Research for Human Exploration
NASA’s Space Life and Physical Sciences Research and Applications Division (SLPS) has been formulated to execute high quality, high value research and application activities in the areas of:

- Fundamental Space Biology
- Physical Sciences
- Human Research

These programs conduct fundamental and applied research to advance basic knowledge and to support human exploration in the environment of space.

Division serves as the agency liaison with the ISS National Laboratory management organization (CASIS)
Response to the Decadal Survey

Recapturing a Future for Space Exploration
Life and Physical Sciences Research for a New Era
“It is important that investigators use the most appropriate 21st century biological bioanalytic tools (e.g., genetic, proteomic, metabolomic) to discover and characterize underlying mechanisms of adaptation to the space flight environment (e.g., altered gravity, stress, radiation), and that experiments determine cellular and organismal mechanisms that regulate and sustain growth, metabolism, reproduction and development in space.”

Final proposals were due December 19, 2012. NASA anticipates receiving proposals that support omics research.
geneLAB is a Response to the Decadal Survey

The geneLAB campaign serves as a “Grand Science Laboratory” with the following aims:

- Deliver ground-breaking science
- Increase visibility to NASA’s life science efforts
- Promote the value of human space flight
- Responds to the demand for expanded multi-investigator collaborations
- Takes advantage of new, high-throughput bio-molecular research technologies
A Telescope Platform to Unite Life Sciences?

Hubble Extreme Deep Field
### The Expressome as the “Telescope for Life Sciences”

High Content Screening: as platform for high density/high throughput life science utilization of ISS

<table>
<thead>
<tr>
<th>Expressome Components</th>
<th>Details</th>
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<tr>
<td>Transcriptome</td>
<td>mRNA transcription</td>
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<td>Proteome</td>
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<td>Intron/exon editing</td>
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<td>Nitroslylation</td>
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<tr>
<td>Metabolome</td>
<td>Substrates, intermediates, and products for enzyme pathways</td>
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<tr>
<td>Epigenome</td>
<td>Changes in DNA and histone chemistry</td>
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</tbody>
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Transcriptome  
Proteome  
Metabolome  
Epigenome  

\[=\text{Expressome}\]
Omics of Omics

- Nuclear Transport
- Transcription Factors
- Regulatory Elements
- Genetic Control
- Transcription and Translation control
- Receptors and Transduction
- Protein Activity Control
- DNA-RNA Synthesis
- METABOLOME
- Enzymatic Pathways
- Ionome
- Metabolic Partitioning
- Pumps Channels Carriers
- Mechanical Transport
- Cytoskeleton ECM
- Intracellular Transport
- Cell-Cell Integration
- Cell Morphology
1. NRI Creates Science Definition Team

2. NASA develops Research Implementation Plan, and manages payload integration

3. ISS flight experiment operations

4. Sample return for Omics analysis

5. Space Bioinformatics database
geneLAB

multi-investigator utilization
open source science innovation

Individual PI Flight experiments

Open innovation approach to doing science

NRA to perform ground research based on data in informatics database

Non-NRA Outside Data users

CASIS

New scientific insight and publications

geneLAB RFI released
To move forward with the definition of the geneLAB campaign two efforts have been undertaken:

1. NASA Request for Information (RFI) December 11, 2012:
   “Development of Strategies for the Collection, Management, and Distribution, or access to, 'Omics-type' Data Collected in the Course of Space Biology Research” (NNH12ZTT001L)

2. geneLAB Workshop held at NASA Ames Research Center on January 22, 2013.
geneLAB Next Steps

- Define an implementation plan for geneLAB
- Form the Science Definition Team
- Gain participation from the international partners and other US government agencies
- Determine how future NRAs and ILSRAs will encompass geneLAB
- Define the data standards and acquire the data services that are needed to support geneLAB
Questions?