

# Veggie on ICE: The effects of plant production on human behavioral health in long-duration Antarctic overwintering missions



Jess M. Bunchek<sup>1</sup>, D.F. Dinges<sup>2</sup>, M. Basner<sup>2</sup>, P.G. Roma<sup>3</sup>, R.M. Wheeler<sup>4</sup>, G.D. Massa<sup>4</sup>, R.F. Fritsche<sup>4</sup>, A.C. Stahn<sup>2</sup>

<sup>1</sup>LASSO, Kennedy Space Center, FL; <sup>2</sup>University of Pennsylvania, Philadelphia, PA; <sup>3</sup>KBR, Johnson Space Center, Houston, TX; <sup>4</sup>NASA, Kennedy Space Center, FL

## Background

- To mitigate the behavioral risks associated with future exploration class missions, NASA seeks effective and efficient strategies to support crew health and performance.
- This study targets NASA's particular interest in evaluating countermeasure approaches related to the plant growth and the freshness and variety of food. Plant life is expected to\*
  - Augment sensory stimulation (visual, tactile, and olfactory)
  - Provide a psychological link to Earth
  - Reduce stress
  - Increase happiness

## Objective

To assess the effect of plant growth and fresh food on behavioral health during 14 months of isolate and confinement at Neumayer III Station in Antarctica.

\*Source: Odeh & Guy (2017) Open Ag 2:1-13



## Neumayer III – A High-Fidelity Space Analog

- Small overwinter crews (N=9), more similar to long-duration spaceflight missions
- 4.5-5 months of training prior to mission
- 14-month missions
  - 1<sup>st</sup> austral summer (incoming crew transition phase)
  - 8-9 months remote overwintering phase
  - 2<sup>nd</sup> austral summer (outgoing crew transition phase)
- Lack of privacy
- Sensory deprivation & social isolation
- Variations in meaningful tasks
- Operations in a high-risk environment with real dangers, including life-threatening situations
- “Lack of return” – 9 months with no rescue options





## EDEN ISS

- Greenhouse facility near the station
- Operated by the German Aerospace Center, DLR
- First season: 2018
- 12.5 m<sup>2</sup> plant cultivation space
- Currently supplements the crew diet with variety of fresh produce, like Veggie
  - Salad crops (lettuce, mustard greens, etc.)
  - Fruiting crops (tomatoes, peppers, cucumbers)
  - Stem crops (kohlrabi)
  - Herbs
- Located near Neumayer III; requires travel outside station



*Photo credit: DLR*

## Data Collection

- Data are collected in **N=10 crewmembers** as part of the **14-month expedition** at Neumayer III Station in Antarctica.
- Data are collected **once before, 10 times during, and once after** the mission.
- Our **primary outcomes** are changes in **neurobehavioral health** related to **plant growth** and the **fresh food** using self-reported measured.
- Surveys are adapted from the **Veggie crew surveys used on ISS**, developed by BHP (PI: Pete Roma)
- Surveys are delivered in **crew's native language** through Qualtrics software on iPads.
- Data are **transferred immediately** after collection via satellite communication.



## Data Analysis

- Mixed linear models will be used to identify the time course of:
  1. Engagement and enjoyment of interacting with the plant growth system
  2. Individual and team behavioral health and performance measures related to the presence and interaction with the plant growth system

## Current Status

- The crew was recruited in early 2020 and began training in August 2020. All crew members (N=10) have volunteered to participate in this experiment.
- Pre-mission survey was completed in November 2020.
- Participant compliance has been excellent; all pre-mission data were completed as off-nominal.
- The crew has been at the station since January 18 and is preparing for the first data collection on-site.

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