LETTERS TO THE MJM

SPACE MEDICINE IN CANADA

Space medicine is a unique field of medicine applying a broad understanding of medicine to the extreme environment of space. Physicians involved in space medicine play a pivotal role in understanding the effects of space flight on humans as well as mitigating problems associated with space flight, and managing any health effects that might develop on a mission (1). In addition to the many physiological effects, space medicine includes practicing medicine in this extreme environment. Prevention, diagnosis and treatment must be taken into consideration. It is therefore important to understand the mechanisms of altered human physiological functions in space to establish a new "normal" in reduced microgravity, and to then discover new ways of treating astronauts in space. The space environment has a vast array of effects on almost every component of normal human physiology:

a. cardiopulmonary function (2, 3)
b. neurophysiology (2)
c. bone and mineral metabolism (3-5)
d. muscle structure and function (4, 5)
e. hematological and immunologic function (4, 6)
f. biological effects of radiation (7)
g. circadian rhythm (7)
h. psychological effects (8)

It is critical to launch a new era of medicine in Canada. There are many applications of space medicine to medical concerns on Earth. The physiological changes observed in space can shed light on common diseases supporting developments of treatments. First, osteoporosis is a public health concern affecting menopausal women, and the complete absence of microgravity is a model of accelerated osteoporosis. Osteoporosis is a slow, progressive disease except in situations such as short and long-duration space missions and immobilization (9). New treatments addressing these issues and further prevention can be a significant benefit to all women suffering from this disease. Motion sickness is also an obstacle for astronauts and cosmonauts living in microgravity. Pharmaceuticals aimed to prevent space motion sickness can prove useful to terrestrial motion sickness, which affects individuals on long journeys by air, sea, and motor vehicles (10). Additionally, reduced gravity influences the cardiovascular system leading to an understanding of cardiovascular functions in different circumstances. Prolonged hospitalizations can lead to adaptation problems requiring rehabilitation for the cardiovascular system and for muscles. Exercise equipment specifically designed for astronauts in space may be a useful addition to rehabilitation medical equipment (10).

Currently, there is no Canadian residency for aerospace medicine. However, the Canadian Space Agency (CSA) does offer an aerospace medicine medical elective for fourth year medical students or residents. The CSA sends selected students to the Johnson Space Center or the Kennedy Space Center to promote awareness of this branch of medicine and to encourage career pursuits in aerospace medicine (11). In spite of this, if a student hopes to pursue a career as an aerospace physician, the only residencies offered are in the USA. The Centre for Altitude, Space and Extreme Environment Medicine (CASE Medicine) offers a medical elective in space medicine and extreme environment physiology for medical students at University College London. Finally, some students and residents interested in this field complete a diploma of space studies at the International Space University.

The only two American civilian universities that offer aerospace medicine programs are the University of Texas Medical Branch (UTMB) and Wright State University. UTMB focuses more on space medicine whereas the Wright State program centers on aviation medicine. These are competitive programs accepting few candidates from around the world on a per-year basis (12, 13).

The space shuttle is retiring in 2010 and it will be making way for the new Ares Launch Vehicles, which will return humans to the Moon and to other destinations (14). Canada has made significant contributions to the development and enhancement of space exploration through pioneering technology; however, new aerospace medicine initiatives should be supported, such as a Canadian fellowship or residency in aerospace medicine.

Even though Canada has a small number of astronauts, Canada should establish a training program to train specialists in both an occupational and research setting. There are still many medical challenges associated with space flight, and increased Canadian participation in aerospace medicine research would help in understanding and mitigating the effects of space environment on human physiology. Furthermore, applications of this research could also be beneficial to Earth-related issues. Although Canada should support

new training initiatives, political pressure is geared towards addressing the shortage of physicians. For that reason, students interested in this field must be prepared to pursue a unique training path that might not initially include space medicine, but it would be great if students were supported in these pursuits.

It is also essential to optimize the health and safety of astronauts before, during, and after space travel. The future of space medicine is for those who would like to embark on a journey to become a pioneer, a student, a teacher, and an explorer in pursuit of understanding the effects of space travel on human physiology, practicing medicine in extreme environments, and applying new knowledge acquired to health care on Earth.

Sincerely,

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Laura Drudi (M.D., C.M. 2012) is currently a medical student at McGill University. She is conducting aerospace medicine research with Dr. Doug Watt at McGill investigating altered vestibular function in helicopter pilots. She is also working with Dr. Joan Saary at the University of Toronto researching lunar dust toxicity and the implication this poses for missions back to the Moon. Laura is also beginning a project with Dr. Gregg Bendrick at NASA Dryden Flight Research Station studying the relationship between space travel and fatigue.