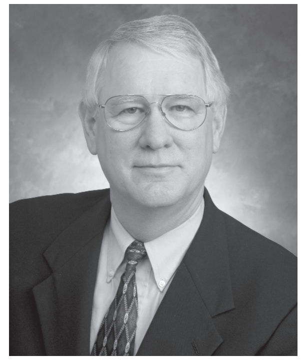
President's Page



Richard T. Jennings, M.D., M.S.

It is an honor to be the new president of the Aerospace Medical Association and to follow in the footsteps of so many distinguished leaders. In particular, I would like to thank Michael Bagshaw for doing such an outstanding job as the first president residing outside North America. Aerospace Medicine is such an international field (and soon hopefully an interplanetary field) that it is fitting for presidential leadership to come from outside the United States and Canada. Mike's wit and eloquence will be a challenge for an Oklahoman to match.

While there is considerable concern about the shrinking of the aerospace medicine field, there will be many opportunities for us in the next few years, and I plan to follow through on the initiatives started by Melchor Antuñano and Michael Bagshaw. These opportunities begin with our strength. I came from the field of obstetrics and gynecology, and by comparison, aerospace medicine has been blessed to have a feeling of family. Our family includes physicians, nurses, physiologists, technicians, and educators who cover military and civilian aviation and space plus includes international members who share a common goal of improving safety, comfort, and performance in the aerospace environment.

While each president has certain areas that they hope to emphasize, there are several initiatives that can help AsMA and the specialty of aerospace medicine. My first specific priority is to see that AsMA establishes a tax-exempt Foundation that can play a role in the development of young AsMA members. I know of very few professional organizations that do not have foundations to support their specialty and individuals who are beginning their careers. As a preventive medicine specialty, aerospace medicine has certain limitations for support of young students, residents, scientists, and nurses. At the current time AsMA offers only two annual scholarship awards of $1000 and $500. It is my hope that the establishment of a Foundation under the 501(c)(3) statutes will encourage the establishing of named scholarships and educational programs instead of further annual awards. This will help the development of our young members and assure a steady future for the specialty. We will also be looking for additional avenues to make young members feel productive and at home in AsMA. Dr. Antuñano's mentorship program was a great beginning. Our legacy rests with this generation of future leaders.

A second priority is to assure that the annual scientific meeting in New Orleans is a success. Due to Hurricane Katrina, the leadership team and the Home Office will work to assure that the hotels and logistical services are in place. We have accelerated planning for that meeting, and the first walk through will be in July. The local event chair is Dr. Bob Johnson. We hope to initiate changes to the abstract process to assure that the vast majority of the scientific sessions qualify for maintenance of certification (MOC) credit in addition to ACCME CME. I have asked the Program Chair, Joe Dervay, to coordinate at least 3 workshops on Sunday that include a space medicine update with emphasis on updating operations on the International Space Station, summarizing the new science knowledge from ISS, and a special session on commercial spaceflight. Other workshops include sessions on high altitude physiology, hypoxia, and cabin pressure considerations, and one on prehospital trauma/medical care and medevac. We hope to be able to offer nursing CEUs for the latter workshop. Of course, there will be additional workshops announced later. We are also planning an invited panel called the "Great Debates" to consider multiple facets of hot topics in aerospace medicine.

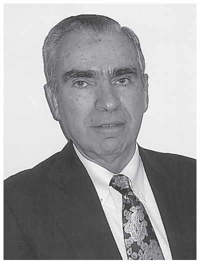
Lastly, the internet and 24/7 news coverage makes timely responses to current topics such as SARS, bird flu, DVT in air travel, periodicity of medical examinations, or cabin air quality much more important. It is my hope that AsMA can develop an agile way to interact with governmental agencies, the media, and the public to provide expert input while decisions are being made. We don't need to abandon processes like resolutions, but for AsMA's voice to be heard, we need to be able to provide more timely comment on the issues of the day. To a large degree, we need the committees and constituent organizations to be active in preparing position papers and providing expertise much faster than has been our experience. It is my hope that we can also develop teams of factual experts to help the Executive Director respond to issues in a timely way. Plans are also well underway for increased use of information technology and our website.

I look forward to working with the new committee chairs, Council, vice-presidents, Executive Committee, and Home Office during this year. It is my current plan to allow each of the vice-presidents to prepare a president's page to inform the membership about the activities under their leadership, but I am excited to be able to communicate through the remainder of the President's Pages. With your continued help, we should have a very productive year for AsMA.

AVIATION, SPACE, AND ENVIRONMENTAL MEDICINE

Medical News

Executive Director's Column



Rayman

FAA Proposed Rule on Human Spaceflight

The Federal Aviation Administration (FAA) recently published a Notice of Proposed Rule Making (NPRM) entitled Human Space Flight Requirements for Crew and Space Flight Participants. It can be retrieved on the FAA website (faa.gov). It is Docket Number FAA-05-23449, Notice Number 05-17. Although most of the Rule addresses operational considerations, there are some paragraphs given to aerospace medical concerns.

This NPRM should be welcomed by all of us in aerospace medicine as it addresses many of the issues associated with commercial space travel. I don't believe anybody would doubt that the commercial use of space is just around the corner and promises to be a reality in the coming decades. Your Association responded to this NPRM in a very positive and laudatory manner, agreeing with the Administration's recommendations regarding environmental controls, life support systems, and human factors related applications.

However, there was considerable ambiguity in the NPRM. In many parts of the narrative it was difficult to ascertain whether a recommendation applied to either a suborbital or orbital flight. It is essential that a clear distinction is made because the flight profiles and stresses of flight are very different. We strongly recommended that the NPRM must be explicitly clear in its recommendations in this regard.

As written, the NPRM calls for a Class II FAA medical certificate for crewmembers. Although this might be reasonable for suborbital flight, it would not be for orbital flight. More stringent physical standards should be applied for the latter in that missions could be of days, weeks, or even months duration. Therefore, it is more compelling in these cases to require physical standards beyond those of a Class II medical certificate.

AsMA did not attempt to describe in detail a recommended physical examination for crewmembers, but did state that the examination should require a physician encounter (one with aerospace medicine training) as well as appropriate screening tests consistent with prudent aeromedical practice and recommendations of the U.S. Preventive Services Task Force.

Regarding a physical examination for passengers, referred to as spaceflight participants in the NPRM, AsMA recommended that it would suffice for the individual to complete a health risk assessment form in consultation with a physician trained in aerospace medicine. It would be at the discretion of that physician to perform a physical examination or order relevant laboratory/imaging tests. In any event, the physician should make a recommendation regarding qualification or disqualification, forwarding it to the company sponsoring the flight and leaving the final decision to that company. AsMA also strongly recommended informed consent and that the spaceflight participant be provided a full explanation of the flight profile with emphasis upon the stresses of flight.

The suspense date for comment was February 27, after which it is possible there would be a public hearing. If so, AsMA will be represented and will convey its position on the Rule.

German Flight Surgeons to Meet

The 52nd working session of Bundeswehr flight surgeons, flight psychologists, and aeromedical assistants will be held in Strausberg this year from 07 until 09 June under the motto "50 Years of Aviation Medicine - Joint, Allied and Combined" and will be chaired by the Surgeon General German Air Force, BG Dr. Erich Rödig.

The Chief of Staff German Air Force and the Chief of Staff Bundeswehr Medical Service as well as high-ranking representatives from many nations have announced their participation.

Following the opening address by the Chief of Staff German Air Force, two ceremonial addresses by Professor Dr. Gunga, Chief of the "Institute of Space Medicine and Extreme Environments" and Professor Dr. Stüben, Chief of the "Lufthansa Medical Service," the "Frankfurt Aeromedical Center," and executive secretary of the "German Academy for Aviation and Travelling Medicine" will follow.

The subsequent scientific program will cover the spectra of clinical and scientific aviation medicine. Theater medicine will be given particular attention. In the sense of this year's session of flight surgeons, international guests will lecture on various aspects of aviation medicine

During the social evening, the Chief of Staff Bundeswehr Medical Service, Vice Admiral (MC) Dr. Karsten Ocker, who served as flight surgeon himself for many years, will be given a farewell address by the Surgeon General, German Air Force on the occasion of his retirement from the active circle of his flight surgeons.

For further information contact the following e-mail address: Kontakt-GenArztLw@bundeswehr.org.

MEETINGS CALENDAR 2006

September 10-14, 2006, Bangalore, India. 54th International Congress of Aviation and Space Medicine. This meeting is being hosted by the Indian Society of Aerospace Medicine. A preliminary registration form may be found at http://www.isam-india.org/conference44/newreg.php.

October 16-20, 2006, Moscow, Russia. 5th International Scientific and Practical Congress. For more info, please call Mr. Valentin Vlasov at 095-953-5842, or Mrs. Dina Valeeva or Mrs. Natalia Mitrokhina at phone/fax 095-239-9851; or e-mail medic@mak.ru, attn: Mr. Vlasov V.D. or e-mail infan.ltd@relcom.ru, attn: Mr. Gabbasov I.Z.; or by fax at 095-953-3508.

October 19-21, 2006, Kauai, Hawaii. US/Japan Panel on Diving Physiology, Diving Technology, and Aerospace Medicine biennial meeting. Abstracts are to be submitted to Don Chandler at donchandler@uhms.org or submitted online at http://www.uhms.org/Meetings/US_JAPAN/UJNR_06.ASP.

October 23-25, 2006, Reno, NV. SAFE Association 44th Annual Symposium. For more info: Ms. Jeani Benton, (541) 895-3012; safe@peak.org; www.safeassociation.org.

November 9-12, 2006, Eilat, Israel. Air Travel and Health. This symposium will deal with flight physiology and a wide array of health issues in air travelers. For more info, visit www.palexconventions.co.il/ath2006.

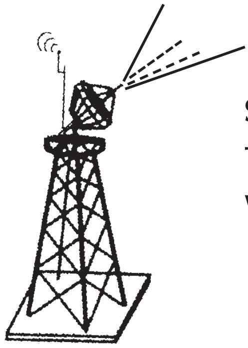
April 22-26, 2007, Dayton, OH. International Symposium on Aviation Psychology: "Airspace as a Cognitive System." For more info, visit www.wright.edu/isap.

SAFE Call for Papers

SAFE has issued a call for papers, panels, workshop, briefings, demonstrations, & open forums for its upcoming 44th Annual Symposium. The Symposium will be held October 23-25, 2006, at the Reno Hilton Hotel, Reno, NV.

The Deadline for entries is June 30, 2006. The SAFE symposium is the premier international showcase for the professionals, inventors, equipment, and systems that have shaped safety in aviation, space, land, and military disciplines. Tentative areas of discovery include: Commercial and Military Crash Safety; NBC Protection; Acceleration; Altitude; Ejection; Life Support Systems; NTSB & FAA Accident Investigation; Human Factors; Biodynamics & Physiology; Hearing Protection; Homeland Security; and many more.

All abstracts must be submitted electronically to the SAFE Office at safe@peak.org. To receive a form for submission contact SAFE Association, P.O.Box 130, Creswell, OR 97426; (541)895-3012; safe@peak.org.



Science & Technology Watch

Keeping You Informed Of The Latest Advances In Science And Technology

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Previously, artificial neural networks were developed that roughly approximated the anatomy of biologic systems. This month's column reviews the trend towards building these models that are more realistic in terms of the physiological parameters and capabilities of real biological networks.

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Physiologically Based Artificial Neural Networks

W. D. Fraser
Human Systems Engineering Group, Human Factors Research and Engineering Section, Defence R&D Canada - Toronto

According to the union within each person of disparate body parts, thus does mind emerge in humans. For it is the composition of body parts which does the thinking."
Parmenides of Elea, c. 475 B.C.

Artificial Neural Networks (ANNs) have long been used to pre-process image, auditory, and time-series data prior to analysis or display of information to a human operator. Sonar, radar, communications, electroencephalographic, and electromyographic data are all routinely analyzed with the assistance of ANNs. In addition to engineering and biomedical applications, simulated networks have also been proposed as an alternative to symbolic/rule-based models of human cognition, albeit their legitimacy as cognitive models is still highly controversial (1). One of the most common and justified criticisms of ANNs as cognitive models is their lack of structural similarity to the actual neural architectures of the brain, i.e., the individual "neuron" units, the patterns of connectivity, and the multiple, large scale, and specialized networks making up the central nervous system. For example, in most ANNs the weighting factor controlling the strength of the activation between the units can take on both positive and negative values and, in some network architectures, there are no upper or lower bounds on the activation. Real neurons only excite or inhibit the activity of other neurons and cannot switch modes and overall excitation and inhibition levels are limited by finite pools of neurotransmitters and the kinetics of the synaptic receptors.

In response to the limitations of traditional ANN architectures there is increasing interest in the development of network simulations that more closely reflect the properties of the complex neural architecture of the brain. This work has focused on developing neural networks by reverse engineering the brain and is motivated primarily by a desire to produce accurate models of neuro-cognition.

Realistic models and simulations of biological neural network cognition have to address the micro- and macro-structures that have evolved since the Cambrian explosion and the appearance of animals with complex nervous systems. The unique and specialized neural networks of the sub-cortical structures, such as the thalamus and corpus striatum, perform complex transformations on signal inputs, which are linked by very specific patterns of bi-directional connectivity to a wide range of cortical structures and other sub-cortical regions. The cerebral cortex is not a homogeneous structure. The arborization of the dendrites and axons of the individual neurons, the distribution of neurotransmitter receptor-types, the interconnectivity of the neurons in and between the micro and macro-columns in each cortical area, and the connectivity to other cortical and sub-cortical networks varies dramatically across the over 100 specialized cortical regions currently identified (2). The impressive computational power of the human brain is due to the integration and interaction of these highly specialized neural networks, organized not in a strict hierarchical structure, but in a complex web, where inputs from multiple areas of the brain can modify how information is learned, recalled, processed, and output to other brain regions.

The complex cerebral structure that forms during development is a very heterogeneous but strictly defined network, such that genetic errors that result in only subtle modifications to the neural connectivity patterns or cellular metabolism can produce specific and often severe cognitive deficits. Trauma or toxins can also rapidly disrupt the system but often environmental stresses induce only a graded decline in neural and cognitive function. Simulations of these networks, combined with computer models of cellular metabolism and advanced brain imaging technologies, can provide powerful tools to investigate a wide range of neurological disorders and the impact of environmental stresses, performance enhancing drugs, trauma and psychological stress on cognitive capabilities.

Over the past 10 years there has been an increased emphasis on the development of more biologically plausible and powerful neural network simulations where (i) the neural units are based on the electrophysiological and anatomical properties of the neurons; (ii) the architecture of different sub-networks correspond to the structurally diverse areas of the brain involved in processing specific sensory data or high level symbolic representations; and (iii) the interconnectivity of the sub-networks is derived from the specific pattern of neural pathways within and between cortical and sub-cortical structures, such as the hippocampus and basal ganglia. These models incorporate biological realism, distributed representation, inhibitory competition, bi-directional activation propagation, and combined error-driven and Hebbian learning. Building these types of models has been aided by O'Reilly's (4) enhancements to the original PDP++ (Parallel Distributed Processing) neural simulator software (3) to incorporate these biologically based unit and network algorithms. This tool allows for configuration and linking of multiple sub-networks representing different cortical and sub-cortical functions. The intensive bi-directional connectivity of these specialized sub-networks results in extensive re-entrant behaviors, producing models that demonstrate sophisticated cognitive capabilities, including episodic memory, short-term memory, decision making, and language processing (4). The role of emotional and psychological stress can be incorporated via linking cognitive pathways to models of sub-cortical structures such as the amygdala. The PDP++ (Ver. 3.0) simulator is freely available for download (http://psych.colorado.edu/~oreilly), along with manuals, source code, and exercises from O'Reilly and Munakata (4). One does require a significantly detailed understanding of both the cognitive psychological and neurophysiology literature to build models of any sophistication.

In addition to simulating complex cognition, some of the learning and processing algorithms derived from biological principals, combined with the complex networks that mimic the brain processing pathways, has resulted in data processing capabilities that exceed those of the traditional ANNs. Complex recurrent and reentrant neural networks can process data streams where there is a need to characterize present status with respect to the past (5). The ability to retain and compare time-based pattern information provides a powerful method of data analysis especially in Network-Enabled Operations where there is an information overload due to the volume of multiple visual and auditory data streams. Biologically plausible neural networks have the potential to process multiple data streams, extracting and interpreting critical information prior to presentation to the human operator, and thus reducing the cognitive workload.

With the development of faster computer technologies, and the rapid advances in understanding the micro- and macro-connectivity of the brain, it is likely that biologically inspired neural networks will become more predominant in both cognitive psychology and signal processing research.

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The AsMA Science and Technology Committee provides the Watch as a forum to introduce and discuss a variety of topics involving all aspects of civil and military aerospace medicine. Please send your submissions and comments via e-mail to: barry.shender@navy.mil

Watch columns are available at www.asma.org in the AsMA News link under Publications.

This Month in Aerospace Medicine History-- June 2006

By Walter Dalitsch III, M.D., M.P.H.

Seventy-five Years Ago

Aircraft crash analysis and pilot marital status (Hempstead, NY): "Before the Department of Commerce had civil aeronautics so well regulated; before the Army and Navy had acquired more modern equipment; and before the National Advisory Committee for Aeronautics had devised the current method of accident analysis, the study of aircraft accidents was more or less haphazard and bases for comparison were few.

"This article deals with an analysis of ninety-one crashes in a group of flyers over a period of four years. This is a small group and deductions may not be justifiable but at least it is strongly significant and suggestive. Many of the causes suggested may be equally important today.

"During the past four years much has been published concerning accident analysis. The mechanical causes are becoming fewer due to better regulated manufacture. With better and more systematic weather reporting, accidents due to meteorological conditions are decreasing. The pilot is blamed for about 60 percent of all crashes…

"The preponderance of flying time accumulated by the bachelors is due, in a measure, to the fact that when a mission involving several days stay away from home comes up, the Squadron Commander more often selects an unmarried pilot for the duty. The same applying to cross country trips, the bachelors participating more freely as they have no ties to bind them to their homes.

"A supposition in regard to the higher prevalence of crashes piled up against the married flying officers; it is probable that the increased number of crashes are due to the fact that very often when away from the home the family man will risk weather hazards to return home, knowing that his family is awaiting him and worrying about him until his return…

"Segregating the 91 crashes according to causes we have: Crashes due to engine defects: 28; Crashes due to plane defects: 6; Crashes due to unfavorable weather: 15; Crashes due to fault of pilot: 28; Crashes due to faulty terrain: 14.

"The causative factors in the crash very often intertwine so much that it is [a] little difficult to separate them, but there are 43 enumerated above which to a certain extent are avoidable. Those ascribed to pilots, numbering 28, and are usually due to inexperience, errors in judgment, carelessness or negligence of existing orders. The inexperience can only be corrected by flying itself. Errors in judgment are very often due to slow reaction time and it is only a question of time when this condition must be included in the semi-annual examination of fliers. Carelessness and negligence of existing orders are inherent qualities which only death can erase…

"The necessity of careful physical selection, careful supervision of pilots by a flight surgeon, and careful maintenance of lanes by trained pilots remains the same now as during the period of this report. The problems of aviation medicine are not particularly new but they are ever present and no laxness can be tolerated in meeting them" (3).

Fifty Years Ago

The aviator, combat and emotions: "Among the many variables that must be considered in aircrew effectiveness is personality. The affective life of an individual has much to do with the levels of stress which he can endure, the motivation with which he attacks a goal, and the perseverance of his efforts in the face of hazards. It may be maintained that among the most fundamental determinants of combat superiority are personality factors; but even if this is true, we know far more about other factors in combat effectiveness than we do about emotion… Men who have been shy and timid have developed into 'tiger,' and men who have all their lives bullied and dominated others about them have cowered in fear and panic. Individuals who previous to combat have had rather stable personalities have found themselves filled with crippling anxiety in combat; men tormented with fears and tensions have found deep gratifications in the release of aggression. Through combat, individuals who previously had never been bothered with interpersonal conflicts have found themselves violently hostile to leaders and colleagues.

"One of the major difficulties facing the investigator of behavior under such conditions is the fact that combat itself is subject to variable types of emotional stresses. Few men can view combat objectively. As in other areas of human behavior where emotions are involved, the investigator must watch lest his own security needs color his findings. An act of heroism is a remarkable event in human affairs. Glory and honor surround it. Yet those who study combat know that sometimes men are heroes as a result of feats performed in states of panic and fear. For this and other reasons, it is most difficult for researchers who have never seen or experienced combat to understand the nature of the stresses involved" (4).

The pathway to specialization in aviation medicine (Headquarters, Tactical Air Command, Langley AFB, VA): "As civilian and military aircraft fly ever higher and faster, the demands for specialists in aviation medicine become increasingly important. Fortunately, aviation medicine is prepared to meet these demands. A program of education has been developed which will guarantee that qualified specialists are available to cope with the problems of air travel now and in the future.

"The present educational requirements for a specialist in aviation medicine consist of a period of graduate study of two years, followed by a minimum of four years of practice in the specialty. Of the latter period, one year or longer is spent as a resident in an institution which can provide a comprehensive applicatory period of training. Because residency training in aviation is new in medicine, it is appropriate to describe its development at a medical installation of the United States Air Force. The history of some of the pitfalls and trials encountered may ease the problems of other who desire to establish similar residencies. Ample opportunities exist for the development of such residencies in many civilian institutions and agencies concerned with flying activities or research in aviation medicine…

"A residency training program of one year's duration has been established in the specialty of aviation medicine at a military installation. The program's objective is to train, through a comprehensive clinical applicatory period, qualified physicians in the broad background of aviation medicine for further progress and practice in that specialty. The conduct of the program is similar to that standardized for residencies in other specialties. Clinical, laboratory and preventive medicine are related to the flyer in the air, on the flight line, in the hospital and on the outpatient service. Continuous and direct supervision is the most important ingredient of the training. Any organization, military or civilian, concerned with flying and the problems of aviation medicine, can establish a similar program" (5).

Twenty-five Years Ago

Pharmacologic control of motion sickness (Naval Aerospace Medical Research Laboratory, NAS Pensacola, FL): "A double-blind, placebo-controlled study compared the efficacy of transdermal therapeutic system-scopolamine administered alone and combined with ephedrine sulfate given orally in doses of 12.5, 25, and 50 mg. Eight normal male students were exposed to stressful accelerations in a slow-rotation room after receiving 10 apparently identical treatments comprising the four drugs and six placebos. Efficacy of the drug was defined in terms of the placebo range and categorized as beneficial, inconsequential, or detrimental. None of the effects was detrimental. Overall beneficial effects were 60% for transdermal therapeutic system-scopolamine (plus placebo) and 57% for the three transdermal therapeutic system-scopolamine plus ephedrine combinations" (1).

Cardiac decompression sickness (Naval Medical Hyperbaric Institute, Haifa, Israel): "A case of first degree atrio-ventricular block, probably representing cardiac involvement by decompression sickness, is presented. The conduction defect resolved spontaneously 36 h after the initiating decompression insult, and was not accompanied by any other cardiovascular changes. The contribution of a recompression treatment, which alleviated accompanying Type I decompression sickness (DCS) symptoms, to the resolution of cardiac DCS is not certain. Cardiac symptoms of DCS do not receive enough consideration. IT is suggested that an electrocardiogram should, whenever possible, form part of the basic evaluation of suspected DCS and of the initial workup of candidates for diving. A flow diagram for management of cardiac DCS is proposed" (2).

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