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| **Fiscal Year:** | FY 2012 | **Task Last Updated:** | FY 07/11/2012 |
| **PI Name:** | Hunter, Jean Ph.D. | | |
| **Project Title:** | Effects of Retronasal Smelling, Variety and Choice on Appetite and Satiety | | |
| **Division Name:** | Human Research | | |
| **Program/Discipline:** | HUMAN RESEARCH | | |
| **Program/Discipline--Element/Subdiscipline:** | HUMAN RESEARCH--Space Human Factors Engineering | | |
| **Joint Agency Name:** | | **TechPort:** | No |
| **Human Research Program Elements:** | (1) **SHFH**:Space Human Factors & Habitability (archival in 2017) | | |
| **Human Research Program Risks:** | None | | |
| **Space Biology Element:** | None | | |
| **Space Biology Cross-Element Discipline:** | None | | |
| **Space Biology Special Category:** | None | | |
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| **Zip Code:** | 14853-5701 | **Congressional District:** | 22 |
| **Comments:** | | | |
| **Project Type:** | GROUND | **Solicitation / Funding Source:** | 2009 Crew Health NNJ09ZSA002N |
| **Start Date:** | 05/01/2011 | **End Date:** | 04/30/2014 |
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| **No. of PhD Candidates:** | 1 | **No. of Master' Degrees:** | |
| **No. of Master's Candidates:** | | **No. of Bachelor's Degrees:** | |
| **No. of Bachelor's Candidates:** | 4 | **Monitoring Center:** | NASA JSC |
| **Contact Monitor:** | Douglas, Grace | **Contact Phone:** | |
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| **Flight Program:** | | | |
| **Flight Assignment:** | NOTE: New end date is 4/30/2014, per NSSC information (Ed., 1/31/13) | | |
| **Key Personnel Changes/Previous PI:** | | | |
| **COI Name (Institution):** | Binsted, Kim ( University of Hawaii, Honolulu )<br>Spies, Rupert ( Cornell University )<br>Halpern, Bruce ( Cornell University ) | | |
| **Grant/Contract No.:** | NNX11AE53G | | |
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| **Task Description:** | Menu fatigue and its sequelae, lower food intake and weight loss, have been documented in military, polar exploration, and space settings, and among subjects in bed rest studies. Isolation, confinement, stress, and low acceptability of available foods amplify menu fatigue. Adequate levels of acceptability, variety, and usability are required to maintain food intake and crew health and performance.<br>We wish to use isolated and confined subjects at the NASA bed rest facility, and different subjects in a Mars analog environment, to explore three issues: 1) the relationship between nasal patency and smelling (orthonasal and retronasal) in the microgravity analog of bed rest and in the isolation/confinement setting of a Mars-like habitat, 2) the effect of orthonasal and retronasal smelling on appetite under conditions of menu fatigue, and 3) the hypothesis that a bulk ingredient based food system, with crew-prepared foods, will improve crew food satisfaction and mitigate menu fatigue. The last study will include an ESM cost comparison of crew-prepared and prepackaged food systems.<br><br>Study #1 on smelling and nasal patency reopens an earlier finding (Vickers et al, 2001) that taste, olfaction and trigeminal response are unaffected by fluid shifts resulting from bed rest. We have returned to the olfaction aspect of that question with objective measurements of nasal cavity dimensions and nasal airway resistance, with a broader and more closely food-related set of odorants, and by adding tests of retronasal smelling which is more representative of odorant perception during eating.<br><br>Study #2 seeks to link odorant acceptability ratings for pure, food-related odorants to bed-rested subjects' appetite, or desire to eat a meal. Subjects will rate the pleasantness and perceived food-relatedness of odorants connected and unconnected with the bed rest menu. Subjects will also be asked to observe and smell their meals, then rate their appetite and desire to eat the meal. These measurements are taken during the pre-bed rest ambulatory period, during early and late bed rest when fluid shifts have stabilized and menu fatigue is increasing, and during the recovery period. Odorants used include the vapor phase odors of foods on the bed rest menu, other food-related odorants not related to the bed rest menu, and pure odorants as controls. We expect to find shifts in odorant acceptability over the course of the study, testing the hypothesis that odorants related to the menu will drop in acceptability over time due to menu fatigue.<br><br>Study #3, a Mars analog study, will test the hypothesis that allowing crews to prepare some of their own meals will mitigate menu fatigue and increase food satisfaction. An analog crew of 6 volunteers will inhabit a Mars analog habitat for 4 months. After an initial acclimation period they will consume meals of two different types: meals containing only prepackaged, shelf-stable foods including instant backpacking foods and commercial packaged foods from the bed rest study, and meals prepared by the crew from a pantry of shelf-stable ingredients. Food preparation time, recipes used, acceptability and intake of each food, self-reported mood and self-reported health status will be tracked; estimated nutritional intake will be tracked from intake and recipe data. We will also generate an ESM cost comparison of the two food systems from video estimates of crew time spent on food-related activities, and from usage data for water and electrical power related to food preparation and cleanup.<br><br>Finally, analog crewmembers will undergo the same airway patency and odorant identification tests as the bed rest subjects, both to provide an ambulatory isolated/confined control and to detect, if possible, effects of habituation to environmental odors upon perception. Analog subjects will also replicate the study of odorant liking, food-relatedness, and appetite done on the bed rested subjects. |
| **Rationale for HRP Directed Research:** | |
| **Research Impact/Earth Benefits:** | Our investigation of nasal patency, olfaction, and appetite in bed rested subjects is generally relevant to the care and nutrition of patients confined to bed for medical reasons. Our research on foods and cooking for long term planetary surface missions is relevant to the provisioning of small isolated groups on Earth and generally relevant to the adventure tourism industry. |
| **Task Progress:** | Data was acquired for only one bed rested subject in the last quarter of 2011 due to a hold on admitting additional subjects while an internal review unrelated to the olfaction study was being conducted. During early 2012, nasal patency data was analyzed fully for this subject. Preliminary findings show that nasal cavity dimension was reduced by head-down tilted bed rest with a simultaneous increase in nasal airflow resistance. Bed rest produced an immediate, marked reduction in nasal cavity volume for both left and right nostrils. Over several days the average nasal cavity volume recovered somewhat, but a net reduction persisted throughout bed rest. Odorant Identification data was assembled and is awaiting comparison with data from future subjects. Meal questionnaire scores were assembled and showed only a slight diminishment in interest by the subject for some meal items very late in bed rest (around 65 days). The website for the analog mission arm of the study was set up at <a target="_blank" href="http://manoa.hawaii.edu/hi-seas/">http://manoa.hawaii.edu/</a> and a call was published on the website and in electronic and print media inviting applications for the analog crew. Around 700 responses were received and are still being evaluated in March 2012. An ideal habitat site was identified and the permitting process initiated. The site, near a cinder cone in the Saddle Road area of Mauna Loa, is not ecologically pristine nor culturally sensitive. Design of the HI-SEAS habitat, which will be a temporary, portable analog habitat testbed designed to accommodate 6 test subjects for isolation/confinement analog research, was initiated. Current design alternatives include concepts based on converted shipping containers and on geodesic dome structures. Engineering evaluation of the power, water, and logistics requirements are in progress. |
| **Bibliography Type:** | Description: (Last Updated: 03/01/2018) |
| **Abstracts for Journals and Proceedings** | Caldwell BJ, Halpern BP, Binsted K, Hunter JB. "Fluid Shift to the Upper Body Reduces Nasal Cavity Dimension and Airflow in Head-Down Bed Rest Subjects." Presented at the 2012 NASA Human Research Program Investigators' Workshop, Houston, TX, February 14-16, 2012.<br>2012 NASA Human Research Program Investigators' Workshop, Houston, TX, February 14-16, 2012. , Feb-2012 |