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# Update on Research Proposal for NASA Space Radiation Laboratory (NSRL) at BNL

N-249 Ground-Based Studies in  
Neurobehavioral Biology

# What is NSRL?

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- NASA-funded beam line and experimental support area based at BNL, making use of existing accelerator infrastructure.
- NSRL is a user facility, similar to NSLS, CFN and RHIC, in that it is open to experimental groups from around the world.
- NSRL proton and heavy-ion beams are used to simulate radiation exposures encountered in space travel.
- All experimental proposals undergo rigorous, multi-step scientific, environmental, safety and health reviews.
- ~400 users per year from over 100 research institutions.
- Approval of proposal for scientific merit is done by NASA.
- BNL evaluates proposals for beam time based on technical and schedule constraints.

# Multi-Step Review Process for NSRL Proposals

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- Suite of reviews administered by NASA, by BNL and by the Principal Investigator's home institution.
- Selects experiments via rigorous evaluation of their:
  - scientific merit and importance to NASA's goal of safe and effective space exploration
  - appropriateness and feasibility of NSRL use
  - appropriateness of any animals involved for providing critical new information illuminating human response to space radiation
  - animal care and use protocols consistent with the highest standards of humane treatment, including the Animal Welfare Act and the Public Health Service "Policy on Humane Care and Use of Laboratory Animals"
  - adherence to all relevant environment, health and safety regulations

# N-249 Ground-Based Studies in Neurobehavioral Biology

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- N-249 is a proposal to expose non-human primates to ionizing radiation at the NASA Space Radiation Laboratory – a first for NSRL
- Why do this experiment?
  - NASA must set astronaut health and safety standards, and evaluate risks, for missions beyond low earth orbit.
  - Elucidate the long-term central nervous system (CNS) risks to humans in extended stays (> few weeks) in outer space?
    - Prior NSRL studies with rodents and neuronal cells suggest detrimental CNS effects from protons and heavy ions. The translation of these results applied to humans is unclear.
    - New aspects of N-249: first heavy-ion irradiation of non-human primates at space-relevant low doses; sophisticated neurobehavioral procedures for systematic analysis of long-term motivation and cognition

# Details of the Proposed Experiment

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- At NSRL
  - 30 adult male squirrel monkeys (*Saimiri sciureus*) would stay briefly at BNL.
  - Exposures of groups of 4 monkeys to low doses of iron (0.1 and 0.5 Gy), protons (0.5 and 1.0 Gy), and silicon (0.1 and 0.5 Gy), with a control group of 6 monkeys unexposed to the radiation.
  - The selected ions are representative of the species encountered beyond low earth orbit.
  - The selected heavy ion doses of 0.1 and 0.5 Gy are the maximum to be encountered by astronauts for extended (months to years) Moon and Mars missions, respectively, and proton doses represent the likely solar and cosmic ray proton doses.
- After NSRL exposure
  - The BNL involvement would end when the animals are transported back to McLean Hospital (Belmont, MA) for long-term evaluation of neurobehavioral effects.

# N-249 Evaluation Timeline

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- May 2009 – McLean Hospital group visits BNL to gather facility information for a NASA grant application. (completed)
- July - McLean Hospital Institutional Animal Care & Use Committee (IACUC) review. (completed in January 2010)
- August – NASA review of non-human primate as an appropriate research model. (completed)
- September - NASA review of grant proposal. (completed)
- November – NASA approves McLean grant proposal. Approved abstract published on NASA website as required by statute.
- January – BNL IACUC receives animal use protocol for review. Protocol sent back for more information and clarification. (review in process)
- February - NASA supplemental NIH 5-Step animal model and usage review. (in process).

# N-249 Evaluation Timeline (continued)

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- February – BNL receives beam use proposal, N-249.
- March – The Scientific Advisory Committee for Radiation Research (SACRR) met to advise on merit of usage of requested beam time. (completed)
- Four additional reviews would have to occur before approving beam time: an experimental safety and worker safety review predicated on the IACUC findings; a review that looks at the care and feeding of the animals; a review to examine the facility safety and experimental protocols at NSRL; and a review of the Industrial Hygiene aspects at NSRL. (all in process)