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ON THE COVER: A casualty being treated by a doctor and two aidmen in the division surgery tent, 7 Dec. 1951 U.S. Signal Corps. Image from the National Library of Medicine.

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HAPS-EDucator is the official publication of the Human Anatomy and Physiology Society (HAPS) and is published four times per year. Major goals of the Human Anatomy and Physiology Society are to promote communication among teachers of human anatomy and physiology in colleges, universities, and related institutions; to present workshops and conferences, both regional and national, where members can obtain information about the latest developments in the health and science fields; and to encourage educational research and publication by HAPS members.

SUBMISSIONS TO HAPS-EDucator

Papers for publication, requests for information, submission of advertisements, and letters to the editor are welcomed. Articles should be submitted to the editor in a Word document as an e-mail attachment. If references are included, please follow the methods in Scientific Style and Format: The CSE Manual for Authors, Editors, and Publishers, 7th edition, 2006. Examples of reference formatting and additional information on formatting the text and figures are provided on the HAPS-EDucator page of The HAPS website (hapsweb.org). Although the HAPS-EDucator is not a peer-reviewed journal, the Editor and the Editorial Advisory Committee reserve the right to determine whether an article is suitable for publication and to make minor editorial changes to the content and style of submitted articles. It is the policy of the Human Anatomy and Physiology Society that any advertising appearing in its publication(s) must be related to the teaching of anatomy and physiology. The HAPS-EDucator Editor and HAPS-EDucator Editorial Advisory Panel jointly determine whether an advertisement meets the criteria of HAPS. Any advertisement that is deemed not to meet the needs of the organization will not be printed, and the advertisement plus any monies collected from the advertiser will be returned. The opinions reflected in advertising that appear in this publication do not necessarily represent the opinions of HAPS. Advertisement of a product in the HAPS-EDucator does not represent endorsement of that product by HAPS. Contact the Editor for information on advertising rates, advertisement size and the procedure for submitting an advertisement to HAPS-EDucator for publication.

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Greetings HAPSters!

I hope that your Fall semester was rewarding, that you had a great break over the holidays, and that your Spring semester is getting off to a great start. As each new semester begins and I review my course materials, I am reminded of what a great resource we have in our colleagues at HAPS. Whether it is a new approach to a topic in lecture, a detail for lab, or an innovative way to employ technology in the classroom or lab, it is more than likely the idea had its genesis with HAPS. We truly are about learning, discovering, and sharing, and our students are the better for it.

We have been working on a couple of things this year to further communication within HAPS. Larry’s regular “What’s HAPSening” e-mails give us a chance to communicate with all our members on a more frequent basis. I hope you have subscribed to the “new” Listserv and participated in some of the discussions. If you have not joined and are wondering about its value, take a moment to review the archives on the HAPS website. If it involves anatomy and physiology education, it has been on the listserv. Subscribing is simple -- just follow the directions on the website. The Executive Director and the Board have also begun a process to update and improve the HAPS website. You will be hearing more about this as work continues. If you have comments or suggestions, we would love to hear them.

Our various committees are reviewing our position statements and we will be updating the statements as necessary. If you have comments or suggestions, feel free to let me know (dkelly@mvcc.edu) and I will pass them along to the appropriate committee.

The HAPS Foundation is completing a leadership drive and will soon be embarking on a fund drive directed at HAPS members and institutional benefactors. Stay tuned for details and please consider a donation of any amount to the Foundation. We will be able to do good things with the resources.

Lastly, it is time to plan your trip to the Annual Meeting. Tulsa is a great town and the Annual Conference Committee is planning an exciting schedule of events, updates, and workshops. It will be great seeing you all again.

Don Kelly
President, Human Anatomy and Physiology Society
Happy New Year! HAPS has a busy year ahead. Our Regional Conference in Jacksonville, Florida, March 2 – 3 is fast approaching. And it won’t be long before our 26th Annual Conference will be held in Tulsa, Oklahoma, May 26 – 31. Don’t miss these incredible professional development opportunities. Our website has all the information about our conferences including the program, presentation opportunities, and hotel information.

The HAPS Institute is alive and well. We are planning to have four courses available at the annual conference. For those of you who are unaware of HAPS-I, this is a graduate level program offering biology courses in Human Anatomy. You will earn 1 – 2 semester credits for each course completed. The conference courses have an online component prior to the conference with face-to-face sessions at the conference. The courses are completed online after the conference. We are also working on the development of cadaver-based courses to be offered during the summer with a similar format. The face-to-face component will be held at a college with appropriate facilities. Please go to our website for more information.

HAPS is a partner on a National Science Foundation grant with the American Physiology Society. The grant is funding a digital community of practice and we are developing an archive of useful learning objects for teachers as a result. Like the HAPS Listserv, this is a valuable resource to aid you in teaching A&P. Go to www.apsarchive.org and register as a user and start your search.

I hope to see you in Jacksonville and/or Tulsa!

Remember...Learn, Discover, Share with HAPS.

Cheers,

Larry

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Medical Advances
That Have Come About as a Result of War:
Damage Control Resuscitation
and Damage Control Surgery

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Modern warfare, war on an industrialized scale, came into being in the mid-19th century; its birth coincided with the emergence of medicine as a modern profession. Scientific advances such as antibiotics, anesthesia, antiseptic surgery, and a rudimentary understanding of microbiology greatly enhanced the ability of mid-19th century medical practitioners to prevent and sometimes to cure disease while diminishing the extent of human suffering (Larner 2008). War and medicine, in a self-reinforcing counterpoint, have traveled in tandem through the ages; one intent on finding more and better weapons and ways to kill and destroy and the other searching for ways to preserve life and put back together what has been systematically torn apart.

As war became less about hand to hand combat and more about being able to kill at a distance, the lines between military and civilian populations became blurred, and as a result both populations needed medical treatment. Gradually, starting with the Crimean War, 1853-1865, the sense of the inevitability of military deaths from exposure and infection began to be replaced by the belief that effective steps could be taken that would decrease casualty rates. This belief was greatly reinforced when simple guidelines for sanitation and personal cleanliness, which were advocated by Florence Nightingale during the Crimean War, resulted in a decrease in the military death rate from 17.5 per 1,000 in 1857 to 4.3 per 1,000 by 1899 (Larner 2008).

The First World War ushered in an era of prevention as vaccinations and inoculations against bacterial infections became commonplace for soldiers. Military training expanded to include instructions on things individual soldiers could do to prevent disease, and officers became responsible for the health of the men who served under them. In spite of these precautions, lice flourished in the trenches in WWI causing many cases of relapsing fever, and the flu epidemic of 1918-1919 took the lives of record numbers of servicemen and women. Along with these setbacks, however, there were also some significant lifesaving advances: tetanus antiserum became available, damaged tissue was easier to excise with the use of anesthesia, evacuation of injured soldiers became a military priority, and the first casualty-clearing stations instituted triage to facilitate the rapid movement of severely wounded soldiers into treatment (Larner 2008).

World War II saw a huge effort to keep disease among the troops at levels that could be effectively managed. Evacuation times for the wounded were shortened, and the process of getting wounded soldiers to well equipped, distant hospitals using air lift capabilities became a priority. Penicillin, which was widely available to the military after 1944, underwent extensive clinical trials in large military medical facilities in North Africa. The Allies first used DDT as a pesticide in the winter of 1943-1944 and by so doing virtually wiped out typhus, a lice-born bacterial disease. The use of helicopters for evacuation started in the Korean War, 1950-1953, and was fine-tuned in Vietnam, 1965-1975. It is still the
Joining innovations that have arisen from specific needs in previous armed conflicts, damage control resuscitation and damage control surgery have emerged from Operation Iraqi Freedom and Operation Enduring Freedom as a new way to deal with trauma. The goal of these procedures is to restore normal physiology as quickly as possible, often leaving restoration of normal anatomy to a later time, a different team of doctors, and another geographical location. Priority number one is simply to keep the patient alive (Eastridge 2006).

Damage control resuscitation and damage control surgery are most likely to be employed when a soldier is suffering from multiple life-threatening injuries such as might be associated with exposure to explosive devices. Wounds of this nature are injuries that simultaneously affect many organs in more than one body cavity. Injuries might encompass the liver, small intestine, pancreas and spleen in the abdominal cavity, coupled with penetrating trauma to the cranial, vertebral, pelvic, and/or thoracic cavities and accompanying widespread vascular damage. In situations like this, treatment typically proceeds in three stages. The first stage is surgical control of hemorrhage. At this stage, clamping or shunting a major blood vessel may be a better alternative than attempting to repair it. Hemorrhage control must be accomplished as quickly as possible and as close to the geographical site of injury as possible. Ideally, a surgeon heads the emergency response team that retrieves the injured from the battlefield and damage control resuscitation is often started in the evacuation helicopter. Blood pressure is stabilized at approximately 90 mmHg in order to maintain blood flow to the brain and vital organs while simultaneously guarding against re-bleeding. Whatever wound closure is accomplished is a temporary one that is done with the knowledge that the final surgery will be postponed until a later date in a modern medical facility. Stage two is the correction of hypothermia, acidosis, and coagulopathy to reestablish normal physiological function. The hope is to minimize further blood loss while maximizing the oxygenation of body tissues. The third and final stage is a planned reoperation where definitive care including re-exploration of wounds and surgical reconstruction can take place (Byers 2010).

Damage control resuscitation differs from previous ways of treating the victims of trauma in that it builds upon the established sequence of events. Previously, the ABC (airway, breathing, and circulation) system of managing severely ill patients was accepted and followed on a worldwide basis. Under this guideline, treatment starts with restoring the integrity of the airway and proceeds only once that has been accomplished. As data began to come in from battlefield personnel who had been injured by explosive devices in Operation Iraqi Freedom, it became apparent that as many as 7% to 10% of them died as a result of hemorrhage from extremities. The extremities are the most vulnerable body parts today because body armor effectively protects the trunk of the body. Wounds in the extremities are generally considered to be survivable wounds if hemorrhage can be stopped in time. The new paradigm that grew out of this knowledge is (C) ABC where the first C stands for the highest priority, which is the control of life threatening bleeding. Once hemorrhage is under control, management of the wounded proceeds with establishment of an airway (Byers 2010, Hodgetts 2006).

Extremity hemorrhage is seen as such a great threat to survival that today’s soldiers routinely receive training in the use of combat application tourniquets (CAT) that are reliable, light weight, easy to carry, and easy to use. In previous wars, tourniquet use in combat and mass casualty situations or in the dark was discouraged for fear of causing further injury to the wounded due to ischemia or nerve damage, and use of tourniquets in civilian emergency medicine had virtually
been eliminated. However, the Israeli Defense Forces and the US Special Operations forces continued to champion the use of tourniquets on the battlefield, and their use today, with specific guidelines and practical training, is widespread (Byers 2010, Walters 2005).

Other ways to stop bleeding include the use of recently developed products like QuikClot (Z-Medica, Newington, CT) and HemCon (HemCon Inc., Tigard, OR) which can be used on the extremities and in the head and neck areas where tourniquets cannot be applied (Wedmore 2006). HemCon is made from chitosan, a polysaccharide derived from shrimp shells. Once impregnated into a bandage, the positively charged chitosan attracts negatively charged red blood cells. As red blood cells move into the bandage, they form a very tight, antibacterial seal over the wound that is effective in the control of moderate to high pressure bleeding. HemCon bandages are standard issue for American soldiers in Iraq and Afghanistan where Special Operation Forces (SOF) and regular Army medics are taught to use these bandages in situations where standard gauze field dressings and direct pressure on wounds would likely fail to control bleeding (Wedmore 2006). QuikClot is now available to the general public as well as to the military. Some forms of it can be purchased online and it is available in a few retail outlets. QuikClot is made from an aluminosilicate mineral called kaolin, which is used to impregnate a rayon/polyester gauze bandage. Kaolin activates the natural clotting cascade and can accomplish most hemostasis in 5 minutes or less. QuikClot is currently accepted and in use today by all branches of the US military (Byers 2010, Eastridge 2006, Hodgetts 2006).

Once hemorrhage control has been achieved, damage control resuscitation turns to the mechanisms by which normal physiological function can be restored. This is a fight against what has become known as the lethal triad of acidosis, hypothermia, and coagulopathy. This lethal triad is associated with a very high risk of death in patients who display all three of these conditions (Byers 2010, Cosgriff 1997).

Both acidosis and hypothermia are known to provoke coagulopathy. There is a 98% risk of developing coagulopathy when the following conditions are present: a pH less than 7.10, a temperature less that 34°C, a systolic blood pressure less that 70 mmHg, and a severe injury score of greater than 25. The injury severity score (ISS) is an anatomical scoring mechanism with a range from 0 to 75 that can be used as an assessment tool for patients with multiple severe injuries (Byers 2010). When patients suffer catastrophic blood loss, the loss of circulating blood volume is accompanied by vasoconstriction of peripheral blood vessels. The result is a decrease in the perfusion of body tissues, a condition in which lactic acid can build up causing metabolic acidosis. In the past, acidosis has probably been prolonged and possibly worsened by the use of normal saline, which has a pH of approximately 5, and red blood cells, which are slightly acidic and tend to become more acidic when they have undergone storage. Both have historically been used aggressively in an effort to stabilize patients in distress. Acidosis is believed to affect blood clotting capabilities at the platelet level. It also interferes with the clotting cascade affecting the formation of the prothrombin complex, thrombin generation, and the concentration of available fibrinogen. In light of this information, the US military now uses a special buffering system known as THAM (Tri-hydroxymethyl-aminomethane) in its hemostasis protocol, which quickly lowers blood carbon dioxide levels to re-establish appropriate acid-base equilibrium in the blood stream (Byers 2010).

Hypothermia causes a shift in the oxygen dissociation curve so that oxygen becomes less available to body cells. This contributes to acidosis and also affects clotting mechanisms by inhibiting platelet function and the effectiveness of enzymes associated with clotting factors. It is also known to activate fibrinolytic systems. Many factors in a battlefield situation can lead to hypothermia. Among the most common are direct exposure to extreme environmental conditions, blood loss, and the decreased motor and metabolic activity that usually accompanies severe injury. Because the use of warmed fluids alone is not sufficient to re-warm the body once hypothermia has set in, today’s military medical protocols call for trying to prevent as much heat loss as possible as soon as possible. To this end, exposure to the elements is minimized, external hemorrhage is

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controlled rapidly and air-warmed blankets are applied as soon as possible. All intravenous fluids, even those given on or near the battlefield, are warmed with the use of portable infusers whenever possible, before being given to the patient. The goal is to have hypothermia managed in the pre-hospital environment rather than waiting to treat it in the hospital after it has already set in (Byers 2010).

To further help in the effort to ward off coagulopathy and accomplish hemostatic resuscitation, pre-hospital IV fluids are used in small quantities. When used aggressively, excessive fluids can dislodge already formed clots and restart internal or external bleeding. Excessive fluids can also further deplete the body’s natural clotting factors that have already been diluted by blood loss (Byers 2010).

In the fight for survival that all wounded soldiers face, damage control resuscitation and damage control surgery are not seen as procedures of last resort. In order to save lives, the decision to use damage control techniques must be made quickly at the start of the resuscitation process when patients present with multiple severe injuries (Byers 2010).

The huge populations of injured soldiers who are treated in military hospitals in wartime have always sparked advances in trauma care, and today’s wars are no exception. Fortunately, advanced trauma care is better today than it has ever been in human history, and more soldiers are surviving wounds previously thought to be un-survivable. Technological advances have evolved at the forefront of 21st century medicine, making it possible for critical information about patients to be passed quickly from doctor to doctor as an injured soldier progresses from the battlefield to a distant hospital. Treatment can be coordinated along the way, and eliminating redundant procedures can save a great deal of valuable time. Some elements of damage control resuscitation, such as the use of HemCon bandages for the control of moderate to severe bleeding and the routine pre-warming of patients who are scheduled to undergo elective surgery, are already being used in emergency care facilities and hospitals (Byers 2010, Wedmore 2006). Likely future civilian applications include the rapid processing of victims of inner city gunshot and knife wounds and treatment for the victims of terrorist attacks resulting in mass casualties such as those that took place in London in July 2005 (Hodgetts 2006). The world has never been a safe place, and war is not a good thing. But it may be good to know that some value will ultimately emerge from the chaos, and future generations may be better off as a result of advances made in response to today’s dire necessities.

**Literature Cited:**


Several years ago I was privileged to be asked to participate in a Penn College speaker’s program called My Last Words. Each speaker was asked to address the departing seniors to give them parting advice. My chosen title was: The most dangerous place.

To me, that place is in a boring, dead-end job, doing the same things day after day. Perhaps this dismal fate is not surprising given the many examples of life-threatening close calls I have had through my unexpectedly long life. Probably the largest collection of dire circumstances I have encountered was when I felt the call to help others by teaching high school science and agriculture in Sierra Leone — for never more than $1900/year.

Sierra Leone is a former British colony on the west coast of Africa, near the equator and just north of Liberia. Originally the place was covered with a magnificent tropical forest of titanic floss silk trees, gigantic vines, entire field armies of ants and termites, air armadas of mosquitoes and black flies, a flying circus of chimps, jewel-like butterflies and birds, and garlands of stunning flowers. When I first saw the country I thought I had arrived in Eden.

I was wrong: it continues to be one of the poorest countries in all of Africa with the lowest levels of education/literacy in any language. In the end, it turned out that my idealistic and altruistic choice was disastrous and nearly lethal. To illustrate, I’ll take you briefly through some of my three years in Sierra Leone.

On my first night in the village where I was to teach, my principal introduced me to the two most important people in that far-away village. First, there was “Chief B,” a well-known cannibal who possessed 50 wives and had one eye. He looked at me, grunted, and seemed to immediately lose interest in me, both gastronomically and socially. Later, I discovered that it was a rare week when somebody was not eaten somewhere in the country. The next day, Mr. “A” took me to the back of his mansion and showed me a pool filled with around a dozen fat crocodiles. This was in the middle of a tropical forest with only two species of large mammals with which to feed a crocodile — the rare chimp and the many people. Again, the crocodiles were fat. Why did he need to show them to me? You probably have already done the math.

Miraculously, I awoke alive and completely intact the next morning, and a gentleman was waiting to take me to see the high school. The classrooms were primitive: no chalk, no running water, no microscopes, no electricity, no books in the absent library, no telecommunications, and the student desks were Refugees from pre-WW I. The “blackboards” were smoothed places on the concrete walls which someone had painted black. I comforted myself that conditions were about the same for George Washington Carver a century earlier when he taught chemistry at the Tuskegee Institute: he had shown the way — improvise.

There really are a lot of things you can do if desperation is driving you. You can demonstrate a number of plant and animal physiological phenomena with handmade equipment. A raid, cash in hand, on a medical supply company in the capital, Freetown, yielded a lot of useful things too. Anatomy was also within my grasp since students brought in skeletons of the sparse jungle mammals. I was surprised at how easy it was to identify ulnae and scapulae, to name two examples, from diverse families. I talked someone from my home town into sending me a dozen really beautiful magnifying glasses. Various embassies started contributing books, so we teachers nagged the principal into setting aside a library room which could be locked.

Things were looking up but then the tropics got to me. There were just so many ways the biota were likely to strike — literally.

- A boomslang, a venomous snake found through sub-Saharan Africa, was within a foot of my gluteal area when a large, observant friend grabbed me and literally threw me out of the way. The venom prevents blood-clotting so how might it kill? If you wish, challenge your students with this question.
- Within the first month, I got a tapeworm and lost 20 pounds in that month. I must have been in awful shape because an MD took one look at me and gave me 10 days of yucky pills. As a result, the worm and I parted company forever.
- A squadron of enterprising termites found their way through cracks in the library’s concrete foundation and began to consume the books.
- A bus accident nearly scalped me. I was rushed to the great Connaught Hospital where a very

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fine local doctor saved me once again. It is now impossible to find the scar, so brilliantly did he work.

- Within three months, a cholera epidemic hit the country. The World Health Organization (WHO) had anticipated this tragedy since these epidemics normally followed the end of the return from the Pilgrimage to Mecca. Therefore, WHO had several teams of medical assistants at the headwaters of each of the main rivers in the nation. Since cholera spreads downstream, each team would vaccinate every village in advance by proceeding in boats. Somebody, allegedly Mr. A, stole all the boats so the teams had to hack their way through the forest going from village to village. Needless to say, cholera easily won the race, and hundreds died horrible deaths. A gentleman across the street from me began the rice-water diarrhea symptom of cholera (typical fluid loss is around one L/h) at sundown one day and was dead by 4:00 the following morning. Eventually, Mr. A was seen water skiing using those boats. As an exercise, you might challenge your students to explain why/how cholera causes death in so many cases. You could further challenge them by asking about the most effective treatment after diagnosis.

There were lots of other ghastly ways to suffer in Sierra Leone. The worm causing river blindness was in 90% of the local population. Leprosy cases abounded. Lhasa fever had somehow made its way from northern Nigeria to our area. TB was everywhere. Intestinal nematodes were at one time or another within almost everyone. Rabies epidemics came and went. A nun and many of our students died of nameless diseases; most often, nobody ever found out what happened.

All of this was, sadly, trivial beside the 800 pound gorilla -- malaria. I was lucky to know a lot about malaria; I was absolutely paranoid about any mosquito coming close to me and I took my quinine derivatives religiously. Except for me, everyone I knew had malaria; it routinely killed babies and the elderly. Young adults and middle-agers would be unable to work from 1-7 days every month. Malaria is a great disabler. Even today, malaria affects 216 million people and kills 655,000 more according to WHO. A thought: Is it the parasite that kills so many or is it the poverty (of money or knowledge) that is behind the killing?

Here is another exercise you can do with your students related to malaria. As you probably know, the malarial parasites cause the massive destruction of millions of red blood cells. Ask your students if they can explain the following symptoms in light of their understanding of human physiology: anemia, extreme weakness, metabolic acidosis, and “black water” urine (not the most common symptom but interesting).

Toward the end of my contract, civil unrest and lawlessness stalked the land. I saw and heard horrible things being done to my fellow humans so casually, so cruelly. I had insomnia and nightmares almost every night and feared going out many days. My first impression of Sierra Leone had been so wrong: these things did not happen to me in any Eden; they happened in another, very human place. After three years, I left to work on my PhD, a different, wiser man.

Suggested solutions:

Boomslang venom: any small cut or tiny blood vessel rupture might have resulted in massive hemorrhage.

Cholera: most clearly, extreme dehydration with subsequent hypovolemia will result but students may point out that there will be extensive electrolyte loss as well.

The best, and cheapest, treatment is massive water/electrolyte replacement. To prevent it use only clean water for drinking, brushing your teeth, and washing vegetables. There is a cholera vaccine but is not 100% effective (Harmon 2012).

Malaria questions:

Anemia: the blood cells are often destroyed so quickly and massively that the body has no time to replace them.

Extreme weakness: the loss of the erythrocytes would mean that it is hard to supply muscles with sufficient oxygen.

Metabolic acidosis: Low oxygen supplies to the tissues would cause tissues to rely on anaerobic respiration with consequent lactic acid production.

Black water urine: The breakdown products of hemoglobin will give a dark appearance to the urine.

Literature cited:


For additional information:

http://en.wikipedia.org/wiki/Boomslang
http://www.youtube.com/watch?v=xNha62dw1GQ
http://www.who.int/topics/cholera/about/en/index.html
Using Process Oriented Guided Inquiry Learning (POGIL) to Teach Human Anatomy and Physiology

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Human anatomy and physiology is most often taught by means of traditional lecture, but most HAPS members who lecture recognize that more can be done with students than talking at them while showing PowerPoint slides. Additionally, research in science education over the past 30 years has shown the limitations of lecture in areas such as the promotion of critical thinking and interpersonal communication skills. Many anatomy and physiology educators are looking for alternatives to traditional lecture, but lack the time and resources to develop new materials and methods. One promising approach is that of POGIL—Process Oriented Guided Inquiry Learning. A POGIL classroom is far different from traditional lecture in that it is largely driven by student questions and small group learning. The role of the instructor is transformed from “information dispersal agent” to that of a content expert who facilitates learning by both posing and answering student questions.

With help from the National Science Foundation (NSF), and the Minnesota State Colleges and University System, a group of instructors in the Midwest are working on learning the POGIL approach to teaching and learning and are developing a set of curriculum materials specific to entry level anatomy and physiology courses. The POGIL method has been used in high school and college chemistry classes for over ten years, but is new to anatomy and physiology.

The two year NSF project began in the summer of 2011 when 41 high school and college anatomy and physiology instructors met at Minneapolis Community and Technical College (MCTC) for a three day POGIL workshop led by Dr. Patrick Brown, (East Tennessee State University) and Dr. David Parkin (Adelphi University). Workshop participants learned the basic structure of a POGIL lesson in which small groups of students examine “models,” which can be graphs, figures, short videos, or small text files. Students then work together to answer questions that range in difficulty from direct questions, which are at the lower levels of Bloom’s taxonomy, to convergent and divergent questions which promote critical thinking and creativity. The goal of a POGIL lesson is two-fold: first, to have students develop a conceptual understanding of a topic (e.g., homeostasis, cell to cell communication, etc.) and second, to develop process skills such as interpersonal communication and group management skills.

The 40 participants at the July MCTC workshop were divided into teams of three or four, assigned a specific topic relevant to anatomy and physiology (digestive system, histology, cell biology, etc.), and given the task of drafting a POGIL activity for that area. These activities were then posted on a web site and used with students during the fall semester. A focal group of eight college instructors has been charged with revising the original curricular materials through the use of feedback from other instructors, and is also developing new activities. These instructors first met at the summer workshop and then reconvened at the University of Minnesota during the first week of January for a round of review and planning. This group will meet

(Continued on next page)
again at the end of the summer 2012, at which point the materials will go through a third round of revision.

The goal of the NSF project is to submit 10 to 20 well refined activities to the POGIL main office, which will then package the materials into a workbook, or electronic library, and make them widely available at an affordable price.

Over the next two years there will be a series of POGIL workshops at regional and national HAPS conferences for interested instructors to learn how to manage a POGIL classroom and how to make best use of the new curriculum modules. All eight participants in the NSF grant will be sponsoring workshops at the 2013 HAPS conference in Las Vegas to share expertise on specific POGIL curriculum modules.

For more information:
Real-time Drawings: Sketches That Help Students Understand Difficult Concepts

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For the past few years at the HAPS Annual Meeting, Pearson Education Publishing Company has sponsored the Pearson Art Contest. The goal is simple: share the sketches that you do on the fly in your classroom that help you explain difficult concepts to your students. At the annual meeting, faculty make their sketches, and the sketches are taped to the wall in the vendor’s area so that all attendees can see them. HAPSters vote on their favorites and Pearson rewards those with the most votes with first, second, and third place prizes.

Here are some of our favorites.

From Meg Flemming, Austin Community College (mflemmin@austincc.edu), analogies of transport mechanisms.

I use this illustration to give my students visual, concrete ideas about moving substances either against or down gradients. Most of my students know I was in the horse business for many years before returning to academia. And, like a good Texas horsewoman, I still drive a pickup truck. I use the truck in the illustration to represent a transport protein. Sometimes we don’t need a truck; sometimes we need the truck, but it can just roll down the hill. But, if we need to use the truck to move something up the hill we have to crank the engine and burn a little diesel ATP. On the other hand, we can haul something in its own truck up the hill if it is attached to a truck that will just roll down the hill. We don’t need to crank the engine of either truck.

From Melissa Carroll, University of Texas at El Paso (macarroll2@utep.edu), help with understanding the organelles of the neuron.

Electrophysiology of the Neurons – axoplasmic (axonal) transport. This image is used to outline the necessity of the organelles that we introduce (rER, Golgi) and neuronal/synaptic communication. We first describe the protein synthesis that occurs in the soma, more specifically in the rough endoplasmic reticulum (rER). We talk about the primary secretory vesicle and the modification (i.e. glycosylation) that is necessary at the

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Golgi apparatus and then the anterograde transport that is necessary to send these precursors to the axon terminals. We talk about slow anterograde transport (laying down the “tracks” of the rail road) and the elongation of the microtubules that occurs in the axons, and then we also talk about the “arms” of kinesin that are critical for rapid/fast anterograde transport. Once the secretory vesicle makes it to the nerve terminal we talk about cleavage into small molecule neurotransmitters for exocytosis/synaptic transmission. Rapid retrograde transport is then discussed when we talk about recycling the surplus plasma membrane, the endocytosis of nerve growth factor and even the possible spread of toxins when we uptake herpes simplex or tetanus toxin. It is stressed that this process occurs simultaneously with the generation and propagation of action potentials.

From Cathy Whiting, Gainesville State College (cwhiting@gsc.edu), tricks for learning the cranial nerves.

My students love this diagram to help them learn the cranial nerves. The location of each number on the drawing helps them to remember the name and/or function of the 12 cranial nerves, and the colors help them remember sensory (blue), motor (red), and mixed (green).

1 = “nose” – Olfactory – smell
2 = “eye” – Optic – vision
3 = “eyebrow” – Oculomotor – eye mover
4 = “around eye” – Abducens – eye mover
5 = “cheek” – Trigeminal – sensation and mastication
6 = “around eye” – Trochlear – eye mover
7 = “cheek” – Facial – taste and facial expression
8 = “ear” – Vestibulocochlear – hearing and equilibrium
9 = “mouth” – Glossopharyngeal – taste and swallowing
10 = “buttons” – Vagus – the “wanderer”
11 = “tie” – Accessory – head, neck, and shoulder movements
12 = “below the mouth” – Hypoglossal – tongue movements

From Kartika Tjandra, Mount Royal University (ktjandra@mtroyal.ca), a great analogy for the events immediately following bacterial invasion in the body.

For the most part, my students are not as comfortable with the immune system as perhaps they are with other systems, such as the cardiovascular or respiratory systems. They tend to be overwhelmed by the details and, therefore, I try to simplify it for them whenever possible. I have used this cartoon to illustrate how our innate immunity works following an invasion, and from the feedback I have received, it seems to help.

I compare their skin, which is always surrounded by eager bacteria willing to enter, to a home surrounded by burglars or “bad guys” just as committed to breaking-in. If the skin should break open, bacteria now have

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access into our body causing tissue injury, similar to the bad guys breaking into a home and stealing its contents, or possibly causing property damage. Fortunately the home is equipped with guard dogs (comparable to neutrophils within the blood vessels), ready to mount a counter attack! Just as guard dogs are trained to find and attack burglars, neutrophils are ready to exit the circulation system and enter tissue to hunt down and fight the body’s invaders such as bacteria. Neutrophils will eat and destroy invaders by phagocytosis, similar to guard dogs biting the “bad guys” and chomping down at whatever they can to eliminate the threat of intruders from the home. Victory will eventually be claimed by the host’s defense system, and the guard dogs will sleep well on a full stomach. The host will prosper once again.

And from Elizabeth Micheel, Minnesota State College Southeast Technical (EMicheel@SOUTHEASTMN.EDU), a humorous way to help students remember the concept of concentration gradients.

The origin of my diffusion cartoon is actually a funny story. I was on my way to interview for my first teaching job in 2009. I was told to prepare a 10-15 minute presentation on membrane diffusion. It was a long drive to the interview site, but it turned out that my mom needed to get to the nearby airport the same day, so she was driving. I was deep in thought in the passenger seat going over my presentation when my mom whispered “oh, pardon me” out of the blue. Then she giggled. A moment later, I knew why. With that, a thought was born. I re-worked my presentation (and artwork) for the interview and I’ve used the analogy ever since. When I tell that story in the classroom, my point to the students is: don’t over-think it...you already know how diffusion works!

Thank you to the artists for their kind permission to use their artwork and for sharing how they use their art in the classroom. And thank you to Pearson for their continued dedication to helping A&P professors be successful through fun and educational activities like the annual Pearson Art Contest where these drawings were created and shared with the A&P community.
EDU-Snippets – from Here to There

EDU-Snippets – A column that survives because you - the members - send in your Snippets

Roberta Meehan
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EDU-Snippets is a column designed to let you, the members of HAPS, share your “ways to make sure your students get it.” Since EDU-Snippets began, our members have been continuously amazed at how many teaching and demonstration ideas pop up and are easily transferred from one instructor to another through Snippets. This edition is no exception. Below you will see some great ideas – fast, fun, easy, and cheap!

Today’s ideas are great for teaching the early concepts in your Anatomy - Physiology sequence. Some, such as the bonding exercises, can be given to students to try on their own. This is especially good for students who are having trouble with basic A and P building blocks.

When I put out the call for ideas for this issue, some interesting “magic moments” came through. Some are included here and some will be in later issues. Some other ideas were also generated from the Haps-I discussion list. Meanwhile, the EDU-Snippets desk certainly encourages everyone to keep right on submitting! This column thrives on what you do – both in lab and in lecture.

I. To Know a Snippet

David Evans (Penn College, devans@pct.edu) started thinking about the problems our students have with that very idea – thinking. And so he told us about his ingenious way of helping his class understand the basics of thinking.

At the beginning of my classes I present the view that there are three ways of knowing: science, religion, and magic.

a. I define science as being the body of knowledge gained about the natural world through observations of real events. Each principle in science must be falsifiable. This knowledge is then offered openly to all who would take the time to study it.

b. Religion is a body of knowledge about natural and supernatural phenomena gained through supernatural forces. Religious information may not undergo any natural process of testing but is generally shared openly with all who wish to know it.

c. Magic is also the body of knowledge gained about the natural world through observations of real events. However, unlike science, magical knowledge often is presented as if it were supernatural in origin and the information supporting its activities is never revealed to others.

A student can then move to clear thinking when presented with various ideas. Is there a way to disprove that “fact?” Is one expected to believe everything without question? Is the placebo effect based on science or on belief? There are actually a number of medical practices that allegedly have no scientific bases!

It may be interesting that many things that we understand as relating to science actually began as magic. I challenge everyone to think of the many discoveries of Leonardo da Vinci and some of the work of the alchemists.

What do others think of this approach? Be sure to let me know: devans@pct.edu

II. A Sarcomer(ic) Snippet

We’ve had other interesting ideas on sarcomeres over the years but this one from Janice Fritz (St. Clair County Community College, jfritz@sc4.edu) is one of the best and most unique. Picture your students involved in this exercise!

Here is a quick demonstration I like to use for demonstrating how a sarcomere works:

I find that my students have a hard time understanding how a sarcomere gets shorter without changing the length of the myofilaments. I have two students sit in rolling office chairs facing each other, 10-15 feet apart. These students represent the Z-discs. They each hold a broomstick or meter stick representing the actin filaments. Two students stand back to back in the area between the

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broomsticks to represent a myosin thick filament. The myosin students grasp the broomstick with one hand to form an actin-myosin cross-bridge and bend their wrists to pull the stick toward them in the power stroke. They grasp the broomstick a little further along with the other hand before breaking the first cross-bridge and repeat the action, pulling the stick toward them a little at a time. This pulls the z-discs closer together to shorten the sarcomere and shows the students what happens to the A band, I band, and H band during contraction.

III. U-Write a Snippet

Roberta Meehan (Maricopa County Community College District, biology@ctos.com) thought about how to increase conceptual comprehension in her class.

The U-Write test is an exceptionally valuable instructional tool. There are a number of ways to do a U-Write test but this is the one I have found to be especially successful. This exercise takes a bit of time, but for my students it has always been well worth those extra minutes. Not only have student test scores gone up, but countless students have thanked me for giving them the opportunity to do this U-Write test exercise.

I assign the U-Write test to be due at the beginning of the next class period. Each student is asked to write a test including a minimum of 30, and up to 50, questions covering the material scheduled for the in-class test. Answers are to be included. Questions can be in any format. I do try to steer them away from simplistic questions and answers. Virtually everyone complies with this request.

When the students gather with their U-Write tests, I break them into groups of not more than four. (More than four causes slacking off and a lack of concentration within the group.) The students then ask each other their questions and discuss the correct answers. They are free to use their texts or notes to verify answers. Meanwhile, I circulate from group to group, answering questions and clarifying material. The students are welcome to distract me from my rounds if a particular group has a problem.

At the end of the allotted time (which is variable, based on the length of the class period), I call the class back together and collect the U-Write tests. We then have a discussion about general problems and everyone feels more comfortable about the REAL test.

I do not grade these U-Write tests but merely note whether or not the student has the required number of questions. I simply check each student as complete or incomplete. Virtually everyone gets a complete on this assignment. They really work hard at it. The students can have their U-Write tests back as soon as the checkmark is in the grade book.

This is a very successful learning exercise. Yes, it does take away from “programmed” time but, considering the increase in conceptual understanding, I am all for it.

IV. And We Hope You Will....

Thank you all for your EDU-Snippet contributions. The influx of Snippets has been wonderful. Please keep it up because more are always needed. If you have thoughts or ideas, or any interesting ways to help our students understand anatomy and physiology, EDU-Snippets would love to hear from you. Once again, EDU-Snippets encourages new submitters to submit – and regulars to keep on submitting!

For the next issue of the HAPS-Educator, send your EDU-Snippet experiences and ideas to biology@ctos.com as soon as possible. You will also find a reminder on the HAPS-L list. Plan ahead. You can even submit your ideas now and maybe next issue you too will see your EDU-Snippet in print!

The HAPS 26th Annual Conference will be a GUSHER of information you won’t want to miss!
Tuesday was the first day to begin the dissection of the cat in the Human Anatomy & Physiology Laboratory at Waleetka College. The instructor, Tammy Bird, thought everything was under control since all of the preserved cats and dissection tools had arrived the day before.

Two students were assigned per preserved cat. After putting their dissection specimen on a tray, they were instructed to remove the cat from the bag. All seemed to go well until Jared splashed some of the containing fluid in his eye and he immediately felt a burning sensation in his eye.1

As the students were removing skin from the cats, Ashley noticed that her scalpel was dull. Since there were replacement blades at the front desk, she immediately attempted to remove the dull blade from the scalpel handle but slipped and cut her forefinger which bled over the lab bench.2

The class was hard at work dissecting the cat muscles. By the end of the last hour of the three hour lab, several students complained of the smell in the laboratory and a noticeable stench was seeping into the hallway and bothering passing students as well.3

How could the instructor have better prepared the students and herself for these safety lapses?

What is the correct way to prepare and respond to these safety incidents in the Human Anatomy & Physiology Laboratory?

1. Students should be equipped with personal safety gear. Gloves, apron or lab coat, and eyewear should be provided to each student in the A&P laboratory to prevent splashes from preservatives and holding fluids or flying bone chips. Before classroom activities begin, the instructor should point out the location and operation of safety equipment such as the eyewash station or shower.

2. A blade remover is the safe way to remove dull or broken scalpel blades. Instructors or teaching assistants should remove all broken blades with a blade remover or instruct students on its use. A fresh (less than 24 hrs old) 10% Clorox solution should be used to clean blood spills. Cuts should be cleaned with soap and water. A first aid kit with band aids should be easily accessible in the laboratory.

3. Adequate ventilation is necessary to provide a safe laboratory classroom environment. OSHA sets 4-12 room air changes per hour as normally adequate for the general science laboratory. For cadaver dissection laboratories, a rate of 18-20 changes per hour is recommended. The air supply must come from non-laboratory areas and be vented to the outside of the building, preferably above the roof. Ventilation systems should be regularly checked to see if adjustments are needed.
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