

IAF/IAA Space Life Sciences Symposium

Held at the 75th International Astronautical Congress
(IAC 2024)

Milan, Italy
14-18 October 2024

Volume 1 of 2

ISBN: 979-8-3313-1206-0

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© (2024) by International Astronautical Federation
All rights reserved.

Printed with permission by Curran Associates, Inc. (2025)

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

VOLUME 1

BEHAVIOUR, PERFORMANCE AND PSYCHOSOCIAL ISSUES IN SPACE

Teams that SIRIUSly Go the Distance: Effect of Isolation and Confinement on Team Performance	1
<i>Noshir Contractor, Alina Lungeanu, Leslie Dechurch, Megan Chan</i>	
Social Action Research: Comparison of Emotional Experience and Psychological State of Crews SIRIUS-19 and SIRIUS-21 During Simulated Spaceflight.....	10
<i>Matylda Klosova, Katerina Bernardova Sykorova, Eva Chroustova, Anna Zubková, Katerina Krásná, Jakub Babický, Kryštof Kerndl</i>	
Lunar Colonies: Psychological and Sociological Issues.....	16
<i>Nick Kanas</i>	
Architectural Properties' Impact on Stress and Cognition – Preliminary Results from a Study Conducted on Space Analogues and the ISS.	20
<i>Michail Magkos, Guilherme Elçadi, Mikael Forsman</i>	
Personal Values Among Crew Members During Long-Duration Space Missions: Temporal Patterns and Implications for Crew Tension.....	30
<i>Gro M. Sandal, Nathan Smith</i>	
Development of a Virtual Reality Space Docking Simulator for Research and Training - A Case Application in the Space Analogue SIRIUS-21	39
<i>Miquel Bosch Bruguera, Santiago Lopez Bermudez, Gisela Detrell, Reinhold Ewald</i>	
Leading the Crew to Mars: Evidence from NASA HERA Analog Crews.....	50
<i>Leslie Dechurch, Alina Lungeanu, Megan Chan, Noshir Contractor</i>	
Exploring Human Adaptation and Performance Dynamics in Deep Space Analogues: Insights from LunAres Mission Simulation.....	58
<i>Lucie Rácková, Matej Políacek, Jan Krajhanzl, Gabriel G. De La Torre, Iva Polácková Šolcová, Julie Bienertová-Vášku</i>	
Exploring the Relationship Between Crew Interpersonal Dynamics and Mental Workload: SIRIUS- 21.....	67
<i>Wakako Migaki, Norishige Kanai, Tsukasa Takahashi, Yuichi Oi, Shin-Ichiro Sasahara, Shotaro Doki, Daisuke Hori, Maral Soronzonbold, Satoshi Uchida, Toshiya Hayashida, Rim Al Assaad, Hotaka Tsukada, Asako Matsuura, Mami Ishitsuka, Kei Muroi, Yu Ikeda, Tadashi Murai, Ichiyo Matsuzaki</i>	

HUMAN PHYSIOLOGY IN SPACE

New Routes to Advance Knowledge in Microgravity Research: The ASI Research Portfolio for Ax- 3	70
<i>Serena Pezzilli, Luca Di Fino, Marino Crisconio, Claudia Esposito, Francesca Ferranti, Germana Galoforo, Claudia Pacelli, Luca Parca, Serena Perilli, Giovanni Valentini, Franco Cardone, Cristiano Corona, Gianni Ciofani, Giada Graziana Genchi, Livio Narici, Giorgia Santi Amantini, Flavio Gentile, Davide De Pietri Tonelli, Andrea Masotti, Monica Monici, Francesca Cialdai, Gabriele Mascetti, Barbara Negri</i>	

Dynamics of Functional Reserves of Cosmonauts in a Long Space Flight According to the Results of the 'Individual Strategies' Test.....	85
<i>Elena Fomina, Anna Burakova, Natalya Senatorova</i>	
NASA's Human Research Program: Evolving Collaborations to Enable the Future of Human Spaceflight.....	91
<i>Jancy McPhee, David Baumann</i>	
Precision Health for Children Takes First Steps in Space	98
<i>Simona Ferraro, Anilkumar Dave, Dario Cattaneo, Gianvincenzo Zuccotti, Alessia Mauri, Martina Tosi, Elvira Verduci, Valeria Calcaterra, Cristina Cereda, Santica Marcovina, Stephana Carelli</i>	
Advanced Audiological Tools for Non-Invasive Monitor of Intracranial Pressure in Microgravity	128
<i>Arturo Moleti, Triestino Minniti, Altea Russo, Yoshita Sharma, Andrea Civiero, Renata Sisto, Filippo Sanjust, Teresa Botti, Luigi Cerini, Giorgio Pennazza, Marco Santonico, Alessandro Zompanti, Rosa Sapone, Alessandro Crisafi, Maurizio Deffacis, Marco Lucertini, Dario Castagnolo, Gabriele Mascetti, Giovanni Valentini, Monia Vadrucchi, Maria Patrizia Orlando</i>	
T-Mini Meets Everywear: Enhancing Space Health Through Seamless Integration.....	135
<i>Oliver Opatz, Tomas Bothe, Stefan Mendt, Hanns-Christian Gunga, Martina Anna Maggioni</i>	
Modification of Hematopoietic Niche Under Long-Term Simulated Microgravity in Vitro.....	136
<i>Ludmila Buravkova, Ekaterina Tyrina, Danila Yakubets</i>	
Lower Body Negative Pressure May Not Be a Suitable Countermeasure for SANS	144
<i>Mimi Lan, Jay Buckey</i>	

MEDICAL CARE FOR HUMANS IN SPACE

Healing of Ex Vivo Sutured Wound Models in Human Tissues Exposed to Spaceflight	147
<i>Monica Monici, Francesca Cialdai, Chiara Risaliti, Paolo Cirri, Anna Caselli, Desirée Pantalone, Daniele Bani, Stefano Bacci, Marco Bernini, Lucia Morbidelli, Nicola Marziliano, Alessandra Colciago, Daniela Grimm, Jack J. W. A. Van Loon, Marcel Egli, Theodoor H Smit, Aleandro Norfini, Michele Balsamo, Michele Ghiozzi, Juergen Kempf, Van Ombergen Angelique, Christiane Hahn, Claudio Moratto, Marco Vukich, Gabriele Mascetti, Francesca Ferranti</i>	
COOLFLY: Beating Gravity's Pull with Peripheral Cooling.....	159
<i>Oliver Opatz, Tomas Bothe, Hanns-Christian Gunga, Martina Anna Maggioni</i>	
A Review Evaluating the Efficacy of Non-Pharmacological Countermeasures for Spaceflight-Associated Neuro-Ocular Syndrome	162
<i>Misha Iyer, Tugberk Khan, Nicole Demitry, June Gitau, Rochelle Velho</i>	
Spaceflight Environment Effects on Human Skin Microbiome	176
<i>Jaume Puig, Florence Pauline Basubas</i>	
The Pursuit for a “Gold Standard” Cardiopulmonary Resuscitation (CPR) Method for Human Spaceflight: A Novel CPR Testing Platform.....	180
<i>Zoé Victoria Lord, Lawrence Leroux, Lyes Kadem</i>	
Pilot Study of a Newly Designed Mobile LBNP.....	190
<i>Angélique Verrecchia, Billette De Villemeur Rebecca, Guillaume Truong, Bernard Comet, Anaïs Llodra-Perez, Amandine Fabre, Alain Maillet, Audrey Berthier, Didier Chaput, Cecile Thevenot, Théo Alexis, Arnaud Runge, Anne Pavy Le Traon, Jean-Philippe Cecille</i>	

Analog Spaceflight Medicine: An Opportunity for Medical Research for Human Spaceflight on Terrestrial Analog Stations	200
<i>Oscar Ojeda, Bruno Sarli, Dana Martin, Tarek Rivas Granados</i>	
Creating Surgical Capabilities for Exploration Spaceflight.....	207
<i>George Pantalos</i>	
Automated Phage Susceptibility Testing in Microgravity Using Digital Microfluidics to Advance Space Healthcare in Long-Term Missions.....	214
<i>Bernadette Ng, Michael Dryden, Danielle Peters, Jonathan Cook, Teodor Veres, Aaron Wheeler, Greg J. German</i>	
APHRODITE: A Lab-On-Chip Biosensor for Chemiluminescence Immunodetection of Salivary Biomarkers Onboard the International Space Station.....	222
<i>Mara Mirasoli, Seyedeh Rojin Shariati Pour, Afsaneh Emami Amin, Martina Zangheri, Donato Calabria, Massimo Guardigli, Domenico Caputo, Giampiero De Cesare, Nicola Lovecchio, Lorenzo Nardi, Nithin Maipan Davis, Thiago Baratto De Albuquerque, Parsa Abbasrezaee, Elisa Carrubba, Michele Balsamo, Liyana Popova, Marco Ceccarelli, Michele Ghiozzi, Andrea Tenaglia, Marino Crisconio, Augusto Nascetti</i>	
Perspectives for Future Space Biomedical Research to Ensure Crew Health and Performance for Future Human Space Exploration Missions Beyond Low-Earth Orbit, a Multidisciplinary Approach.....	231
<i>Lucia Vicente Martinez, Matthieu Komorowski, Guillaume Calvet, Emma Chabani, Marion Trousselard, Madison Diamond, Benoît Bolmont, Christian Clot, Thierry Varlet, Laure Boyer, Audrey Berthier, Alexis Paillet</i>	
Understanding of the Effects of Spaceflight on Human Health: Future Contribution of the Italian Space Agency	246
<i>Serena Perilli, Luca Di Fino, Marino Crisconio, Silvia Mari, Serena Pezzilli, Angelo Taibi, Paolo Zamboni, Beatrice Fraboni, Mara Mirasoli, Gabriele Mascetti, Barbara Negri</i>	

MEDICINE IN SPACE AND EXTREME ENVIRONMENTS

Antimicrobial Resistance: The Lesson from Word and Its Application in Space	252
<i>Omer Aydin, Zakarya Al-Shaebi, Münevver Akdeniz, Serra Ilayda Yerlitas, Ruveyda Benk, Ahmet Sezgin, Pinar Sagiroglu, Mustafa Altay Atalay, Gokmen Zararsiz</i>	
Astro-Psychiatry: A Novel Solution for Mental Health in Space Exploration.....	259
<i>Susan Ip-Jewell, Maria Harney, Tamara Pack, Jesus A. Guerra-Rivera, Jay Valesco, Emmy Helen Jewell, Nicholas Jewell, Salam Abualhayja'A</i>	
Circadian Rhythm Changes of Core Body Temperature During Long-Duration Spaceflight (Circadian Rhythm Project).....	272
<i>Martina Anna Maggioni, Stefan Mendt, Mathias Steinach, Anika Friedl-Werner, Katharina Brauns, Oliver Opatz, Alexander Christoph Stahn, Hanns-Christian Gunga</i>	
Circadian Rhythms Alterations During Overwintering at the High-Altitude Antarctic Station CONCORDIA (CardiCorTEx Project).....	275
<i>Martina Anna Maggioni, Mathias Steinach, Alexander Christoph Stahn, Oliver Opatz, Hannes Hagson, Simone Porcelli, Stefan Mendt, Hanns-Christian Gunga</i>	
Utilizing Virtual, Hybrid, and Augmented Reality to Enhance Surgical Training and Preparedness for Long-Duration Space Missions.....	278
<i>Danielle Carroll, George Pantalos</i>	

Overview of Multilayered Data Monitoring in the APICES Space Analogue Mission	282
<i>Lucie Rácková, Alexandra Lissouba, Maneesh Kumar Verma, Javier Garrido, Aditi Sathe, Margot Issertine, Marc Heemskerk, Charlotte Pouwels, Eleonora Zanus, Oliver Swainston, Chanud Sithipreedanant, Mykyta Kliapets, Petra Borilová Linhartová, Petra Brenerová, Jan Bohm, Veronika Vidová, Elliot Price, Julie Bienertová-Vášku, Patrik Kutilek, Gabriel G. De La Torre, Iva Polácková Šolcová, Jan Hejda, Marek Sokol, Abhishek Akash Diggewadi</i>	
On the Circadian Cycle Modifications of the Members of the First Latin American Analogous Mission for Research of Mars	294
<i>Sagrario Linares Melo, Vidalis Mx</i>	

RADIATION FIELDS, EFFECTS AND RISKS IN HUMAN SPACE MISSIONS

Engineering Human Cell-Based Radioresistance to Bolster Astronaut Health on Long-Term Space Missions	300
<i>Aaron Rosenstein, Daniel Benko, Lucy Ma, Jeff Chen, Michael Garton</i>	
Adaptive Hepatic Gene Expression Patterns in Mice in Response to Simulated Or Space Radiation Exposure.....	313
<i>Sara Reyes, Jesus Gomez Montalvo, S. Eréndira Avendaño-Vázquez, Diego Morelos, Diego Alvarez, Kevin Batalla</i>	
Engineered Stem Cells and the Spaceflight Environment: What Happens When Exposed to Cosmic Radiation?.....	323
<i>Fay Ghani, Cuiping Zhang, Peng Huang, Abba Zubair</i>	
Characterizing Space Radiation Inside the ISS: Anisotropies as Measured by LIDAL Detector in Columbus.	328
<i>Luca Di Fino, Giorgia Santi Amantini, Luca Lunati, Virginia Boretti, Gaetano Salina, Francesco Monnati, Alice Mentana, Giorgio Baiocco, Livio Narici</i>	
Miniature Radiation Spectrometer HardPix	333
<i>Robert Filgas</i>	
Wearable, Lightweight and Flexible Ionizing Radiation Dosimeters for Real-Time Crew Personal Monitoring.....	339
<i>Lorenzo Margotti, Andrea Ciavatti, Aleandro Norfini, Ilaria Fratelli, Giulia Napolitano, Giorgio Baiocco, Alice Mentana, Livio Narici, Marino Crisconio, Beatrice Fraboni</i>	
MRADSIM (Matter-RADiation Interactions SIMulations).....	346
<i>Ali Behcet Alpat, Giovanni Bartolini, Talifujiang Wusimanjiang, Haider Raheem, Ersin Hüseyinoglu, Raziye Bayram, Arca Bozkurt, Deniz Dolek, Lucia Salvi, Ahmed Imam Shah, Nora Ciccarella, Yakup Bakis, Stefano Gigli, Arca Bozkurt, Arca Bozkurt</i>	
Active Shielded Mars Base	357
<i>Marco Peroni</i>	
ERFNet – DH: Enhancing the Space Radiation Research for Future Human Space Travels	361
<i>Lorenzo Scavarda, James Carpenter, Rosario Messineo, Rosa Sapone, Jens Dirk Schiemann, Alfredo Villa, Alessandro Rovera</i>	

ADVANCEMENTS IN ASTROBIOLOGY AND SPACE EXPLORATION

Astrobiology in the Italian Space Agency: An Overview of Ongoing Research Projects	366
<i>Micol Bellucci, Maria Pedone, Serena Perilli, Serena Pezzilli, Manuele Ettore Michel Gangi, Silvia Mari, Claudia Pacelli, Luca Parca, Francesca Ferranti, Sara Piccirillo, Giovanni Valentini, Daniela Billi, Barbara Cavalazzi, Laura Selbmann, Giuseppe Mitri, John Robert Brucato, Aleandro Norfini, Raffaele Saladino, Barbara Negri</i>	
The BIOMEX Space Experiment on the EXPOSE R2 Mission: The Resistance of the Antarctic Black Fungus <i>Cryomyces Antarcticus</i> and Implications for Astrobiology	372
<i>Claudia Pacelli, Alessia Cassaro, Jean-Pierre Paul De Vera, Silvano Onofri</i>	
Desert Cyanobacteria Under non-Earth Conditions: Implications for Astrobiology and Life Support	381
<i>Daniela Billi</i>	
Extremophiles from Saudi Arabia for Space Applications	386
<i>Mohammed Baeshen</i>	
VENOM (Venture the ExtractionN of Organic Molecules): Preliminary Design and Tests on the Instrument Breadboard	395
<i>Giacomo Colombatti, John Robert Brucato, Alessio Aboudan, Carlo Bettanini, Francesca Ferri, Andrea Meneghin, Giovanni Valentini, Francesca Ferranti</i>	
Microfluidic: A Tool to Understand the Interaction Between Minerals and Prebiotic Molecules on Earth and Beyond	402
<i>Selene Cannelli</i>	
Plant Magnetoreception: Quantum Biology of Life Beyond the Geomagnetic Field.....	406
<i>Massimo Maffei</i>	

LIFE SUPPORT, HABITATS AND EVA SYSTEMS

Centralized Testing Facility Uniting Food Systems for Space Exploration.....	413
<i>Kyunghwan Kim, Tor Blomqvist, Daniel Schubert</i>	
In-Situ Manufacturing of Photobioreactors on the Moon Using Local Resources	421
<i>Lina Salman, Francisco J. Guerrero-Gonzalez, Richard Ubiennyh, Gisela Detrell, Philipp Reiss</i>	
Ergonomic Evaluation of Extravehicular Activity (EVA) Systems on Musculoskeletal Strain and Fatigue During Extended Lunar Surface EVAs	433
<i>Zoé Victoria Lord, Paul Hungler</i>	
Risk Assessment and Mapping in a Space Analog Station: Collaborations to Ensure Safety and Minimize Failures.....	441
<i>Iris Cabral, Ana Santana, Julio Rezende, Gabriel Matheus Dutra Santos, Soraya Chucair, Cristina Furstenuau</i>	
Study of the Composition of Garbage and Estimation of the Mass of Waste from the Year-Long Isolation Experiment Within the Framework of the SIRIUS Project.....	460
<i>Irina Shumilina, Vyacheslav Ilyin</i>	
Preliminary Design of a Human Habitat for the Melissa Pilot Plant.....	468
<i>Antoine Pigamo, Fériel Bernardinis, Gabriela Cuervo, Pier Lorenzo Murra, Julie Nadal, Guillaume Poncin, Chloé Audas, Blandine Gorce</i>	

Integrated Bioregenerative System for Astronaut Waste Processing and Autonomous Cultivation Exploiting ISRU Techniques: BEATRICE Project.....	476
<i>Paolo Marzioli, Anna Barra Caracciolo, Paola Grenni, Valeria Ancona, Cristina Cavone, Michele Balsamo, Liyana Popova, Alessandro Donati, Fabrizio Carrai, Domenico Borello, Ioannis Ieropoulos, Luca Nardi, Francesca Ferranti, Cristina Baldetti, Fabrizio Piergentili</i>	
Habitat Harmony: Next-Gen Astronautics Meets Physiological Innovation	483
<i>Oliver Opatz, Tomas Bothe, Martina Anna Maggioni, Hanns-Christian Gunga</i>	
Leveraging Lessons from Trauma Surgery, Robotics, and Wound Healing to Inform Technological Design for Exploration-Class Missions to the Moon and Mars.....	484
<i>Danielle Carroll, Spencer Dansereau</i>	
Moon-Rice: Cereal Crop Production for Future Planetary Bases.....	489
<i>Marta Del Bianco, Vittoria Brambilla, Stefania De Pascale, Raffaele Dello Ioio</i>	
Plant Based Water Filtering: Towards Regenerative Water Processing Systems.....	493
<i>Antonin Lecomte, Sungyoon Hong, Rebecca Blum, Katherine Mulry, Evandros Theodosiou, Guillaume Truong--Allié</i>	

BIOLOGY IN SPACE

Researches and Activities in Health and Life Sciences at the Italian Space Agency.....	500
<i>Micol Bellucci, Sara Piccirillo, Marta Del Bianco, Barbara Negri, Gabriele Mascetti</i>	
Advancements in Microscopic Observation Technology for Space Biological Experiments.....	504
<i>Kohei Yoshioka, Soichiro Ueno, Wataru Ikeda, Yusuke Takeuchi</i>	
Genomic Exploration in Microgravity: MESSAGE (Microgravity Associated Genetics) Science Mission Preliminary Results.....	508
<i>Cihan Tastan, Berranur Sert, Gamze Gülden, Fatmanur Erkek, Özge Demir, Batuhan Yolver, Ebru Çam, Busra Tekirdagli</i>	
Exposure of Cartilage Tissue Models to Gravitational Transitions Associated with Spaceflight: Implications for Interplanetary Exploration	523
<i>Giada Graziana Genchi, Alessia Favale, Alessio Carmignani, Matteo Battaglini, Michele Tricarico, Antonio Cibelli, Grazia Paola Nicchia, Antonio Papangelo, Gianni Ciofani</i>	
Bone Scaffolds in Simulated Microgravity: An Experimental Approach to Assess Cell Response to a Biomimetic Microenvironment.....	528
<i>Elisa Scatena, Giulia Gramigna, Martina Rescigno, Antonella Lisi, Costantino Del Gaudio, Mario Ledda, Eleonora Zenobi</i>	
Possibility to Expand Opportunity and Benefit with JAXA Mouse Habitat Unit for the International Space Station and Beyond.....	533
<i>Kenichi Nagamoto, Masashi Ohara</i>	
Hypergravity Induces Changes of Erythrocyte Membrane and Antioxidant Potential of Mice Housed in the MDS Facility	538
<i>Angela Maria Rizzo, Giampaolo Murgia, Antonio Lentini, Irma Colombo, Francesca Ferranti, Sara Tavella, Daniela Santucci, Jack Van Loon, Paola Antonia Corsetto</i>	
Mycotoxycological Studies Under Microgravity: An Innovation for Food Safety and Security.....	544
<i>Funmilola Oluwafemi, Precious Debo-Ajagunna, Ropo Afolabi Olubiye, Tolulope Olayinka, Beverley Chelsea Saungweme, Ruvarashe Michelle Muwonde, Florence Ibrahim, Dunamis Akande, Asma Bettika</i>	

Exploring Retronasal Aromas and Mouthfeel Perception in Simulated Space Environments: Implications for Enhancing Astronaut Nutrition and Palatability in Long-Term Missions.	548
<i>Claudia Gonzalez Viejo, Natalie Harris, Sigfredo Fuentes</i>	

INTERACTIVE PRESENTATIONS - IAF/IAA SPACE LIFE SCIENCES SYMPOSIUM

Human Performance of a Colombian Aerospace Force Crew in Extravehicular Space Analog in the ILMAH Habitat in Nord Dakota (ATLAS).....	555
<i>Diego Ernesto Cortes Guaje, Brian Ingerman Sánchez Ayala, Joseph Nestor David Sequeda Ramón, José David Ortega Pabón, Ingrid Xiomara Bejarano Cifuentes, Jeimmy Nataly Buitrago Leiva, Hernán David Mateus Jiménez</i>	
Extravehicular Activity (EVA) Under Pressure. Simulated Emergency Scenarios During EVA in Space Analogs.	569
<i>Gabriel G. De La Torre, Celia Avila-Rauch, Sara Gonzalez-Torre, Miguel Angel Ramallo</i>	
Social Research and Sociomapping: Advantage of Implementing the Social Action Research Model into the “SIRIUS 2017 – 2027 International Project”	577
<i>Katerina Bernardova Sykorova, Eva Chroustova, Matylda Klosova, Pavel Bohacek, Radvan Bahbouh, Eva Hoschlova</i>	
Social Research: Qualitative Analysis of Perceived Characteristics of the SIRIUS-19 and SIRIUS- 21 Crew Commanders Through the Lens of Comparison	585
<i>Kryštof Kerndl, Katerina Bernardova Sykorova, Eva Chroustova, Anna Zubková, Katerina Krásná, Matylda Klosova</i>	
Prevention of Behavioral Disruption in Analog Astronauts Missions	597
<i>Celia Avila-Rauch, Gabriel G. De La Torre, Bernard Foing, Henk Rogers, Kato Claeyss</i>	
Astronaut Parapsychic Training.....	601
<i>Anibal Bentes</i>	
Biomechanics Stability Assessment of a Passive Vibration Isolation and Stabilization Analog Design for Exploration Exercise Devices.....	607
<i>Stephanie Carey, Sandra Faragalla, Kaitlin H. Lostroscio</i>	
Production and Stimulation of Interleukin-2 Through Transgenesis as a Pro-Immunological Therapeutic	612
<i>Alexis Uriel Barbosa, Emmanuel Guzman</i>	
AstRNAuts: Monitoring Space-Induced Stress by Small RNAs in Body Fluids	617
<i>Kiril Tuntevski, Lidia Giantomasi, Alessandro Paolini, Antonella Baldassarre, Roberta Pelizzoli, Sergio Decherchi, Serena Perilli, Luca Di Fino, Barbara Negri, Jack Miller, Livio Narici, Marco De Vivo, Andrea Masotti, Serena Pezzilli, Davide De Pietri Tonelli</i>	
Exploring microRNA-206-3p as a Biomarker in Spaceflight-Induced Depression: A Neurobiological Perspective.....	627
<i>Madiha Rasheed, Han Wang, Maazouzi Mohamed, Yifan Deng, Hafsa Sunniya, Zixuan Chen, Yulin Deng</i>	
An Investigation of the Effects of Sounding Rocket Travel in the Ionosphere on the Structure, Elemental Composition and Photosynthetic Viability of Cyanobacteria Nostoc.....	636
<i>Catherine James</i>	

The Development and Formation of Blood Malignancies in Astronauts and Space Travelers as a Result of Cosmic Radiation During Deep Space Travel.....	649
<i>Fay Ghani, Abba Zubair</i>	
Improved Morphology and Biochemical Properties of Carrot's Roots After Simulated Microgravity Impact.....	655
<i>Funmilola Oluwafemi, Adetoun H. Akinlami, A. Babatunde Rabi, Lily Rospeen Asongfac</i>	
Assisted Reproductive Technologies in Space Improve Life on Earth.....	666
<i>Angelo C. J. Vermeulen, Seerat Maqsood, Egbert Edelbroek</i>	

VOLUME 2

ÉOS: The Optimal Recovery Experience	671
<i>Emma Chabani, Madison Diamond</i>	
Galvanic Vestibular Stimulation as a Countermeasure to Motion Sickness Following Gravity Transitions in Astronauts	683
<i>Aaron Allred</i>	
EMSi Suit: Electrical Muscle Simulation Suit for Countering Musculoskeletal Changes in Microgravity Through Interaction with Postural Muscles.....	691
<i>Giorgio Lorini, Eleonora Zan, Flavio Gentile</i>	
Nutritional Countermeasures Against Immune System Dysregulation Caused by Oxidative Stress in Microgravity and Ionizing Radiation in Long-Term Spaceflights.....	702
<i>Luisa Garcia Rojas Vazquez, Jose Cerano</i>	
Breath-Actuated VR Experimental Protocol Countermeasures: A Report Contextualizing an Analog Astronaut HCI User-Study	709
<i>Sarah Jane Pell, Floyd Mueller, Rakesh Paibanda, Jonathan Duckworth</i>	
The Impact of Prebiotic Molecules on Inorganic Silica Deposition and Its Significance for the Identification of Putative Biomarkers on Mars.....	736
<i>Khushi Daga</i>	
Potential Habitable Environment for Cultivating Algae: Proxima Centauri B	741
<i>Bilal Sayin</i>	
Mathematical Astrobiology: The Statistical Drake Equation Solved in 50 Steps by Maccone's Lognormal Method.....	747
<i>Claudio Maccone</i>	
Exploring the Intersection Between Space and Life Sciences	802
<i>Alexandre Mencik</i>	
Post-Flight Rehabilitation of Astronauts	816
<i>Goncha Yusifova</i>	
Real Heroes that Exist in Our World	819
<i>Aylin Quliyeva</i>	
Navigating Musculoskeletal Challenges in Space Exploration: Mechanisms, Interventions, and Future Directions.....	822
<i>Kamran Mahmudov, Nigar Ismayilzada, Medine Qulizade</i>	

Psychological Challenges of Space Travel	828
<i>Shabnam Ibrahimova, Amina Valiyeva</i>	
Human Physiology in Space.....	832
<i>Sara Mammadova</i>	
Human Physiology and Health in Space Missions: Changes, Effects, and Coping Strategies	837
<i>Nargiz Aliyarli, Elza Salimli, Fidan Huseynzada, Alizada Ravan</i>	
Exploring the Human Element of Space Exploration.....	854
<i>Tuncay Isgenderli, Arzu Mirzabayova</i>	
Exploring the Psychosocial Impacts of Space Tourism: Challenges and Opportunities.....	861
<i>Elza Salimli, Alizada Ravan, Nargiz Aliyarli, Fidan Huseynzada</i>	
Heroes Conquering Interstellar Space	866
<i>Aylin Quliyeva</i>	
From Earth to Space: Emotional Intelligence and Interpersonal Dynamics Among Astronauts	869
<i>Elza Salimli, Alizada Ravan, Nargiz Aliyarli, Fidan Huseynzada</i>	
Anorexia Nervosa in Space Environments	877
<i>Fidan Huseynzada, Alizada Ravan, Nargiz Aliyarli, Elza Salimli</i>	
Space Physiotherapy	883
<i>Vusale Kazimova</i>	
Cognitive Behavioral Therapy for Loneliness and Isolation of Astronauts in Space Mission.....	887
<i>Elza Salimli, Alizada Ravan, Nargiz Aliyarli, Fidan Huseynzada</i>	
Horizontal Running Bouts Inside a Circular Wall on the Moon as a Countermeasure to Prolonged Low Gravity Deconditioning of Bone, Muscle and Cardio-Vascular Fitness. Implications for Habitat Design	892
<i>Alberto Minetti</i>	
Thermodynamic and Biophysical Effects of Extreme Conditions on Analog Astronauts in the Astroland Interplanetary Habitat: A Study of the First Latin American Analog Mars Research Mission Using Sustainable Smart Socks	896
<i>Diana Karen Hernández Araujo, Rivaldo Carlos Duran Aquino, Nataly Andrea Rojas Barnett, Mónica Ortiz Álvarez, Julio Abraham Rizo Churape, Nadia Lizbeth Zenteno Perez, Arlette Pamela Silva Hernandez, Laura Guadalupe Barajas Martell</i>	
Sustainability in Space Missions: Innovation in Radiation Protection Using Recycled Water.....	903
<i>Rivaldo Carlos Duran Aquino, Karen Cuba, Ariadna Celeste Pillaca Llanos, Avid Roman- Gonzalez</i>	
Designing of a Multifunctional Astronaut Gauntlet for Health and Communication	912
<i>Sukhjot Singh, Agnieszka Pukacz, Agata Stefanczyk, Agnieszka Elwertowska, Jasjit Singh</i>	
AstroCognita: Advanced Neural Monitoring and Radiation Protection System for Deep Space Exploration	923
<i>Sukhjot Singh, Kiran Mankame, Agnieszka Pukacz, Agnieszka Elwertowska, Agata Stefanczyk</i>	
Conservation and Production of Plant Material and Microalgae with Important in the Implementation of Human Colonies in the Solar System Through the Encapsulation Technique	935
<i>Mario Colorado, Sandra Lerma, German Sarmiento, Lukasz Wilczynski</i>	

Deep Space Fine - A Pilot Study on Arctic Crew Experiences with Extreme Environment Habitat Design.....	948
<i>Konstantin Chtere, Melissa Marselle, Birgitta Gatersleben</i>	
Impact of Isolation/Confinement (IC) Stress on Human Biophysiology: A Multiomic Analysis.....	956
<i>Catherine Taylor, Andrew Blaber</i>	
The Effect of Spaceflight and Microgravity on the Human Brain.....	968
<i>Alizada Ravan, Nargiz Aliyarli, Fidan Huseynzada, Elza Salimli</i>	
Exploring the Impact of Jain Meditation on Astronauts' Mental Well-Being for Extended Isolation Space Missions	980
<i>Aagam Jain, Pushpdant Jain, Sejal Jain</i>	
Olfactory Enhancement for Astronaut Well-Being in Confined Space Habitats	989
<i>Bartosz Choinski, Agnieszka Elwertowska, Sukhjit Singh, Julio Rezende, Celia Avila-Rauch</i>	
Neurodiversity in Space, Industry and Beyond	995
<i>Nykoda Cooper, Briana Kroeker</i>	
Effect of Microgravity on Titanium Device-Induced Bone Remodeling: Preclinical Study Using C57BL/6 Mice	1003
<i>Andrea Cariz Quezada, Vanessa Campos - Bijit, Alejandro Rivera Palacios</i>	
A Wearable-Based System to Reduce Space Motion Sickness by Multi-Sensory Pre-Habitation: Assessment of Adaptation to SMS in Isolated-Conditions	1012
<i>Carole-Anne Vollette</i>	
Modelling of Hepatic Alterations Health Risks in Long-Term Human Space Missions	1017
<i>Antoni Perez-Poch, Jordi Torner</i>	
Cardiopulmonary Resuscitation (CPR) in Microgravity: Effectiveness of Using the MMM Vs. the CMRS – CPR Simulation in Neutral Buoyancy.	1022
<i>Arkadiusz Trzos, Ryszard Pokladnik, Matt Harasymczuk, Karol Lyzinski, Agnieszka Elwertowska</i>	
Genetically Manufacture Probiotic Capsules for Nutrition Fullfillment & Improvization of Microbiome Health with Vaccination for Development of Immunogloblin.	1031
<i>Shivani Pande, Dhiraj Thote, Nitin Chakole, Dinesh Tundalwar, Amit Bhoyar, Gauri Thote, Apeksha Pande, Mohit Thote, Sougat Nandy, Diya Pande</i>	
Exploring the Psychological Impact of Menstruation in Space on Female Astronauts	1037
<i>Nargiz Aliyarli, Elza Salimli, Fidan Huseynzada, Alizada Ravan</i>	
Identifying and Characterising Personal “styles” on EVA Operations.	1045
<i>Giuseppe Scavo</i>	
Astropharmacy and Astromedicine: Investigation of Potential Methods for Medication Production in Long-Term Space Missions Via an ISS Experiment.....	1055
<i>Marialina Tsinidis, Chantal Cappelletti, Li Shean Toh</i>	
The Potential Effects of Suborbital Spaceflight Stressors on Passengers with Cardiovascular Comorbidities: A Systematic Review.	1063
<i>Sarah Gaier, Anita Adiga, Jasmine Biswas, Arkadiusz Kolodziej, Nina Purvis, Eleonor Frost, Lauren Church, Maia Gummer, Anthony Yuen, Rochelle Velho</i>	

Effects of Artificial Gravity on the Musculoskeletal System	1077
<i>Francesc Casanovas Gassó</i>	
Exploration of the Biomechanical Stress on the Body While Performing Functional and Operationally Relevant Movement Patterns Under Variable Gravitational Stress	1091
<i>Devjoy Dev, Bria Morse, Önder Bakir, Alita Regi</i>	
Acute Cardiovascular Response to Gravity Changes: A Multiscale Mathematical Model for Microgravity and Hypergravity Applications	1106
<i>Francesco Tripoli, Luca Ridolfi, Stefania Scarsoglio</i>	
Understanding Mechanisms and Unveiling Countermeasures for the Bedrest-Induced Decrease in Cerebral Blood Flow	1118
<i>Carmen Possnig</i>	
Synergistic Advances in Space Radiation Health Effects: Collaborative Insights from AMS Roma Sapienza and Medical Physics Division of IRCCS University Hospital of Bologna Hospital	1124
<i>Lidia Strigari, Alessandro Bartoloni</i>	
Multi-Stage Adaptive Filtering of Cosmic Ray Signal Data - Application and Configuration for Ultra-High-Energy Cosmic Ray Study at Pierre Auger Observatory	1131
<i>Diana Pawlicki, Krzysztof Stasiak, Zbigniew Szadkowski</i>	
Extra-Virgin Olive Oil as a Countermeasure for the Effects of Space on Human Health	1149
<i>Marta Del Bianco, Gabriele Mascetti, Stefano Polato, Sara Rocci Denis, Raimondo Fortezza, Cinzia Benincasa, Elvira Romano, Massimiliano Pellegrino, Enzo Perri</i>	
Space Weather Mitigation: A Multidisciplinary Proposal for Enhanced Astronaut Radiation Protection	1153
<i>Rochelle Velho, Andrea Civiero, Alice Pais De Castro, Joshua Finn, Andrea Troise, Odelia Petersen-Mahrt, Jessica D'Urbano, Leonard Carl Luigi Lidgard, Francesco Giordano</i>	
Radiation Protection by Design Strategy for Lunar Habitats	1158
<i>Valentina Sumini, Lorenzo Isolan, Marco Sumini</i>	
A Re-Evaluation of the Early Effects of Weightlessness	1172
<i>Jay Buckey, Mimi Lan</i>	
Exposure to Mars Gravity is Not Sufficient to Provide Mitigating Effects on Orthostatic Intolerance Upon Return to Earth.....	1175
<i>Antoni Perez-Poch, Jordi Torner</i>	
Modelling the Irradiation Experiments of Microbic Films Within the BOREALIS Payload	1180
<i>Nunzio Burgio, Stefano Carletta, Alfonso Santagata, Tiziana Tedde, Augusto Nascetti, Massimo Frullini, Mara Mirasoli, Silvia Natalucci, Marta Albano, Daniele Urban</i>	
Mitigating Bone Loss in Astronauts Through the Application of the 'Aggregation of Marginal Gains' Approach	1189
<i>Erik Seedhouse</i>	
Adaptive Vertical Farm for Space Cultivation: A First Proof of Concept.....	1192
<i>Patrizia Bagnerini, Mauro Gaggero, Marco Ghio, Franco Malerba</i>	
The Potential Role of Biomedical Lab-On-Chip for Human Space Exploration.....	1201
<i>Elisa Scatena, Eleonora Zenobi, Vittorio De Franciscis, Carla Lucia Esposito</i>	

Wound Healing Real Time Monitoring Multi-Sensing Electronics.....	1206
<i>Giorgio Cortelli, Beatrice Fraboni, Erika Scavetta, Augusto Nascetti, Monica Monici, Isacco Gualandi, Marta Tessarolo, Erika Pittella, Mohamed Salim Farissi, Francesco Decataldo, Marta Colletti, Gabriele Mascetti, Fabio Lorenzini, Enrico Gabriele, Pierluigi Luciano, Vito Vurro, Donato Calabria, Elisa Lazzarini, Andrea Pace, Mara Mirasoli</i>	
Dental Guidelines for Astronauts on Short- And Long Term Missions : A Scopic Review.....	1215
<i>Dirk Neefs, Massimo Del Fabbro, Shahnawaz Khijmatgar, Gianluca Tartaglia, Ishita Singhal, Bart Vandenbergh, Edward Kijak, Malgorzata Kulesa, Basil Britto Xavier, Linda Dao, Victoria Sampson</i>	
Exploring Microgravity Induced Changes to the Coagulation System Using Thromboelastometry.....	1231
<i>Jesper Mølgaard, Ivy Mayor, Karsten Lindgaard, Bijan Harandi, Jakob Steensballe</i>	
Palm Cooling for Heat Mitigation.....	1238
<i>Katherine Maguire, Margaret Wydotis, Neel Patel, Jason Jagers, Pete Quesada, Jennifer Daily, John Caruso</i>	
Synthesizing the Future of Astropharmacy: Enabling On-Demand Protein Production in Space Through Cell-Free Systems.....	1245
<i>Marialina Tsinidis, Joshua Clark, Alice Wingfield, Sedat Izcan, Phil Williams, Chantal Cappelletti, Li Shean Toh</i>	
The Effect of Simulated Microgravity by Clinostat on the Stability of Circular DNA and Circular mRNA.	1250
<i>Pattarada Maneesri, Pitchaya Sawangmaneeelert, Yanisa Benjapornpong, Thanathip Samkham, Suchayaa Kritsabannarat, Tanthai Thummasorn, Jakkapath Puriteerangkul, Piyapong Tirpatsakoon, Potiwat Ngamkajornwiwat, Patompon Wongtrakoongate, Wares Chancharoen</i>	
Isolation and Confinement in Space and Underwater Missions	1262
<i>Monica Monici, Francesca Cialdai, Chiara Risaliti, Matteo Lulli, Amedeo Amedei, Duccio Cavalieri, Massimiliano Marvasi, Stephan Bohm, Andreas Osterman, Alexander Choukér, Judith Irina Buchheim, Lucia Morbidelli, Carlo Iorio, Angela Maria Rizzo, Paolo Magni, Felice Strollo, Alamelu Sundaresan, Vivek Mann, Alessandro Papa, Stefano Oliva, Alessandro Alcibiade, Domenico Antonacci, Ines Antunes, Juan Gabriel Rios, Francesca Ferranti</i>	
Terrestrial and Space Applications of Innovations in Telemedicine and Biomedical Monitoring for Extreme and Remote Environments	1277
<i>Antonio Pallotti</i>	
Deep Learning Optimization in Cardiovascular Deconditioning Modelling for Long-Term Human Space Missions.	1286
<i>Antoni Perez-Poch</i>	
Possible Factors in the Cascade of Events Where the CREB1 Gene May Modulate the Adverse Effects of Microgravity on Astronaut Health	1291
<i>Laura Rosa Cornejo-Roldán, Cristina Pérez Ramos</i>	
Probing Eye Adaptation in Analog Mission Environments	1298
<i>Barbara Szaflarska, Wojciech Kajfosh, Igor Kondek, Martyna Baran, Kajetan Gudowski</i>	

LATE BREAKING ABSTRACTS (LBA)

A Transcriptomic Approach to Understand Pharmacogenetics of Mice Exposed to Spaceflight Conditions	1303
<i>Jette Ritz</i>	

Evaluation of Calcium Salts in Dietary Supplements and Nutraceuticals: Proposal for Treatment of Bone Demineralization in Astronauts.....	1311
<i>Katherine Del Socorro Luna Abundis, Andrea Alejandra Lopez Cardona, Fernando González Chavez, Zobeida Lopez Vizcarra, Gerardo Villaseñor Castañeda, Paola Ithzel Juárez Rodríguez, Melanie Alejandra Guzmán Díaz, Kerry Axel Basulto González, Gustavo Alexei Rayas Martinez</i>	

Illuminating Life's Origins: The LEORigin Space Experiment.....	1321
<i>Uma Cladellas Sanjuan, Blandine Gorce, Emilie Bessette, Ines Torres, Rosie Wilson, Thomas Steurbaut, Alexander Rützler, Leon Schiltz</i>	

Escherichia Coli Survival and Adaptation in Simulated Spaceflight Conditions	1336
<i>Jaume Puig, Florence Pauline Basubas</i>	

Author Index