

The National Academies of
SCIENCES • ENGINEERING • MEDICINE

DIVISION ON ENGINEERING AND PHYSICAL SCIENCES
SPACE STUDIES BOARD

Carriage House
314 Quisset Avenue

J. Erik Jonsson Center
Woods Hole, D.C. 02543

Sixth Forum for New Leaders in Space Science

AGENDA (12 May)

May 15-18, 2017

Monday, May 15, 2017

- 6:45 p.m. Rendezvous in Arrivals area of Terminal A at Boston/Logan Airport for bus to hotels
- 9:00 p.m. Old Leaders/others dropped off at *Inn on the Square* in Falmouth
- 9:15 p.m. New Leaders dropped off at the *Sands of Time* in Woods Hole

Tuesday, May 16, 2017

- 7:30 a.m. New Leaders meet at the *Sands of Time* main office for shuttle bus to the Jonsson Center
- 7:45 a.m. Old Leaders/others meet in the lobby of *Inn on the Square* to carpool to Johnson Center
- 7:45 a.m. Meeting room opens *Breakfast available at the Jonsson Center Main House*
- 9:00 a.m. Welcome to Woods Hole
Mark ABBOTT
Director
Woods Hole Oceanographic Institution
- 9:10 a.m. Opening Remark
Ji WU
Director General
National Space Science Center, CAS
- 9:15 a.m. Opening Remark
Michael MOLONEY
Space Studies Board

SESSION I: James PAWELCZYK, chair

- 9:20 a.m. Bulk Metallic Glass Formation and Relaxation of Undercooled Melts by Containerless Processing Mingxiang PAN
Institute of Physics, CAS
- 9:55 a.m. Novel Plasma Instability Studies using the Nyquist Stability Criteria on *in situ* Solar Wind Measurements Kristopher G. KLEIN
University of Michigan
- 10:30 a.m. Break and Group Photograph *Coffee/tea/snacks available in Carriage House*
- 11:00 a.m. Atomic Diffusion in Ce-Based Glass Forming Liquids Bo ZHANG
Hefei University of Technology
- 11:35 a.m. Coarsening in Solid-Liquid Mixtures Peter VOORHEES
Northwestern University
- 12:10 p.m. Break *Lunch available in Jonsson Center Main House*

SESSION II: Mingxiang PAN, chair

- 2:00 p.m. Transcriptome Analysis of tch2 (cml242 and cml244) Arabidopsis Mutants Grown on Board the ISS Identified Genes that are Differentially Expressed Due to Spaceflight are also Involved in Plant Defence Responses to Pathogens Richard J. BARKER
University of Wisconsin, Madison
- 2:35 p.m. Potential of Proliferation and Differentiation of Stem Cells Under (Micro-) Gravity Xiaohua LEI
Institute of Zoology, CAS
- 3:10 p.m. Break *Coffee/tea/snacks available in Carriage House*
- 3:40 p.m. Transcriptome Analyses Reveal the Tissue-Specific Role of a Defense Associated Regulator in Plant Hypobaric Response Mingqi ZHOU
University of Florida
- 4:15 p.m. Mechanical Response of Calcium and Mechanical Sensory Component Candidates Seeking in *Arabidopsis thaliana* Ting LI
California Institute of Technology
- 4:50 p.m. The Influence of Space Environment on the Evolution of Biological Molecules and its Experimental Payload for Space Flight Yulin DENG (read by Ji WU)
Beijing Institute of Technology
- 5:05p.m. General Discussion of Presentations

6:10 p.m.	Adjourn for dinner	<i>Assemble to Bus/Carpool to dinner</i>
6:30 p.m.	Dinner at <i>The Flying Bridge</i>	220 Scranton Ave Falmouth MA 02540
8:30 p.m.	Adjourn	<i>Assemble to Bus/Carpool back to hotels</i>

Wednesday, May 17, 2017

7:30 a.m.	New Leaders meet at the <i>Sands of Time</i> main office for shuttle bus to the Jonsson Center	
7:45 a.m.	Old Leaders/others meet in the lobby of <i>Inn on the Square</i> to carpool to Johnson Center	
7:45 a.m.	Meeting room opens	<i>Breakfast available at the Jonsson Center Main House</i>

SESSION III Peter VOORHEES, chair

9:10 a.m.	A New Look at the Role of the Splanchnic Circulation in Cardiovascular Regulation:	James PAWELCZYK Pennsylvania State University
9:45 a.m.	Gaussian target Theory Based on the Two-Stage Stochastic Process and Its Applications	Lei ZHAO Dalian Maritime University
10:20 a.m.	Break	<i>Coffee/tea/snacks available in Carriage House</i>
10:50 a.m.	Quantifying, Understanding, and Predicting Individual Differences in Human Sensorimotor Adaptive Responses to Altered Gravity Environments	Torin K. CLARK University of Colorado
11:25 a.m.	Parabolic Flight to Test Equipment for a Plant Root Module On-Board the ISS	Heather D. SMITH NASA Ames Research Center
12:00 p.m.	Break	<i>Lunch available at the Jonsson Center Main House</i>

SESSION IV: Ji WU, Chair

1:50 p.m.	Advising NASA	Michael Moloney National Academies
2:25 p.m.	Microgravity Biological Mechanism Study of Muscle Movement in <i>Caenorhabditis elegans</i> During Shijian-10 Spaceflight	Wei WANG Dalian Maritime University
3:00 p.m.	Break	<i>Coffee/tea/snacks available in Carriage House</i>
3:30 p.m.	Astronaut Injury Prevention and Measurement Inside the Space Suit	Allison ANDERSON University of Colorado
4:05 p.m.	Exploration, Journey to Mars, STEAMD?	Dava Newman Massachusetts Institute of Technology
4:40 p.m.	General Discussion	
5:15 p.m.	Concluding Comments	Ji WU
5:30 p.m.	Concluding Comments	James PAWELCZYK
5:45	Adjourn for Dinner	
6:00 p.m.	Adjourn	<i>Dinner available at the Jonsson Center Main House</i>
8:00 p.m.	End of Forum	<i>Carpool back to Hotels</i>

Thursday, May 18, 2017

8:30	New Leaders meet at the <i>Sands of Time</i> main office for bus to Boston/Logan Airport
8:45	Old Leaders/others meet in lobby of <i>Inn on the Square</i> for bus to Boston/Logan Airport

NOTES

Jonsson Center: Is located at 314 Quisset Avenue, in Woods Hole. Directions available at the following website: <http://www7.nationalacademies.org/woodshole/>.

Parking: Parking is free and space is usually plentiful. Participants are requested to park in the designated areas only and not on the lawn, driveways or in delivery entrances. Please observe all ONE WAY and NO PARKING signs.

Hotel for “New Leaders”: A block of rooms has been reserved for the New Leaders at the *Sands of Time*; 549 Woods Hole Road, Woods Hole, MA 02543. The telephone number is 508-548-6300. Additional information can be found at: <http://www.sandsoftime.com/>. The *Sands of Time* is 2.6 km from the Jonsson Center. A shuttle bus will leave the *Sands of Time* at approximately 7:30 and 7:45 daily and make return trips in the evening. The bus is small so to be sure of a seat be in the main office of the *Sands of Time* at 7:30. Those using the Peter Pan public bus service to and from Boston’s Logan Airport should note that the Woods Hole bus terminal is at 1 Cowdry Rd, Woods Hole, this is about a 5 minute walk (see Google Maps for details) from the *Sands of Time*.

Hotel for “Old Leaders” and “others”: A block of rooms has been reserved Old Leaders and others at the *Inn on the Square*; 40 North Main Street (Route 28), Falmouth, MA 02540. The telephone number is 508-457-0606. Additional information can be found at: <http://www.innonthesquare.com/>. The *Inn on the Square* is 3.5 km from the Jonsson Center. Participants should rendezvous in the lobby at 7:45 daily to carpool to Johnson Center. Those using the Peter Pan public bus service to and from Boston’s Logan Airport should note that the Falmouth bus terminal is at 59 Depot Ave, i.e., almost directly behind (see Google Maps for details) the *Inn on the Square*.

Dinner 1: There will be a dinner for all participants at *The Flying Bridge*, 220 Scranton Ave, Falmouth, MA 02540 on the evening of Tuesday, May 16. Additional information can be found at flyingbridgerestaurant.com. The telephone number is 508-548-2700. The Flying Bridge is 5.6 km from the Jonsson Center. A shuttle bus will depart the Jonsson Center at 6:20 p.m. and make a return trip to both hotels starting at 8:30 p.m. Those with cars should drive to the restaurant.

Dinner 2: There will be a dinner for all participants on the Jonsson Center terrace on the evening of Wednesday, May 17.

Jonsson Center: History of the Estate: In 1884, James Marshall, a stockbroker who lived and worked in New York City, and who had summered at the Quisset Harbor Hotel in Woods Hole Massachusetts, purchased property on the harbor on which to build a summer cottage for his family. After completing the estate which included the Carriage House and a sizable dwelling (now the Wheeler House) and enjoying 8 summers in that house, the family desired a larger, more formal residence. The original house was moved at the end of the summer season in 1906 by workers using wench horses and an earthen ramp to a location on a hill opposite Quisset Avenue slightly to the right of the drive as you exit the Center. This was a challenging feat for the day and made more exacting by the fact that it was moved with the furniture, family belongings and stone chimneys intact.

The new house was a replica of the earlier one, with enlarged rooms, the addition of the rear porch and rooms above, formalized fireplaces, added servant's quarters and pantries, and many decorative and ornamental features. Completed in just 11 months, the residence was ready when the

family arrived the following July. A remarkable accomplishment, but made possible by the availability of the ships carpenters in surplus as a result of the fading whaling industry and the resulting reduced ship building.

The Marshall's had three children, two girls and a boy. In time the ownership of the house passed to one of the Marshall's daughters, who sold it in 1934 to Mr. Hobart Ames of Boston. Again it passed to the heirs, who in turn sold it to Mr. Howard Houston. In 1975, the National Academies of Sciences, Engineering, and Medicine purchased the house from Mr. Houston to use as a site for holding meetings of the Academy and the National Research Council during the late spring, summer, and early fall months.

Preservation and restoration efforts have been accomplished gradually and are ongoing. As projects of any magnitude have been identified, great authentic reproduction, and identical or superior quality materials are specified in order to ensure the architectural integrity of the structures. (Courtesy of Jonsson Center website)

The National Academy and Woods Hole: The NAS's association with Cape Cod science dates to its earliest days. In 1873, the Swiss-born naturalist Louis Agassiz, one of the NAS's incorporators, set up the Anderson School of Natural History on the Elizabeth Islands directly opposite Woods Hole. The 1880's brought about the creation of the National Marine Fisheries and the Marine Biological Laboratory. Distinguished biologist Frank R. Lillie served as director and then president of the Laboratory and concurrently president of the NAS from 1935 to 1939. In 1929, an NAS Committee's report considering "the share of the United States of America in a worldwide program of Oceanographic Research" recommended the creation of the Woods Hole Oceanographic Institution.

The first study performed by the NAS in Woods Hole was in 1956. Known as the Nobska Study, it concerned the development of anti-submarine weapons defense and took place at the Whitney Estate on Little Harbor. The NAS rented this facility for a number of years and then the Fenno House on the Quissett Campus of the Woods Hole Oceanographic Institution. In 1971 the NAS moved to other rented summer quarters northwest to a point jutting into Quissett Harbor off Buzzards Bay, the present location of the Jonsson Center.

The new rental house was owned by Mr. Howard Houston, who had served as Minister to India in the 1950's under President Eisenhower. The building's handsome collection of oriental carpets and 18th century British and American furniture were included in the NAS's purchase of the property in 1975. The Center is operated year-round as an extension of the conference facilities in Washington D.C. and Irvine, California which support the extensive meetings requirements of the National Academies of Sciences, Engineering, and Medicine. (Courtesy of Jonsson Center website)

Woods Hole: Woods Hole is a village in the town of Falmouth in Barnstable County, Massachusetts, United States. It lies at the extreme southwest corner of Cape Cod, near Martha's Vineyard and the Elizabeth Islands. The population was 781 at the 2010 census.

It is the site of several famous marine science institutions, including Woods Hole Oceanographic Institution, the Marine Biological Laboratory, the Woods Hole Research Center, NOAA's Northeast Fisheries Science Center (which started the Woods Hole scientific community in 1871), the Woods Hole Science Aquarium, a USGS coastal and marine geology center, and the home campus of the Sea Education Association. It is also the site of United States Coast Guard Sector Southeastern New England (formerly USCG Group Woods Hole), the Nobska Light lighthouse, and the terminus of the Steamship Authority ferry route between Cape Cod and the island of Martha's Vineyard.

Historically, Woods Hole included one of the few good harbors (along with Hyannis) on the southern side of Cape Cod (i.e. Great Harbor, contained by Penzance Point). The community became a center for whaling, shipping, and fishing, prior to its dominance today by tourism and marine research.

At the end of the nineteenth century, Woods Hole was the home of the Pacific Guano Company, which produced fertilizer from guano imported from islands in the Pacific Ocean, the Caribbean, and the coast of South Carolina. After the firm went bankrupt in 1889, Long Neck—the peninsula on which their factory was located—was renamed Penzance Point and was developed with Shingle-Style summer homes for bankers and lawyers from New York and Boston. Notable property owners on Penzance Point at the beginning of the twentieth century included Seward Prosser of New York's Bankers Trust Company; Francis Bartow, a partner in J. P. Morgan and Company; Joseph Lee, a partner in Lee, Higginson & Co.; and Franklin A. Park, an executive of Singer Sewing Machine. Other notable businessmen established homes on Gansett Point, Nobska Point, and at Quisset Harbor, further from the village center.

Woods Hole is located at the southwest tip of the town of Falmouth (and of Cape Cod) at 41°31'36"N 70°39'47"W (41.526730, -70.663184). The term "Woods Hole" refers to a passage for ships between Vineyard Sound and Buzzards Bay known for its extremely strong current, approaching four knots. The strait separates Cape Cod from the Elizabeth Islands (specifically, Uncatena Island and Nonamesset Island). It is one of four straits allowing maritime passage between Buzzards Bay and the Vineyard Sound. The others are Canapitsit Channel, Quick's Hole and Robinson's Hole. Ferries operated by the Steamship Authority run regularly between Woods Hole and Martha's Vineyard. In the past ferries also ran between Woods Hole and Nantucket, but these have been discontinued in recent decades.

Much of Woods Hole centers around the enclosed harbor of Eel Pond. A drawbridge at the mouth of the harbor allows boats to enter and exit the harbor according to a fixed schedule. The local lighthouse at Nobska Point is operated by the United States Coast Guard, and the accompanying house is the home of the commander of the Coast Guard base at Little Harbor. Local landmark The Knob is a rocky outcropping that overlooks Buzzards Bay and Quisset Harbor. It is a part of the privately owned Salt Pond bird sanctuaries.

According to the United States Census Bureau, the Woods Hole CDP has a total area of 3.9 square miles (10.1 km²). 2.1 square miles (5.5 km²) of it is land, and 1.8 square miles (4.6 km²) of it (45.24%) is water. (Courtesy of Wikipedia)

Woods Hole Oceanographic Institution: WHOI is a private, nonprofit research and higher education facility dedicated to the study of all aspects of marine science and engineering and to the education of marine researchers. Established in 1930 in Woods Hole, Massachusetts, it is the largest independent oceanographic research institution in the U.S., with staff and students numbering about 1,000. On October 1, 2015, Mark Abbott became the institution's tenth president and director.

The Institution is organized into six departments, the Cooperative Institute for Climate and Ocean Research, and a marine policy center. Its shore-based facilities are located in the village of Woods Hole, Massachusetts, United States and a mile and a half away on the Quissett Campus. The bulk of the Institution's funding comes from grants and contracts from the National Science Foundation and other government agencies, augmented by foundations and private donations.

WHOI scientists, engineers, and students collaborate to develop theories, test ideas, build seagoing instruments, and collect data in diverse marine environments. Working in all the world's oceans, their research agenda includes: geological activity deep within the earth; plant, animal, and microbial populations and their interactions in the ocean; coastal erosion; ocean circulation; ocean pollution; and global climate change.

Ships operated by WHOI carry research scientists throughout the world's oceans. The WHOI fleet includes two large research vessels (*Atlantis II* and *Neil Armstrong*), the coastal craft *Tioga*, small research craft such as the dive-operation work boat *Echo*, the deep-diving human-occupied submersible *Alvin*, the tethered, remotely operated vehicle *Jason/Medea*, and autonomous underwater vehicles such as the *REMUS* and *SeaBED*.

WHOI offers graduate and post-graduate studies in marine science. There are several fellowship and traineeship programs, and graduate degrees are awarded through a joint program with the Massachusetts Institute of Technology (MIT) or by the Institution itself. WHOI also offers other outreach programs and informal public education through its Exhibit Center and summer tours. The Institution has a volunteer program and a membership program, WHOI Associate.

In 1927, a National Academy of Sciences committee concluded that it was time to “consider the share of the United States of America in a worldwide program of oceanographic research.” The committee’s recommendation for establishing a permanent independent research laboratory on the East Coast to “prosecute oceanography in all its branches” led to the founding in 1930 of the Woods Hole Oceanographic Institution.

A \$2.5 million grant from the Rockefeller Foundation supported the summer work of a dozen scientists, construction of a laboratory building and commissioning of a research vessel, the 142-foot (43 m) ketch Atlantis, whose profile still forms the Institution's logo.

WHOI grew substantially to support significant defense-related research during World War II, and later began a steady growth in staff, research fleet, and scientific stature. Over the years, WHOI scientists have made seminal discoveries about the ocean that have contributed to improving US commerce, health, national security, and quality of life. (Courtesy of Wikipedia.)

The Marine Biological Laboratory: MBL is an international center for research and education in biology, biomedicine, and environmental science. Founded in Woods Hole, Massachusetts in 1888, the MBL is a private, nonprofit institution affiliated with the University of Chicago. After being independent for most of its history, it became affiliated with the university in 2013. It also collaborates with other institutions, including Brown University, the Woods Hole Oceanographic Institution, and the Woods Hole Research Center.

The MBL has approximately 300 year-round employees, about half of which are scientists and scientific support staff. They are joined each year by more than 300 visiting scientists, summer staff, and research associates from hundreds of institutions around the world, who conduct research in the Whitman Center for Visiting Research.

During the summer, more than 1,400 students and faculty from around the world come to the MBL to participate in the laboratory’s graduate-level courses, including Neurobiology, Microbial Diversity, Frontiers in Reproduction, and Biology of Parasitism. Some of these courses (Physiology, Embryology, and Neural Systems and Behavior, formerly called Invertebrate Zoology) have been offered for more than a century.

The MBL’s three main resident research centers are The Ecosystems Center, The Bay Paul Center for Comparative Molecular Biology and Evolution, and the Eugene Bell Center for Regenerative Biology and Tissue Engineering.

The MBL and Brown University share a research and educational affiliation. However, the Brown-MBL Partnership, which included a Ph.D.-awarding Graduate Program in Biological and Environmental Sciences, has ended. Other MBL programs train postgraduates, undergraduates, science teachers, historians, and science journalists. Throughout the year, the MBL is the site for research and planning conferences organized by professional scientific groups (MBL Facts).

The MBL shares a library, the MBLWHOI Library, with Woods Hole Oceanographic Institution. The MBLWHOI Library holds print and electronic collections in the biological, biomedical, ecological, and oceanographic sciences, and houses a growing archival collection, including photograph and videos from the MBL’s 120-year history. The library also conducts digitization and informatics projects.

The Marine Biological Laboratory grew from the vision of several Bostonians and Spencer Fullerton Baird, the country's first Fish Commissioner. Baird had set up a United States Fish Commission research station in Woods Hole in 1882, and had ambitions to expand it into a major laboratory. He invited Alpheus Hyatt to move his marine biology laboratory and school which he had

founded at the Norwood-Hyatt House in Annisquam, Massachusetts to Woods Hole. Inspired by Harvard biologist Louis Agassiz's short-lived summer school of natural history on Penikese Island, off the coast of Woods Hole, Hyatt accepted the offer. With \$10,000 raised by the Woman's Education Association of Boston and the Boston Society of Natural History, land was purchased, a building was erected, and the MBL was incorporated with Hyatt as the first president of the board of trustees. The Fish Commission supplied crucial support, including marine organisms and running sea water.

Charles Otis Whitman, an embryologist, was retained as the first director of the MBL. Whitman, who believed "other things being equal, the investigator is always the best instructor," emphasized the need to combine research and education at the new laboratory. The MBL's first summer course provided a 6-week introduction to invertebrate zoology; facilities for visiting summer investigators were also offered.

The MBL Library was established in 1889, with scientist and future MBL trustee Cornelia Clapp serving as librarian. In 1899, the MBL began publishing *The Biological Bulletin*, a scientific journal that is still edited at the MBL.

The MBL formally affiliated with the University of Chicago on July 1, 2013. In order to further scientific research and education, the affiliation builds on historical ties with the university, as MBL was led by University of Chicago faculty members in its first four decades. The president of the university chairs the MBL trustee's board and with their advice appoints its members. The Laboratory is a non-profit Massachusetts corporation, whose sole member is the university. (Courtesy of Wikipedia)