

## SPACE MEDICINE BRANCH REPORT

# Space Medicine and Its Inflight Practice

*This article is the seventh in a series on Space Medicine, and was written by James P. Bagian, M.D., a physician-astronaut.*

Despite the tremendous amount of work already expended in the pursuit of a more complete understanding of the human physiologic changes which accompany spaceflight, much is yet unknown. This incomplete knowledge makes it even more imperative that the crew is adequately prepared for their spaceflight to maximize the probability of a safe and successful mission.

The training that each crew receives from the Medical Operations Branch at the Johnson Space Center is designed to accomplish a variety of goals ranging from familiarization with the adaptive physiologic phenomena they will experience during spaceflight to basic cardiopulmonary resuscitation (CPR). From an operational standpoint, the familiarization portion of the syllabus serves not only to make the crew aware of some of the changes they might experience or witness, it also provides them with a common set of descriptive terms which will allow them to characterize and communicate any such changes more succinctly. Such communication can play an important role in the delivery of appropriate medical care to a crewmember in need.

In the clinical area, the only training that all crewmembers receive is CPR to the extent that all are certified in basic life support. Beyond this, all additional diagnostic and therapeutic procedural training is supplied to two designated Crew Medical Offic-

ers (CMOs) on each crew. The CMOs are trained to a level such that they can perform an adequate physical examination and then report the results, if necessary, to the NASA flight surgeon on the ground in the Mission Control Center. In the event that any therapeutic measures are required, the CMO will, as a rule, be directed by the ground. In most cases, the procedures which will be undertaken will be covered in the Medical Checklist, which is a manual carried onboard the Space Shuttle. The CMOs will have gained great familiarity with the Medical Checklist during their preflight training as well as practiced the various procedures which are described. The Checklist is designed to be used with the Shuttle Orbiter Medical System (SOMS) Kit, which is an extremely compact and well thought-out kit that contains all the diagnostic and therapeutic medical equipment onboard. By using such a highly integrated and well planned system, the CMO is able to be extremely efficient with only a modest amount of training.

On some flights, one or more physicians may be members of the crew. In these cases, the physicians will be assigned the CMO duties and training can progress even more rapidly. However, the major advantage of having a physician CMO comes during the mission itself. Here, the insights that an experienced physician provides can prove invaluable, both in the description and diagnosis of problems, as well as in the area of therapeutics. Physician CMOs are gener-

ally not required to get prior approval from the ground before instituting any clinical interventions and this helps to shorten the response time in dealing with a medical problem. Also, since the physician CMOs are more experienced in using the various therapeutic modalities, they are often able to evaluate the efficacy of a particular intervention in a more timely fashion.

The majority of health problems encountered inflight are related to Space Motion Sickness (SMS) which effects approximately  $\frac{2}{3}$  of all first time Shuttle flyers. The training enables the crew to be more effective observers and helps to make their postflight debriefs with the flight surgeons even more informative. It is through these debriefs that future crews benefit in two major ways. 1) The training for future crews can be modified to be more relevant and effective; and 2) information conveyed during debriefs by the crew may suggest new avenues of research to investigators on the ground, which may in turn result in solutions to problems currently encountered.

As in most operational environments, good communication and feedback between the crews, the flight surgeons, and investigators result in the highest levels of mission productivity and the most timely solutions to encountered problems.

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