

Contents

Part I Prelude

- 1 Space Travel: A Personal View from Above** 3
Thomas Reiter
- 2 Space Travel: An Integrative View from the
Scientists of the Topical Team “Stress and Immunity”** 5
Sarah Baatout, Alexander Choukèr, Ines Kaufmann, Nicola Montano,
Siegfried Praun, Dominique de Quervain, Benno Roozendaal,
Gustav Schelling, and Manfred Thiel

Part II “Stress and Immunity” - Research: A Link Between Space and Earth

- 3 What Is Stress?** 11
Bruce S. McEwen and Ilia N. Karatsoreos
- 4 The Impact of Everyday Stressors on the Immune
System and Health** 31
Lisa M. Christian and Ronald Glaser

Part III Stress and Immune Allostasis in Space, from Brain to Immune Responses

- 5 Neurobiological Mechanisms of Stress and Glucocorticoid
Effects on Learning and Memory: Implications for Stress
Disorders on Earth and in Space** 47
Raquel V. Fornari, Amanda Aerni, Benno Roozendaal,
and Dominique J.-F. de Quervain
- 6 The Autonomic Nervous System** 71
Nicola Montano, Eleonora Tobaldini, and Alberto Porta
- 7 Circadian Rhythm and Stress** 87
Mathias Steinach and Hanns-Christian Gunga

8	Endocannabinoids, “New-Old” Mediators of Stress Homeostasis	107
	Daniela Hauer, Roland Toth, and Gustav Schelling	
9	Immune System in Space: General Introduction and Observations on Stress-Sensitive Regulations.	127
	Brian Crucian and Alexander Choukèr	
10	Innate Immunity Under Conditions of Space Flight	141
	Matthias Feuerecker, Alex P. Salam, Ines Kaufmann, André Martignoni, and Alexander Choukèr	
11	NK Cells Assessments: A Thirty-Year-Old History of Immune Stress Interaction in Space.	155
	Boris Morukov, Marina Rykova, and Eugenia Antropova	
12	Adaptive Immunity and Spaceflight	165
	Brian Crucian and Clarence Sams	
13	Stress, Hypoxia, and Immune Responses	177
	Manfred Thiel, Michail Sitkovsky, and Alexander Choukèr	
14	Gravitational Force: Triggered Stress in Cells of the Immune System	187
	Oliver Ullrich and Cora S. Thiel	
15	Microbial Stress: Spaceflight-induced Alterations in Microbial Virulence and Infectious Disease Risks for the Crew	203
	C. Mark Ott, Aurélie Crabbé, James W. Wilson, Jennifer Barrila, Sarah L. Castro, and Cheryl A. Nickerson	
16	Stress, Spaceflight, and Latent Herpes Virus Reactivation.	227
	Raymond P. Stowe, Duane L. Pierson, and Satish K. Mehta	
17	Stress and Radiation Responsiveness	239
	Marjan Moreels, Louis de Saint-Georges, Filip Vanhavere, and Sarah Baatout	
Part IV Preventive and Diagnostic Tools and Strategies		
18	Considerations for Development and Application of Health Monitoring Tools in Space.	263
	Ines Kaufmann and Alexander Choukèr	
19	Psychological Monitoring.	269
	Bernd Johannes and Berna van Baarsen	
20	Monitoring of Autonomic Activity by Cardiovascular Variability: How to Measure?	279
	André E. Aubert and Bart Verheyden	

21	Breath Gas Analysis	289
	Michael Dolch, Siegfried Praun, Johannes Villiger, Alexander Choukèr, and Gustav Schelling	
22	Monitoring the Microbial Burden in Manned Space Stations	299
	Rob Van Houdt and Natalie Leys	
23	Monitoring of Body Core Temperature in Humans	309
	Andreas Werner and Hanns-Christian Gunga	
24	Flow Cytometry Methods to Monitor Immune Dysregulation Associated with Spaceflight	327
	Brian Crucian and Clarence Sams	
25	Assessment of Radiosensitivity and Monitoring of Radiation-Induced Cellular Damage	345
	Marjan Moreels, Roel Quintens, and Sarah Baatout	

Part V Preventive and Therapeutic Strategies

26	Considerations for Preventive and Therapeutic Strategies.	359
	Jean-Pol Frippiat, Martina Heer, and Alexander Choukèr	
27	Psychological Countermeasures	363
	Gro Mjeldheim Sandal and Gloria R. Leon	
28	Physical Countermeasures to Stress	373
	Vera Abeln and Stefan Schneider	
29	Nutritional Countermeasures for Spaceflight-Related Stress.	387
	Martina Heer, Natalie Baecker, Scott M. Smith, and Sara R. Swart	
30	Pharmacological Countermeasures to Spaceflight-Induced Alterations of the Immune System.	405
	Nathan Guéguinou, Matthieu Bascove, and Jean-Pol Frippiat	

Part VI Perspectives for Manned Space Exploration

31	Platforms for Stress and Immune Research in Preparation of Long-Duration Space Exploration Missions	417
	Oliver Angerer	
32	Exploration Class Missions on Earth: Lessons Learnt from Life in Extreme Antarctic Isolation and Confinement	425
	Alex P. Salam	
33	Moon, Mars and Beyond	441
	Marc Heppener	
	Index.	461