H, Kondo H, Ohira Y. Decreased succinate dehydrogenase activity of gamma and alpha motoneurons in mouse spinal cords following 13 weeks of exposure to microgravity. *Neurochemical Research*. 2013 August 14; 38: 2160-2167. DOI: 10.1007/s11064-013-1124-y. *

Microbial Tracking Payload Series (Microbial Observatory-1) — Blachowicz A, Romsdahl J, Chiang AJ, Masonjones S, Kalkum M, et al. The International Space Station environment triggers molecular responses in Aspergillus niger. *Frontiers in Microbiology*. 2022; 13: 893071. DOI: 10.3389/fmicb.2022.893071.

Microbial Tracking Payload Series (Microbial Observatory-1) — Bijlani S, Parker CW, Singh NK, Sierra MA, Foox J, et al. Genomic characterization of the Titan-like cell producing Naganishia tulchinskyi, the first novel eukaryote isolated from the International Space Station. *Journal of Fungi*. 2022 February; 8(2): 165. DOI: 10.3390/jof8020165.

Microbial Tracking Payload Series (Microbial Observatory-1) — Danko DC, Mohan GB, Sierra MA, Rucker MA, Singh NK, et al. Characterization of spacesuit associated microbial communities and their implications for NASA missions. *Frontiers in Microbiology*. 2021 July 29; 12: 27pp. DOI: 10.3389/fmicb.2021.608478. *

Microbial Tracking Payload Series (Microbial Observatory-1) — Kumar RK, Singh NK, Balakrishnan S, Parker CW, Raman K, et al. Metabolic modeling of the International Space Station microbiome reveals key microbial interactions. *Microbiome*. 2022 July 6; 10(1): 102. DOI: 10.1186/s40168-022-01279-y.

Microbial Tracking Payload Series (Microbial Observatory-1) — Lombardino J, Bijlani S, Singh NK, Wood JM, Barker RJ, et al. Genomic characterization of potential plant growth-promoting features of Sphingomonas strains isolated from the International Space Station. *Microbiology Spectrum*. 2022 January 12; eoub: e0199421. DOI: 10.1128/spectrum.01994-21.

Microbial Tracking Payload Series (Microbial Observatory-1) — Singh NK, Lavire C, Nesme J, Vial L, Nesme X, et al. Comparative genomics of novel *Agrobacterium* G3 strains isolated from the International Space Station and description of Agrobacterium tomkonis sp. nov. *Frontiers in Microbiology*. 2021 December 6; 12: 765943. DOI: 10.3389/fmicb.2021.765943.

Microbial Tracking Payload Series (Microbial Observatory-1) — Sushenko NS, Singh NK, Vellone DL, Tighe SW, Hedlund BP, et al. Complete genome sequence of Klebsiella quasipneumoniae subsp. similipneumoniae strain IF3SW-P1, isolated from the International Space Station. *Microbiology Resource Announcements*. 2022 June 23; e0047622. DOI: 10.1128/mra.00476-22.

Microbial Tracking Payload Series (Microbial Observatory-1) — Urbaniak C, Grams T, Mason CE, Venkateswaran KJ. Simulated microgravity promotes horizontal gene transfer of antimicrobial resistance genes between bacterial genera in the absence of antibiotic selective pressure. *Life*. 2021 September; 11(9): 960. DOI: 10.3390/life11090960. *

List of Archived ISS Publications

Oct. 1, 2021 - Sept. 30, 2022

Microgravity Crystal Growth for Improvement in Neutron Diffraction and the Analysis of Protein Complexes/ Improving the Quality of Taspase1 Crystals by Microgravity (CASIS PCG 15/ CASIS PCG 18) — Drago VN, Devos JM, Blakeley MP, Forsyth VT, Kovalevsky AY, et al. Microgravity crystallization of perdeuterated tryptophan synthase for neutron diffraction. *npj Microgravity*. 2022 May 4; 8(1): 13. DOI: 10.1038/s41526-022-00199-3.

Molecular Muscle/ Epigenetics in spaceflown C. elegans/ RNA Interference and Protein Phosphorylation in Space Environment Using the Nematode Caenorhabditis elegans (Molecular Muscle/ Epigenetics/CERISE) — Sudevan S, Muto K, Higashitani N, Hashizume T, Higashibata A, et al. Loss of physical contact in space alters the dopamine system in C. elegans. *iScience*. 2022 February 18; 25(2): 103762. DOI: 10.1016/j.isci.2022.103762.

Mouse Antigen-Specific CD4+ T Cell Priming and Memory Response during Spaceflight (Mouse Immunology) — Siamwala JH, Macias BR, Healey RM, Bennett B, Hargens AR. Spaceflight-associated vascular remodeling and gene expression in mouse calvaria. *Frontiers in Physiology*. 2022 May 13; 13: 893025. DOI: 10.3389/fphys.2022.893025.

Mouse Antigen-Specific CD4+ T Cell Priming and Memory Response during Spaceflight (Mouse Immunology) — Sultemeier DR, Choy KR, Schweizer FE, Hoffman LF. Spaceflight-induced synaptic modifications within hair cells of the mammalian utricle. *Journal of Neurophysiology*. 2017 June 1; 117(6): 2163-2178. DOI: 10.1152/jn.00240.2016. *

Multidisciplinary Approach to the Analysis of the Functional Alterations Induced by Microgravity in Human Satellite Cells, and Study of Possible Countermeasures (MYOGRAVITY) — Di Filippo ES, Chiappalupi S, Balsamo M, Vukich M, Sorci G, et al. Preparation of human muscle precursor cells for the MyoGravity project's study of cell cultures in experiment units for space flight purposes. *Applied Sciences*. 2022 January; 12(14): 7013. DOI: 10.3390/app12147013.

Multi-use Variable-g Platform Fly-01 (MVP Fly-01) — Mhatre SD, Iyer J, Petereit J, Dolling-Boreham R, Tyryshkina A, et al. Artificial gravity partially protects space-induced neurological deficits in Drosophila melanogaster. *Cell Reports*. 2022 September 6; 40(10): 111279. DOI: 10.1016/j.celrep.2022.111279.

NanoRacks-CellBox-Effect of Microgravity on Human Thyroid Carcinoma Cells (NanoRacks-CellBox-Thyroid Cancer) — Wise PM, Neviani P, Riwaldt S, Corydon TJ, Wehland M et al. Changes in exosomal miRNA composition in thyroid cancer cells after prolonged exposure to real microgravity in space. *International Journal of Molecular Sciences*. 2021 November 27; 22(23): 12841. DOI: 10.3390/ijms222312841.

Phase II Real-time Protein Crystal Growth on Board the International Space Station (Real-Time Protein Crystal Growth-2 (RTPCG-2)) — Quirk S, Lieberman RL. Improved resolution crystal structure of Acanthamoeba actophorin reveals structural plasticity not induced by microgravity. *Acta Crystallographica Section F: Structural Biology Communications*. 2021 December 1; 77(Pt 12): 452-458. DOI: 10.1107/S2053230X21011419.

Plant Signaling (formerly known as Seed Growth-1) — Sheppard J, Land ES, Toennisson TA, Doherty CJ, Perera IY. Uncovering transcriptional responses to fractional gravity in Arabidopsis roots. *Life*. 2021 October; 11(10): 1010. DOI: 10.3390/life11101010.

List of Archived ISS Publications

Oct. 1, 2021 - Sept. 30, 2022

Quantifying Selection for Pathogenicity and Antibiotic Resistance in Bacteria and Fungi on the ISS – a Microbial Tracking Study (Microbial Tracking-3) — Simpson AC, Suzuki T, Miller DR, Venkateswaran KJ. Microbial burden estimation of food items, built environments, and the International Space Station using film media. *Microorganisms*. 2022 September; 10(9): 1714. DOI: 10.3390/microorganisms10091714.

Rodent Research Hardware and Operations Validation (Rodent Research-1) — Rettig TA, Nishiyama NC, Pecaut MJ, Chapes SK. Effects of skeletal unloading on the bone marrow antibody repertoire of tetanus toxoid and/or CpG treated C57BL/6J mice. *Life Sciences in Space Research*. 2019 August 1; 22: 16-28. DOI: 10.1016/j.lssr.2019.06.001. *

Role of Environmental Stress-responsive Transcription Factor Nrf2 in Space Stress (Mouse Habitat Unit-3 (Mouse Stress Defense)) — Suzuki N, Iwamura Y, Nakai T, Kato K, Otsuki A, et al. Gene expression changes related to bone mineralization, blood pressure and lipid metabolism in mouse kidneys after space travel. *Kidney International*. 2021 November 9; DOI: 10.1016/j.kint.2021.09.031.

Role of Environmental Stress-responsive Transcription Factor Nrf2 in Space Stress (Mouse Habitat Unit-3 (Mouse Stress Defense)) — Uruno A, Saigusa D, Suzuki T, Yumoto A, Nakamura T, et al. Nrf2 plays a critical role in the metabolic response during and after spaceflight. *Communications Biology*. 2021 December 9; 4(1): 1-18. DOI: 10.1038/s42003-021-02904-6.

Seedling Growth-1/Seedling Growth-2 — Shymanovich T, Vandenbrink JP, Herranz R, Medina F, Kiss JZ. Spaceflight studies identify a gene encoding an intermediate filament involved in tropism pathways. *Plant Physiology and Biochemistry*. 2022 January 15; 171: 191-200. DOI: 10.1016/j.plaphy.2021.12.039.

Stem Cell Differentiation — Wang Y, Jia Y, Xu Y, Liu X, Wang Z, et al. Exploring the association between glutathione metabolism and ferroptosis in osteoblasts with disuse osteoporosis and the key genes connecting them. *Computational and Mathematical Methods in Medicine*. 2022 May 12; 2022: e4914727. DOI: 10.1155/2022/4914727.

Study on the Effect of Space Environment to Embryonic Stem Cells to Their Development (Stem Cells) — Yoshida K, Hada M, Kizu A, Kitada K, Eguchi-Kasai K, et al. Comparison of biological measurement and physical estimates of space radiation in the International Space Station. *Heliyon*. 2022 August 1; 8(8): e10266. DOI: 10.1016/j.heliyon.2022.e10266.

Studying the Features of the Growth and Development of Plants, and Technology for their Culturing in Spaceflight on the ISS RS (Rastenia-Gorokh (Plants-Pea)) — Podolski IG, Strugov OM, Bingham GE. [Performance characteristics of root zone moisture and water potential sensors for greenhouses in the conditions of extended space flight]. *Aviakosmicheskaia i Ekologicheskaia Meditsina (Aerospace and Environmental Medicine)*. 2014; 48(5): 39-45. *

Systemic Therapy of NELL-1 for Osteoporosis (Rodent Research-5 (RR-5)) — Henrich M, Ha P, Wang Y, Ting K, Stodieck LS, et al. Alternative splicing diversifies the skeletal muscle transcriptome during prolonged spaceflight. *Skeletal Muscle*. 2022 May 31; 12(1): 11. DOI: 10.1186/s13395-022-00294-9.

The Coenzyme Q10 (CoQ10) as an Antiapoptotic Countermeasure for Retinal Lesions Induced by Radiation and Microgravity on the ISS: Experiment on Cultured Retinal Cells (CORM) — Cialdai F, Bolognini D, Vignali L, Iannotti N, Cacchione S, et al. Effect of space flight on the behavior of human retinal pigment epithelial ARPE-19 cells and evaluation of coenzyme Q10 treatment. *Cellular and Molecular Life Sciences.* 2021 October 29; DOI: 10.1007/s00018-021-03989-2.

The Effect of Macromolecular Transport of Microgravity Protein Crystallization (LMM Biophysics 1) — Martirosyan A, Falke S, McCombs D, Cox M, Radka C, et al. Tracing transport of protein aggregates in microgravity versus unit gravity crystallization. *npj Microgravity*. 2022 February 17; 8(1): 1-12. DOI: 10.1038/s41526-022-00191-x.

Threshold Acceleration for Gravisensing - 2 (Gravi-2) — Karoliussen I, Coelho LH, Hauan M. Integration and pre-experiment test flow of the Gravi2 experiment performed in the EMCS: From ground testing to space flight. *AIAA SPACE 2016*, Long Beach, CA; 2016 September 9. 11pp. DOI: 10.2514/6.2016-5611. *

Tissue Regeneration-Bone Defect (Rodent Research-4 (CASIS)) — Zamarioli A, Adam G, Maupin KA, Childress PJ, Brinker A, et al. Systemic effects of BMP2 treatment of fractures on non-injured skeletal sites during spaceflight. *Frontiers in Endocrinology.* 2022 August 15; 13: 910901. DOI: 10.3389/fendo.2022.910901.

Utilization of the micro gravity condition to examine the cellular process of formation of the gravity sensor and the molecular mechanism of gravity sensing (Plant Gravity Sensing) — Nakano M, Furuichi T, Sokabe M, Iida H, Yano S, et al. Entanglement of Arabidopsis seedlings to a mesh substrate under microgravity conditions in KIBO on the ISS. *Plants*. 2022 March 31; 11(7): 956. DOI: 10.3390/plants11070956.

Veg-03 I/J/K/L (Veg-03) — Hummerick ME, Khodadad CL, Dixit AR, Spencer LE, Maldonado Vazquez GJ, et al. Spatial characterization of microbial communities on multi-species leafy greens grown simultaneously in the vegetable production systems on the International Space Station. *Life*. 2021 October; 11(10): 1060. DOI: 10.3390/life11101060.

Vegetable Production System (Veggie) — Poulet L, Zeidler C, Buncheck JM, Zabel P, Vrakking V, et al. Crew time in a space greenhouse using data from analog missions and Veggie. *Life Sciences in Space Research*. 2021 November; 31: 101-112. DOI: 10.1016/j.lssr.2021.08.002.

Veggie hardware validation test (Veg-01) — Haveman NJ, Schuerger AC. Diagnosing an opportunistic fungal pathogen on spaceflight-grown plants using the MinION sequencing platform. *Astrobiology*. 2021 November 18; 22(1): DOI: 10.1089/ast.2021.0049.

Veggie PONDS (Veggie PONDS Validation) — Levine HG, Richards JT, Koss LL, Weislogel MM, Reed DW, et al. PONDS : A new method for plant production in space. *In-Space Manufacturing and Resources*; 2022. DOI: 10.1002/9783527830909.ch12.

List of Archived ISS Publications

Oct. 1, 2021 - Sept. 30, 2022

HUMAN RESEARCH

Advanced Resistive Exercise Device/ Bisphosphonates as a Countermeasure to Space Flight Induced Bone Loss (ARED/Bisphosphonates) — Okada A, Matsumoto T, Ohshima H, Isomura T, Koga T, et al. Bisphosphonate use may reduce the risk of urolithiasis in astronauts on long-term spaceflights. *JBMR Plus.* 2022 January; 6(1): e10550. DOI: 10.1002/jbm4.10550.

Assessing the Impact of Communication Delay on Behavioral Health and Performance: An Examination of Autonomous Operations Utilizing the International Space Station (Comm Delay Assessment) — Kintz NM, Palinkas LA. Communication delays impact behavior and performance aboard the International Space Station. *Aerospace Medicine and Human Performance*. 2016; 87(11): 940-946. DOI: 10.3357/AMHP.4626.2016. *

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Astronaut's Energy Requirements for Long-Term Space Flight (Energy) — Bourdier P, Zahariev A, Schoeller DA, Chery I, LeRoux E, et al. Effect of exercise on energy expenditure and body composition in astronauts onboard the International Space Station: Considerations for interplanetary travel. *Sports Medicine*. 2022 July 13; DOI: 10.1007/s40279-022-01728-6.

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Oct. 1, 2021 - Sept. 30, 2022

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List of Archived ISS Publications

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List of Archived ISS Publications

Oct. 1, 2021 - Sept. 30, 2022

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† Additional investigations associated with publication.
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