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# SCIENCE IN SPACE FOR LIFE ON EARTH

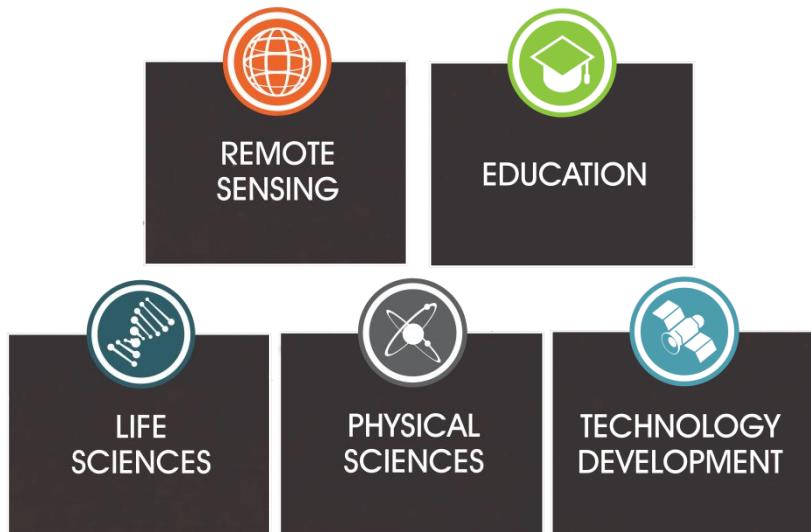
*Gregory H. Johnson, Executive Director*



# THE ISS U.S. NATIONAL LAB

The ISS U.S. National Lab provides opportunity for research and discovery targeted to a definitive impact on Earth

The opportunities are wide-ranging:



POWERED THROUGH PARTNERSHIP

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# ISS NL: A PLATFORM FOR COMMERCIAL INNOVATION

- ⊕ Historically, NASA has funded nearly all aspects of space research (NASA as the customer)
- ⊕ Commercialization requires capital investment and faith in marketplace potential
- ⊕ CASIS is working in partnership with NASA to create a future sustainable marketplace in Low Earth Orbit, i.e., LEO Commercialization
- ⊕ **NASA builds the supply side for LEO** through contracts with launch service providers and technology developers focused on new space
- ⊕ **CASIS builds the demand side for space R&D** through seed grants and sponsored research programs via partnerships with other government agencies, commercial and academic institutions



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# ISS NATIONAL LABORATORY PROGRESS

## Significant Signs of Progress in Three Key Areas

- ⊕ **Advancing the Rodent Research effort**
- ⊕ **New Discoveries with Impacts on Human Health**
- ⊕ **Commercial Product Development**
- ⊕ **Growth in Demand for Space Station Research:**
  - ⊕ *In FY 2015, 22 new-to-space customers*
  - ⊕ *ISS National Lab Customers include: Procter & Gamble, Merck, Novartis, Milliken, NEMAK, Eli Lilly, DoD, NIH, NSF, Emory, MIT, and more*
  - ⊕ *Success in securing outside NASA investments for impactful science*  
(2015: \$15 million in outside-NASA funding; \$25 million including in-kind contributions)





# EXPANDING MODELS OF HUMAN DISEASE ACCELERATED BY MICROGRAVITY

- ⊕ **New Analytical Tools** — CASIS supported the development of new analytical tools onboard ISS for rodent research as models of human disease enabling
  - Bone mineral density scans (2015)
  - Grip strength measurement (2016)
- ⊕ **Novartis: Muscle Atrophy Research** – Completed two back-to-back rodent research experiments in different mouse strains to better understand treatments for muscle atrophy and are now collaborating with an academic institution on a third rodent mission.
- ⊕ **Eli Lilly: Muscle Wasting/ Department of Defense: Wound Healing**  
Eli Lilly currently has mice in orbit exploring a drug to combat muscle wasting diseases and the Department of Defense is supporting a rodent experiment for an upcoming mission to accelerate wound healing.



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# NEW DISCOVERIES WITH HEALTH BENEFITS ON EARTH

⊕ **NASA NIH BioMed Program** — The NASA NIH-BioMed program, created to support flight experiments focused on human health, has completed two experiments to the ISS National Lab with CASIS support.

- ***New Mechanism of Immune Regulation by microRNAs*** –

*“Self-limiting induction” (expected to play role in global cellular processes, including wound healing and cancer)*

- ***Mechanosensation of Osteocytes in Microgravity***

*Data demonstrate that sensing of mechanical forces by bone-cells involves unexpected gene regulation related to glycolysis and hypoxia*



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# COMMERCIAL PRODUCT DEVELOPMENT

⊕ **Procter & Gamble: Complex Fluids** – A P&G experiment has correlated the microscopic behavior of complex fluids with the macroscopic properties of commercial products—over length-scales relevant to improving product shelf life. Unexpected findings related to coarsening have improved the understanding of polydispersity and ordering to benefit product chemistry.

⊕ **Made In Space: 3D Printing/Additive Manufacturing Facility (AMF)** Made in Space has launched a commercial facility to the ISS; 6-month backlog of customers.

⊕ **Remote Sensing – Multiple Projects in Commercial Development**

**Improvement of a custom algorithm associated with detecting harmful algal blooms.** The algorithm is now in use by downstream external customers (e.g., various universities and the Naval Research Lab).

**Web application that allows cloud-based remote sensing image analysis,** a prototype currently being pushed out by Harris Corporation to their customers



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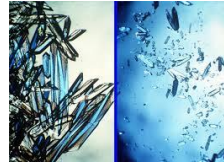


# WHAT'S HEADING TO ISS IN FY16

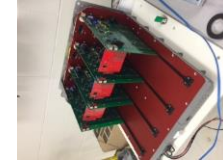
## Stem Cells



## Protein Crystal Growth



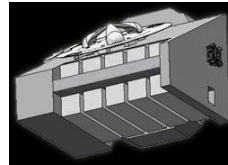
## New Facilities



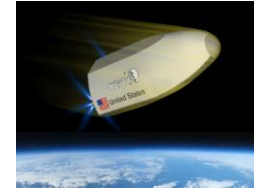
## Rodent Research



## External Platform Payloads



## Test Validation Payloads



## MassChallenge '14 Winners



## STEM Payloads



## Earth Observation Inquiries





# THANK YOU

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