E-SLATE

American Academy of Underwater Sciences (AAUS)

EDITOR'S NOTE – December 2009

Welcome to the December issue of the E-Slate. The deadline for submitting OM statistics is approaching. Be sure to read about the web-based dive record logging as it will guide you through the steps needed to submit dives to AAUS. The AAUS Scientific Diving Internship, DAN Research Internship, and Rolex Scholarship all offer great opportunities to get involved in the diving field and gain experience. Do not miss this opportunity, read below for more information. There are several new publications to check out. The deadline for ticket sales for the VR NHeO dive computer raffle is midnight December 1. Log onto www.aaus.org now and enter to win.

The E-Slate is a newsletter from and for the scientific dive community. We welcome news, announcements, job positions, new citations, and images with captions of underwater work. Please email submissions to aaus@disl.org. Current and past issues of the E-Slate are available at www.aaus.org.

AAUS BOD. (From top row left) Kevin Flanagan, Director-at-Large and Standards Chair; Jeff Godfrey, President; Christian McDonald, President-Elect; David Pence, Director-at-Large; Nathan Schwark, Secretary; Chris Rigaud, Appointed Director and Membership Chair; Neal Pollock, Director-at-Large and Meetings & Publications Chair; and Mike Dardeau, Treasurer. Not pictured: Brenda Konar, Liz Kintzing, and Phillip Lobel.

NEWS/ANNOUNCEMENTS

Web-Based Dive Record Logging

Our first year of web-based logging is nearly complete. Over 40 organizational members (OMs) requested that sites be set up for them. Most feedback has been positive but the proof of efficacy will be the ease of tallying. If DSOs have been having divers log their dives throughout the year and checking completeness, only a couple things are left to do to submit OM statistics to AAUS in January.

Send out an email to your divers asking them to look over their logs for accuracy and completeness. Review the logs yourself to ensure compliance. Check depths (blanks will be recorded as zero), dive times, gases, modes, etc. Counseling divers on records needing corrections will make your job easier in the future. After confirming that dives have been entered correctly, run the AAUS report (which will not count dives not checked as having met AAUS standards). If you have been unfortunate enough to suffer an incident, gather the information necessary.

Go to http://aauscf.egofactory.com/omservices1.cfm and enter the data printed on your report. OMs not using the AAUS web-based logging software to track their program's dives must still log in to submit and review annual summary statistics as they have in years past. Contact aaus@disl.org if your organization is not listed or you do not know your password. The data entry form mirrors the report printed out by your web-logging site. If you have an incident to report, follow the instructions carefully. Do not include identifying characteristics (i.e., individual, vessel or facility name or geographical location). Provide age, gender and experience level of diver, environmental conditions, signs and symptoms (including onset times), known medical conditions, treatment (both field and hospital), response to treatment, diagnosis by physician and ultimate outcomes.

Remember that neither statistics nor incidents reach AAUS until the DSO goes to the URL above and actively uploads them. Your OM summary statistics may be edited later, if necessary. There are some error-checking routines built into the entry form so be prepared to defend your numbers. If you are using the web-based logging and encounter problems, please notify mdardeau@disl.org with as much information as possible. Suggestions for improvements are also welcome. As an organization, we are averaging over 100,000 dives per year with very few incidents. Help us to continue to document our experience.

Appendix Two Format Change

Format changes to the form constituting Appendix 2, Medical Evaluation for Fitness Report, were approved unanimously at the November 05, 2009 AAUS BOD meeting in Orlando. The impetus for the modification was to include the physician's signature on the primary (first) page rather than the second. Physician initials are no longer required beside each test. Text above the signature line confirms that all required tests were completed. The revised form will be incorporated into the AAUS standards document by January 01, 2010. Questions to Kevin Flanagan (kflanaga@hawaii.edu; 808-956-6617).

DSO Meeting - Call for Topics and Speakers

The DSO meeting scheduled for the 2010 symposium in Honolulu will include time for formal debate of topics. The first topic selected is, 'Should it be mandatory for a DSO to attend one symposium at least every five years for that OM to remain in good standing?' Please submit ideas for other questions or requests to participate as a speaker to Kevin Flanagan (kflanaga@hawai.edu) for consideration by the BOD. The debate format will be structured: five minute pro view, five minute con view; two minute pro rebuttal; two minute con rebuttal; and five minute open questions by membership.

Win a New VR Tech. – VR NHeO Dive Computer

Kevin Gurr, VR Technology Ltd., has graciously donated another VR NHeO dive computer for the third year in a row. This is the most advanced trimix dive computer on the market today. It is set up for use with air, nitrox, heliox and trimix. It is suitable for both open-circuit as well as closed-circuit. This computer has a retail value of over $2000. All proceeds will go to the AAUS Scholarship fund. Ticket sales will be limited to 300 tickets. Tickets cost $10. They will only be issued after the payment is received by the AAUS DISL office. The drawing will take place on December 2, 2009. Please do not miss this chance to support your AAUS student scholarship and at the same time get a chance to win this fantastic computer. The deadline for ticket sales is midnight December 1, 2009. To enter visit: https://web.memberclicks.com/mc/quickForm/viewForm.do?orgId=aaus&formId=51518. For computer information visit: http://www.vr3.co.uk/vr3/main.php?content=intro.

Call for Abstracts – AAUS 2010

Abstracts for the upcoming AAUS symposium can be submitted until January 15, 2010. As is the custom for AAUS, full papers are required for all presentations. These will be published in the ISBN-indexed proceedings of the meeting. It is expected that some papers will be brief (minimum around 2000 words) and may focus on the diving methods of central interest to the Academy to avoid compromising the ability to publish research data in peer-reviewed journals. For more information or to submit abstracts (150-250 words) visit http://www.aaus.org.

New Student Competition - AAUS Symposium 2010

A new competition - the best student presentation - will be initiated at the 2010 symposium. Recognition will include both certificates and cash awards ($250 for first place with an optional $100 for honorable mention, if appropriate).

AAUS Scientific Diving Internship

The Our World-Underwater Scholarship has collaborated with AAUS to create a new scientific diving internship. This internship will provide undergraduates with the experience and opportunities necessary for a future in science, diving for research, or scientific diving-related fields. Intern applicants can be students from colleges and universities with an interest in science and diving. The program runs primarily from mid-May through August and will include training at one of several AAUS organizational member sites. This training will give the intern the necessary dive qualifications to allow participation on research projects requiring scientific diving and introduce the intern to careers that utilize scientific diving as a tool. Once trained as an AAUS-recognized diver-in training, interns will participate in underwater field-work at one or more locations and research facilities associated with AAUS. The internship will be supported by funding for travel to/from site, room, board, and other internship-related expenses. For more information visit: http://www.owuscholarship.org/internships/current.aspx

Divers Alert Network (DAN) Research Internship

The DAN Research Internship Program provides experiences that motivate young people toward careers in medicine, diving or dive-related fields. Intern applicants are students from colleges, universities and medical schools. The regular program runs mid-May through August. Training is conducted at DAN headquarters in Durham, NC, where interns receive an orientation to dive-related science and research. Two- to four-month field or lab placements follow. Placements are matched to intern background, interests and community needs. The application deadline is January 15, 2010. Visit: http://www.diversalertnetwork.org/research/projects/intern/index.asp.

2010 Rolex Scholarship

The Rolex Scholarship provides a broad-based introduction to underwater and other aquatic-related careers. Scholars travel and have opportunities throughout the underwater world. The range of experiences may include active participation in field studies, underwater research, scientific expeditions, laboratory assignments, equipment testing and design, photographic instruction, and other specialized assignments. The scholarship emphasizes hands-on experience in activities that will contribute to a well-rounded education and a broad network of contacts. The application deadline is December 31, 2009. Visit: http://www.owuscholarship.org.

FROM THE PRESIDENT

On January 1st Christian McDonald will take over as president and I will join the ranks of past presidents. Anything accomplished during my tenure as president was a completion of the work started by others. As is expected with this type of effort, I did not complete everything I had hoped to but I have great confidence in the abilities of Christian and the new and returning board members to continue working towards completion of the strategic planning goals of the academy. To update you on one of those goals, work continues on a final version of the DSO training and certification program. The membership should receive a copy for review early in 2010.

I thank those serving on the Board of Directors during the past two years for the countless hours they have volunteered in support of scientific diving. I also thank those serving on the various committees. AAUS has grown at a very rapid rate in recent years and the support in vetting new members, awarding scholarship and reviewing symposia submissions has been essential. Finally, I thank the members of the academy for my opportunity to serve. My tenure on the board has created many personal growth opportunities that I value.

I encourage all members to make the time to provide service to your profession. The work can be frustrating but it is also rewarding. As one of my last acts as president, I wish all academy members happy holidays, a prosperous new year and safe diving.

Jeff M. Godfrey

UPCOMING EVENTS

Ocean Sciences Meeting 2010

The 2010 Ocean Sciences Meeting will be held February 22-26 at the Oregon Convention Center in Portland Oregon. Visit: http://www.agu.org/meetings/os10/index.php.

Diving for Science - 2010 AAUS Symposium

The 29th AAUS scientific symposium will be held at the Ala Moana Hotel, March 25-27, in Waikiki, HI. Mention AAUS when making reservations to get a reduced room rate of $119 (available March 22-29). If hotel rates decrease before the symposium, the AAUS rate will also decrease. If the hotel rate increases, the AAUS fee is locked in at $119. All symposium meetings including the DSO meeting and business meeting will be held at the hotel. The banquet will be at the Waikiki Aquarium (http://www.waquarium.org). Call 808-955-4811 or visit http://www.alamoanahotelhonolulu.com/ for reservations.

2010 Diving for Science Symposium Workshops

Monday, March 22

- University of Hawaii Diver Training Methods - $50
- Oceanic Regulator Repair Workshop - $150

Tuesday, March 23

- PSI Visual Cylinder Inspector Training - $250 (Refresher - $175.00)
- Digital Photography for Scientific Divers - $100 (includes 2-tank dive)

Wednesday, March 24

- PSI Oxygen Cleaning and Cylinder Valve Repair Technician - $175
- Identification and Study of Coral Disease - $100 (includes two-tank dive*)
- Towboarding techniques for Science - $100 (includes tows over shallow reef*)
- * diving activity requires current AAUS Scientific Diver LOR and UH Visiting Diver Forms

For more information visit: http://www.aaus.org/mc/page.do?sitePageId=94127&orgId=aaus.

Future AAUS Meetings - Site Solicitation

OMs interested in hosting future scientific diving symposia are invited to submit proposals. For more information contact Christian McDonald (cmcdonald@ucsd.edu).

NEW PUBLICATIONS

Breskovic T, Valic Z, Lipp A, Heusser K, Ivancev V, Tank J, Dzamonja G, Jordan J, Shoemaker JK, Eterovic D, Dujic Z. Peripheral chemoreflex regulation of sympathetic vasomotor tone in apnea divers. Clin Auton Res. 2009 Oct 10. [Epub ahead of print]

OBJECTIVES: Involuntary apnea episodes in obstructive sleep apnea patients result in selective potentiation of peripheral chemoreceptor regulation of sympathetic vasomotor tone. Breath-hold diving is associated with repeated 'voluntary' apnea episodes and massive arterial oxygen desaturation, which could also perturb chemoreflex function. METHODS: We measured ventilation, heart rate, blood pressure, cardiac stroke volume, and muscle sympathetic nerve activity (MSNA) during isocapnic hypoxia in 11 breath-hold divers and eleven matched control subjects. The study was carried out at least one month after intense apnea training. RESULTS: Baseline MSNA frequency was 30±4 bursts·min^{-1} in control subjects and 31±7 bursts·min^{-1} in divers (ns). During hypoxia MSNA frequency and total activity increased similarly in both groups (30 and 66% in controls and 27 and 60% in divers, respectively). MSNA remained increased after termination of hypoxia and approached baseline measurements after 20 min. Hypoxia-induced stimulation of minute ventilation was similar in both groups, although in divers it was maintained

by higher tidal volumes and lower breathing frequency compared with control subjects. In both groups, hypoxia-induced tachycardia drove an increase in cardiac output whereas total peripheral resistance decreased. Blood pressure remained unchanged. INTERPRETATION: We conclude that after the end of intensive training/competition periods, apnea divers show normal peripheral chemoreflex regulation of ventilation and sympathetic vasomotor tone. Although voluntary apnea may not lead to sustained changes in sympathetic nervous system regulation, we cannot exclude the possibility that repeated sympathetic activation elicited by voluntary apnea imposes a burden on the cardiovascular system.

Goplen FK, Grønning M, Aasen T, Nordahl SH. Vestibular effects of diving--a 6-year prospective study. Occup Med (Lond). 2009 Oct 23. [Epub ahead of print]

BACKGROUND: Permanent injuries to the vestibular end organs may occur in diving due to decompression illness (DCI) or barotraumas. This may lead to distressing long-term symptoms, including dizziness and disequilibrium. AIMS: To look for evidence of vestibular disorders in working divers and to relate this to diving exposure or injuries. METHODS: A cohort of 67 men aged 28±5 years (mean±SD) completing a basic course for working divers answered a questionnaire and underwent clinical otoneurological examination, electronystagmography (ENG), including alternate bithermal caloric tests and platform posturography. The procedure was repeated after three and six years. RESULTS: At follow-up, none of the divers had experienced inner ear barotraumas or inner ear DCI. Two cases of untreated probable DCI were diagnosed retrospectively in 27,232 dives. Middle ear barotrauma was reported by 36%. There was no correlation between diving frequency and postural sway at follow-up. Transient dizziness during or shortly after a dive was reported by 63 and 15%, respectively. The prevalence of dizziness on land and ENG abnormalities did not change during follow-up. No vestibular disorders were diagnosed. CONCLUSIONS: Transient vestibular symptoms and middle ear barotraumas are common in diving. This study found no evidence of long-term vestibular effects. Vestibular disorders in divers are probably related to singular events, like inner ear barotraumas or inner ear DCI, rather than frequent diving per se.

Lang, MA, Macintyre IG, Ruetzler K, eds. Proceedings of the Smithsonian Marine Science Symposium. Smithsonian Contributions to the Marine Sciences, 2009:38. Washington, DC: Smithsonian Institution Scholarly Press. 529 pp.

Lang MA, Robbins R. Scientific Diving Under Ice: A 40-Year Bipolar Research Tool. Smithsonian at the Poles, Contributions to International Polar Year Science, In: Krupnik I, Lang MA, Miller SE, eds. Smithsonian Institution Scholarly Press. 2009: 3-14.

Marinovic J, Ljubkovic M, Obad A, Bakovic D, Breskovic T, Dujic Z. Effects of successive air and trimix dives on human cardiovascular function. Med Sci Sports Exerc. 2009;41(12):2207-12.

INTRODUCTION: The use of trimix (a mixture of oxygen, helium, and nitrogen) has significantly increased among the diver population. However, data indicating how trimix dives at most common depths affect the cardiovascular function are sparse. The purpose of this study was to investigate the cardiovascular effects of trimix dives and compare them with air dives and to determine whether the repetition of dives in successive days affects their extent. METHODS: Nine professional divers performed four dives in consecutive days where the dive depth was progressively increased to the maximum of 55 m. Divers used air in the first dive, nitrox 25 in the second, and trimix 20/30 in the third and fourth dives. Echocardiography was performed before and after each dive. RESULTS: After each dive, a significantly decreased left ventricular ejection fraction and fractional shortening and an increased end-systolic volume without a change in end-diastolic volume were found, indicating a depressed systolic function of the left side of the heart. Assessment of the ratio between pulmonary artery acceleration time and right ventricular ejection time (used as an indicator of pulmonary artery pressure (PAP)) revealed an increase in PAP after all the dives. No physiologically relevant cumulative effects of the multiple dives or signs of acclimatization were found. CONCLUSIONS: The current study shows that the cardiovascular effects of trimix dives do not differ from those of the dives with compressed air. However, it suggests that even a very safe and conservative trimix diving profile exerts significant cardiovascular effects.

Merkel BJ, Schipek M. Research in Shallow Marine and Fresh Water Systems. 1st International Workshop – Proceedings Freiberg Online Geology. 2009: 22.

Miller B, Dawson S. A large-aperture low-cost hydrophone array for tracking whales from small boats. J Acoust Soc Am. 2009;126(5):2248-56.

A passive sonar array designed for tracking diving sperm whales in three dimensions from a single small vessel is presented, and the advantages and limitations of operating this array from a 6 m boat are described. The system consists of four free floating buoys, each with a hydrophone, built-in recorder, and global positioning system receiver (GPS), and one vertical stereo hydrophone array deployed from the boat. Array recordings are post-processed onshore to obtain diving profiles of vocalizing sperm whales. Recordings are synchronized using a GPS timing pulse recorded onto each track. Sensitivity analysis based on hyperbolic localization methods is used to obtain probability

distributions for the whale's three-dimensional location for vocalizations received by at least four hydrophones. These localizations are compared to those obtained via isodiachronic sequential bound estimation. Results from deployment of the system around a sperm whale in the Kaikoura Canyon in New Zealand are shown.

Peker I, Erten H, Kayaoglu G. Dental restoration dislodgment and fracture during scuba diving: a case of barotrauma. J Am Dent Assoc. 2009;140(9):1118-21.

BACKGROUND: The term 'barotrauma' is used to describe a physical injury caused by a rapid or extreme change in air pressure. Enclosed areas within the body are particularly affected by barotrauma. CASE DESCRIPTION: A 40-year-old man had complaints of restorations in three teeth fracturing and dislodging while he was scuba diving at a depth of 35 m. The affected teeth contained carious dentin. The caries was removed, and the affected teeth underwent endodontic, restorative and prosthetic rehabilitation. CLINICAL IMPLICATIONS: Inadequate restorations and selection of dental materials in some cases predispose patients to barotrauma. To prevent barotrauma-related damages on the teeth, it is important to maintain good-quality restorations and avoid trapping air beneath them. Dentists and patients who are exposed to barometric stress as part of their jobs or hobbies should know the causes of barotrauma and be aware of the importance of routine dental checkups to avoid barotrauma-related dental problems.

Randsoe T, Hyldegaard O. Effect of oxygen breathing and perfluorocarbon emulsion treatment on air bubbles in adipose tissue during decompression sickness. J Appl Physiol. 2009 Oct 22. [Epub ahead of print]

Decompression sickness (DCS) after air diving has been treated with success by means of combined normobaric oxygen breathing and intravascular perfluorocarbon (PFC) emulsions causing increased survival rate and faster bubble clearance from the intravascular compartment. The beneficial PFC effect has been explained by the increased transport capacity of oxygen and inert gases in blood. However, previous reports have shown that extra vascular bubbles in lipid tissue of rats suffering from DCS, will initially grow during oxygen breathing at normobaric conditions. We hypothesize that the combined effect of normobaric oxygen breathing and intravascular PFC infusion could lead to either enhanced extra vascular bubble growth upon decompression due to the increased oxygen supply, or that PFC infusion could lead to faster bubble elimination, due to the increased solubility and transport capacity in blood for nitrogen causing faster nitrogen tissue desaturation. In anaesthetized rats decompressed from a 60 minutes hyperbaric exposure breathing air at 385 kPa, we visually followed the resolution of micro air bubbles injected into abdominal adipose tissue while the rats breathed either air, oxygen or oxygen breathing combined with PFC infusion. All bubble observations were done at 101.3 kPa pressure. During oxygen breathing with or without combined PFC infusion, bubbles disappeared faster when compared to air breathing. Combined oxygen breathing and PFC infusion caused faster bubble disappearance when compared to oxygen breathing. The combined effect of oxygen breathing and PFC infusion did neither prevent nor increase transient bubble growth time, rate- or growth ratio when compared to oxygen breathing alone. We conclude, that oxygen breathing in combination with PFC infusion cause faster bubble disappearance and does not exacerbate transient bubble growth. PFC infusion may be a valuable adjunct therapy during the first aid treatment of DCS at normobaric conditions.

Sames C, Gorman D, Mitchell SJ, Gamble G. Utility of regular medical examinations of occupational divers. Intern Med J. 2009;39(11):763-6.

The utility of regular medical fitness-for-diving examinations of occupational divers is unknown. The aim of this audit was to investigate the impact on the employment of occupational divers of a five-yearly medical examination and an annual health surveillance questionnaire administered in intervening years. The medical records of all New Zealand occupational divers registered with the Department of Labour for at least five years were audited (n= 336). Each record included at least two full medical examinations (mean spacing of 5.6 years). An impact on career was defined as the diver being issued with either a conditional certificate of fitness or being graded as temporarily or permanently unfit for diving. The means by which the relevant medical issue was identified was recorded. Ten (3%) of 336 divers had an assessment outcome, which had a career impact. One was considered permanently unfit, four were temporarily unfit, and five were issued with conditional certification. Two were identified by respiratory function testing and eight by way of their responses to the questionnaire; none was found by the medical interview and examination process. The questionnaire system did not 'miss' any divers who developed a critically important health problem, and detected most of those with less important problems. Five yearly medical examinations have a low detection rate for important health problems, but remain useful for discussion of risk understanding, acceptance and mitigation.

Shearer D, Mahon R. Brain natriuretic peptide levels in six basic underwater demolitions/SEAL recruits presenting with swimming induced pulmonary edema (SIPE). J Spec Oper Med. 2009 Summer;9(3):44-50.

Swimming induced pulmonary edema (SIPE) is associated with both SCUBA diving and strenuous surface swimming; however, the majority of reported cases and clinically observed cases tend to occur during or after aggressive surface swimming. Capillary stress failure appears to be central to the pathophysiology of this disorder. Regional pulmonary capillaries are exposed to relatively high

pressures secondary to increased vascular volume, elevation of pulmonary vascular resistance, and regional differences in perfusion secondary to forces of gravity and high cardiac output. Acute pulmonary edema can be classified as either cardiogenic or noncardiogenic or both. Cardiogenic pulmonary edema occurs when the pulmonary capillary hydrostatic pressure exceeds plasma oncotic pressure. Noncardiogenic pulmonary edema occurs when pulmonary capillary permeability is increased. Given the pathophysiology noted above, SIPE can be described as a cardiogenic pulmonary edema, at least in part, since an increased transalveolar pressure gradient has been implicated in the pathogenesis of SIPE. Brain natriuretic peptide (BNP) is used in the clinical setting to differentiate cardiac from pulmonary sources of dyspnea, specifically to diagnose cardiogenic pulmonary edema. During clinical management, BNP levels were drawn on six BUD/S recruits simultaneously presenting with pulmonary complaints consistent with SIPE, after an extended surface bay swim. This paper analyzes that data after de-identification and reviews the pathophysiology and clinical management of SIPE.

Uzun G, Cakar E, Kiralp MZ, Carli A, Durmuş O, Senol MG, Mutluoğlu M, Uz O, Dinçer U, Ozçakar L. Neurological symptoms after a provocative dive: spinal DCS or anterior spinal artery syndrome? Aviat Space Environ Med. 2009;80(10):898-9.

Reported here is a 37-yr-old professional diving instructor who had developed complaints of back pain and weakness in the lower extremities after diving. He was eventually diagnosed as having spinal cord decompression sickness along with a likely diagnosis of anterior spinal artery (artery of Adamkiewicz) syndrome. Additionally, since the transthoracic echocardiography revealed patent foramen ovale, we hypothesized that it might have been a potential route for gas bubbles to occlude the anterior spinal artery in this diver.

The mission of the American Academy of Underwater Sciences is to facilitate the development of safe and productive scientific divers through education, research, advocacy, and the advancement of standards for scientific diving practices, certifications, & operations.

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