Fiscal Year:	FY 2019	**Task Last Updated:**	FY 07/01/2019
PI Name:	Nielsen, Sheila Ph.D.		
Project Title:	Characterizing the Effects of Spaceflight on the Candida albicans Adaptation Response		
Division Name:	Space Biology		
Program/Discipline:			
Program/Discipline--Element/Subdiscipline:			
Joint Agency Name:		**TechPort:**	No
Human Research Program Elements:	None		
Human Research Program Risks:	None		
Space Biology Element:	(1) Cell & Molecular Biology (2) Microbiology		
Space Biology Cross-Element Discipline:	(1) Reproductive Biology (2) Immunology		
Space Biology Special Category:	(1) Translational (Countermeasure) Potential		
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Comments:	PI name change to Sheila Nielsen in 2014 (formerly Sheila Nielsen-Preiss)--Ed., 1/12/2015		
Project Type:	Flight	**Solicitation / Funding Source:**	2014 Space Biology Flight NNH14ZTT001N
Start Date:	11/01/2014	**End Date:**	03/31/2020
No. of Post Docs:	0	**No. of PhD Degrees:**	0
No. of PhD Candidates:	0	**No. of Master' Degrees:**	0
No. of Master's Candidates:	1	**No. of Bachelor's Degrees:**	3
No. of Bachelor's Candidates:	2	**Monitoring Center:**	NASA ARC
Contact Monitor:	Sato, Kevin	**Contact Phone:**	650-604-1104
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Flight Program:	ISS		
Flight Assignment:	NOTE: Extended to 3/31/2020 per F. Hernandez/ARC and NSSC information (Ed., 6/11/19) NOTE: Extended to 4/30/2019 per F. Hernandez/ARC (Ed., 11/2/17) NOTE: End date changed to 10/31/2017 per NSSC information (Ed., 11/29/16)		
Key Personnel Changes/Previous PI:			
COI Name (Institution):			
Grant/Contract No.:	NNX15AB37G		
Performance Goal No.:			
Performance Goal Text:			

Task Description:	The common yeast pathogen, Candida albicans, can cause a range of diseases from superficial skin infections to systemic and life threatening infections in immunocompromised individuals. Most members of the population are carriers of this yeast at some point in their lifetime. This point becomes more concerning for astronauts who experience diminished immune responsiveness during spaceflight. In addition, many bacteria have been shown to become more virulent when grown in space. The combination of increased virulence and diminished immunity can jeopardize the health and wellbeing of flight crew. The goal of these studies is to characterize the mechanisms underlying the adaptation responses we have observed in yeast grown in modeled microgravity and in spaceflight. In addition, we will focus on determining whether yeast also become more virulent when grown in space, as our observed cellular alterations might predict. Furthermore, we will define the environmental stressors that exist during spaceflight that influence yeast growth. Our overriding research goals are to characterize the virulence of Candida albicans in the space environment, to understand which aspects of the environment contribute to adaptive changes within the yeast, and to identify targets that might be exploited to control yeast infection in space and on Earth.
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	There are low fluid shear environments within the human host so we hope to exploit the low fluid shear environment of microgravity to better understand the yeast adaptation to this physical force and the microenvironment created by it.
Task Progress:	[Ed. note (June 2019)--compiled from PI's technical progess report covering work done through February 2019] Our overriding hypothesis is that exposure of C. albicans to microgravity will alter gene expression and morphology, consistent with a potential increase in virulence. More specifically, we suggest that diminished fluid shear results in alterations to the physical environment that contribute, directly or indirectly, to adaptations in the yeast cell surface resulting in increased virulence. Notably, these studies will further explore and document the genotypic and phenotypic parameters of C. albicans associated with pathogenicity, identify specific environmental influences on the physiological adaptation processes, and provide insight into mechanisms used by higher eukaryotes when adapting to spaceflight conditions. Objectives/Aims of Investigation • Evaluate the microgravity-induced alterations in biosynthetic regulation, cellular content, and subcellular localization of ergosterol and b-glucans. • Delineate the contributions of fluid shear, oxygen depletion, and carbon dioxide enrichment in the microenvironment to cellular adaptation responses. • Characterize the effect of spaceflight on C. albicans virulence using a human monocyte host. The experiments included in the payload that flew on Space X CRS-16 specifically addressed Aim #2 (internally the payload is being referred to Micro-14alpha). Additional experiments flew on Space X CRS-17 and will address the other aims listed above (Micro-14beta). Initial reporting for both aspects of this payload will occur mid-summer 2019. A full scale experiment verification test (EVT) (including all hardware components for the full Micro-14 payload) was initiated on 9/24/18 with BioServe Space Technologies personnel on site. The 6-well BioCell and FEP (fluorinated ethylene-propylene) bag experiments were carried to completion as planned and on schedule. The Fluid Processing Apparatus (FPA) in experiments required some final adaptations. Ultimately, each phase of the FPA experiment was completed, albeit with overlapping timelines. Selection for Flight permission was granted on 11/14/18, with some reservations due to the compartmentalized nature of the FPA EVT. Experiment preparation: FPA loading spanned 11/29/18 (L-5) through 12/1/18 (L-3, including a reload of one condition – N2). FPAs were handed over to BioServe on 12/2/18 at 8 am for incorporation into Group Activation Packs (GAP). GAPs were turned over to CMC on 12/3/18 at 8 am. Launch was delayed 24 hrs to 12/5/18 at 1:16 pm, without implications for the Micro-14a payload. On-orbit Operations: Spaceflight time line -- all ground controls were conducted with a 1-hr offset based on real time communication with BioServe. Ground GAPs were stored on the horizontal and rotated 180° daily. When at 30°C, the ground GAPs were laid on the horizontal and very slowly rocked length wise.
Bibliography Type:	Description: (Last Updated: 06/23/2023)