

Fiscal Year:	FY 2013	Task Last Updated:	FY 04/03/2013
PI Name:	Rabin, Bernard M. Ph.D.		
Project Title:	Individual Differences in the Neurochemical and Behavioral Response to Exposure to Protons		
Division Name:	Human Research		
Program/Discipline:	HUMAN RESEARCH		
Program/Discipline--Element/Subdiscipline:	HUMAN RESEARCH--Radiation health		
Joint Agency Name:	TechPort:	No	
Human Research Program Elements:	(1) <b>SR</b> :Space Radiation		
Human Research Program Risks:	(1) <b>BMed</b> :Risk of Adverse Cognitive or Behavioral Conditions and Psychiatric Disorders		
Space Biology Element:	None		
Space Biology Cross-Element Discipline:	None		
Space Biology Special Category:	None		
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Comments:			
Project Type:	GROUND	Solicitation / Funding Source:	2007 Space Radiation NNJ07ZSA001N
Start Date:	05/18/2008	End Date:	01/31/2013
No. of Post Docs:	No. of PhD Degrees:		
No. of PhD Candidates:	No. of Master' Degrees:		
No. of Master's Candidates:	No. of Bachelor's Degrees: 2		
No. of Bachelor's Candidates:	4	Monitoring Center:	NASA JSC
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Flight Program:			
Flight Assignment:	NOTE: Gap changes per IRP Rev E (Ed., 3/27/14) NOTE: new end date is 1/31/2013 (previoulsy 5/17/2012) per NSSC information (Ed., 12/21/2011) NOTE: new end date is 5/17/2012 per NSSC information (Ed., 5/31/2011)		
Key Personnel Changes/Previous PI:			
COI Name (Institution):	Shukitt-Hale, Barbara ( USDA, HNRCA )		
Grant/Contract No.:	NNX08AM66G		
Performance Goal No.:			
Performance Goal Text:			
Task Description:	Long-term exploratory class missions will increase the risk that astronauts will be exposed to significant doses of protons resulting from solar flares. Evaluating these risks requires knowledge of the potential effects of proton irradiation on a variety of endpoints, including central nervous system (CNS) functioning. However, the effects of exposure to protons on CNS function and on behavior have not been the subject of significant amounts of research. Limited research has produced equivocal results about the consequences of exposure to protons on neurochemical and behavioral endpoints, with some data suggesting an effect of exposure to protons on these endpoints and other data indicating no effect following exposure. The objectives of the experiments detailed in this proposal are to describe and evaluate the effects of exposure to protons on CNS function and behavior and to characterize the role of individual differences, such as gender and age, in modulating the effects of exposure on neurocognitive endpoints.		
Rationale for HRP Directed Research:			
Research Impact/Earth Benefits:			
Task Progress:	The key findings are: 1. Exposure to 4He particles produces deficits in cognitive performance at doses of 0.1 to 0.5 cGy. These results are consistent with previous observations which indicate that as particle linear energy decreases, there is a concomitant decrease in the dose needed to disrupt cognitive performance. 2. Ovariectomized female rats given implants of estradiol in sesame oil or sesame oil alone (vehicle) prior to exposure to 12C particles. In contrast to the results obtained following exposure to 56Fe particles, there were no differences in cognitive performance as a function of hormonal status at the time of irradiation. The reasons for the differences in the effects of estradiol following exposure to different HZE particles remain to be established. 3. Preliminary data suggest that oxidative stress may play a role in mediating the changes in the disruption of autophagy and in the phosphorylation of tau protein following exposure to HZE particles. Because the hyperphosphorylation of tau protein gives rise to the development of neurofibrillary tangles, this data may link exposure to HZE particles to the development of neurodegenerative diseases, such as Alzheimer's Disease. Rats that were maintained on antioxidant berry diets (strawberry or blueberry) did not show the changes in autophagy and the development of neurofibrillary tangles. These results indicate: (1) a causal relationship between radiation-induced oxidative stress and neurochemical changes in the central nervous system; and (2) that antioxidant diets may be able to function to reduce the possibility of nervous system dysfunction of exploratory class missions.		
Bibliography Type:	Description: (Last Updated: 10/16/2023)		
Abstracts for Journals and Proceedings	Rabin BM, Gomes S, Shukitt-Hale B, Heroux N, Bonilla J, Carrihill-Knoll, KL. "Reliability of the disruptive effects of exposure to protons on neurocognitive performance." 23rd Annual NASA Space Radiation Investigators' Workshop, Durham, NC, July 8-11, 2012. 23rd Annual NASA Space Radiation Investigators' Workshop, Durham, NC, July 8-11, 2012. , Jul-2012		

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Abstracts for Journals and Proceedings	Poulouse SM, Bielinski DF, Gomes SM, Carrihill-Knoll K, Rabin BM, Shukitt-hale BP. "Protective effects of berries and walnuts against accelerated aging and age-associated stress caused by irradiation in critical regions of rat brain." Experimental Biology 2012, San Diego, CA, April 21-25, 2012. FASEB Journal 2012 Apr;26(Meeting Abstract Supplement):abstract 255.6, p. 69. Search: <a href="http://www.fasebj.org/content/vol26/1_MeetingAbstracts">http://www.fasebj.org/content/vol26/1_MeetingAbstracts</a> , Apr-2012
Abstracts for Journals and Proceedings	Poulouse SM, Bielinski DF, Gomes SM, Carrihill-Knoll K, Rabin BM, Shukitt-Hale B. "Protective effects of berries on brain against radiation-induced tau-hyperphosphorylation and ubiquitin aggregates." Presented at the 41st Annual Meeting of the American Aging Association, Fort Worth, TX, June 1-4, 2012. AGE 2012, Program and Abstracts. Abstract 141, p. 86, June 2012. , Jun-2012
Abstracts for Journals and Proceedings	Poulouse SM, Bielinski DF, Gomes SM, Carrihill-Knoll K, Rabin BM, Shukitt-Hale B. "Attenuation of stress/age associated toxic protein accrual and tau-hyperphosphorylation in brain by berries and walnuts. " American Chemical Society National Meeting Philadelphia, PA, August 19-23, 2012. ACS 2012. Abstract AGFD30, p. 34, August 2012. , Aug-2012
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Articles in Peer-reviewed Journals	Shukitt-Hale B, Lau, FC, Cheng V, Luskin K, Carey AN, Carrihill-Knoll K, Rabin BM, Joseph JA. "Changes in gene expression in the rat hippocampus following exposure to 56/Fe particles and protection by berry diets." Cent Nerv Syst Agents Med Chem. 2013 Mar 1;13(1):36-42. PubMed <a href="https://pubmed.ncbi.nlm.nih.gov/23692409/">PMID: 23692409</a> , Mar-2013
Articles in Peer-reviewed Journals	Rabin BM, Carrihill-Knoll K, Long LV, Pitts SC, Shukitt-Hale B. "Effects of 17β-estradiol on cognitive performance of ovariectomized female rats exposed to space radiation." Journal of Behavioral and Brain Science. 2013 Feb;3(1):67-73. <a href="http://dx.doi.org/10.4236/jbbs.2013.31007">http://dx.doi.org/10.4236/jbbs.2013.31007</a> , Feb-2013