

IAF/IAA Space Life Sciences Symposium

Held at the 74th International Astronautical Congress
(IAC 2023)

Baku, Azerbaijan
2-6 October 2023

ISBN: 978-1-7138-8544-3

Printed from e-media with permission by:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571



Some format issues inherent in the e-media version may also appear in this print version.

Copyright© (2023) by International Astronautical Federation
All rights reserved.

Printed with permission by Curran Associates, Inc. (2024)

For permission requests, please contact International Astronautical Federation
at the address below.

International Astronautical Federation
100 Avenue de Suffren
75015 Paris
France

Phone: +33 1 45 67 42 60
Fax: +33 1 42 73 21 20

www.iafastro.org

Additional copies of this publication are available from:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571 USA
Phone: 845-758-0400
Fax: 845-758-2633
Email: curran@proceedings.com
Web: www.proceedings.com

TABLE OF CONTENTS

BEHAVIOUR, PERFORMANCE AND PSYCHOSOCIAL ISSUES IN SPACE

Process-Based Cognitive Behavioural Interventions for Enhancing the Performance, Mental Health, Team Cohesion and Autonomy of the Analog Astronauts, Flight Controllers and Support Staff in the AMADEE20 Mission Simulation.	1
<i>Karoly Schlosser</i>	
Crossing Boundaries in Space Exploration Multiteam Systems: Insights from SIRIUS-21 Mission.....	2
<i>Alina Lungeanu, Leslie Dechurch, Joy Caroline Liebman, Noshir Contractor</i>	
Human Factors & Psychology Study in EMMIHS Moonbase Campaigns	10
<i>Celia Avila-Rauch, Bernard Foing, Henk Rogers, Serena Crotti, Kato Claeys, Brent Reymen</i>	
Neural Correlates of Working Memory Changes in Cosmonauts After Long Duration Spaceflight.....	19
<i>Floris Wuyts</i>	
It's a Heart Time - Analysis of the Effects of Heartbeat and Physical Activity on Subjective Time Perception in the Isolated Environment of an Analogue Space Mission	20
<i>Mateusz Daniol, Agata Kolodziejczyk, Matt Harasymczuk, Anna Kowalewska</i>	
Sociomapping - Qualitative Analysis of the Structure and Dynamics of Relationships and Ties in the Crews of SIRIUS-18/19 and SIRIUS-21 During a Simulated Space Mission to the Moon Through the Lens of Comparison.....	21
<i>Katerina Bernardova Sykorova, Eva Chroustova, Radvan Bahbouh</i>	
Measurement and Analysis of the Structure and Dynamics of Crew Communication Concerning Its Quantity and Quality in Three Stages of the SIRIUS Experiment	34
<i>Eva Hoschlova, Radvan Bahbouh, Michal Hužva, Eva Chroustova, Katerina Bernardova Sykorova</i>	
Irregular Shift Work Affected Work Engagement in an Isolated Environment	48
<i>Ruilin Wu, Qianying Ma, Yiren Wang, Hailong Chen, Qisong Yue, Yinghui Li</i>	

HUMAN PHYSIOLOGY IN SPACE

A 5-Day “dry” Immersion: Influence on the Reproductive System of Women.....	57
<i>Elena Gorbacheva, Konstantin Toniyan, Yulia Biriukova, Nadezhda Lukicheva, Oleg Orlov, Valery Boyarintsev, Irina V. Ogneva</i>	
Adaptive Changes in Heart Rate Variability and Cardiac Function During Long-Term Spaceflight: Insights from Wearable Devices.....	59
<i>Paniz Balali, Cyril Tordeur, Jeremy Rabineau, Vitalie Faoro, Irina Funtova, Olivier Debeir, Elena Luchitskaya, Pierre-Francois Migeotte, Jens Tank, Philippe Van De Borne</i>	
The Russian System of Countermeasure to Negative Effects of Weightlessness Provides a Sufficient Level of Performance for a Martian Expedition	61
<i>Elena Fomina, Pavel Romanov, Natalya Senatorova, V. Bakhtereva, Anna Ganicheva, Maria Kokueva, Petr Dubrov, Alexey Grishin, Tatyana Kukoba, Andrey Krukhmalev, Kryuchkov Boris, Maksim Kharlamov</i>	

Correlation of Changes in Aortic Stiffness with Other Parameters of Cardiovascular Health After 60-Day Head-Down Bed Rest	69
<i>Jeremy Rabineau, Paniz Balali, Cyril Tordeur, Margot Issertine, Enrico Caiani, Fabian Hoffmann, Stefan Möstl, Jan-Niklas Hönemann, Darius Gerlach, Vitalie Faoro, Pierre-François Migeotte, Jens Tank, Philippe Van De Borne</i>	
Evaluation of the Effect of 21-Day Head-Down Bed Rest on the Cardiovascular System by Blood Protein Composition, Including Markers sST2, NT-proBNP and D-Dimer	71
<i>Daria Kashirina, Luidmila Pastushkova, Anna Goncharova, Irina Larina</i>	
Interplay of miRNAs and Differentially Expressed Genes in the Psychopathology of Depression Under Simulated Complex Space Environment	72
<i>Madiha Rasheed, Han Wang, Zixuan Chen, Fengyuan Zhuang, Yulin Deng</i>	
Long-Term Analysis of Electro-mechanical Activity During the Two Analog Lunar Missions EMMPOL 10 and EMMPOL 11	73
<i>Sarah Solbiati, Federica Mozzini, Claudio Pighini, Agata Kolodziejczyk, Matt Harasymczuk, Emanuela Locati, Enrico Caiani</i>	
The NEBULA Project: Effect of Preflight Endurance and Resistance Training as a Countermeasure Against Microgravity-Induced Musculoskeletal Deconditioning	81
<i>Margot Issertine, Théo Fovet, Pierre Delobel, Theuil Julian, Clémence Bronstein, Guillaume Py, Thomas Brioche, Angèle Chopard</i>	
The Variability of Urine Proteome and Coupled Biochemical Blood Indicators in Cosmonauts with Different Preflight Autonomic Status	83
<i>Luidmila Pastushkova, Vasily Rusanov, Anna Goncharova, Daria Kashirina, Andrey Nosovsky, Kirill Kireev, Irina Larina, Oleg Orlov</i>	
Piezo1 Channel Act as a Space Environment Mechanotransducer in Bone Metabolism	85
<i>Yanan Zhang</i>	

MEDICAL CARE FOR HUMANS IN SPACE

New Extravehicular Activity's Spacesuit Design to Allow Access to Emergency Medications.....	86
<i>Carla Tamai, Virginia Wotring</i>	
Does Sex Influence Cardiovascular and Autonomic Responses to Central Hypovolemia?.....	97
<i>Vishwajeet Shankhwar, Bianca Brix, Stefan Du Plessis, Nandu Goswami</i>	
Far Infrared (FIR) Ray-Emitting Garments to Mitigate Muscle Loss Onboard the International Space Station (ISS).....	98
<i>Aya Hesham, Omar Elmetwally, Julien Louis</i>	
Federated Learning for Space Medicine Research and Its Application for Spaceflight Associated Neuro-Ocular Syndrome (SANS).....	105
<i>Scott Ritter, Franco Terranova, Claudia Stern, Eóin Tuohy, Aidan Cowley, Juergen Drescher, Robert Siggel, Ommar Ahmad, Raphael Sznitman</i>	
3D PRINTED BIOMIMETIC SCAFFOLDS for BONE-CELLS MICROGRAVITY RESPONSE.....	110
<i>Eleonora Zenobi, Elisa Scatena, Luca Panizza, Raffaella Pecci, Antonella Lisi, Mario Ledda, Costantino Del Gaudio</i>	
Aging and Putative Frailty Biomarkers Are Altered by Spaceflight.....	120
<i>Fathi Karouia</i>	

Healing of Ex Vivo Sutured Wound Models in Human Tissues Exposed to Spaceflight	122
<i>Monica Monici, Francesca Cialdai, Chiara Risaliti, Desirée Pantalone, Marco Bernini, Aleandro Norfini, Michele Balsamo, Juergen Kempf, Lucia Morbidelli, Stefano Bacci, Daniele Bani</i>	
Combined Electromyostimulation Mode as a Potential Countermeasure for Flights to the Moon and Back.....	124
<i>Alina Saveko, Maria Bekreneva, Ivan Ponomarev, Elena Tomilovskaya</i>	
Factors Influencing Surgical Procedures in Spaceflight Environments.....	129
<i>Kangsan Kim, Dora Babocs</i>	
Measurement System of Myotube Morphological Parameters for Space Life Experiment Mission About Muscle Atrophy in Astronauts	136
<i>Xinyu Wang, Yonghe Zhang, Guopeng Ding, Ping Hu, Wenxiu Zhang, Ming Guo, Zhongguang Yang</i>	
Study of the Plasma Component of the Hemostasis Regulation System in Healthy Subjects in the 240-Day Isolation Experiment «sirius-21».....	145
<i>Alexey Kochergin</i>	

MEDICINE IN SPACE AND EXTREME ENVIRONMENTS

The World-Class Research Center "The Pavlov Center" - A Cooperative Platform for Verification of Healthcare Technologies on the Basis of Space Medicine Achievements	149
<i>Anna Kussmaul, Sergey Ponomarev, Ilya Rukavishnikov, Maria Bekreneva, Shigueva Tatiana, Milena Koloteva, Alexey Salnikov, Vadim Gushin, Ivan Rozanov, Elena Tomilovskaya, Mark Belakovskiy, Oleg Orlov</i>	
"Beyond Earth: Advancements in Medicine for Space and Extreme Environments"	154
<i>Javidan Mammadov</i>	
An Overview of Space Analogues in Portugal	155
<i>Sofia Souto, Joan Alabart, Hugo Andre Costa</i>	
An Artificial Intelligence Method for Autonomous Monitoring of the Retina for Medical Applications in Space and Extreme Environments.....	170
<i>Scott Ritter, Franco Terranova, Claudia Stern, Eóin Tuohy, Aidan Cowley, Juergen Drescher, Robert Siggel, Ommar Ahmad, Raphael Sznitman</i>	
Brain Oxygenation Monitoring in a Parabolic Flight Using Portable Functional Near-Infrared Spectroscopy	175
<i>Jesica Kehala Studer, Laure Boyer</i>	
Peripheral Cooling as a Countermeasure to Orthostatic Stress During Parabolic Flight – the COOLFLY Experiment.....	177
<i>Tomas Bothe</i>	

RADIATION FIELDS, EFFECTS AND RISKS IN HUMAN SPACE MISSIONS

Fuzzy Logic Trigger in the Distinction of Pierre Auger Observatory's Signals from Neutrino-Induced Showers - Application and Analysis in the Study of Ultra-high-energy Cosmic Rays	178
<i>Diana Pawlicki, Krzysztof Stasiak, Zbigniew Szadkowski, Krzysztof Pytel</i>	

Radiation Fields, Effects, and Risks in Human Space Missions	186
<i>Debarshi Mukherjee</i>	
In-Situ Investigation of Mars Atmosphere and Ionizing Radiation Environment Through a Distributed Network of Tumbleweed Measurement Stations	187
<i>Abhimanyu Shanbhag, David Reid, James Kingsnorth, Alessandra Menicucci, One Mikulskyte, Julian Rothenbuchner, Danny Tjokrosetio, Giovanni Cozzolongo</i>	
Artificial Radiation Shielding for Spacecraft - Using ReBCO Superconductive Material	203
<i>Raj Krishnan Angusamy, Anumadhubala Rajakumari, Arunkumar P, Soundharya Thirumoorthy, Vignesh Krishnan</i>	
Experimental Analysis of h-BNNT/SiC/Graphene/Epoxy with Phenolic Resin for COTS and Spacesuit Materials.....	204
<i>Sanjeeviraja Thangavel, Gianmarco Radice</i>	
Innovative Solutions for Radiation Shielding.....	218
<i>Eleonora Zenobi, Giulia Salvatore, Federica Galante, Luca Novello, Giuseppe Felici, Antonio Rinaldi, Ilaria De Stefano, Elisa Scatena</i>	
Assessment of Dose-Dependent Endocrine and Immune Responses to Simulated Ionizing Radiation	224
<i>Carol Mitchell, Amber Paul, Cassandra Juran, Lane Christenson, April Ronca, Marissa Burke, Makaila Olson</i>	
Space Radiation Induced Bystander Effects in Estimating the Carcinogenic Risk : The Heavy Nuclei Case.....	231
<i>Alessandro Bartoloni, Aboma Negasa Guracho, Lidia Strigari</i>	
Designing a Neural Helmet, Mapping Neural Patterns in an Astronaut's Brain to Detect Cognitive Problems.....	240
<i>Akshay Rajshekhar Hiremath, Rochelle Velho, Emebet Mehabaw Tegegne, Sukhjit Singh</i>	
Radiation Spectrometer HardPix	246
<i>Robert Filgas, Benedikt Bergmann, Milan Malich, Michael Holik, Ondrej Pavlas</i>	
 <u>ASTROBIOLOGY AND EXPLORATION</u>	
Sustainable Exploration of Giant Planets' Icy Moons	250
<i>Athena Coustenis</i>	
Exploring the Co-Evolution of Earth-Moon System Through Lunar Mineralogy and Meteorite Impacts	260
<i>Akanksha Bhagat, Sathesh Raj V Periasamey, Siddhesh Durgude, Sourabh Sindagi, Anuj Soni</i>	
SimLE Stardust: How an Experiment Evolved from Student Tinkering to a Stratospheric Research Platform.....	261
<i>Marcin Jasiukowicz, Magdalena Sadowska, Bartosz Rybacki, Karol Pelzner, Szymon Magrian</i>	
A New Approach for the Search of Bio-Signatures and Assessment of Habitability on Mars Using a Swarm of Wind-driven Mobile Impactors.....	267
<i>Abhimanyu Shanbhag, Reut Sorek Abramovich, James Kingsnorth, Danny Tjokrosetio, One Mikulskyte, Julian Rothenbuchner</i>	
Preliminary Scientific Research on Enzymatic Activity During Suborbital Rocket Flight - AMBER Project.....	283
<i>Bartosz Rybacki, Wojciech Wysocki</i>	

LIFE SUPPORT, HABITATS AND EVA SYSTEMS

Studies on Monitoring the Use of Clothes, Underwear and Personal Hygiene Means in 17-Days, 120-Days and 240-Days Isolation Experiments Under the SIRIUS Project.....	288
<i>Irina Shumilina</i>	
IRMA Project – Standardization of a Microbial Culture on Agar Media and Payload Operations for Minimizing Astronaut’s Manipulation Risks and Optimizing Sample Return.	294
<i>Roberto Adolfo Ubidia Incio, Martín Santos Salazar Macalupu, Edir Sebastian Vidal Castro, Maria Nimia Muñoz Diaz, Camilo Andres Reyes Mantilla, Diego Adolfo Dueñas Parapar, Ramiro Gustavo Tintaya Quispe, María Fernanda Gutiérrez Moreno, Marko Josue Puchuri López, Lielka Noelia Caballa Huaman, Gaus Abdul Gonzales Sáenz, Alejandro Javier Iza Zurita, Nilton Cesar Rojas Vales, David De La Torre, Kiara Micaela Rodriguez Bautista, Gabriel Luis Dario Loayza Pretel, Lorena Sofía Marcelo Delgado, Andres David Reina Castro, Piero Beraun</i>	
Chlorella Vulgaris and Extremophile Bacillus Spp. Growth with Hydrazine.....	296
<i>Reut Sorek Abramovich, Yael Kinel-Tahan, Rivka Alexander-Shani, Irit Shoval, Hagit Hauschner, Igor Derzy, Itsik Sapir, Yitzhak Mastai, Ashraf Al Ashhab, Yaron Yehoshua</i>	
Development Status of a Carbon Dioxide Reduction System "SPDU" for the ISS.....	298
<i>Kogan Ioann, Alexandr Zheleznyakov, Sergei Rukavitsin, Elena Novoselova, Alexey Yurgin, Artur Potemkin, Yurii Butilkin</i>	
Design and Development of an Autonomous Capillary-Based Hydroponic System for Plant Growth for Deep Space Missions	306
<i>Tanmay Sharma</i>	
Hygiene Water Processing Aboard Prospective Space Stations	307
<i>Nikolay Salnikov, Leonid Bobe, Aleksandr Pavlov, Sergei Rukavitsin, Aleksandr Tsygankov</i>	
Rational Management of Space Food Waste	316
<i>Umide Macnunlu</i>	
Structural and Architectural Design of the Phaxsi Lunar Analogue Habitat in Salar De Uyuni, Over Environments Similar to the Moon	320
<i>Bernarda Loretto Sanjines, Jorge Soliz, Alejandro Herrera</i>	
MEEVA: A Smart System to Estimate and Mitigate Stress Effects During Analogue Astronauts EVAs.....	321
<i>Davide Scalettari, Lucie Rácková, Gonçalo Oliveira Pinho, Maddalena Lovotti, Elisabetta Marrucci, Giuseppe De Luca, Fabio Piazza, Maneesh Kumar Verma, Ludovico Bernasconi, Andrea Sportillo, Luca De Angeli, Fiammetta Lair</i>	
Reconstruct Earth's Karst Caves to Simulate Human Live in Extraterrestrial Cave Bases	336
<i>Gengxin Xie, Jinghang Ding</i>	
Space Habitat Dormancy Transitions: A Simulation-Based Investigation of Associated Challenges and Design Considerations	340
<i>Luca Vaccino, Mohsen Azimi, Shirley Dyke, Kenneth Pritchard</i>	
Disruptive Material Technologies to Address Microbial Hazards for Space Human Exploration.....	341
<i>Eleonora Zenobi, Elisa Scatena, Pietro Ioppolo, Raffaella Pecci, Fabrizio Quadrini, Bruno Brunetti, Gerardo Grasso, Roberto Dragone</i>	

BIOLOGY IN SPACE

Differential Expression of Genes Encoding Adhesion and Cell-To-cell Interaction Molecules in Bone Marrow Niche Under Simulated Microgravity	349
<i>Elena Markina, Danila Yakubets</i>	
ER Stress is Activated and Involved in Disuse-Induced Muscle Atrophy	356
<i>Xiaoping Chen, Peng Zhang</i>	
Lunar Gravity is Sufficient to Prevent Skeletal Muscle Atrophy, but Not Muscle Myofiber Type Transition in Mice.	357
<i>Takuto Hayashi</i>	
The Microbiome and the Metabolome of the International Space Station: The 3DMM Project.....	364
<i>Fathi Karouia</i>	
Repair of Radiation Induced DNA Damage in Space - Preparation of the BIOLAB Experiment LUX-in-Space	365
<i>Petra Rettberg, Elke Rabbow, Johanna Piepjohn, Corinna Panitz, Kristina Beblo-Vranesevic, Christine Hellweg</i>	
Innovative Antioxidant Therapies for Space Medicine	366
<i>Gianni Ciofani, Giada Graziana Genchi, Matteo Battaglini, Alessio Carmignani, Elisa Carrubba, Michele Balsamo, Andrea Degl'Innocenti</i>	
The Extracellular Matrix of Stromal Lineage Cells as a Target for Microgravity	368
<i>Ludmila Buravkova, Elena Andreeva, Irina Andrianova</i>	
REALISE – Automated Payload Operations Onboard the Lunar Gateway.....	374
<i>Tobias Niederwieser, Matthew Beck, Colin Monks, Andrew Barazia, Glen Redford</i>	
Possibility to Expand Opportunity and Benefit with JAXA Mouse Habitat Unit for the International Space Station and Beyond.....	379
<i>Kenichi Nagamoto</i>	
Comparison of Plant Growth Between Self-Watering Pots with Lunar Regolith Simulant and Hydroponic System.	380
<i>Maria Francesca Cecchi, Solene Wurtz Pra, Bertrand Goldman</i>	

INTERACTIVE PRESENTATIONS - IAF/IAA SPACE LIFE SCIENCES SYMPOSIUM

Designing a Biosensor to Detect Volatile Organic compounds(VOCs) Released by Infected Plants in Space	387
<i>Varshini Gs, Parvathi D Bhat, Yashvi Tripathi, Eeshaan Kashid, Sinchana P Kumar</i>	
Evaluation of the Lactoferrin Influence on the Indicators of Bone Tissue Metabolism at 21-Day Unloading of the Hind Limbs in Rats.....	388
<i>Nadezhda Lukicheva, Kirill Gordienko, Elena Sadchikova, Galina Vassilieva</i>	
Body Composition and Bone Status of Women of Reproductive Age Exposed to the Conditions of 3 and 5-Day "dry" Immersion Without Countermeasures	389
<i>Galina Vassilieva, Valery Novikov, Kirill Gordienko, Nadezhda Lukicheva, Elena Tomilovskaya, Oleg Orlov</i>	

Investigating the Effects of Space on in Vitro Fertilization in Mice Cells	391
<i>Sumbal Mushtaq, Egbert Edelbroek, Marta Ferraz</i>	
The Impact of Gravity on Biological Systems: Insights from Groundbased and Space Flight Experiments.....	397
<i>Debarshi Mukherjee</i>	
Designing a Biosensor Using CRISPR-Cas 9 Technique for Microbiome Analysis	398
<i>Parvathi D Bhat, Varshini Gs, Yashvi Tripathi, Eeshaan Kashid, Sinchana P Kumar</i>	
Transcriptional Activity of Wnt Signaling Pathway in Mesenchymal Stromal Cells Under Long-Term Simulation of Microgravity and Co-cultivation with Hematopoietic Precursors	399
<i>Ekaterina Tyrina, Andrey Ratushnyy, Ludmila Buravkova</i>	
Automated Pupillometry in Space Neuroscience	400
<i>Bader Shirah</i>	
A Wearable-Based System to Reduce Space Motion Sickness by Multi-sensory Pre-habituation	401
<i>Carole-Anne Vollette</i>	
Investigating the Neuropsychological Impact of the Overview Effect Using Virtual Reality	402
<i>Sahba El-Shawa, Gabriel G. De La Torre, Annahita Nezami</i>	
Analysis of the Plastic Changes Induced in the Soleus Muscle Under a Microgravity Condition	407
<i>Ryosuke Tsuji</i>	
Microgravity Applications in Pharmacy for Protein Therapeutics	413
<i>Funmilola Adebisi Oluwafemi, Ropo Afolabi Olubiyi Oluwafemi, A. Babatunde Rabiu, Arthur Vimalachandran Thomas Jayachandran, Aya Hesham, Yumna Majeed</i>	
Improvement in Mechanical Properties of Fungal-Bacterial Biocomposites as Space Construction Material - Transgenic Microorganisms in mWALLd.....	418
<i>Diana Pawlicki, Mateusz Balka</i>	
Asteroid Mining - Role of Microbes in Extraction of Minerals Using Bioreactor	428
<i>Parvathi D Bhat, Varshini Gs, Yashvi Tripathi, Eeshaan Kashid, Sinchana P Kumar</i>	
Development and Performance Analysis of a Machine Learning Based Cognitive Performance and Mental Fitness Monitoring System for Astronauts in Training	429
<i>Sriram Kumar, Gaudham P, Sandeep Adithya K, Krishna Sai M A, Sathya Sai Ram S</i>	
Astrobiology and Exploration	444
<i>Aysu Ibrahimli</i>	
Planetary Protection: Safeguarding the Future of Space Exploration.....	450
<i>Debarshi Mukherjee</i>	
Towards an Analogue Environment for Space Radiation and Radiobiology Investigations: The Laser Plasma Accelerators Case	451
<i>Alessandro Bartoloni, Aboma Negasa Guracho, Lidia Strigari</i>	
Bioinformatics as a New Tool for Astrobiology Research	456
<i>Abraham Tamargo Vinces</i>	

Comparative Analysis of Water Recovery Technologies for Life Support Systems for Deep Space Missions	457
<i>Vladimir Rifert, L. I. Anatychuk, Roman Desiateryk, Petr Barabash, Andrii Solomakha, Valerii Petrenko, Vladyslav Boianivskiy</i>	
CubeSat-Based Testing Techniques for Space Suit and Equipment Components	465
<i>Arwa Bin Tareef, Sara Trawneh</i>	
Public Perception and Attitude of Space Travel and Exploration and Space Medicine in Saudi Arabia	468
<i>Bader Shirah</i>	
Relationship Between Space Activities and Climate Smart Agriculture: The Soil Biochar Influence on Root Anatomy and Nodulation of Common Bean Genotypes	469
<i>Funmilola Adebisi Oluwafemi, Ropo Afolabi Olubiyi, Oluwafemi Adeleke, Lily Rospeen Asongfac, Beverley Chelsea Saungweme, Tosin Oyewole, Aurthur Vimalachandran Thomas Jayachandran</i>	
Pulmonary Volume and Capacity Outcomes Upon Returning to Earth Following Microgravity Exposure: A Systematic Review and Meta-Analysis.....	475
<i>Fay Ghani, Irene Cheung, Anthony Phillips, Merryn Tawhai, Edward Ashworth</i>	
EDEN 2.0 Greenhouse Design Study in Neumayer-III Station in Antarctica	485
<i>Kyunghwan Kim, Daniel Schubert, Jess Bunchek, Vincent Vrakking</i>	
A Case Definition is Needed for the Spaceflight Associated Neuro-Ocular Syndrome	486
<i>Mimi Lan, Jay Buckey</i>	
Cancer in Space: Evaluating the Impact of the Space Environment on Cancer Pathogenesis and Novel Opportunities for Cancer Research.....	491
<i>Chandan Sanghera, Ivy Mayor</i>	
Combined Electromyostimulation Mode to Mitigation of Space Flight Effects on Contractile Properties of Lower Extremities Muscles.....	503
<i>Ivan Ponomarev, Alina Saveko, Maria Bekreneva, Vladimir Kitov, Elena Tomilovskaya</i>	
Correlation Analysis as Part of a Novel Biomarker Analysis System for Astronaut Health in Space	507
<i>Anurag Sakharkar</i>	
Effects of Different Duration Dry Immersion on Sensory Organization of Postural System	508
<i>Nikita Shishkin, Vladimir Kitov, Elena Tomilovskaya</i>	
Exploratory Study of Neuroplasticity in Association with Human Spaceflight	512
<i>Krishna Bulchandani, Jyothir Vishnu Bharadwaja Perugu</i>	
Female Dry Immersion: Results of a Posturographic Study.....	519
<i>Nelly Abu Sheli, Vladimir Kitov, Elena Tomilovskaya</i>	
Physical Performance of Participants in Eight-Month Voluntary Isolation (Sirius-21 Experiment)	522
<i>V. Bakhtereva, Natalya Senatorova, Maria Kokueva, Pavel Romanov, Elena Fomina</i>	
Regulation of Leptin Secretion Through Space Food Or Oral aids(Drugs).....	523
<i>Varshini Gs, Parvathi D Bhat, Yashvi Tripathi, Eeshaan Kashid, Sinchana P Kumar</i>	
The Art of Cellular Resilience: Unlocking the Secrets of DNA Protection in a Radiation-Filled Universe	524
<i>Jaume Puig</i>	

The Relevance of a Topical Team in the Investigation, Advancement and Opportunities in the Research from the Scientific Community Through Space Technologies to Terrestrial Impacts.....	531
<i>Lorenzo Scatena, Eleonora Zenobi, Bartosz Kempisty, Liyana Popova, Michele Balsamo, Lucy Di Silvio, Arnaud Scherberich, Stefano Gabetti, Umberto Morbiducci, Diana Massai, Daniel Rodriguez, Maria Pau Ginebra, Elisa Scatena</i>	

Imbibition of Machine Learning and Artificial Intelligence Tools for Inferring Exoplanetary Habitability.....	539
<i>King Kumire</i>	

Impact of Neurotechnology on Space Medicine.....	561
<i>N/A</i>	

Electronic Components for Analog EVA Space Suit: Design and Performance Analysis.	562
<i>Arwa Bin Tareef, Tasbeeh Alargha, Lana Albalkhi</i>	

Augmented Cognition: Supporting Astronaut Performance During Mission-Critical Tasks.....	569
<i>Jacquelyn Berry, Claudia Covarrubias, Rawda Zaki, Andreia Oliveira</i>	

Astronaut's Health and Well-Being on Long Term Missions to Moon and Mars - Technology, Concepts and Closed Loop Automation	582
<i>Oliver Opatz</i>	

LATE BREAKING ABSTRACTS (LBA)

Eye Length is a Potential Predictor of Spaceflight-Related Visual Changes.....	583
<i>Bofan Chen, Mimi Lan, Jay Buckley</i>	

Virtual Reality (VR) Technology-Psychological Support for Astronauts in Space Exploration.....	586
<i>Alizada Ravan, Elza Salimli</i>	

Exploring Biofeedback and Multidisciplinary Approaches to Psychological Support for Astronauts in Space	592
<i>Alizada Ravan, Elza Salimli</i>	

Characteristics of a Centrifugal Flash Boiling Distiller for Regeneration of Wastewater in a Life Support System During Long-Term Space Flights.....	593
<i>Roman Desiateryk, Andrii Solomakha, Vladimir Rifert, Petr Barabash, Valerii Petrenko, Vladyslav Boianivskiy</i>	

Martian Biosphere	598
<i>Miguel Correa</i>	

Cognitive Behavioral Therapy for Astronauts in Space Psychology: Enhancing Psychological Well-Being and Performance in Space Missions	638
<i>Alizada Ravan, Elza Salimli</i>	

Earth-Based Psychological Support to Mitigate Asthenia in Space: Strategies and Considerations	639
<i>Alizada Ravan, Elza Salimli</i>	

Author Index