The Translational Research Institute for Space Health is a consortium led by Baylor College of Medicine and includes California Institute of Technology and the Massachusetts Institute of Technology.
The Translational Research Institute for Space Health (TRISH) is a Baylor College of Medicine-led consortium with the California Institute of Technology (Caltech) and the Massachusetts Institute of Technology (MIT).

Funded by NASA through a cooperative agreement, TRISH engages and enables new health technologies to predict, protect and preserve astronaut health during deep space exploration missions.

We fund high risk, high reward health and human performance science and technology development that can be implemented in space.
BRASH = Biomedical Research Advances for Space Health

Budget up to $400,000 annually with a project duration of 2 years

BRASH solicitation is solely focused on the following 6 topics:

- Predictive algorithms of health, behavior, and medical
- Improving resilience through nucleotide-based therapy
- Non-pharmacological improvement of human performance
- Multipurpose edible plants for spaceflight applications
- New materials for shielding medications
- Test your expired medications

TRISH offers:

- Non-dilutive federal funding
- Access to spaceflight and space analogs
- New partnerships through our virtual network
- High risk threshold

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Key Dates

- Step-1 Proposal due April 16
- Step-1 Notifications sent April 27
- Step-2 Proposal due June 25
- Announcement in November
Predictive algorithms of health, behavior, and medical events

Challenge
Test automated approaches to identify early signs of impending medical conditions of high consequence and relevance for space flight with the aim of developing predictive algorithms. All projects should include some preliminary validation of algorithms.

Examples of projects that could be considered
- Projects that use retrospective data from existing databases to develop, test and validate algorithms to predict risk of impending medical events.
- Proposals that use existing data from wearable or other non-invasive devices, or from standard clinical tests to develop and validate algorithms to predict risk of impending medical events.

Examples of projects that will not be considered
- Projects that depend on new and lengthy prospective data collection.
- Projects that do not include any validation of predictive algorithms.
- Proposals whose primary focus is development of hardware.
- Projects that develop new wearable technology for collection of medical or health data.
- Projects that rely on collection of data that would not be feasible in a limited resource, closed loop system of a long duration spaceflight mission.
  - For the purposes of this solicitation, TRISH is not concerned about the required database size, cloud computing, computer clusters, or highly power-demanding algorithms. We anticipate that future technical advances will permit complex algorithms to be run on deep-space exploration space crafts.
Improving resilience through nucleotide-based therapy

**Challenge**
This project should aim to provide a solid proof of principle of a safe method to administer therapeutic gene expression, transfer and express radioprotective genes, or enhance radioprotective pathways.

**Examples of projects that could be considered**
- Proposals that use optimized vectors such as: liposomes, polymers, conjugates, exosomes, mini-vectors, bacteriophages, etc.
- Proposals that could increase the expression of several genes of interest (G-CSF, GMCSF, EPO, gamma globulin, etc.).
- Proposals that develop a proof of concept model to demonstrate the effectiveness of nucleotide-based therapy for radiation protection using small animal models.
- Proposals that focus on long-term safety and test adverse effects of an emerging nucleotide-based therapeutic technology using animal models.
- Proposals that propose a nucleotide-based approach as a countermeasure for the type of damage anticipated from space radiation; either from solar particle events or galactic cosmic rays.

**Examples of projects that will not be considered**
- Proposals that require long-term refrigeration or freezing of therapeutic reagents during a deep space exploration mission.
- Proposals that require equipment or technical expertise that are unlikely to be available during a deep space exploration mission.
- Approaches that result in an integration of exogenous DNA into the genome of the recipient.
- Proposals that focus on protection from damage from non-ionizing radiation.
Non-pharmacological improvement of human performance

Challenge
Optimize non-invasive approaches to brain stimulation to safely enhance human performance and wellness in the long-term across multiple physiological systems. Desirable endpoints include, but are not limited to, improved sleep and/or mood, improved attention, learning or memory, and response to stressors. A rigorous approach should be employed to adequately establish efficacy of the treatment protocol across the chosen endpoints. The potential for adverse effects (short or long term) with repeated stimulus should be carefully evaluated. Proposals should include a realistic projection of the operational feasibility during deep space exploration.

Examples of projects that could be considered
- Proposals that use a non-invasive brain stimulation approach in healthy normal or astronaut-like subjects.
- Proposals that include screening for undesirable effects across multiple physiological systems, including long-term effects of repeat exposure to stimulus.
- Research designs that include control groups so that treatment efficacy can be adequately evaluated.

Examples of projects that will not be considered
- Proposals that focus solely on the use of pharmaceuticals, nutritional supplements, particular foods, meditation, or exercise regimens.
- Proposals that test lighting prescriptions to entrain the circadian system as these are already supported by NASA.
- Proposals whose primary focus is developing hardware.
- Proposals that do not include testing on healthy normal or astronaut-like subjects.
- Solutions that would not be feasible in the limited resource, closed system of a long duration spaceflight mission.
Multipurpose edible plants for spaceflight applications

Challenge
Use molecular biology tools to increase the in-mission production of nutritious plant foods. Desirable endpoints include increased plant growth rate, increased nutrient content in edible plant parts; plants must tolerate carbon dioxide concentrations of up to 1 percent and artificial light. Elevated absorption of carbon dioxide by edible plants is highly desirable, but only if CO2 is shown to be sequestered in the edible parts of the plant.

Examples of projects that could be considered
- Proposals that use genetic engineering to alter genes involved in regulation of plant growth and development of edible parts.
- Projects that use genetic techniques to increase CO2 utilization or sequestration into edible plant parts.
- Proposals that genetically alter edible plants to increase nutrient content of edible parts.
- Projects that use genetic techniques to improve plant growth in the spaceflight environment (limited volume, elevated CO2, artificial lighting, etc.)
- Projects that test existing genetically modified plants but in new optimized growing conditions, nutrients, or hardware.

Examples of projects that will not be considered
- Approaches involving plants that are tall or large.
- Approaches involving plants whose ratio of non-edible waste is large compared to the mass/volume of edible plant parts.
- Proposals that that will eventually require large equipment, conditions, or resources not available or feasible in space.
- Proposals whose primary focus is development of a commercial product.
- Projects that duplicate NASA’s existing efforts (e.g., Vegetable Production System [Veggie] https://go.nasa.gov/2pJ7URk)
- Proposals that do not include safety and palatability testing of edible plant products.

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New materials for shielding medications

Challenge
Design mission feasible shielding materials to help keep medications safe and effective at all times during a five-year spaceflight mission. Successful strategies could include use of barrier materials to shield from light, oxygen, humidity, thermal extremes and space radiation, or alternatively could include strategies that actively scavenge or react with moisture, oxygen, or radiation. Proposals must demonstrate efficacy using a set of medications aged alongside an unshielded control medication set, followed by analysis conducted per USP guidelines to determine level of protection. Please see drug-specific monographs at https://bit.ly/2Ge8j5b and www.usp.org. Use of FDA-approved accelerated aging protocols is recommended – https://bit.ly/2pGyhrO. For examples of medications stocked on the International Space Station (ISS), see https://bit.ly/2ulZPYn.

Examples of projects that could be considered
- Proposals that shield medications from multiple environmental stressors combined into a single mission-feasible (low volume, low mass, low energy) protection system.
- Proposals that could be applied to any and all medications, regardless of their formulations.
- Proposals conducted using the FDA’s validated accelerated aging protocols.
- Proposals that also include the development of models of medication aging.

Examples of projects that will not be considered
- Proposals using materials that will generate radiation from the Bremsstrahlung interaction (radiation produced by the deceleration of a charged particle when deflected by another charged particle, for example lead or other very dense shielding materials).
- Proposals that only test a single medication class or are only effective for selected formulations or routes of administration.
- Proposals that do not include adequate tests of the shielding system.

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Challenge
Locate stores of expired medications and analyze them for active pharmaceutical ingredient 18 (API) amount as well as purity. Data regarding storage conditions should also be collected (packaging, temperature, humidity, duration, light exposure, etc.) Solvers should (at a minimum) perform their analyses using USP Guidelines for each medication (monographs at www.usp.org).

Examples of projects that could be considered
- Proposals that locate unused stocks of spaceflight-relevant OTC and prescription medications, expired for at least 2 years, stored at room temperature and humidity.
- Proposals that perform API analyses according to USP Guidelines and also include identification and toxicity testing of unexpected degradation products.

Examples of projects that will not be considered
- Proposals that do not include USP approved analytical methods.
- Proposals that do not include relatively accurate information on storage conditions or duration.
- Proposals that do not include medications of interest to NASA for spaceflight.
- Proposals that include medications whose manufacturers or formulations are unknown, or were not FDA approved for sale in the U.S.
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More about TRISH. www.bcm.edu/spacehealth

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BCM Translational Research Institute for Space Health
### About the Solicitation

TRISH is seeking and funding emerging scientific and Biomedical Research Advances for Space Health (BRASH), disruptive technologies, therapies, and new approaches that reduce risks to human health and performance during deep space exploration.

Annual budget up to $400,000 with a project duration of 2 years

### Areas of Interest

BRASH solicitation is solely focused on the following six topics:

- Predictive algorithms of health, behavior, and medical events
- Improving resilience through nucleotide-based therapy
- Non-pharmacological improvement of human performance
- Multipurpose edible plants for spaceflight applications
- New materials for shielding medications
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See Section B

### Schedule

The solicitation is composed of 4 phases. Phase 1 includes the release, pre-proposal webinar, and three-page proposal (Step-1). In Phase 2, select Step-1 proposers will be invited to submit a full-length Step-2 proposal. In Phase 3 proposals are reviewed for scientific, technical, and programmatic merit. Awardees are notified in Phase 4.

<table>
<thead>
<tr>
<th>Date</th>
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<tr>
<td>March 16, 2018</td>
<td>BRASH 1801 Release</td>
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<tr>
<td>March 28, 2018</td>
<td>2-3:00 pm EST Pre-Proposal Webinar</td>
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<td>April 27, 2018</td>
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<td>June 25, 2018</td>
<td>5:00 pm EST Step-2 Proposals Due</td>
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<td>November 2018</td>
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### About TRISH

At TRISH, we focus on approaches that NASA needs and is not currently pursuing. We seek high risk, high reward, high quality and efficient solutions that can be adapted (or translated) for use in space. Cool, right?! Find out more information about TRISH at [bcm.edu/spacehealth](http://bcm.edu/spacehealth).

See Section C

### Why TRISH?

TRISH offers:

- Non-dilutive federal funding
- Access to spaceflight and space analogs
- New partnerships through our virtual network
- High risk threshold

See Section C

### Eligibility

Personnel employed by U.S.-based institutions or companies may apply. All organizations must register (or already be registered) with the System for Award Management (SAM).

See Section D

### Contact

Questions regarding BRASH1801? Not sure whether or how your research could apply to the challenges astronauts face in space? We can help! Contact emmanueo@bcm.edu about BRASH1801 or to learn about other TRISH funding opportunities.

See Section H
Please stay tuned. BRASH Webinar will begin shortly.

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