Task Book Report Generated on: 05/07/2024

Fl Name:    Project Title:   B Complex: A Nutracentical SANS Countermessure	Fiscal Year:	FY 2023	Task Last Updated:	FY 11/04/2022
Project Title: B Complex: A Numeronical SANS Countermeasure    Human Research   Human Resea			Tush Zust o puntuu	111110112022
Program Discipline-  Program Risks:   None   Program Risks:   Program Risks:   None   Program Risks:   Program Risks:   None   Program Risks:   Program		,	re	
Program/Discipline: Program/Discipline- Element/Subdiscipline- Element/Subdiscipline- Joint Agency Name:    Iteman Research Program Elements:   (1) HIIC-Human Health Countermeasures	110/000 111101	2 complement management of the comment	•	
Program/Discipline-  Element/Subdiscipline-  Element/Subdiscipline-  Element/Subdiscipline-  TechPort: No	Division Name:	Human Research		
Flements Subdiscipline:   TechPort: No   No   Marker   No   No   Marker   N	Program/Discipline:			
Human Research Program Elements: (I) IHIC-Human Health Countermeasures  Human Research Program Risks: None  Space Biology Cross-Element: None  Space Biology Cross-Element: None  Space Biology Special Category: None  PI Email: Sam_avant_l@msa_gov Fax: FY  PI Organization Type: NASA CENTER Phone: 281-483-3753  Organization Name: NASA Johnson Space Center  PI Address 1: Department of Preventive Medicine and Community Health  PI Address 2: 2101 Nasa Plevy, Mail Stop SK3  PI Web Page:  City: Houston State: TX  Zip Code: 7708-3607 Congressional District: 36  Comments:  Project Type: FILGITT Solicitation / Funding Source: Directed Research  Start Date: 01-032022 End Date: 12/31/2032  No. of Post Does: 0 No. of PhD Degrees: 0  No. of PhD Candidates: 0 No. of Master' Degrees: 0  No. of Master's Candidates: 0 No. of Master' Degrees: 0  No. of Master's Candidates: 0 No. of Monitoring Center: NASA JSC  Contact Monitor: Stenger, Michael Monitoring Center: NASA JSC  Contact Changes/Previous PI: Laura Pardon removed 11/2022 from the list of Colovestigators; she took a position outside of NASA.  Smith, Scott Ph.D. (NASA Johnson Space Center)  Col. Name (Institution): Smith, Scott Ph.D. (NASA Johnson Space Center)  Col. Name (Institution): Directed Research  Performance Goal No.:				
Human Research Program Rislos: None Space Biology Element: None Space Biology Cross-Element Discipline: None Space Biology Cross-Element Discipline: None Space Biology Special Category: None PI Email: Star. zownt-1/@uses.gov Fax: FY PI Organization Type: NASA CENTER Phone: 281-483-3753 Organization Name: NASA Johnson Space Center PI Address 1: Department of Preventive Medicine and Community Health PI Address 2: 2101 Nasa Pkwy, Mail Stop SK3 PI Wch Page: City: House None State: TX Zip Code: 77058-3607 Congressional District: 36 Comments: Project Type: FLGHT Solicitation / Funding Source: Directed Research Start Date: 0.103/2022 End Date: 12/31/2032 No. of Post Does: 0. No. of PhD Degress: 0. No. of PhD Candidates: 0. No. of Master' Degrees: 0. No. of Master's Candidates: 0. No. of Master' Degrees: 0. No. of Master's Candidates: 0. No. of Master' Degrees: 0. No. of Master's Candidates: 0. No. of Bachelor's Degrees: 0. No. of Master's Candidates: 0. Monitoring Center: NASA JSC Contact Monitor: Stenger, Michael Contact Monitoring Center: NASA JSC Contact Monitor: Stenger, Michael Contact Phone: 281-483-1311 michael-h. stenger@mass.gov Flight Program:  SS NOTE: End date changed to 12/31/2032 per C. Ribeiro/JSC. The period of performance was updated after the "Scleet for Flight" was completed (Ed., 8/18/23)  Key Personnel Changes/Previous PI: Laura Pardon removed 11/2022 from the list of Colovestigators; she took a position outside of NASA.  Smith, Scott Ph.D. (NASA Johnson Space Center) Chen. John M.D., Ph.D. (NASA Johnson Space Center) Colinate (Institution): Michael Ph.D. (NASA Johnson Space Center) Colinate (Institution): Directed Research Performance Goal No.:	Joint Agency Name:		TechPort:	No
Space Biology Cross-Element Space Biology Cross-Element Space Biology Special Category: None PI Email: sura_wart_l@mass_nov Fax: FY PI Organization Type: NASA CENTER Phone: 281-483-3753 Organization Name: NASA Johnson Space Center PI Address 1: Department of Preventive Medicine and Community Health PI Address 2: 2101 Nan Pkwy, Mail Stop SK3 PI Web Page: City: Houston State: TX Zip Code: 77058-3607 Congressional District: 36 Comments: Project Type: PLIGHT Solicitation / Funding Source: Directed Research Start Date: 01/03/2022 Bind Date: 12/31/2032 No. of Post Does: 0 No. of PhD Candidates: 0 0 No. of Master' Degrees: 0 No. of Master' Scandidates: 0 0 No. of Master' Degrees: 0 No. of Master' Candidates: 0 No. of Master' Candidates: 0 No. of Bachelor's Candidates: 0 Stenger, Michael Contact Email: michael b. stenger@mass.nov  Flight Program:  Key Personnel Changes/Previous PI: Laura Pardon removed 11/2022 from the list of Colnvestigators: she took a position outside of NASA.  Sonith, Scott Pl.D. (NASA Johnson Space Center) Chen, John M.D. Ph.D. (Mayo Clinic) Hauris, Steven Ph.D. (RASA Johnson Space Center) Vorum, Sillienia Ph.D. (NASA Johnson Space Center) Vorum, Sillie	<b>Human Research Program Elements:</b>	(1) <b>HHC</b> :Human Health Countermeasures		
Space Biology Cross-Element Discipline:  Space Biology Cross-Element Discipline:  None  PI Email:  Space Biology Special Category:  None  PI Email:  Space Biology Special Category:  Nose  PI Candina Type:  NASA CENTER  Phone:  281-483-3753  Organization Type:  NASA Johnson Space Center  PI Address 1:  Department of Preventive Medicine and Community Health  PI Address 2:  2101 Nasa Pkwy, Mail Stop SK3  PI Web Page:  City:  Houston  State:  TX  Zip Code:  77058-3607  Congressional District:  36  Comments:  Project Type:  FLIGHT  Solicitation / Funding Source:  Directed Research  Start Date:  10403/2022  Find Date:  1231/2032  No. of Phot Decres:  No. of Phot Decres:  No. of Master' Degrees:  No. of Master' Scandidates:  No. of Master's Candidates:  No. of Bachelor's Degrees:  No. of Bachelor's Candidates:  No. of Bachelor's Can	Human Research Program Risks:	None		
Discipline: " Space Biology Special Category: None  Space Biology Special Category: None  PI Email: Stata Zwart   @mass. seov	Space Biology Element:	None		
PI Email: Stra. Zwart-Li@missa.gov Fax: FY PI Organization Type: NASA CENTER Phone: 281-483-3753 Organization Type: NASA CENTER Phone: 281-483-3753 Organization Name: NASA Johnson Space Center PI Address 1: Department of Preventive Medicine and Community Health PI Address 2: 2101 Nasa Pkwy, Mail Stop SK3 PI Web Page: City: Houston State: TX Zip Code: 77058-3607 Congressional District: 36 Comments: Project Type: FLIGHT Solicitation / Funding Source: Directed Research Start Date: 01/03/2022 End Date: 12/31/2032 No. of Post Docs: 0 No. of PhD Degrees: 0 No. of PhD Candidates: 0 No. of PhD Degrees: 0 No. of PhD Candidates: 0 No. of Bachelor's Degrees: 0 No. of Master' Scandidates: 0 No. of Bachelor's Degrees: 0 No. of Bachelor's Candidates: 0 Monitoring Center: NASA JSC Contact Monitor: Stenger, Michael Contact Honior: Stenger, Michael Contact Email: michael b stenger@nasa.gov Flight Program:  Siss Flight Assignment: Siss NOTE: End date changed to 12/31/2032 per C. Ribeiro/JSC. The period of performance was updated after the "Select for Flight" was completed (Ed., 8/18/23)  Key Personnel Changes/Previous PI: Laurn Pardon removed 11/2022 from the list of Colnvestigators; she took a position outside of NASA.  Smith, Scont Ph.D. (NASA Johnson Space Center) Coll Name (Institution): Laurie, Steven Ph.D. (KalSMASA Johnson Space Center) Young, Millennia Ph.D. (NASA Johnson Space Center)		None		
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PI Address 1: Department of Preventive Medicine and Community Health PI Address 2: 2101 Nasa Pkwy, Mail Stop SK3  PI Web Page:  City: Houston State: TX  Zip Code: 77058-3607 Congressional District: 36  Comments:  Project Type: FLIGHT Solicitation / Funding Source: Directed Research  Start Date: 01/03/2022 End Date: 12/31/2032  No. of Post Docs: 0 No. of PhD Degrees: 0  No. of PbD Candidates: 0 No. of Master' Degrees: 0  No. of Master's Candidates: 0 No. of Master' Degrees: 0  No. of Master's Candidates: 0 No. of Master' Degrees: 0  No. of Bachelor's Candidates: 0 No. of Master' Degrees: 0  No. of Master's Candidates: 0 No. of Master' Degrees: 0  No. of Bachelor's Candidates: 0 No. of Master' Degrees: 0  No. of Master's Candidates: 0 No. of Master' Degrees: 0  No. of Master's Candidates: 0 No. of Master' Degrees: 0  No. of Master's Candidates: 0 No. of Bachelor's Degrees: 0  No. of Master's Candidates: 0 No. of Bachelor's Degrees: 0  No. of Bachelor's Candidates: 0 No. of Bachelor's Degrees: 0  No. of Bachelor's Candidates: 0 No. of Bachelor's Degrees: 0  No. of Bachelor's Candidates: 0 No. of Bachelor's Degrees: 0  No. of Bachelor's Candidates: 0 No. of Bachelor's Degrees: 0  No. of Bachelor's Candidates: 0 No. of Bachelor's Degrees: 0  No. of Bachelor's Candidates: 0 No. of Bachelor's Degrees: 0  No. of Bachelor's Candidates: 0 No. of Bachelor's Degrees: 0  No. of Bachelor's Candidates: 0 No. of Bachelor's Degrees: 0  No. of Bachelor's Candidates: 0 No. of Bachelor's Degrees: 0  No. of Bachelor's Candidates: 0 No. of Bachelor's Degrees: 0  No. of Bachelor's Candidates: 0 No. of Bachelor's Degrees: 0  No. of Bachelor's Candidates: 0 No. of Bachelor's Degrees: 0  No. of Bachelor's Candidates: 0 No. of Bachelor's Degrees: 0  No. of Bachelor's Candidates: 0 No. of Bachelor's Degrees: 0  No. of Bachelor's Degrees: 0  No. of Bachelor's Degrees: 0  No. of Bachelor's Degrees: 0  No. of Bachelor's Degrees: 0  No. of Bachelor's Degrees: 0  No. of Bachelor's Degrees: 0  No. of Bachelor's Degrees: 0  No. of Bachelor's Deg	PI Organization Type:	NASA CENTER	Phone:	281-483-3753
PI Address 2: 2101 Nasa Pkwy, Mail Stop SK3  PI Web Page:  City: Houston State: TX  Zip Code: 77058-3607 Congressional District: 36  Comments:  Project Type: FLIGHT Solicitation / Funding Source: Directed Research  Start Date: 01/03/2022 End Date: 12/31/2032  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: 0 No. of Bachelor's Degrees: 0  No. of Bachelor's Candidates: 0 No. of Bachelor's Degrees: 0  No. of Bachelor's Candidates: 0 Monitoring Center: NASA JSC  Contact Monitor: Stenger, Michael Contact Phone: 281-483-1311  Contact Email: michael b. stenger@nasa.gov  Flight Program:  Siss NOTE: End date changed to 12/31/2032 per C. Ribeiro/JSC. The period of performance was updated after the "Select for Flight" was completed (Ed., &18/23)  Key Personnel Changes/Previous PI: Laura Pardon removed 11/2022 from the list of Colnvestigators; she took a position outside of NASA.  Smith, Scott Ph.D. (NASA Johnson Space Center) Chen, John M.D., Ph.D. (Mayo Clinic) Heer, Martina Ph.D. (University of Bonn, Germany) Lauric, Steven Ph.D. (KBR/NASA Johnson Space Center) Young, Millennia Ph.D. (NASA Johnson Space Center)	Organization Name:	NASA Johnson Space Center		
PI Web Page:  City: Houston State: TX  Zip Code: 77058-3607 Congressional District: 36  Comments:  Project Type: FLIGHT Solicitation / Funding Source: Directed Research  Start Date: 01/03/2022 End Date: 12/31/2032  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: 0 No. of Master' Degrees: 0  No. of Bachelor's Candidates: 0 No. of Bachelor's Degrees: 0  No. of Bachelor's Candidates: 0 No. of Bachelor's Degrees: 0  No. of Bachelor's Candidates: 0 Monitoring Center: NASA JSC  Contact Monitor: Stenger, Michael Contact Phone: 281-483-1311  Contact Email: michael.b.stenger@masa.gov  Flight Program:  ISS  NOTE: End date changed to 12/31/2032 per C. Ribeiro/JSC. The period of performance was updated after the "Select for Flight" was completed (Ed., 8/18/23)  Key Personnel Changes/Previous PI: Laura Pardon removed 11/2022 from the list of Colnvestigators; she took a position outside of NASA.  Smith, Scott Ph.D. (NASA Johnson Space Center) Chen, John M.D., Ph.D. (Mayor Clinic) Her., Martina Ph.D. (Diversity of Bonn, Germany) Laurie, Steven Ph.D. (KBR/NASA Johnson Space Center) Voung, Millennia Ph.D. (NASA Johnson Space Center)	PI Address 1:	Department of Preventive Medicine and Community Health		
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Zip Code: 77058-3607 Congressional District: 36  Comments:  Project Type: FLIGHT Solicitation / Funding Source: Directed Research  Start Date: 01/03/2022 End Date: 12/31/2032  No. of Post Does: 0 No. of PhD Degrees: 0  No. of PbD Candidates: 0 No. of Master' Degrees: 0  No. of Master's Candidates: 0 No. of Bachelor's Degrees: 0  No. of Bachelor's Candidates: 0 Monitoring Center: NASA JSC  Contact Monitor: Stenger, Michael Contact Phone: 281-483-1311  Contact Email: michael b.stenger@nasa.gov  Flight Program:  ISS  NOTE: End date changed to 12/31/2032 per C. Ribeiro/JSC. The period of performance was updated after the "Select for Flight" was completed (Ed., 8/18/23)  Key Personnel Changes/Previous PI: Laura Pardon removed 11/2022 from the list of Colnvestigators; she took a position outside of NASA.  Smith, Scott Ph.D. (NASA Johnson Space Center) Chen, John M.D., Ph.D. (I Mayo Clinic) Heer, Martina Ph.D. (University of Bonn, Germany) Lauric, Steven Ph.D. (KBRNASA Johnson Space Center) Vaung, Millennia Ph.D. (NASA Johnson Space Center) Young, Millennia Ph.D. (NASA Johnson Space Center)	PI Web Page:			
Comments:  Project Type: FLIGHT Solicitation / Funding Source: Directed Research  Start Date: 01/03/2022 End Date: 12/31/2032  No. of Post Docs: 0 No. of PhD Degrees: 0  No. of Post Docs: 0 No. of Master' Degrees: 0  No. of Master's Candidates: 0 No. of Master' Degrees: 0  No. of Master's Candidates: 0 No. of Bachelor's Degrees: 0  No. of Bachelor's Candidates: 0 Monitoring Center: NASA JSC  Contact Monitor: Stenger, Michael Contact Phone: 281-483-1311  Contact Email: michael.b.stenger@nasa.gov  Flight Program:  Stand date changed to 12/31/2032 per C. Ribeiro/JSC. The period of performance was updated after the "Select for Flight" was completed (Ed., 8/18/23)  Key Personnel Changes/Previous PI: Laura Pardon removed 11/2022 from the list of Colnvestigators; she took a position outside of NASA.  Smith, Scott Ph.D. (NASA Johnson Space Center) Chen, John M.D., Ph.D. (Mayo Clinic) Heer, Martina Ph.D. (University of Bonn, Germany) Laurie, Steven Ph.D. (WaRNASA Johnson Space Center) Young, Millennia Ph.D. (University of Bonn, Germany) Jaurie, Steven Ph.D. (NASA Johnson Space Center) Young, Millennia Ph.D. (NASA Johnson Space Center)	City:	Houston	State:	TX
Project Type: FLIGHT Solicitation / Funding Source: Directed Research  Start Date: 01/03/2022 End Date: 12/31/2032  No. of Post Docs: 0 No. of PhD Degrees: 0  No. of Post Docs: 0 No. of PhD Candidates: 0 No. of Master' Degrees: 0  No. of Master's Candidates: 0 No. of Bachelor's Degrees: 0  No. of Bachelor's Candidates: 0 Monitoring Center: NASA JSC  Contact Monitor: Stenger, Michael Contact Phone: 281-483-1311  Contact Email: michael b. stenger@nasa.gov  Flight Program:  SSS NOTE: End date changed to 12/31/2032 per C. Ribeiro/JSC. The period of performance was updated after the "Select for Flight" was completed (Ed., 8/18/23)  Key Personnel Changes/Previous PI: Laura Pardon removed 11/2022 from the list of Colnvestigators; she took a position outside of NASA.  Smith, Scott Ph.D. (NASA Johnson Space Center) Chen, John M.D., Ph.D. (University of Bonn, Germany) Lauric, Steven Ph.D. (University of Bonn, Germany) Lauric, Steven Ph.D. (KBRNASA Johnson Space Center) Young, Millennia Ph.D. (University of Bonn, Germany) Lauric, Steven Ph.D. (KBRNASA Johnson Space Center) Young, Millennia Ph.D. (NASA Johnson Space Center)	Zip Code:	77058-3607	<b>Congressional District:</b>	36
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No. of Post Docs:  0	Project Type:	FLIGHT	Solicitation / Funding Source:	Directed Research
No. of PhD Candidates:  0	Start Date:	01/03/2022	End Date:	12/31/2032
No. of Master's Candidates:  0	No. of Post Docs:	0	No. of PhD Degrees:	0
No. of Bachelor's Candidates:  Contact Monitoric  Stenger, Michael  Contact Phone: 281-483-1311  Contact Email:  michael.b.stenger@nasa.gov  Flight Program:  ISS  NOTE: End date changed to 12/31/2032 per C. Ribeiro/JSC. The period of performance was updated after the "Select for Flight" was completed (Ed., 8/18/23)  Key Personnel Changes/Previous PI:  Laura Pardon removed 11/2022 from the list of Colnvestigators; she took a position outside of NASA.  Smith, Scott Ph.D. (NASA Johnson Space Center) Chen, John M.D., Ph.D. (Mayo Clinic) Heer, Martina Ph.D. (University of Bonn, Germany) Laurie, Steven Ph.D. (KBR/NASA Johnson Space Center) Macias, Brandon Ph.D. (NASA Johnson Space Center) Young, Millennia Ph.D. (NASA Johnson Space Center) Young, Millennia Ph.D. (NASA Johnson Space Center) Portant No.:  Directed Research	No. of PhD Candidates:	0	No. of Master' Degrees:	0
Contact Monitor: Stenger, Michael Contact Phone: 281-483-1311  Contact Email: michael.b.stenger@nasa.gov  Flight Program:  ISS NOTE: End date changed to 12/31/2032 per C. Ribeiro/JSC. The period of performance was updated after the "Select for Flight" was completed (Ed., 8/18/23)  Key Personnel Changes/Previous PI: Laura Pardon removed 11/2022 from the list of CoInvestigators; she took a position outside of NASA.  Smith, Scott Ph.D. (NASA Johnson Space Center) Chen, John M.D., Ph.D. (Mayo Clinic) Heer, Martina Ph.D. (University of Bonn, Germany) Laurie, Steven Ph.D. (KBR/NASA Johnson Space Center) Macias, Brandon Ph.D. (NASA Johnson Space Center) Young, Millennia Ph.D. (NASA Johnson Space Center) Young, Millennia Ph.D. (NASA Johnson Space Center) Performance Goal No.:	No. of Master's Candidates:	0	No. of Bachelor's Degrees:	0
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Flight Program:  ISS NOTE: End date changed to 12/31/2032 per C. Ribeiro/JSC. The period of performance was updated after the "Select for Flight" was completed (Ed., 8/18/23)  Key Personnel Changes/Previous PI:  Laura Pardon removed 11/2022 from the list of CoInvestigators; she took a position outside of NASA.  Smith, Scott Ph.D. (NASA Johnson Space Center) Chen, John M.D., Ph.D. (Mayo Clinic) Heer, Martina Ph.D. (University of Bonn, Germany) Laurie, Steven Ph.D. (KBR/NASA Johnson Space Center) Macias, Brandon Ph.D. (NASA Johnson Space Center) Young, Millennia Ph.D. (NASA Johnson Space Center)  Grant/Contract No.:  Directed Research  Performance Goal No.:	Contact Monitor:	Stenger, Michael	Contact Phone:	281-483-1311
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Performance Goal No.:	COI Name (Institution):	Chen, John M.D., Ph.D. (Mayo Clinic) Heer, Martina Ph.D. (University of Bonn, Germany) Laurie, Steven Ph.D. (KBR/NASA Johnson Space Center) Macias, Brandon Ph.D. (NASA Johnson Space Center)		
	Grant/Contract No.:	Directed Research		
Performance Goal Text:	Performance Goal No.:			
	Performance Goal Text:			

Task Book Report Generated on: 05/07/2024

Some astronauts on International Space Station (ISS) missions have experienced ophthalmic pathologies including optic disc edema, part of what is characterized as Spaceflight Associated Neuro-ocular Syndrome (SANS). While the precise cause for the optic disc edema is not known, it is likely that there are multiple contributing factors, including genetic and environmental factors that may affect the response to headward fluid shifts. Biochemical evidence reveals that crewmembers with optic disc edema have higher circulating concentrations of at least 4 metabolites from the one-carbon metabolic pathway before, during, and after flight compared to astronauts that did not develop optic disc edema. B-vitamin status at landing and the presence of specific one-carbon pathway single nucleotide polymorphism (SNP) alleles were significant predictors for the incidence of astronaut ophthalmic pathologies, including optic disc edema, choroidal folds, and cotton wool spots. When looking at the individual SNPs, the G allele of methionine synthase reductase (MTRR, rs1801394) A66G, and the C allele of serine hydroxymethyltransferase-1 (SHMT1, rs1979277) C1420T, were associated with higher incidence of ophthalmic findings after flight compared to those with the A or T

In ground analog studies, end-tidal CO2, a reflection of arterial CO2, response to acute head-down tilt (HDT) bed rest and CO2 exposure was related to G and C alleles of MTRR A66G and SHMT1 C1420T and B-vitamin status. Supportive of this, these same alleles were related to the presence of optic disc edema in different bed rest subjects. Subjects were exposed to strict 6°-HDT bed rest and 0.5% CO2 for 30 days and 5 out of 11 subjects developed optic disc edema. The number of G and C alleles were found to be associated with the change in total retina thickness (?TRT), a quantitative measure of optic disc edema. Based on our data, differences in genetics and altered one-carbon biochemistry before flight support that one-carbon metabolism may be involved.

We hypothesize that genetics and B-vitamin status are indispensable elements of this phenomenon, along with other potential factors. Dietary B-vitamin insufficiencies and variants in genes involved in the one-carbon metabolic pathway can contribute to lower B-vitamin status and pathway inefficiency, which can affect numerous outcomes, including nitric oxide (NO) production and endothelial function.

To that end, we propose a nutraceutical containing bioactive B-vitamins as a countermeasure to optimize function of the one-carbon pathway and prevent or mitigate optic disc edema during spaceflight.

This proposal aims to test the hypotheses that one-carbon pathway genetics can predispose an individual to SANS pathologies during flight, and that this effect may be prevented or mitigated through supplementation of vitamins that can affect one-carbon pathway function.

The hypothesis will be tested in the following specific aims:

- 1. Determine whether provision of a daily nutraceutical containing 5-methyltetrahydrofolate (5-MTHF), pyridoxine, methylcobalamin (vitamin B12), and riboflavin prevents or mitigates SANS pathology (significant ?TRT) compared to astronauts who did not take the supplement in previously flown astronauts with available TRT data.
- 2. Determine one-carbon pathway SNP profiles in all participating astronauts being supplemented, and assess whether individuals with 3-4 risk alleles for MTRR A66G and SHMT1 C1420T polymorphisms have greater mitigation of ?TRT during and after spaceflight.
- 3. Determine whether subjects with 3-4 risk alleles exhibit differences in biomarkers of endothelial function, compared to subjects with 0-2 risk alleles.

We propose to provide the nutraceutical countermeasure to all participating crewmembers before and during flight, and we will assess whether the supplement provides greater mitigation of changes in TRT in individuals with 3-4 risk alleles. We will include assessments of ocular health, along with determinants of vascular endothelial function, advanced glycation end products, and nutritional status and one carbon biochemistry. These additional measures will be critical for the further definition of the causes of SANS, and in understanding the effect of the countermeasure. Finally, the supplemented subjects in this study will be compared against TRT data from previously flown astronauts known to have not taken supplements during their missions.

Rationale for HRP Directed Research:

**Task Description:** 

This research is directed because it contains highly constrained research. This project originated as an update to a proposal originally titled "B Complex: 5- Methyltetrahydrofolate, Riboflavin, Pyridoxine, and Methylcobalamin Supplementation as a Non-Mechanical Countermeasure to Mitigate Optic Disc Edema Changes During Strict 6° Head-Down Tilt Bed Rest", which was reviewed and selected from the 80JSC018N0001-SANS NASA Research Announcement. The implementation of this countermeasure during bed rest was not possible given constraints around this type of countermeasure study at the German Aerospace Center's (DLR) :envihab facility. Therefore, this bed rest study was converted to a flight study in order to test this countermeasure in an actual spaceflight environment.

Research Impact/Earth Benefits:

The B Complex investigation aims to provide a countermeasure for the risk of SANS, a syndrome that affects some astronauts. If proven, the results of this study could help scientists to better understand the relationship between nutritional biochemistry and cardiovascular function, both in space and on Earth. Furthermore, there is a clinical population on Earth with similar characteristics of astronauts who develop SANS: women with polycystic ovary syndrome (PCOS). PCOS is the leading cause of infertility in women, and is a condition that affects 10-20% of all women. Data from this study could be beneficial to this population to better understand how the nutraceutical can promote vascular function.

Task Progress:

After receiving Authority to Proceed on January 3, 2022, the Institutional Review Board (IRB) documentation was developed and submitted for review, and approval was obtained in February 2022. An Investigational New Drug (IND) was submitted to the FDA in April 2022 and the study was successfully registered with ClinicalTrials.gov in May. The first crew were briefed in an informed consent briefing and we are waiting to hear if any of those crew have signed up for the study.

**Bibliography Type:** 

Description: (Last Updated: )