

and through other mechanisms. Compounds such as aminoethiols, vitamin E, vitamin A and glutathione have been suggested as potential countermeasures to space radiation [6]. More research is clearly needed in this area since this would provide some potential therapies in the event of an increased radiation exposure.

### MEDICAL CARE

On July 13th 1999, the New York Times carried an article about a woman who had developed a mass in her breast while at the Amundsen-Scott research station at the South Pole. At the station, planes could not land and advanced medical care was not available. How should this situation be handled?

Situations like these could challenge a Mars crew. Weight and mass limit the amount of medical support and hardware that can be provided. The crew may or may not include a doctor. The doctor, if present, may not have any recent experience with a medical condition that arises. After being away from Earth for 2 or more years, the doctor may not have much recent medical experience at all. The communications time between Earth and the crew, which increases to 40 minutes round trip, would make emergency consultations with the ground impossible. Clearly, if the crew is going to be ready to handle medical emergencies they will need a way to maintain medical proficiency while on the mission.

### VIRTUAL MENTOR

Advances in computer training and simulation may make it possible to provide a virtual mentor for the Mars crew. Just as an aircraft simulator provides the pilot with training in different emergencies, the mentor could provide virtual scenarios that crewmembers could work through. Diagnostic problems, emergency care, or even surgical operations could be simulated with the virtual mentor. The mentor could include computer-based models of other crewmembers or of different physiologic systems. The ground could send up scenarios for the mentor to help the crew training on situations that might be developing or are anticipated.

The mentor would be only one part of the Mars medical system. Mission planners would have to make hard decisions on what conditions could and could not be treated during the flight based on the equipment and medicines provided. Nevertheless, the virtual mentor would allow the crew to make the best use of the equipment at hand, and to be ready to deal with medical emergencies even if it had been years since they had last encountered the problem.

### CONCLUSION

A Mars trip, like any space voyage, is risky. As experience with the Challenger and Mir has shown,

the greatest risk to life with space travel is equipment failure. Despite this, a healthy, strong crew is much more likely to be successful, and they would deserve the best possible medical and physiological support.

The International Space Station provides an excellent opportunity to have a focussed, Mars-oriented, research program that can answer both basic and applied questions about physiology and medical care. The results would provide the Mars travelers with the tools and training they would need to maintain bone mass, stay strong, and cope with medical emergencies while they embark on mankind's greatest adventure.

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