



Translating Space Medicine to Earth: Synergistic Benefits of Mentorship

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Disclosure Information

Marian B. Sides

I have no financial relationships to disclose



Objectives

- Identify synergistic variables in mentorship for participating young investigators
- Determine the variables that have the highest influence on mentee benefits
- Analyze implications of synergy among variables to advance mentoring theory



Bellagio II International Summit



Bellagio 2017
International Summit on Space Medicine



Hotel Imperial
Moltrasio, Italy
September 2017

Bellagio II Team



“

GOAL: Create a scientific pathway for translating mature science from space to earth

”

Space Medicine: Terrestrial Applications for Human Health Performance and Longevity

Initiative of: The AsMA Corporate Forum





Bellagio 2017

International Summit on Space Medicine

Bellagio II Objectives



2. Mentor the next generation of young scientists

4. Create public awareness of scientific benefits for the general population



3. Create networking among nations in an international venue



1. Contribute scientifically to the field of aerospace medicine

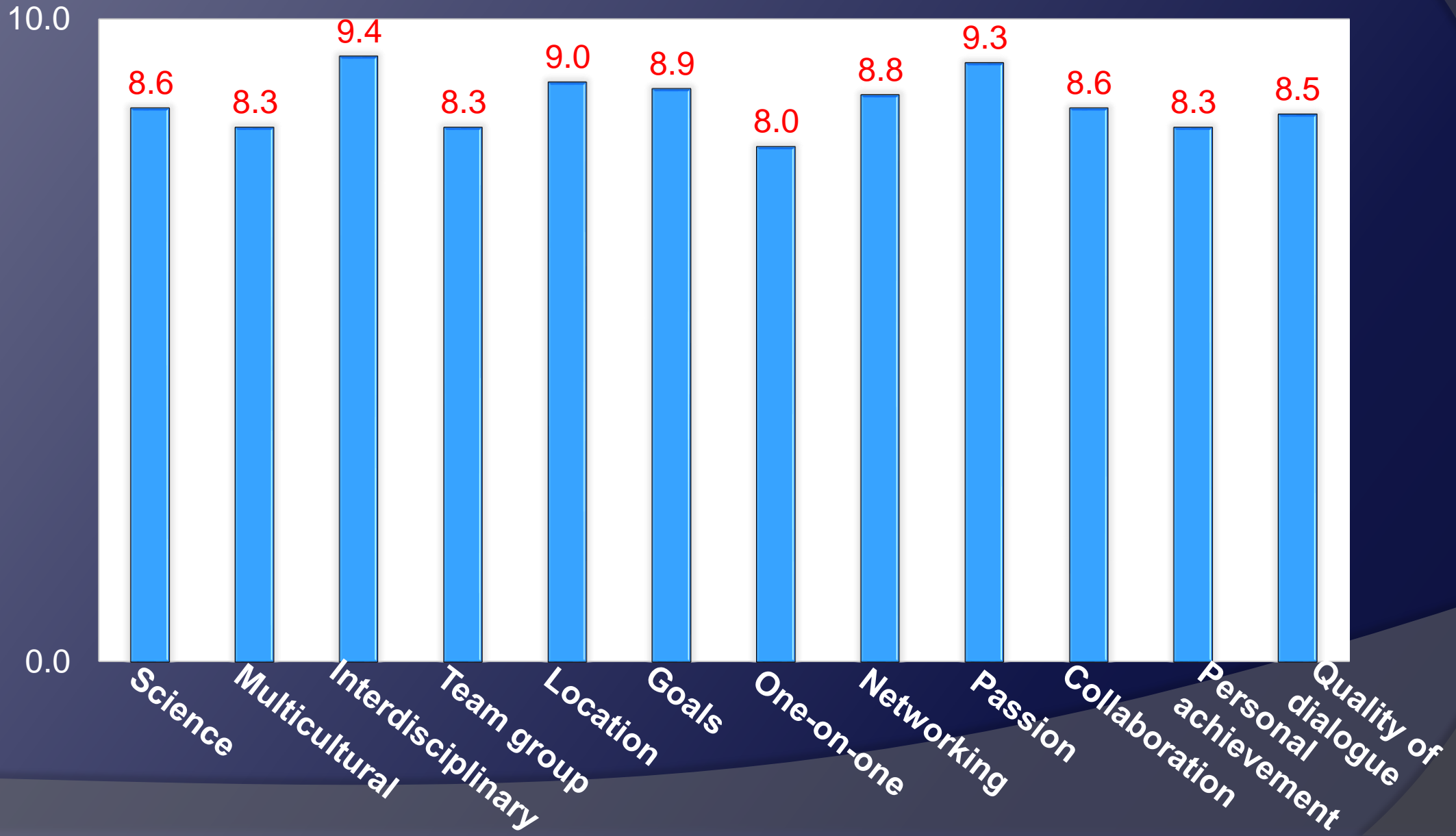


Mentorship Questionnaire

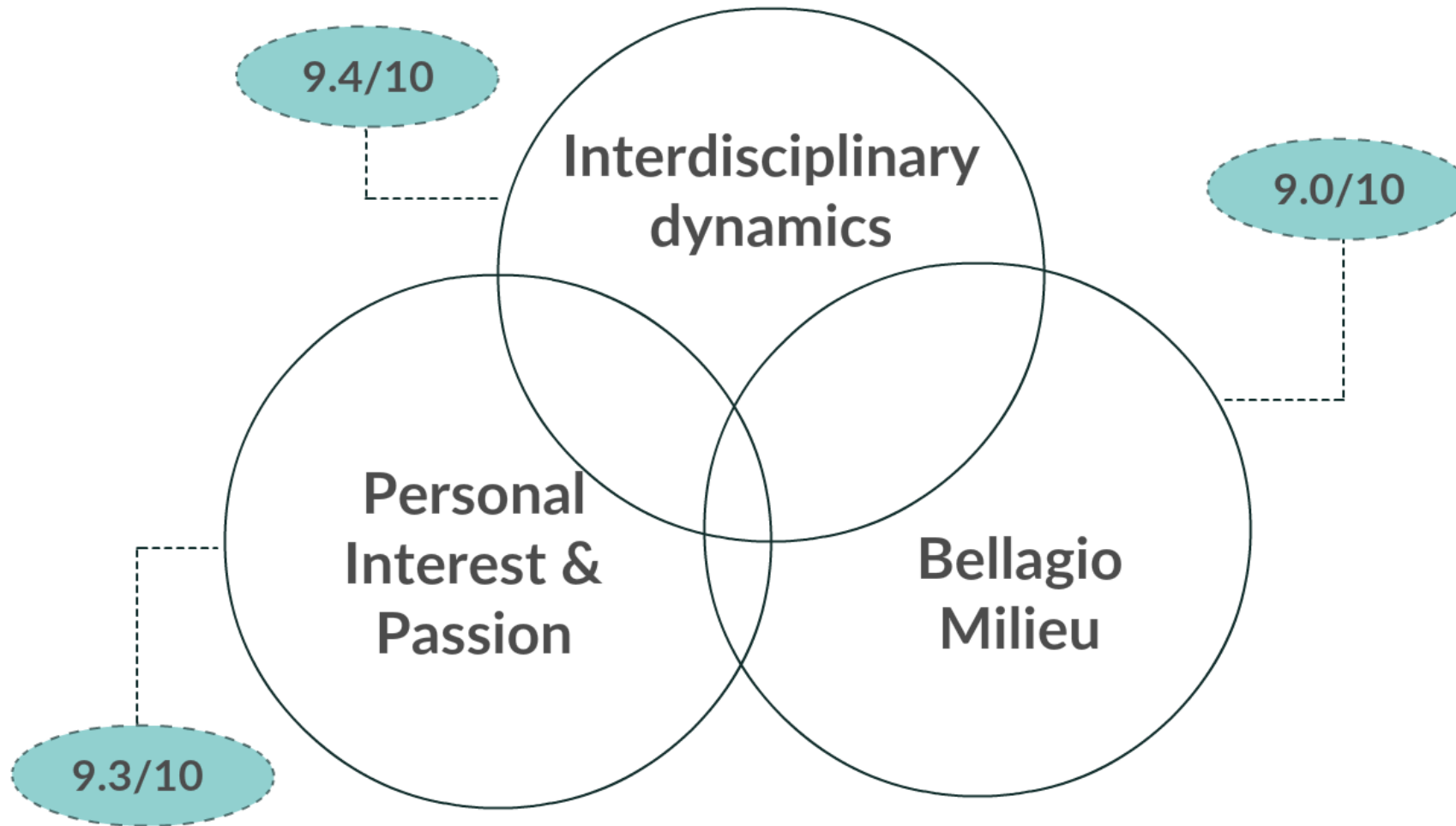
1. Scientific merit of Bellagio initiative
2. Multicultural dynamics
3. Interdisciplinary dynamics
4. Team group dynamics
5. Location milieu dynamics
6. Goal driven dynamics
7. One-on-one dynamics
8. Networking dynamics
9. Personal interest, passion
10. Collaboration
11. Personal achievement
12. Quality, inspiration of dialogue
13. Other



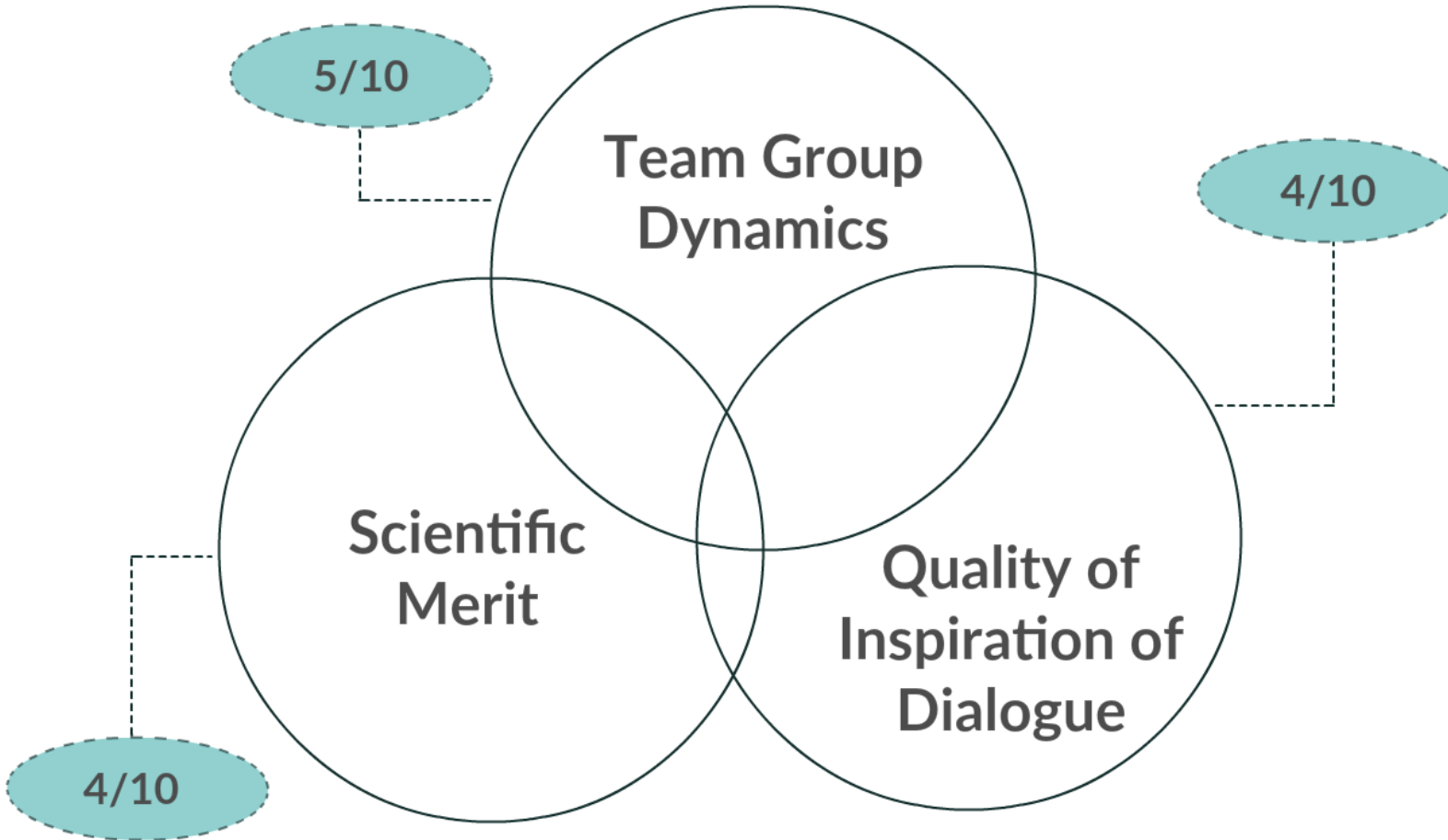
Average Ratings of Synergistic Variables



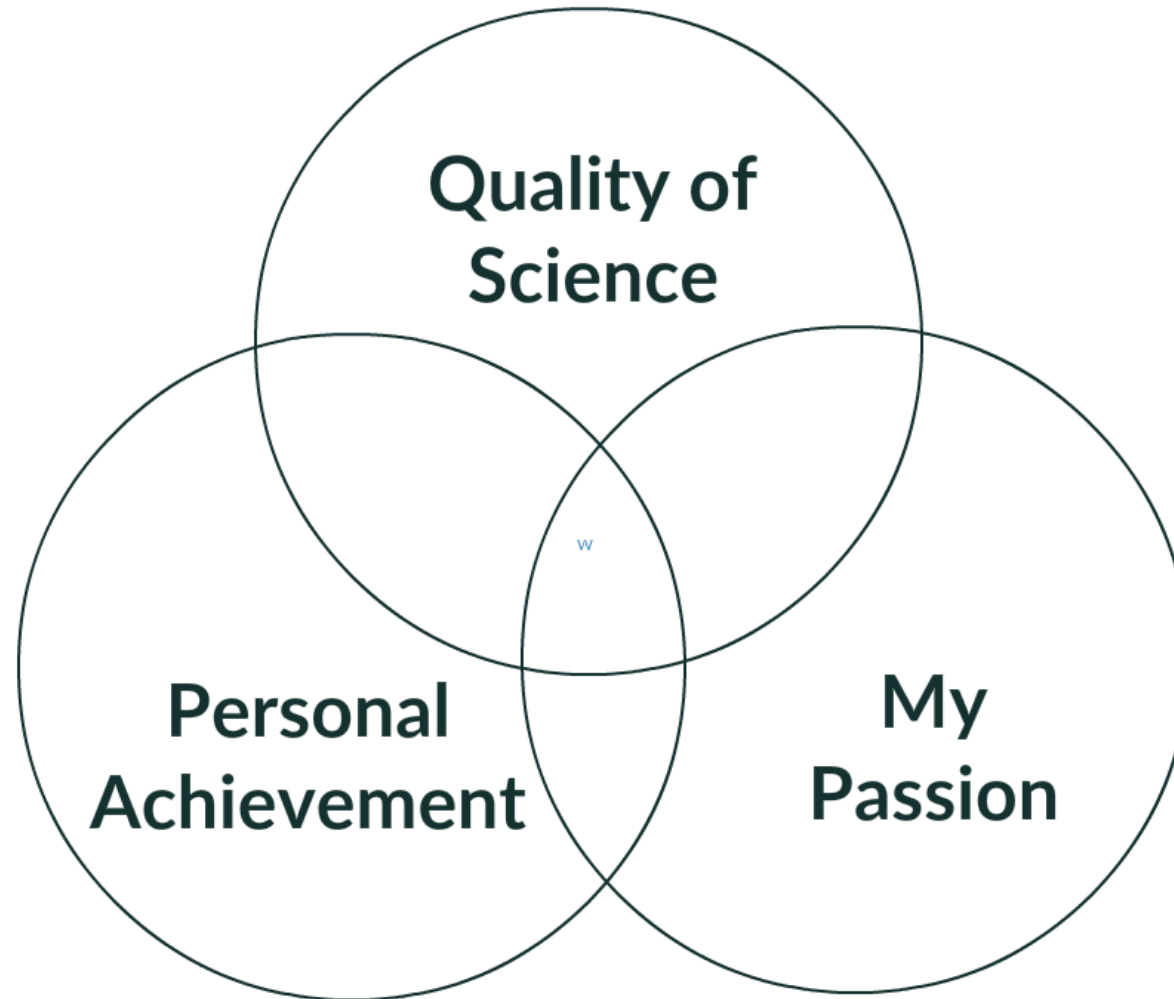
Highest Rated Synergistic Variables



Most Frequently Chosen Variables: Top Three



Individual Synergy

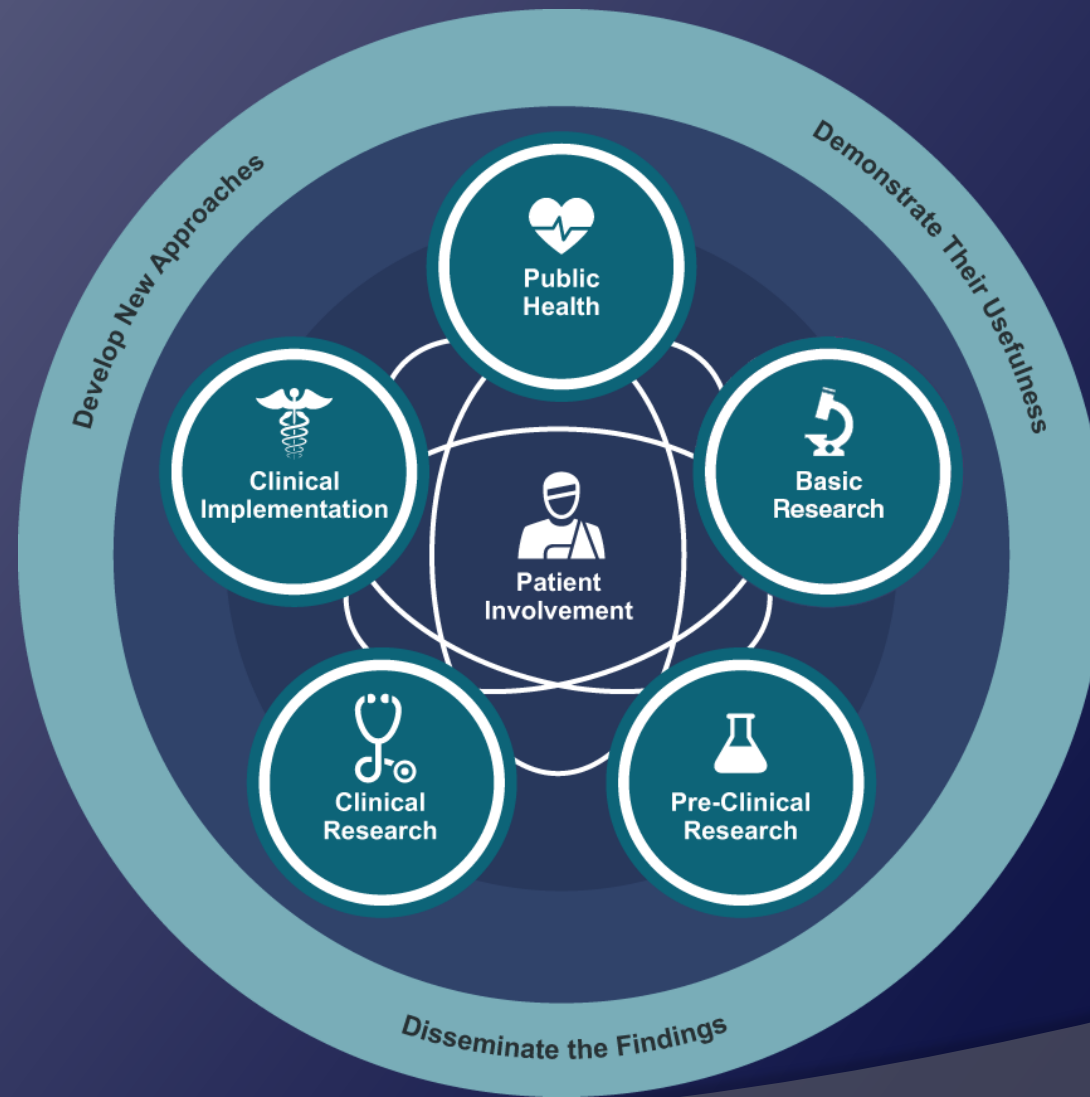


Purpose of Translational Science

- Connecting basic and clinical science



National Institutes of Health Translational Science Model



(NCATS, 2017)



Bellagio 2017

International Summit on Space Medicine

Osteoporosis

Brent Monseur, MD, ScM

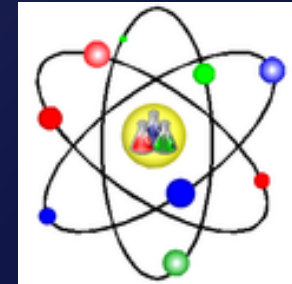
OBGYN | Reproductive Biologist



Basic Research: Discovery of Vitamin D

“An experimental demonstration of the existence of a vitamin which promotes calcium deposition.”

1922 McCollum et al.⁴



- Testing hypothesis that Vitamin A could cure rickets
- Most important compounds in humans: vitamin D₃ (cholecalciferol) & vitamin D₂ (ergocalciferol)⁷
Inactive forms obtained from diet/sunlight (ultraviolet [UV]) exposure on skin are processed/activated by liver & kidney

Pre-Clinical: Murine Model in Microgravity

Decreased Mineralization & Increased Calcium Release in Isolated Fetal Mouse Long Bones Under Near Weightlessness.”

1995 Van Loon et al.⁵



- Mechanical loading's role in the development and maintenance of skeletal tissues can be altered by bed rest and immobilization
- Spaceflight, additionally, results in decreased bone mass & disuse osteoporosis
- *In vitro* experiment using embryonic mouse cartilaginous long bones (metatarsals) cultured in microgravity in the Biorack facility of SpaceLab
- Demonstrated a reduction in glucose utilization, mineralization, and an increase in mineral resorption as measured by calcium release

Clinical Research: Astronaut Nutrition

The Nutritional Status of Astronauts Is Altered after Long-Term Space Flight Aboard the International Space Station.”

2004 Smith et al. ⁶

- Examined various nutritional changes during long-term spaceflight including bone metabolism and vitamin D status
- Pre-flight
 - 80-90% participants suboptimal baseline of vitamin D
- Post-flight
 - Decreased vitamin D levels and possibly altered metabolism⁹
 - Increased bone resorption
 - Bone formation did not consistently rise after landing
 - Concluded that bone loss and decreased vitamin D are critical health concerns for long-term spaceflight

Clinical implementation: Antarctic analog

*“Efficacy of vitamin D supplementation in an Antarctic ground analog of space flight”
2009 - Smith et al.⁷*

Intervention study comparing three different doses of vitamin D supplements in regard to vitamin D status in an environment without exposure to UV light

- Optimal levels were not reached; however, significant increases in vitamin D levels were measured
- Calcium status was not affected
- Initial vitamin D status can affect individual response

Public health: Fortified Dairy

“A Scoping Review of the Public Health Impact of Vitamin D-fortified Dairy Products for Fracture Prevention.”

2017 Hiligsmann et al.⁸

Population based study investigating public health/economic impacts of enriched dairy products particularly in regard to bone fracture

- Concluded that vitamin D supplementation through dairy products could cost- effectively decrease osteoporotic fractures in high-risk elderly & elderly population
- Future countermeasures to address various gaps in knowledge
 - Clinical trial showed individual differences in vitamin D supplementation (high/low responders: genetics, body mass, baseline)¹⁰
 - Reviews highlighting gender/sex & socioeconomic differences¹¹
 - Use of sequential pharmacotherapeutic regimens (anabolic→anti-bone remodeling drugs) opposed to mono- or concurrent in patients with imminent fracture risk¹²



Synergy Effects & Outcomes

1. Sense of belonging to a new dynamic community
2. Shaping the final synthesis of data and writing the abstracts
3. Unique multidisciplinary experience
4. Pre summit preparation data retrieval
5. Contribution of different perspectives from surgical background from my corner of the world
6. Realization that the impact of translation is a starting point for building new multidisciplinary fields in research
7. Provided a strong voice in focus group initiatives
8. Delivering actual presentations of scientific topics
9. Unique venue driven inspiration for scientific dialogue



Synergy Effects & Outcomes cont...

9. Brainstorming experience for new pathways for translation science
10. Interactions with other young investigators
11. Career goals refinement
12. Networking with leaders and experts in the field
13. Confidence building
14. Galvanizing interpersonal skills
15. Fellowship, and being a part of something BIG
16. Mentorship in a life altering way
17. Experience of team, group dynamics as a 2nd year medical student

Conclusions

- Mentoring is highly associated with positive outcomes in all 12 criterion variables
- No duplicate Venn patterns emerged, which suggests that mentoring is highly individualized
- The mentoring process in this evaluation initiative, influenced motivation, desire, attitudes, goal setting, self perception, interpersonal relationships, knowledge acquisition, personal performance, and self confidence



Recommendations

- This evaluation project should be replicated as a quantitative research study with a larger sample size
- Future research on mentoring is needed , using controlled designs and research methods, to advance mentoring scholarship



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