Life Sciences Division
Organization

- Director
- Deputy Director

Chief Scientist

Strategic Planning
Program Control

Aerospace Medicine Office

Life Support Branch
- Space Physiology & Countermeasures
- Radiation Health
- Environmental Health
- Space Human Factors
- CELSS
- Life Support Systems Integration

Programs & Flight Missions Branch
- Space Shuttle
- Space Station Freedom
- Free Flyers
- Small Payloads
- Advanced Missions

Research Programs Branch
- Biospheric Research
- Exobiology
- Space Biology
- Planetary Protection
<table>
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<tr>
<th>Event</th>
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<tr>
<td>Space Station</td>
<td>1997-2003</td>
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<tr>
<td>Humans Return to the Moon</td>
<td>2004</td>
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<tr>
<td>Lunar Presence</td>
<td>2005</td>
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<td>Lunar Habitat</td>
<td>2007-2009</td>
</tr>
<tr>
<td>Humans Land on Mars</td>
<td>2018</td>
</tr>
</tbody>
</table>

* Schedule currently under scrutiny by various outside Advisory Committees
Biomedical Programs

Goals

• Develop an understanding of the physiological, psychological and behavioral adaptation to space

• Ensure the health, well-being, and performance of humans in space and on return to Earth's gravity

• Promote the application of biomedical research to improve the quality of life on Earth

Objectives

• Determine the acute and long-term physiological and behavioral adaptation to space

• Determine the psychological and sociological implications of space flight

• Determine the crew performance and mission consequences of the physiological, psychological and behavioral adaptation to space

• Develop adequate monitoring techniques and countermeasures

• Verify adequate models and/or analogs for space
INFLIGHT VALIDATION

Training Protocols
Design Requirements
Procedures
Selection Criteria
Other Procedures

Requirements

Undersea Habitat Model
- Contained
- Link w/Outside
- EVA-Type Activity
- Crew Coordination
- Group Dynamics
- Selection & Training
- Immunology Studies*
- Environmental Monitoring

Antarctic Model
- Isolation
- Self-Sufficiency
- Very Long-Duration
- Psychological C&M
- Crew Coordination
- Group Dynamics
- Selection & Training
- Immunology Studies
- Circadian Rhythms
- Stress Related
- Endocrinology
- Advanced HIF Testing
- Environmental Monitoring
- Instrument Testing
- Galactic Cosmic Radiation

Requirements

Simulations/Aviation

HYPOTHESIS TESTING

Computer Modelling

Hypothesis

Feedback

BASIC RESEARCH

* If longer than 2 weeks
Justification for Using the Antarctic as an Analog

- Similarities Between Extended Duration Space Missions and Antarctica Conditions
  - Long Duration
  - Extreme Environments
  - Isolated Location
  - Delayed Communications
  - Confinement
  - Small Group Dynamics
  - Diverse skill mix
  - Various Nationalities
NASA Proposed Biomedical Research in the Antarctic

Goal

- To use the Antarctic as an analog for space exploration to study human behavior and performance, physiology under stress, and environmental health.

Areas of Research Interest

- Space Human Factors
- Human Physiology
- Environmental Health
NASA Proposed Biomedical Research in the Antarctic (Continued)

- Space Human Factors
  - Crew Selection and Training
  - Isolation
  - Psychological Support/Countermeasures
  - Human-Machine Interactions
  - Work Station/Habitability Requirements
  - Workload
  - Small Group Dynamics
  - Command and Control Structure
  - Crew Composition: Gender, Nationality, Skill Mix

- Human Physiology
  - Stress-Related Endocrinology/Immunity issues
  - Circadian Rhythms and Sleep Disorders
  - Sedentary Issues Related to General Fitness/Motivational Aspects of Exercise

- Environmental Health
  - Microbiology and Toxicology Issues
  - Epidemiology of Infectious Diseases
<table>
<thead>
<tr>
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<th>Date</th>
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<tbody>
<tr>
<td>Initial Meeting of the Science Working Group</td>
<td>October 11-12, 1990</td>
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<tr>
<td>NASA/NSF Research Announcement Release</td>
<td>March 1, 1991</td>
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<td>Proposal Submission Deadline</td>
<td>June 1, 1991</td>
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<td>Investigation Selection</td>
<td>Summer 1991</td>
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<td>Investigation Initiation</td>
<td>Fall 1991 (FY92)</td>
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Charge to the Committee

The NASA/NSF Science Working Group is charged with defining specific science requirements and priorities for biomedical research to be conducted using the Antarctic as an analog for space exploration.
Attachment 9