

Space medicine in the United Kingdom

What has intensive care got to do with a mission to Mars? How can human space travel benefit hospital patients? What on earth is space medicine and why do we need it? **Julie Sladden** recently went along to the UK's first Space Medicine Day to find out

Let's start by clarifying definitions. The dictionary definition of space medicine is the medical science of the biological, physiological, and psychological effects of space flight upon humans—or, essentially, the effect of microgravity on the body.

Apparently weightlessness isn't a benign state. It has a multisystem impact. We're talking bone demineralisation, muscle atrophy, impaired coordination and neurovestibular tracking skills, cardiovascular deconditioning and orthostatic intolerance, motion sickness, altered hormone levels and, to top it off, hallucinations. As Dr Kevin Fong, co-director of the Centre for Aviation, Space and Extreme Environment Medicine (CASE), puts it, "Space really screws you up."

This begs the question—why go there? Well, by studying humans in microgravity we can learn how gravity affects us here on Earth. Dr Alyson Calder, senior house officer in cardiology and Space Medicine Day organiser explains, "It provides a fresh way of looking at the human body. Many of the conditions experienced by astronauts have analogous conditions back here on earth. The bedbound lady in the geriatrics ward who develops muscle wasting, orthostatic intolerance, and disuse osteoporosis may, by proxy, be helped by research carried out in space."

More than just a walk in space . . .

There are other benefits from human activity in space, including advances in medical research and technology. For example, crystallography can be used more effectively in space. The clearer picture of structure and growth of protein crystals gives useful information in pharmacology research. Also,



three-dimensional tissue cultures can be grown in space. These cultures behave like tumours and can be used to test new cancer treatments. In addition, bioimaging systems, which will have higher resolution and greater efficiency, are being created using technology developed for x ray astronomy satellites.

So what are the medical implications of a human mission to Mars?

Going to Mars is not an easy task to plan. It needs a mission of about 1000 days. This is largely due to the timing of Earth's and Mars' orbits. Dr Fong explains, "You can go to Mars whenever you like—it just might not be there when you arrive." So, with missions of almost three years there is an increased likelihood of having to deal with critical events and medical emergencies in space. Add to this the long-term effect of living in zero gravity and we've got a few things to think about if we're serious about getting to, and back from, Mars. Fortunately there are people working on these issues—such as how to perform cardiopulmonary resuscitation in space, how to deal with critical injuries in a vacuum, how surgery can be performed in space, and how to take gravity.

For those of us back on Earth, the real gains in having a human space flight programme are in innovation. Dr Fong says, "I think the technology drivers for space medicine and the technology drivers for leading edge terrestrial medicine such as ICU are very similar as far as non-invasiveness, miniaturisation, advanced image-processing, wireless telemetry, and telemedicine. Like nowhere else in science you can have people from very diverse backgrounds, quite literally rocket scientists, internal physicians, and engineers, coming together to solve common problems."

What's happening in the United Kingdom?

Unfortunately the UK's involvement in human space flight and research could be described as minimal at best. Dr Calder says, "We specialise more in unmanned space flight. I think this is a pity, given the huge amount of public and professional support in this field. We've had 120 people attend today's conference and I've had many emails from UK students and doctors interested in space medicine."

In his statement on microgravity Lord Sainsbury, the Science Minister, writes, "The UK government will not subscribe to the ESA's [European Space Agency] ELIPS (microgravity) programme, nor fund a national programme of microgravity research at the present time." Dr Fong, who regularly lectures doctors and students interested in space medicine, explains, "This is partly due to the financial costs involved. But also, there is currently no mechanism through the research council to run a space or microgravity related programme."

The situation may improve if the UK government signs up for "Aurora"—the European Space Agency's programme of planetary exploration—they will make a decision on this soon.

This programme includes all projects from Mars (for example, Beagle-like missions) up to human space flight. Dr Fong says, "Without our participation, the prospects for people interested in space medicine in the UK are extremely bleak."

Growing interest in space medicine

Despite the political uncertainty there are some opportunities for those who want to get involved in space medicine. University College London will begin running a masters course in Human Health and Performance, including a module on space medicine, starting in October 2005. The course is open to all science graduates with appropriate backgrounds and can be done either full time (one year) or part time (up to five years) (see further information). There are also international groups to join, like the Aerospace Medical Association (ASMA), which holds annual international conferences; there are plans to set up a UK branch of ASMA in 2005.

With the interest and success of this first Space Medicine Day, plans are already under way for another in 2005. Dr Calder says, "I've been setting up links with the Space Research Centre, the National Space Centre, the European Space Agency, and space experts in Moscow for next year's conference. Russian space medicine research is not widely published in English so it will be great to have some of the Russian experts speak about their years of experience and research."

Conclusion

Space medicine seems to have a lot on offer even for those who prefer to keep their feet firmly on the ground, and in the coming years it may become difficult to ignore this field of medicine. Dr Calder explains, "Long-haul flights half way around the world seemed fantastical only a matter of decades ago. Now we commonly see post-flight DVT's [deep vein thromboses] in the emergency department. As space tourism starts to come into play will we be seeing patients with post-flight orthostatic intolerance after their recent space holiday?"

Aside from the novelty of it all, there are real gains to be had in medical research and technology as we gain a greater understanding of how the human body reacts to microgravity.



Dr Fong sums up, "This isn't about massive funding for jaunts out in space. It's about what can be done with that knowledge here on earth."

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1 Lord Sainsbury's statement on microgravity, 10 May 2004. www.microgravity.org.uk/review.htm (accessed 10 Oct 2004).

Further information

If you want to learn a bit more about space medicine

- The UCL masters course in Human Performance under Extreme Conditions (with space medicine as one of the modules) starts in September 2005. For more details contact The Administrator, MSc School of Human Health and Performance, Archway Campus, University College London, 10 Highgate Hill, London N19 3UA. Tel 020 7288 3183.
- For details about next year's UK Space Day contact Dr Alyson Calder—alysoncalder@doctors.org.uk
- For information on space medicine and other forms of extreme environment medicine contact the Centre for Aviation, Space and Extreme Environment Medicine—www.case.ucl.ac.uk
- Information and minister's statement about microgravity research in the United Kingdom—www.microgravity.org.uk
- For information about the Aerospace Medical Association—www.asma.org
- For a list of medical spin-offs from the space programme—www.thespaceplace.com/nasa/spinoffs.html#health

General information on space

- The British National Space Centre coordinates UK civil space activity and has information on UK space policy and space activity—www.bnsc.gov.uk
- The European Space Agency has information on "Aurora", other European projects, and space activity—www.esa.int
- General space and NASA activity information—www.nasa.gov
- The National Space Centre in Leicester—www.spacenow.org.uk If you want to go to space and have a spare £13 million lying around, take a look at www.spaceadventures.com for a trip to the International Space Station—starting next year through the Russian Space Agency.