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COVER ILLUSTRATION: Abstract histology print of the human prostatic urethra by Christine Eckel (Copyright, Christine Eckel, 2011, used by permission). Dr. Eckel is an Associate Professor of Anatomy at the West Virginia School of Osteopathic Medicine. She has taught undergraduate Human Anatomy and Physiology for the last fifteen years and Medical Gross Anatomy and Medical Histology for the past eight years. Anatomy-related artwork is one of her hobbies.
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 can’t believe how quickly my year as President has gone. It seems like only yesterday when I was sitting around worrying about running my first Board of Directors meeting, and now here I am getting ready (and worrying about) running my eighth. It has been a terrific year; I am privileged to serve such a terrific group. Thanks to you all for the opportunity. It has been an interesting winter.

Despite the challenging economic climate, HAPS remains strong and thriving. Our membership remains at the same high level and we are taking steps to encourage a greater number of student members. Two of our greatest strengths are our inclusivity and the welcoming climate we provide. Whether you teach at the university, community college, or high school level, you have a home at HAPS. Our members provide support, encouragement, and an endless supply of teaching tips and advice to members and non-members alike. Our members are innovative and resourceful and Anatomy and Physiology education is the better for it.

HAPS Institute is also thriving, with four courses offered in association with the Annual Conference and more courses on the way. We have established a new credit-granting relationship with Alverno College and are busy recruiting instructors for additional courses.

We just held a terrific and successful Regional Conference at Florida State College in Jacksonville. Everyone I’ve talked to about it has praised the host college, the location, and the content. If you’re thinking about hosting a regional, drop us a line. We would love to help you make it happen.

The 2012 Annual Conference is shaping up to be a terrific time in Tulsa. The Annual Conference Planning Committee has scheduled an engaging series of updates and workshops as well as an entertaining lineup of special events during and following the conference. I hope to see you all there.

We are currently in the final stages of choosing a consultant to help us redesign the HAPS website to make it an even more valuable resource for our members as well as a greater attraction for prospective members. Stay tuned for further information.

While I still have your attention, let me make a shameless appeal for funds. Whether you attend the Annual Meeting or not, please consider the HAPS Foundation when you are thinking about charitable donations. As we build this fund, we will be able to do more, whether it’s providing scholarships or expanding services.

And I can’t leave without a word of thanks to my fellow Board of Directors members, Committee Chairs, and committee members. They accomplish the day-to-day activities of HAPS. And a special thanks to Marsha Sousa, who has, despite an increase in workload due to her professional responsibilities, continued to serve as HAPS-EDucator Editor. We welcome Jennelle Malcos and Sarah Cooper as the new co-editors and wish Marsha the best on her “retirement.”

Don Kelly
President, Human Anatomy and Physiology Society
Spring came early in many parts of the country, and you will find that your organization has been busy cultivating new projects that will support the continued growth of HAPS for the benefit of its members. The HAPS Strategic Initiative One calls for the expansion of the reach of HAPS to professionals in the field of Human Anatomy and Physiology. Much of this initiative has to do with better communication with members and potential members. I hope you all have found the regular “What’s HAPSening” newsletter a good source for information about HAPS activities and opportunities. Another important source of information to our members is our website. An Ad Hoc committee has reviewed proposals to redesign our website. A company has been selected and we are now working to create a new, fresh-looking website that is easy to navigate. We hope our new look will be unveiled soon.

In March, a regional conference was held at Florida State College at Jacksonville. Over 100 Hapsters attended this excellent conference. Holding more regional conferences is another of our Strategic Initiatives so that more HAPS members have an economical option for HAPS professional development. We are looking for more colleges interested in holding a one or two day conference. Please contact me if you are interested.

Our 26th Annual Conference will be held May 26 – 31 in Tulsa, Oklahoma. This is going to be one of the best professional development opportunities ever for HAPS members. Seven outstanding Update Speakers will be presenting cutting edge material. There will be over 60 workshops and 35 posters. We also hold our Annual Business Meeting where you can participate in the Society’s governance. Our committees hold their annual meetings at the conference and all members are welcome. This is a great way to participate in your organization and I hope you take advantage of this opportunity, too.

Remember…Learn, Discover, Share with HAPS.

Cheers,

Larry
Dr. Laurence Spraggs
Executive Director
Human Anatomy and Physiology Society
lspraggs@hapsweb.org

Twitter
Facebook
Candidates for President-elect

Valerie Dean O’Loughlin
Associate Professor of Anatomy, Director of Undergraduate Studies
Indiana University
Bloomington, IN

HAPS member for 12 years
Attended 3 HAPS national or regional meetings in the last 3 years

HAPS Service:
• Presented posters and/or workshops at national or regional meetings
• Served on Cadaver Use, Nominating, Membership, Foundation Oversight, Curriculum and Instruction, and Partnership committees
• Chaired Membership and Foundation Oversight committees
• Written contributions for the HAPS-EDucator
• Taught a HAPS-I course
• Served as HAPS member Liaison to American Association of Anatomists

I feel I can bring leadership and a vision to the organization, and strengthen partnerships with other anatomical and physiological organizations. HAPS has a special spot in my heart and I want to see the organization continue to flourish and thrive.

Karen McMahon
Instructor
University of Tulsa
Tulsa, OK

HAPS member for 15 years
Attended 3 national meetings in the last 3 years

HAPS Service:
• Presented posters and/or workshops at national or regional meetings
• Hosted national meeting
• Chaired Safety Committee
• Served on Nominations and annual conference committees
• Contributed articles for the HAPS-EDucator

I am honored by the nomination and would be privileged to serve as HAPS President. I owe HAPS a great deal. When I joined in 1997, I was warmly welcomed into an organization with exactly the resources I needed as a faculty member new to teaching anatomy and physiology. I later helped to grow those resources by serving as chair of the newly formed safety committee. During my years as chair, the safety committee wrote the Safety Guidelines, Safety Case Studies, and, for the first time this year, will offer a course in safety training (Red Cross CPR/AED) at the annual conference. If elected, I would continue to expand HAPS resources for the teaching of A&P by wholeheartedly supporting the work of the HAPS committees, HAPS-I, and the HAPS Foundation. My experience as annual conference host has made me more fully aware of the impact HAPS can have as the leading society for innovative teaching of A&P and I would work to make HAPS even more of an international presence in the future. I would also seek to increase the student presence at HAPS by supporting a poster competition for faculty-sponsored student research.

Candidates for Treasurer

Elizabeth A. Becker
Professor of Biology
Elgin Community College
Elgin, IL

HAPS member for 22 years
Attended 3 HAPS national or regional meetings in the last 3 years

HAPS Service:
• Presented posters and/or workshops at national or regional HAPS meetings
• Served on the planning committee for a regional meeting
• Served on Membership and Safety committees
• Served 4 years as Central Regional Director
• Currently serving 4th year as Treasurer

HAPS is an organization that I truly believe in. It has afforded me the opportunity to grow tremendously as an instructor of Anatomy/Physiology. Information from HAPS was critical in my being able to design and implement a two-semester A&P sequence at Elgin Community College. I have been fortunate to have attended many Regional and Annual Conference meetings to further my knowledge, growth, and connections with other instructors.
When you have been fortunate enough to have gained so much, it is important to give back to the organization. HAPS has been growing tremendously in the past few years. There have been challenges and there still are challenges ahead. I feel that I have made positive contributions to HAPS while serving on the Board and would like to continue to contribute. In my time as Treasurer we have grown in numbers, we have transitioned to having an Executive Director, and we have moved our HAPS-I course delivery to Alverno College. We are currently in the process of looking at major upgrades to the HAPS Website and changes to the HAPS-EDucator. During all these changes and some tough economic times, HAPS has stayed solvent and kept to its budget. I would ask for your vote for Treasurer. I will continue to work hard to ensure HAPS continued financial stability. Thank you.

Christine Eckel
Associate Professor of Anatomy
West Virginia School of Osteopathic Medicine
Lewisburg, WV

HAPS Member for 14 years
Attended 2 HAPS national or regional meetings in the last 3 years

HAPS Service:
• Presented a poster or workshop at a national or regional meeting
• Served as Western Regional Director (2004-2008)
• Served on Cadaver Use Committee and Nominating Committee
• Chaired the Cadaver Use Committee from 2002 – 2004
• Written a contribution for the HAPS-EDucator
• Contributed original artwork for the HAPS-EDucator

Throughout my career I have had a keen interest in serving on the HAPS Board of Directors and committees whenever possible because I have seen countless instances in which HAPS has been an enormous resource for instructors of A&P. One of the most exciting has been seeing the long-term effects of the emergency efforts we, the Board of Directors, made in 2005-06 to help stem the wholesale firing of many A&P instructors by institutions who were afraid of the possibility of losing accreditation status from the Southern Association of Colleges and Schools (SACS). This issue arose because an administrator at SACS was concerned that instructors did not specifically hold degrees in “Anatomy and Physiology”. This led us to create new position statements, and ultimately led to the formation of HAPS-I – one of the greatest things to come out of HAPS in the last several years. When we put our minds and our talents together, we do great things!

This past fall I served on the STURP Task force for the AAA (STURP = Strategic Thinking in Undergraduate Recruitment and Promotion). The AAA is current making a big push to bring undergraduates and undergraduate instructors into the organization. I have been trying for years to support efforts that bring the talents of people in both organizations together for the benefit of the members of both organizations. Getting people in the AAA to fully accept and believe in HAPS has been a very difficult sell over the years. I feel that now is the time for us to act to strengthen the relationship between HAPS and the AAA, particularly when it comes to sponsoring regional meetings, HAPS-I courses, and the like. These efforts would not only be beneficial in terms of potentially increasing membership in HAPS and providing HAPS members with even more resources, but also to strengthen our “status” as an organization, which would put even more weight behind our position statements, our courses, etc.

It would be both a pleasure and an honor to come back into the fold and serve the HAPS membership as Treasurer. After a few years of being less involved in HAPS governance and activities (as a consequence of life circumstances, not from a lack of desire), I am eager to once again become involved and play an active role in this wonderful organization that is doing wonderful things! Thank you for your considering my interest in serving on the HAPS BOD.

Candidates for Eastern Region Director

Javanika Mody
Associate Professor
Anne Arundel Community College
Arnold, MD

HAPS member for 17 years
Attended 3 HAPS national or regional meetings in the last 3 years

HAPS Service:
• Presented posters and/or workshops at national or regional HAPS meetings
• Served on the planning committee for a regional meeting
• Chaired Regional conference committee
• Served as Marketing Manager

My first HAPS conference was the 1995 HAPS Annual Conference in St. Louis. It was there that I realized I
had stumbled into one of the best things to come along professionally for me. Loving every single minute of my HAPS experience I would like to thank this group of special people who have shared their knowledge, talents, spirit and friendship. You embody everything that it means to be a “HAPSTER”.

Over the last seventeen years I have given my time and talent whenever or wherever I have felt needed or asked by HAPS. For me serving as a regional director would be the next logical step in a progression to serve HAPS and the membership. The regional director’s job description indicates that we should serve as the representative to ensure continuity of policies and procedures. It also states that we are to act as a liaison between our constituency and the Board of Directors. I believe that as a regional director I should do this first, but also should think more globally about the well-being of the entire membership when working on policy or procedures that affect us all. Even though I would be the Eastern Regional Director, if elected, I would more importantly be a “HAPS” Regional Director and would work constantly for the Society as a whole. As a regional director I would also serve as a member of the Regional Conference Committee and would be able to promote increased involvement of the membership in the activities of HAPS both locally and internationally.

In addition to the experiences with, and working knowledge of, the Society and my other academic activities discussed below, I bring an incredible energy and enthusiasm to the position, as well as a commitment to you and to myself to be the best that I can be. Everyone who knows me knows of my spirit, energy, fairness, and enthusiastic zest for life. Being a part of a team that works for the membership of HAPS would give me personal and professional satisfaction. I promise to work for you, the members of HAPS, in continuing to promote excellence in the teaching of anatomy and physiology and to always have time for your concerns, questions and comments and to take time to enjoy HAPS with you. I am fortunate to have had the moral and financial support of my administration over the last seventeen years that has enabled me to remain active in HAPS.

I have been an active member of HAPS since 1995 and during that time I have served HAPS in many different capacities. This helps me better understand the organization. During my tenure as the Marketing Manager for the organization for five and a half years, I have worked with the HAPS Board, HAPS members, and vendors in close proximity. During my service in that capacity, HAPS earnings from vendor income more than doubled. I have chaired the HAPS Regional Conference Committee for four years, and had been a member of that committee for five years. Under my leadership we were able to fine-tune the guide for regional conference coordinators with the hope that it would encourage more members to host HAPS regional conferences.

I have served on the steering committee and/or coordinated four annual or regional HAPS Conferences. I have co-presented various workshops at annual and regional HAPS meetings.

With my qualifications, experience, enthusiasm, and energy I would welcome the opportunity to further serve you and HAPS as the Eastern Regional Director. Thank you for your support and may we work together to further the goals of HAPS.

Elizabeth Hodgson
Instructor
York College of Pennsylvania
York, PA

HAPS member since the Philadelphia Annual Conference

HAPS Service:
• Served on the Membership Committee and the Web Committee
• Chaired the Membership Committee
• Written contributions for the HAPS-EDucator

I greatly value HAPS as an organization and would like to continue to give back to it as best as I can. In the past, I have participated on committees, chaired the Membership Committee, and run for the position of Secretary. I have been to each Annual Conference since I became a member the year of the Philadelphia conference. I would like to continue to serve the organization as the Eastern Regional Director.

(Continued on next page)
Candidates for Western Region Director

Mark Thomas Nielsen
Professor of Biology
University of Utah
Salt Lake City, UT

HAPS member for 15 years
Attended 3 HAPS national or regional meetings in the last 3 years

HAPS Service:
• I have presented 10 different workshops at national or regional HAPS meetings.

I have benefitted greatly over the years through my involvement with HAPS and have met so many wonderful colleagues. I feel it is time to give back and become more involved in helping HAPS continue its strong and important mission in undergraduate anatomy.

Anne Geller
Professor
San Diego Mesa College
San Diego, CA

HAPS member for 16 years
Attended 2 HAPS national or regional meetings in the last 3 years

HAPS Service:
• Presented a poster or workshop at a national or regional meeting
• Service on the planning committee for a national meeting
• Served on the HAPS Steering Committee or Board of Directors
• Currently serving 2nd year as Western Regional Director

I have been privileged to serve as the Western Regional Director of HAPS for the past two years, and in that capacity, have learned so much more about this outstanding organization than I had during my previous years of membership. In addition to having the opportunity to work with, and therefore get to know better, some amazing, talented, and dedicated A&P instructors, I have gained insight into the complexity of ensuring that a large professional society such as ours continues to thrive and support its members in the teaching community. As in any organization, there are many decisions to be made and tasks to accomplish which are necessary to keep things moving forward in a positive direction. In taking on this leadership role in HAPS, I feel that I have been able to give back to an organization that I have personally and professionally gained so much from; but in that respect, I feel like I have just begun to scratch the surface of being able to contribute to this process. Although I believe that a lot has been accomplished over the past two years, there is always more work that needs to be done, and I would like to be able to continue to participate in this capacity. Therefore, it would be a sincere honor and pleasure if I could continue to represent HAPS as the Western Regional Director.
If you were a “First-Timer” at the Victoria HAPS Conference, you should have received an email from me (Craig Clifford) back in January. As stated in my email, I was putting together an article for the HAPS-EDucator about First-Timer experiences. Thanks to Marsha Sousa, our editor, for keeping me working on this after I promised I would do such an article. I now present to you the comments, good and bad, from all those who responded. Now remember that the conference was in May, 2011, and I asked for comments in January, 2012, - not the smartest thing to do. Still I wanted the experiences that had stood the test of time. And was I impressed. My heartfelt thanks go to all of you who responded. I have no compunction about adding a few comments to get a short article in the HAPS-EDucator. I have no shame. So here they are.

Even the short comments were great. F. Ellis from Gulf Coast State College said “I loved the workshops and most of the lectures. Overall, I would say the whole experience was great!”

Regina Rector (William Rainey Harper College) was the most responsive (Thank you, Regina). Regina summarized the event from top to bottom. And as Regina states she did not stay at the beautiful Empress but at one of the other hotels. “My first experience at the HAPS Conference in Victoria was excellent. Everyone working/volunteering at check-in and throughout the conference was so very helpful. I felt like they really wanted me there and I learned so much, plus they gave great recommendations about things to see and places to eat (very well organized). Other than the seminars, I really learned a lot from the other participants. It was great to network and learn about how other schools run their A&P courses. The extra field trips and evening gatherings were enjoyable since they were very relaxed and I always found someone to hang around with (everyone was very open and enthusiastic about being there). Victoria is such a wonderful location, too. The restaurants and shops were numerous and so many different types. Things were really easy to get to and with the supplied transport it was simple to get to all the sites. I enjoyed having the different sites to go to as well. It enabled me to see different parts of the island, even though we stayed pretty close. I didn’t stay at the Empress, but close enough by that I could just walk. And I found getting up and walking in the morning to be very refreshing. So, the central location of the hotel was very accommodating.”

Tara Leszczewicz of Elgin Community College was not on my dance card in Victoria (that I remember) but from her first comment about her First-Timer experience I knew she better be on my card in Tulsa. “First of all, the overall experience of the Annual Conference was in one word, fun. Everyone was so friendly and enthusiastic to be at both the educational and social events. Secondly, the presentations and seminars were informative, both from a biological standpoint as well as instructionally. Finally, I made some wonderful friends and professional contacts. On the plane home from Victoria, I was already excited about attending in the years to come!” I would have to agree that despite all of the great educational activities, the informative update seminars and the hands-on workshops, FUN is to be had by all.

When Dr. Andrew Lokuta (University of Wisconsin School of Medicine) responded with a “Good afternoon!” I knew he must have enjoyed High Tea at the Empress Hotel. His comments went on to say that “As a first time attendee of a HAPS Annual Conference …, I was struck by the abundant enthusiasm for teaching, the camaraderie, the pervasive spirit to share ideas and experiences with the ultimate goal of teaching excellence by all for all. Looking forward to subsequent Conferences!”

I didn’t quite know what to do with the statements sent in by Leo Stouder from Broward College. Leo apparently was not feeling that well; I’ll just let Leo tell you in his own words. “I was sick, sick unto death. I came from Florida in shorts and a tee shirt expecting that Canada was warm in May. Mistake. I caught the flu and it laid me out for three days. I couldn’t speak and I had a workshop scheduled! But the beauty of Victoria shined through. It was a great juxtaposition of misery and beauty, of mindlessness and great education. If you want a good experience take a vacation, if you want an excellent experience attend a HAPS conference, but do it without the flu!” Thanks for the advice from Leo. Get that flu shot and stay healthy.
When Gary V. Allen of Dalhousie University responded to my request for a comment about the meeting, he said, “No problem,” and then went on to say “I found the HAPS meeting in Victoria, BC, to be very well organized. The program suited my needs and I was able to attend all of the breakout sessions that sparked my interest. The facilities were excellent and the organized dinners and excursions were wonderful. I would not hesitate to attend another meeting and I intend to join this organization.” I didn’t check up on Gary, but I’m sure he did join.

Carrie Allen from North Georgia College and State University probably said it the best and in a way that is natural for ending this article on first-timers experiences. “My first HAPS Annual Conference was everything I expected and more. The fantastic workshops and seminars combined with the friendly, knowledgeable people I met really encouraged me to register for the 2012 conference; Tulsa here I come!” Are you going to be there in Tulsa to welcome Carrie? I will be. See you there.
One of the highest priorities of modern medicine is the control of pain, and opioid analgesics have been intensely studied for decades because of their unique ability to modulate moderate to severe pain. A dramatic increase in the knowledge of the mechanisms of opioid action has taken place in the last two decades making possible increased research and greater understanding of the properties of this class of drugs. Until quite recently, most studies of opioid-based pain management in a clinical setting focused on cancer patients but current indications are that the results of this previous research can now safely be applied to patients who have persistent, non-cancer related pain (Inturrisi 2002). The overall objective of current opioid research is to develop targeted drugs for the relief of pain that have minimal side effects coupled with a low potential for physical or psychological abuse (Okada 2002).

The most common reason for seeking medical treatment in the United States today is the presence of pain that cannot be adequately controlled by over-the-counter medications. It is estimated that thirty-five percent of Americans may suffer from some form of chronic pain and as many as 50 million Americans are either totally or partially disabled as a result of chronic pain (Fudin 2011). Amazingly, forty to fifty percent of this group report that they do not experience adequate pain relief as a result of seeking treatment in general medical practices. Since opioids are the most effective drugs available for pain management, it would appear that an effort should be made to educate healthcare professionals and the public about the safe and appropriate use of opioids in pain management. The most commonly expressed reasons for failing to adequately treat pain with opioids include the provider’s fear of disciplinary action for prescribing opioids, the patient’s fear of side effects and addiction to narcotics, and the patient’s hesitancy to take opioids on a long-term basis (Fudin 2011).

Opioids can function as agonists, antagonists, or mixed agonist/antagonists at various receptor sites. Opioid agonists are morphine-like drugs that bind to G-protein-mediated opioid receptors. They have strong analgesic properties but they can also depress the respiratory system, decrease the mobility of the gastro-intestinal tract, and cause other side effects such as sedation, nausea, vomiting, and urinary retention (Fudin 2011, Inturrisi 2002). There are three well-studied opioid receptors known as delta-opioid receptor, kappa-opioid receptor, and mu-opioid receptor. Of these, the receptor designated mu-1 plays the most significant role in pain control; maximum pain control is currently thought to be achieved by using a mu-1 receptor combined with some degree of kappa-receptor activity. Mu-2 receptors are most closely associated with side effects rather than with pain relief (Fudin 2011). Opioid receptors are primarily located in the peripheral nervous system, the posterior horn of the spinal cord at presynaptic and postsynaptic sites and in the brain stem, the thalamus, and the cerebral cortex. They are abundant in the lateral spinothalamic ascending transmission pathway for pain and are also found in an inhibitory descending system that serves to modulate pain in the spinal cord (Inturrisi 2002). At the cellular level, opioids cause a decrease in the release of neurotransmitter from pre-synaptic neurons by inhibiting the entry of calcium ions into the neurons and hyperpolarization of the post-synaptic neuron due to enhanced release of potassium ions; the result is a decrease in overall synaptic transmission (Inturrisi 2002).

Opioids available for clinical use include morphine, oxycodone, levophanol, hydromorphone, oxymorphone, methadone, and fentanyl (Inturrisi 2002). Most opioid analgesics are available in both extended release and rapid release forms and each preparation has advantages for patients in certain situations. Extended release opioids are most helpful for treating chronic pain, which is pain that has been experienced continuously for three months or longer. The cause of chronic pain is sometimes unknown and it may be accompanied by sleeplessness, depression, and anxiety. Except for end-of-life situations requiring pain medication, the sedative effects of opioids are usually not desirable in the treatment of chronic pain (Fudin 2011). Rapid release opioids are most useful in the control of acute pain. Unlike chronic pain, acute pain usually has a known cause and the pain is expected to go away within a certain period of time. The sedative effects of opioids may be desirable for the treatment of acute pain such as that experienced after surgery or for the initial relief from the pain associated with a bone fracture (Fudin 2011).

Opioid antagonists, such as naloxone, are drugs that have a greater affinity for opioid receptors than opioid agonists do, but they lack the ability to cause analgesic activity. They block opioid receptors, preventing the body from responding to the opioid, thereby inducing withdrawal effects in people who suffer from opioid dependence (Fudin 2011, Inturrisi 2002). Mixed agonist/antagonist drugs like pentazocine and butorphanol might, depending on the circumstances of the patient,
exhibit agonist activity at the kappa receptor or antagonist activity at the mu receptor. They could produce pain relief in a patient who has not developed tolerance to morphine-like drugs and withdrawal symptoms in a patient who is tolerant and dependent on these drugs. Advantages of mixed drugs include a ceiling effect in their ability to produce respiratory depression and an overall lower possibility of abuse than is associated with the morphine-like drugs (Inturrisi 2002).

The side effects of opioid drugs can sometimes be reduced by the use of certain combinations of drugs. Opioids are commonly mixed with non-opioid pain relievers such as acetaminophen, a non-steroidal anti-inflammatory drug or NSAID. They can also be mixed with caffeine, antihistamine, antidepressants, anticonvulsant drugs, or CNS stimulants such as dextroamphetamine, depending on the needs of the patient. Side effects are categorized as desirable or undesirable depending on the circumstances under which they occur. The underlying mechanisms that produce side effects can depend on a number of factors such as the age of the patient, the extent of the disease process or organ dysfunction, the other types of drugs the patient is taking, the degree to which the patient has previously been exposed to opioids, and the manner in which the opioid is administered. Among the most common side effects are sedation, constipation, nausea, vomiting, and respiratory depression. Less common side effects include mental confusion, nightmares, hallucinations, and dizziness (Inturrisi 2002).

Potentially the most serious side effect of opioid use is respiratory depression. Opioid agonists like morphine act on respiratory centers located in the brain stem to produce respiratory depression that, depending on the dose given, can result in apnea. When humans die as a result of an overdose of morphine-like drugs, the death is almost always the result of respiratory failure. Morphine, even in therapeutic doses, can depress all measures of respiration including respiratory rate, minute volume, and tidal exchange. Normally when respiratory activity is depressed, the accumulation of carbon dioxide stimulates respiratory chemoreceptors that increase the rate of respiration, masking the degree of depression, but at analgesic doses, morphine-like substances can produce enough respiratory depression to put individuals with bronchial asthma or impaired respiratory function at risk. Respiratory depression is usually accompanied by other signs of CNS depression, such as sedation and loss of mental sharpness, that are observable and can lead to appropriate respiratory therapy. Tolerance to respiratory suppression usually builds rapidly however so that opioid analgesics can safely be used for pain control without undue risk of respiratory depression. If respiratory depression does occur following acute administration of an opioid, giving the drug naloxone, an opioid antagonist, can reverse it (Inturrisi 2002).

Other side effects of opioids are generally less serious than respiratory depression. Nausea and vomiting result from direct stimulation of the chemoreceptor trigger zone in the medulla. The drowsiness and sedation associated with opioid use are the result of overall CNS depression. Fortunately, tolerance to the sedative effect of opioids usually occurs quickly, often within the first few days of treatment. Constipation is the most common side effect of the use of opioids for pain control. Opioids act at many sites in the GI tract and the spinal cord to decrease GI tract motility and normal intestinal secretions. Tolerance to this condition occurs very slowly, if at all, so constipation is often present for the duration of opioid therapy and regular bowel treatments should be included in the patient’s protocol for pain relief. Opioid analgesics cause urinary retention because they increase smooth muscle tone resulting in bladder spasm and an increase in the tone of the bladder sphincter. Urinary retention occurs most frequently in the elderly. Animal studies indicate that morphine-like opioids can also suppress the immune system (Inturrisi 2002).

As with most medications, individuals vary with respect to their response to opioid analgesics. Argoff (2010) reported that there might be as much as a forty-fold variation among patients in the opioid dose required to achieve pain relief and a lack of satisfactory pain relief, defined as less than 30% reduction in the intensity of pain, in as many as 10% to 40% of patients. Argoff’s research points to the presence of single-nucleotide polymorphisms (SNPs) in the gene that encodes for the mu-opioid receptor as the most probable source of the variability in patient responses to opioid analgesics. Genetic diversity is also linked to variations in the amount of drug absorbed, variations in drug metabolism, distribution of the drug in the body, drug toxicity, and the excretion of opioid drugs. More research will be needed in order to link specific SNPs to specific pharmacological effects and to make prescription of these drugs more targeted to the needs of individual patients (Argoff 2010).

Most people on long-term opioid treatment appear to develop some degree of tolerance to opioid analgesics. Tolerance occurs when a given dose of the drug produces a decreased effect or when a larger quantity of the opioid is needed to maintain the desired effect of the drug. Tolerance will often develop at a slower rate if opioids are combined with non-opioid pain relievers since patients do not develop tolerance to the non-opioid part of the resulting mixture (Inturrisi 2002). Along with tolerance, psychological dependence and physical dependence can both occur as a result of pain control with opioid analgesics; both are believed to have their origins in the effects of opioids on the central nervous system. The term psychological dependence refers to compulsive drug-seeking behavior centered on obtaining and using an opioid drug, while physical dependence and tolerance are pharmacological effects that can be predicted and are seen in both
laboratory animals and humans undergoing repeated administration of an opioid. Physical dependence is the term used to describe the withdrawal that occurs when opioid treatment is abruptly terminated. The severity of withdrawal symptoms is related to the dose and duration of opioid treatment. Anxiety, irritability, nervousness, hot flashes, and chills characterize withdrawal. Additionally, some people experience “wetness” during withdrawal where increased production of saliva and tears, and a runny nose, are accompanied by gooseflesh. Nausea, sleeplessness, and abdominal cramps may also be experienced during withdrawal. Most, but not all, people who take opioids will predictably have some degree of physical dependence to opioids, but it is possible to have physical dependence without being psychologically addicted to opioids. It is necessary to decrease the dose of opioids slowly in order to avoid the symptoms of withdrawal. Fear of psychological dependence is a major limiting factor to the use of opioids for pain control in hospitalized patients. Even though analysis of medical use patterns suggests that medical use of opioids rarely results in drug abuse or addiction, some patients do not want to take even small doses of opioids for pain control for fear of becoming addicted (Inturrisi 2002).

Today opioids are the treatment of choice for cancer pain. But for all their many benefits in terms of pain management, there are certain types of pain that do not respond well to opioid treatment alone, among them bone pain, pain centered in other connective tissues, and neuropathic pain. These types of pain often require other pain medications in addition to opioids. Anti-inflammatory drugs are frequently more effective against bone pain or connective tissue pain than opioids alone due to their ability to block prostaglandins. In many instances, a combination of NSAIDs and opioids may be more effective than either medication used alone (Fudin 2011).

Because there are real concerns surrounding the abuse of opioids the FDA encourages drug manufacturers to try to develop “abuse-deterrent” formulations of opioid drugs whenever possible. A few abuse-resistant drugs have already been developed. Some of these exist in forms that cannot be crushed to a powder suitable for inhaling or other abuse. These formulations become a “pancake” when crushed which limits their recreational use. Other attempts to create abuse resistant drugs have resulted in tablets that break apart into fairly cumbersome, sharp-edged components that would be difficult or impossible to inhale. Of course, when tablet formulations do not crush satisfactorily, potential drug abusers are likely to try other ways of releasing the desirable properties of opioid drugs, including making use of rapid-release and intermediate-release drugs to accomplish their goals. Unfortunately, drug abusers are usually a step or two ahead of the government and industry regulations that are intended to thwart their ability to use opioid drugs for illegal purposes (Fudin 2011).

Opioid drugs are extremely effective medications for pain control, but inadequate knowledge of their properties and appropriate use can hinder their effectiveness. Their use requires a cooperative effort among healthcare providers and patients to understand the benefits and risks of these drugs. Future developments of morphine-like drug agonists, based on greater awareness and understanding of the mechanisms and specific sites of opioid drug activity, may lead to new therapeutic drugs that will enhance the analgesic properties of the opioids and reduce their undesirable side effects. Continued research into morphine-like drug antagonists may result in reducing the pain associated with inflammation, ameliorating the desire for the unhealthy consumption of calorie rich foods, stopping the tendency of susceptible people to become alcoholics, and reversing the potentially debilitating immune suppression and bowel dysfunction that are currently associated with opioid drug use (Argoff 2010, Lazarus 2012). There is much to be gained by increasing our understanding of the mechanisms of opioid activity in living systems. The hope is that ultimately it may be possible to individualize opioid analgesic therapy by taking into account each patient’s unique genetic background, thus making it possible to select the right opioid and administer it at the optimal dose, and on an appropriate schedule, to maximize the analgesic effects for each patient and minimize the adverse effects of these very powerful and interesting drugs (Argoff 2010, Okada 2002).

*Jeffrey McDonald graduated from Arcadia University in May of 2011 with a major in Biology. Excerpts from his Senior Thesis “The Physiological Effects of Opioid Agonists and Antagonists and Their Uses” appear in this article. Jeffrey is currently applying to Doctor of Physical Therapy (D.P.T.) programs and he plans to pursue a career in this field.

Literature Cited


Introduction

Using interactive alternative teaching strategies to make anatomy and physiology instruction more engaging and effective has been well-studied in the past decade (Gangata 2008, Finn and McLachlan 2010, Zumwalt et al. 2010, Skinder-Meredith 2010). These methods of student-centered instruction successfully engage students with hands-on learning activities. Other innovative teaching methods that have been successful for both students and faculty include case studies and team-based, problem-based, project-based, and inquiry-based learning (Vasan et al. 2011, Nieder et al. 2005). Service learning is another alternative teaching method that is categorized as community-based experiential education. Experiential education is the process of learning through action (Wilderdom 2007). Learning through experience allows the student to integrate and assimilate the course material in a way that is not possible in the traditional classroom. With service learning, the experience that facilitates learning and motivates the student is the act of helping others. While service learning has been heavily implemented in other fields, very few articles exist on the use of service learning in anatomy and physiology (Tong 1999, Fitzakerly and Westra 2008).

In addition to facilitating a deeper internalization of the course material, service learning offers the student several opportunities for personal growth that are rare in a typical classroom setting (Strage 2004, Wenzel 2002). Participating in community-based service learning projects promotes personal growth in students by encouraging them to overcome limitations, develop a personal set of beliefs and values, and accept responsibility for their education (Eyler and Giles 1999). In addition, through the interactions during community-based projects, students can develop interpersonal skills in communication and leadership (Ferrari and Cather 2002). Furthermore, students learn professionalism in relating to members of the community, cooperating with peers, and managing their time efficiently while working towards their long term goals. During these service learning projects, knowledge learned in the classroom can be applied within the community, further developing critical thinking skills (Markus et al. 1993). Perhaps the most important advantage is that these projects encourage students to develop a sense of civic responsibility and a sense of belonging to the community in which they live (Strage 2004, Ferrari and Cather 2002).
Because of the well-known advantages and effectiveness of alternative learning strategies, we added a service learning component to our course. This consisted of our university students teaching the anatomy and physiology they learned in class to disadvantaged students in an urban environment using anatomy models, preserved specimens, and other resources. In this project, our students taught urban middle and high-school students at two partner institutions.

The Assignment

The university students were asked to choose a topic they wished to present and the partner institution at which they preferred to teach. They were provided with a list of topics that were pre-approved by the partner institutions and the available times and dates for presentations at those institutions. The topics included most of the body systems including the circulatory, respiratory, muscular, skeletal, reproductive, and nervous systems. Students were asked to explain the basic physiological and morphological functions of the body systems in humans and other animals. Students were placed in groups of two to three according to their indicated preferences. The groups were asked to create a PowerPoint lecture format for their presentation, and to include the use of preserved laboratory specimens, models, and microscope slides where appropriate. The groups were also asked to construct a pre-test/post-test assessment tool to gauge the effectiveness of their presentation. Each student was asked to fill out a pre- and post-presentation reflection on the assignment.

Partner Institutions

Both Loyola High School and the Mercy Education Project are private institutions founded in response to the challenges faced by students in the urban environment, and to facilitate and encourage urban students in the goal of achieving a higher education. Loyola High School’s student body is nearly 100% African American and 80% are from single parent households. The Mercy Education Project was established in 1993 with the goal of offering tutoring programs to disadvantaged girls from the Detroit area schools.

Goals and Outcomes

Outcomes for university students:

- To integrate and assimilate the course material
- To develop communication and presentation skills
- To develop an enhanced appreciation of diversity in our society and an understanding of the challenges involved in learning and teaching in the urban classroom

Outcomes for students at the partner institutions we visit:

- To demonstrate that higher education is a real possibility for the students at the institutions we visit
- To demonstrate that a diverse group of people can work together to achieve success
- To demonstrate that the material they are learning in class is relevant and valued by others outside of their learning environment
- To demonstrate that learning is a lifelong pursuit and that learning is a work in progress for individuals at all levels of education
- To enhance the student learning experience by providing diversity in the learning environment

Classroom Strategies

- The students were given background information on the realities of the urban teaching environment in order to inspire a sense of purpose in the assignment.
- The students were given a clear rubric by which they were evaluated. The rubric delineated the evaluation criteria and how the points for the assignment were distributed.
- The students were given wide autonomy in the selection of their topic and how they organized the material in order to inspire a sense of ownership for their work. They were also allowed to select the partner institution and, therefore, the audience for their presentation.
- The instructors assessed group preparedness in bi-weekly meetings by questioning the groups. Groups that required assistance in learning how to organize the material were provided direct feedback and scaffolding in the form of lecture notes, textbook outlines, suggested slides, and suggested ancillaries.
- The instructors monitored group progress at bi-weekly meetings during office hours and progress was measured by a demonstrable product such as information collected, lecture organization,
ancillaries chosen and created, preserved laboratory specimens chosen, and dissections selected.

• The instructors and student leader viewed the presentations and helped the groups to self-edit by questioning and discussion.

• The groups also created an assessment tool for their audience to help assess the outcome of their presentation. This was administered as both a pre-test and post-test to the students at the partner institutions.

• Pre- and post-presentation reflections written by the university students served as a way for students to monitor how the experience affected or changed their perspectives. Students were required to reference the audience feedback in the classroom, pre-test and post-test assessment results, and written evaluations by the partner institution instructors in their post presentation reflection.

• The total assignment counted as 10% of the student’s grade in the course.

Results
Preliminary data and feedback from the students and instructors involved suggest that the program was a success overall. Most of the university students as well as the instructors and students at the partner institutions were enthusiastic and felt the project achieved its mission. The quality of the presentations and mastery of the course material clearly varied among groups, as judged by the instructors at both the university and partner institutions. Pre- and post-test results at the partner institutions were even more positive, but also varied between groups. Similarly, the instructors at the partner institutions felt the effects on their students were very positive overall, but the results still varied between groups. Overall, the feedback from Loyola High School was more positive than that from the Mercy Education Project. It was harder for the university students to prepare for the younger audiences at the Mercy Education Project. Comments from university students included “while preparing for my presentation I learned several new things that were not part of my biology class” and “I learned the subject I presented on much better than the other subjects in the class”. Many stated “I benefited from speaking in front of the crowd” and “Overall, my experience was great, and I would definitely take part in a project like this in the future”. Comments from the students at the partner institutions included “Now we know why we should wash our hands” and “I am going to get my parents to buy hand sanitizer”. It was rewarding to hear the students request “Please come back to teach us more”. In addition, an instructor at the partner institutions commented “The students loved the specimens and being able to touch them; most of them have never experienced that aspect of science before. Our students also benefited by having the opportunity to interact with college students in an informal and comfortable setting.” Our experiences echo the many positive experiences reported by Fitzakerly and Westra (2008) as they engaged medical students to teach children from rural communities in Minnesota and northwestern Wisconsin about the brain.

We were pleased to find that the incorporation of this service learning project was a positive experience for almost everyone involved. We recommend that faculty consider taking their knowledge of Anatomy and Physiology beyond the walls of their own academic institutions by inviting students to participate in service learning projects within their communities.

The authors would like to acknowledge the assistance of Mary Orczykowski, Alison Glinski, Dan Schlegel, Stephanie Swanberg, support from the Ford Community Corps Partnership, and the instructors at the partner institutions: Melanie Ward at the Mercy Education Project and John Buscemi at Loyola High School.

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“Inquiry” might be the single most overused word in science education: This book uses an inquiry approach. This worksheet promotes inquiry. Our labs need more inquiry. I teach for inquiry. Or if you are running for president: What this country needs is more inquiry.

Along with being overused, it is often misunderstood. To understand the meaning of inquiry, it is easiest to begin with what it is not. It is not memorizing a list of anatomical structures, it is not using flashcards to learn the origins and insertions of muscles—it is not the memorization of facts. Inquiry is more complex than that.

Inquiry is, at a basic level, puzzle solving. It is an attempt to create order out of disorder, to try to make sense of a disorganized situation. Inquiry-based learning emphasizes the importance of student construction of understanding rather than a reliance on teachers as the source of expert knowledge.

Example case: Rubik’s Cube

Rubik’s Cubes were popular in the 1980s and have had a bit of resurgence in popularity in the past few years. The three-dimensional puzzle had over a million different permutations, but only one correct answer.

When Rubik’s Cubes first arrived people would play with them and initially try to get one face the same color. Success! An “aha” moment! Soon more and more people were able to get one side the same color. Then some people started to get two faces the same color. Progress.
For many science geeks, the cube was the greatest puzzle ever. First master one side, then two, and finally all six. It was inquiry, and it was cool.

Then a magazine published the solution and the fun was over. People everywhere memorized the steps required to “solve” the puzzle. But they did not truly solve the puzzle; they simply followed a set of directions. One person, somewhere, indeed solved it – and then communicated the solution to millions of others. Today many people can transform a randomized Rubik’s cube into one with the same colors on all six sides. And for them, the cube is no longer a puzzle – it is simply a task to be performed.

The fun was gone. The Rubik’s cube was no longer cool. It became a routine task: like an engine mechanic changing oil, a librarian re-shelving books, or even an experienced heart surgeon performing routine valve replacement surgery. No more exploration required – simply follow a series of well-rehearsed steps.

The Rubik’s cube can still promote inquiry, but a user’s previous experience is key. If a person tries to solve the puzzle, and does not know the steps to the solution – then it’s inquiry. But if the user already knows how to solve it – then there is no inquiry- it’s simply performing a task. Inquiry is not following a set of instructions to get to a goal or engaging in a routine task. There has to be newness to the problem.

When trying to promote inquiry in classrooms, prior knowledge of the students is of the highest importance. If students already know the content (i.e., already know the answers or the steps of the procedure), then they are simply performing tasks. But if they are new to the situation – then they indeed might be engaging in inquiry.

But prior knowledge is only the first requirement.

Some people do not care about Rubik’s cubes. “That’s stupid. It’s impossible. I have better things to do with my time.” A puzzle is not truly a puzzle unless a person engages with it and is motivated to solve it. Likewise, inquiry must involve motivation; there must be at least a modicum of engagement in an activity for it to be considered inquiry.

In the classroom, inquiry is most often fostered on exams, or at least we hope it is. Questions that require simple recall are, of course, not inquiry. But good test questions, those that make students ponder, doubt, and even sometimes wince, do indeed promote inquiry. Good test questions are, in essence, puzzles that students are trying to solve – and when students are in the process of figuring-out the answers, they are experiencing inquiry. (The key is that deriving an answer requires more than simple recall or inducing a simple set of procedures.) And lucky for us instructors, there is also a motivational component for the students who are taking exams due to the enculturated drive for good grades. And student preparation, studying, does indeed help. Studying promotes more robust prior knowledge – which gives the student more cognitive tools to help solve the puzzle, (i.e., answer the test question correctly).

Developing strong inquiry-based exam questions may be relatively easy, but good science teachers want classrooms and labs where inquiry is a regular event. We would like our students to be thinking every day, every hour – trying to see, define, and solve the myriad of puzzles found in nature. There are thousands of curriculum products available that claim to promote inquiry – but finding and implementing the right ones is not easy.

THE QUEST FOR AN INQUIRY LAB

Part 1: Learning from Failure

Our anatomy and physiology lab was structured like most in the 1990s, with a focus on tissue identification, anatomy of bones and muscles, dissection of the fetal pig, etc. My goal back then, as it remains today, was to incorporate more inquiry and reduce rote memorization.

One of the first attempts I made was to incorporate the “The Elvis Lab” (Powell 2012). The Elvis Lab starts with students reading a letter from Elvis Presley (or maybe an impersonator) who encourages students to conduct some simple experiments to learn about blood and vessel physiology, and ultimately about his death. During the HAPS workshop members were able to engage in designing a couple of experiments that enabled us to begin understanding fluid dynamics and, ultimately, the relationships identified in Poiseuille’s Law. Great stuff! We were puzzle-solving – we were experiencing inquiry. The Elvis Lab looked like a great way to promote inquiry with our students.

Back in Minnesota we coached our Teaching Assistants in the goals of the lab: we would like students to understand the relationship between fluid (blood) viscosity, vessel diameter, and vessel length. We did not want the TAs to “give the answers,” but rather we hoped students would figure it out for themselves – to solve the puzzle on their own. We told the students that this lab was going to be different, it was going to be more like “real science” in that they would have to design and implement procedures, collect data, and then make conclusions based on patterns in their data. Students were then given the letter from Elvis and shown the wide array of equipment and told: “Go to work! Your lab reports are due in two weeks.”

It was a total failure.

“What do you want us to do first?” “I’m confused.” “I’m lost.” “I hate this class!” “Aren’t you going to give us more directions?” “I can’t believe I’m paying money for this class!”

After two weeks students did turn in their lab reports and most were awful. One, however, was spectacular. It started with an overview of Poiseuille’s Law, which

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was never mentioned in the students' lab materials, and was followed by some very nice procedures, data, and a spot-on conclusion. “This was easy,” the student said – “I had all this earlier this semester in my fluid mechanics class over in engineering.”

For all but one student in the class, the Elvis Lab had indeed been an adventure in inquiry, but they could not come close to solving the puzzle – most could not even comprehend the nature of the puzzle. “What are we supposed to do?” But for the engineering student, as soon as he figured out that the lab involved Poiseuille’s Law, which probably did indeed require a bit of inquiry, the rest of the lab was simply carrying out a set of steps – little if any inquiry required.

The experience was agonizing for most students because they were indeed motivated to turn in a good lab report but did not have a realistic chance of deducing Poiseuille’s Law. Most did not have a clue about the relationships between vessel length, fluid viscosity, and vessel diameter, and the effect of these factors on the work requirements of the heart. It was too big of a challenge – the puzzle was too complex.

For our freshman students, the Elvis Lab was an open inquiry event. Open inquiry gives students vast amounts of freedom to set up apparatus, design procedures, collect data, and hopefully solve problems. For mature and knowledgeable students, open inquiry is wonderful – graduate students working on Masters or Doctorate projects, for example. They can use the freedom to find new knowledge. For many students, however, vast amounts of freedom and lack of structure lead to frustration, disengagement, and sometimes anger. “I don’t care about that class. I don’t have a clue what they want me to know.”

A step back from open inquiry is guided inquiry. It still involves students solving puzzles, but provides more guidance from the instructor. There is more student support in the quest to comprehend the procedures to be used and types of data to be collected and analyzed. For example, in the Elvis Lab we could have provided more guidance in our directions and use of apparatus. And instead of having students design their own experiments, we could have shown example lab setups to use when deducing the effects of fluid viscosity, vessel length, and vessel diameter. The idea is to show them a few things to get them on their way – but not too much.

This is where the art of teaching comes in – where an instructor must have a good grasp of students’ prior knowledge and motivation. If the lab is full of engineering students who have already learned about Poiseuille’s Law, then of course more freedom and higher expectations are in order. But if the room is full of freshman who are new to science and new to inquiry, more guidance is needed.

Part 2: Dialing-In the Proper Level of Inquiry

Dan Lemons and Joe Griswold have developed a set of physiology labs that have been demonstrated at several HAPS conferences. “The Heart as a Pump” was one that immediately caught my attention (Lemons 2012). Students use a strange looking piece of lab equipment to learn, for example, about the relationships between heart rate, stroke volume, and cardiac output. Along with the apparatus comes a set of procedures to follow that does not give away answers, but guides students to deduce relationships. We adopted the lab for our program, but it did not work perfectly the first time. We had to modify the instructions a bit to fit the prior knowledge of our students. In fact, we had to tweak it three or four times before we were satisfied with the amount of inquiry the lab produced. In most situations, newly adopted labs or any other learning activities need to be modified to fit the prior knowledge, and motivation, of your particular students. There are, indeed, differences in student populations that need to be accommodated. Good instructors recognize good activities and can quickly see how they can fit into course goals and even see how they must be modified to accommodate their students. And they can also determine the appropriate amount of inquiry their students can handle, how complex a puzzle to solve. This, again, is part of the art of teaching.

Open and guided inquiry approaches are two points on a spectrum of both freedom and complexity. Open inquiry offers little support or direction for students. “Go forth and deduce new scientific knowledge – and turn in a lab report next week.” Freedom like that is indeed found in some programs, but it usually involves advanced students who are working for weeks on the same project, and often involves reporting results in a poster or even a published paper. Open inquiry is not realistic for most entry-level students – and this is where guided inquiry fits. Guided inquiry provides some structure, clues, and hints to help students on their way to a conclusion. But not too much guidance, because then inquiry is diminished to a point where students are no longer puzzle solving, but rather simply engaging in a task.

Complicated? No one ever said teaching was easy.
Guided Inquiry and the POGIL Project

In the summer of 2011 a group of 40 anatomy and physiology instructors met in Minneapolis to learn about POGIL (Process Oriented Guided Inquiry Learning) and begin initial development of learning modules for entry-level anatomy and physiology students. (See the reference below for more information on our initial meeting and more information on POGIL.) From the original meeting, eight instructors were identified to continue the curriculum development project through to completion. We are now about halfway through the development of between 10 to 20 guided inquiry activities. It is difficult work. We are trying to promote inquiry by posing divergent and convergent questions that push students to think and to solve a puzzle, without being so difficult so as to cause total confusion and frustration, but then not so easy so that students are merely performing simple tasks. The materials we create will not be useful in advanced courses – they’ll be too easy. And for some introductory courses, the materials will be too difficult. This is the nature of good curriculum – it must fit the objectives of the program and accommodate the prior knowledge of the students.

During the 2012 HAPS conference in Tulsa we will be presenting a workshop to better explain the background of POGIL; we will also present one or two of our draft activities for introductory anatomy and physiology (draft being a key word as we still have another year of development). The final products will be released at the HAPS 2013 conference in Las Vegas where all eight of the anatomy and physiology instructors involved in the project will be presenting workshops on their POGIL activities. This will be the first chance for HAPS member to see our entire set of materials and ask questions of the authors. Prior to the Las Vegas meeting, interested instructors are encouraged to attend a three-day POGIL workshop to learn the theoretical underpinnings of POGIL (e.g., cooperative learning theory, constructivism, etc.) and also learn a few instructional strategies to better implement POGIL lessons with students.

Our final POGIL materials will not magically transform a poor instructor into a good instructor, and they won’t immediately change a slacker kid into a future Nobel laureate. No curriculum materials can do that. And they probably will not be as engaging as the Rubik’s cube. But for HAPS members who are interested in trying something different, who are interested in pushing their students a bit out of their comfort zones and into the world of inquiry, our materials should provide a great starting point.

Literature Cited:


Websites for additional information:

HAPS POGIL Web Site: http://msjensen.cehd.umn.edu/POGIL/Brief_Intro.html
Main POGIL Web Site: http://pogil.org/

Three-Day Regional POGIL Workshops

2012 POGIL South Central Regional Workshop
Tue 07/10/12 12:00 PM – Thu 07/12/12 3:15 PM
Seattle, WA

2012 POGIL Southwest Regional Workshop
Tue 07/10/12 12:00 PM – Thu 07/12/12 3:15 PM
Salt Lake City, Utah

2012 POGIL Northeast Regional Workshop
Tue 07/10/12 12:00 PM – Thu 07/12/12 3:15 PM
Hamden, CT

2012 POGIL Great Lakes Regional Workshop
Mon 07/23/12 12:00 PM – Wed 07/25/12 3:15 PM
St. Paul, MN

2012 POGIL South Central Regional Workshop
Tue 07/10/12 12:00 PM – Thu 07/12/12 3:15 PM
Richardson, Texas
3 Days Public Workshop
EDU-Snippets – In the Beginning

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

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Happy Anniversary! With this EDU-Snippets column, HAPS is celebrating 10 years of EDU-Snippets! Yes, we are approaching 10 years of sharing “ways to help your students get it” in the HAPS-EDucator. Roberta Meehan and Richard Faircloth conceptualized EDU-Snippets and first issued the challenge to all of us back in the Fall of 2002, in their signature way.

“Welcome to YOUR world—the world of the classroom (or the laboratory) where pieces of educational pedagogy come together with scientific facts and phenomena to make a meaningful whole for the eager-to-learn students perched patiently in front of you! Is that introduction a bit pompous? How about this instead? EDU-Snippets—your eye on the NOW classroom? Oh dear! That is just a bit too hip!

Anyway, tah-dah! Introducing EDU-Snippets!! Yes, an exciting new column right here in the HAPS-EDucator! We (namely, Richard Faircloth and Roberta Meehan) have teamed up to challenge your instructional acumen! The plan is to include this feature in every issue of the HAPS-EDucator.”

And so they have. Richard and Roberta gathered and edited EDU-Snippets together until Richard’s retirement 3 years ago. Roberta continues to gather and edit the column. EDU-Snippets is one of the most widely read and valued parts of HAPS-ED because it is so relevant and accessible. Thanks to both Roberta and Richard for their vision and dedication.

So let’s take a trip down memory lane in this issue by featuring bits and pieces of columns from the past. Here are some of the themes and ideas we have presented over the years:

• Songs – numerous songs – designed to implant concepts in your students’ minds.
• Personal engagement demonstrations – such as the various nerve transmission time experiments
• Board demonstrations – such as those dealing with chance and membrane transport
• Analogies (fascinating analogies that just click!) – the theme on numerous occasions
• Pictures, pooled statistics, and instructor led demonstrations – all to help your students focus and conceptualize.

Everything has been included — everything with the idea of you helping your students “get it” when it comes to Anatomy and Physiology.

We have pulled three favorites and features from years gone by: excerpts from the EDU-Snippets column on analogies from Fall of 2003, a terrific rap by David Evans, and Roberta’s PHREDD…. Enjoy!

(Continued on next page)
 Mostly Analogous-Snippets
Originally published in the HAPS-EDucator in Fall 2003
By Roberta Meehan (then at Troy State University, Montgomery, AL) and Richard Faircloth (then at Anne Arundel Community College, Arnold, MD)

I. Introducing an A & P Lab is Like……..

We all know the anxiety we go through when we start an Anatomy & Physiology Lab class! After all, we never have a second chance to make a first impression! So, Wayne Weis (University of Arkansas Community College at Batesville) sent us some introductory ideas.

A. ….A Handshake
At the beginning of the first lab period, after introducing myself, I ask the students to shake hands and introduce themselves to their closest neighbor. Before they can disengage, however, I ask them to hold the handshake for a few moments longer and notice whether they are holding the hand directly across from their right hand or the one diagonally across. This exercise may create some self-consciousness and may even seem silly to students. But, it makes it easier for them to remember that diagrams, dissection specimens, and living patients appear to the observer to be reversed from left to right. Many students in this course are allied health or premedical majors. This simple idea cannot be reinforced enough to them. Perhaps the horror stories we have all heard of medical staff operating on, and possibly removing, organs on the wrong side of the body might be made less common by the use of simple exercises like this to remind students about this left/right reversal.

B. …..Latin and Greek
The first lab period usually covers anatomical terminology, body orientation, and perhaps an introduction to organ systems. In this same first lab, I introduce the use of Latin and Greek roots in medical and biological terminology. I hand out a list of root words, prefixes, and suffixes. Then I pass out a quiz based upon this list. Half of the questions are interpretation of anatomical and physiological terms based upon this list of roots. The second half of the quiz gives a definition, then asks the student to create a term based upon the prefixes and suffixes. This part of the quiz often surprises students. One term may sound logical, but another equally likely term is the preferred one. The explanation is that there are Latin and Greek roots in use that have the same meaning. Professionals in this field generally prefer one root. Two equivalent terms may have the same denotation, but different connotations. This exercise usually does not require much time and the quiz can be given quickly during the first lab period. The list of new terms introduced in this course is often overwhelming. Memorizing a few roots, then using them to guess the meaning of new terms is a more efficient way to learn than brute memorization alone.

II. Nervously So……..

The Nervous System lends itself nicely to a wide variety of analogies. Our list here is hardly complete; we will run more Nervous System analogies as they cross our EDU-Snippet desk.

A. ANS – The Dimmer Switch
For dealing with ANS control, Kelly Sexton stated simply, “I use a dimmer switch analogy.”

Dee U. Silverthorn (University of Texas) followed Kelly’s idea with …
I tell the students that sympathetic control of arterioles is like a radio that is kept on, where you can vary the volume up and down as desired. You can also turn it off if needed, but it stays on most of the time.

My students want everything to be off-on control, and I think the idea of tonic control is one of the toughest things for them to absorb conceptually.

B. Ken’s Complicated and Convoluted Compilation

Ken Saladin (Georgia College & State University) came up with several analogies for us. Sometimes analogies are more complicated and convoluted than the original phenomenon, and I am not sure I can offer anything that does not fit that description. But, when dealing with ANS innervations, perhaps ask the students to imagine (or buy a balloon and demonstrate) wrapping your hand around an elongated water balloon and applying just a little bit of a grip. Your fingers would be analogous to the vasomotor tone maintained by background sympathetic tone. Squeezing a little harder would be like increasing the sympathetic firing rate, and they can easily understand that the pressure inside the balloon would increase (analogous to blood pressure). Relaxing your grip a little would be like a “relaxation” of the sympathetic tone and reduce the water pressure/BP.

If you are in the lab, you might try connecting two rubber hoses to the legs of a Y-connector and attaching the stem through a hose to a water tap. Get just a moderate flow of water running. Slightly squeeze the hose on one leg of the Y and let the reduced water flow there, and increase water flow out the other branch, represent the redirection of blood flow that occurs through selective sympathetic vasoconstriction – e.g., a vasoconstriction in the mesenteric circulation to redirect blood flow to the leg muscles in a state of exercise.

C. Heart Brake – Vaguely So

Judith Gibber (Columbia University) explained her analogy.

How about biking? You are riding a bike at a certain baseline speed. Pedal faster or slower (more or less sympathetic) and the bike speeds up or slows down. Stop pedaling and it will eventually stop,
even without applying the brakes (parasympathetic). I like this analogy because it shows the awareness of a dual control system, but also shows that it is not the only way to function.

Judith then asked if taking your foot off the gas causes the car to slow down. So, **Harry McDonald** answered her:

It does indeed. The analogy I always used for heart rate control is driving in slow stop-and-start traffic. With a manual transmission the interplay is between one foot on the clutch pedal and the other on the brake. On some occasions with an automatic transmission, I have put my left foot on the brake (with my right foot on the accelerator as usual).

Along these same lines, **David Evans (Penn College)** sent us the following.

I use this analogy for the vagus brake on the heart: you can compare it to an automatic transmission-equipped car set on “Drive” and idling. The car will just keep going and going (viz: to the automaticity of cardiac muscle) but can be slowed by the brake (viz: vagus n.). This may sound a bit simplistic, but this is exactly what happens with the heart.

**D. Antagonistic Accelerators**

**Ken Saladin (Georgea College & State University)** sent a couple more analogies too – these related to the Cardiovascular System.

I have been telling my students that the heart is not really contained within the pericardial cavity, nor are the lungs really within the pleural cavities; the only significant contents of these cavities are thin films of pericardial and pleural fluid. The pericardium and pleura wrap around the viscera but do not contain them. By analogy picture the lung as a pillow, with the pillowcase (analogous to the pleura) wrapped around it rather than the pillow being inserted into it. The space between the two layers of the pillow case is analogous to the pleural cavity. The pillow is not within that space any more than the lung is within the pleural cavity, or the heart within the pericardial cavity.

And for demonstrating aortic blood surges, try this: Half-fill a graduated cylinder with water and tightly seal the opening with Paraflim®. Have a student hold out a palm. Invert the cylinder and quickly press the film-sealed end firmly against the palm. The student should feel a thud as the water surges against the hand. This is analogous to the brief reversal of blood flow in the aorta at the start of ventricular diastole, with the thud representing the moment the aortic valve closes, the aortic blood surges against the valve cusps, producing the second heart sound and the dicrotic notch in the aortic pressure curve. Maybe placing a stethoscope bell on the palm next to the cylinder would even enable one to hear a sound analogous to S2.

**B. Freeway Arteries**

**Murray Jensen (University of Minnesota)** tries to use analogies every day. Here is how he explains that blood vessels are like roads.

When you are driving, you may not have the option of getting out of the car. Let us look at different types of roads. There are freeways where you can drive very fast, and highways where you can drive fast, but not quite as fast as on a freeway – but you still cannot stop and get out of your car. And then as you drive into neighborhoods, you proceed much more slowly and you do have the option of getting out or perhaps picking someone up. There are many more miles of roads in the neighborhoods than there are miles of freeway. Freeways are very good for traveling great distances, but not too good for getting you into, or out of your car. But once you are in a neighborhood, you have slowed down and you can get in and out of your car quite easily.

This analogy works well for exchanges (capillaries/neighborhood roads) and for explaining where exchanges are not possible (freeways and highways/great vessels). It also deals well with the total distance of the great vessels vs. the capillaries. The total mileage of the neighborhood roads is so much greater than the total mileage of the freeway system. The analogy is not perfect. For instance, what about stoplights? What about traffic cops? What about road construction? What about changing weather conditions? However, at its basic level, this analogy works well for my students.

**IV. Very Odd Analogical Ends**

**A. Serious Membrane (Transport)**

**Elizabeth Becker (Elgin Community College)** came up with a great analogy for dealing with membrane transport, an analogy that we think not only students but also faculty can easily relate to.
I begin by stating the concept – that the rate of transport across a cell membrane for a substance using either channel or carrier proteins is directly related to the number of channels or carriers available for that substance. And then I state the analogy: Checkout lines at the store! We have all experienced it! I remind them that when shopping at their favorite store, eventually they have to ring up their purchases before they can leave. To do this they have to go through the checkout lines. Often several people will want to go through checkout at the same time. I ask my students what will happen if only one or two lines are available. They easily come up with “then everyone has to wait their turn to go through the checkout.” The students all agree that it takes a great deal of time for everyone to move through the lines with a limited number of lanes open. We then relate this to cell membrane channels and carriers. If there are few channels/carriers then ions, nutrients, etc., must go through single file and the rate of their passage through the cell’s membrane is slow. Then I ask them what will happen if several additional checkout lanes become available. “Does everyone still remain in their long lines?” “NO.” “What do they do?” “Spread out and go through the different lanes” is the typical response. “What affect will that have on how long it takes everyone to check out?” “Much faster, less time.” Then I ask, “If a cell membrane has many copies of a particular type of channel or carrier, what will happen to movement of the substance that uses that carrier?” Usually the majority of the class will respond that the substance will be able to move through the membrane much faster if there are more channels or carriers for that substance. They can visualize the checkout lanes, relate them to membrane passageways, and see how changing the number of those carriers or channels will influence passage of substances through the membrane.

We also talk about specific channels and I make an analogy to specific checkout lanes for different products. Again they get the idea very quickly.

B. Categorically So….

Robert Rawding (Gannon University) uses mnemonic analogies.

Here is one I use for students to learn the kinds/categories of sensors throughout the body.

CEMeNT

Chemical: taste, smell, pH, O2, CO2, osmolarity, etc.

Electromagnetic: vision (some argue that this would possibly also include electromagnetic fields, e.g. magnetite in the brain)

Mechanical: audition, vestibular system (static and dynamic) joint receptors, Golgi tendon organs, muscle stretch receptors, touch receptors

Nociception: pain

Thermal: hot, cold

C. Love on a Filament

Murray Jensen (University of Minnesota) uses an analogy to present the sliding filament theory.

Troponin and tropomyosin surround actin and prevent the interaction between myosin and actin. But when troponin and tropomyosin interact with calcium, myosin cross-bridges are formed with actin and contraction occurs. The analogy I use here is a modification of the Romeo and Juliet story. Juliet really wants to go out with Romeo, and Romeo really wants to go out with Juliet, but Juliet’s parents will not permit it. The parents surround her and tell Romeo, “No way are you interacting with our daughter.” Romeo stands waiting, but knows as long as the parents are there that he cannot get to Juliet. Bowling night (you can think of something better, but I like bowling night) comes along (think calcium) and Juliet’s parents leave for a while – and when the parents leave...well....

Romeo and Juliet get together and, well, contact!? Bowling night ends and Juliet’s parents come back home and kick Romeo out of the house and they go back to protecting their daughter and preventing those two crazy kids (actin and myosin) from getting together.

This one usually causes several groans and some laughter, but it works pretty well.

Musical Snippets

As mentioned above, we have had many Snippets that can easily be set to song. David Evans (one of our most faithful and prolific EDU-Snippets contributors) (Penn College, devans@pct.edu) had this one published a number of years ago. He asked that it be re-published for this anniversary column. This is very typical of what you, as educators, can do to help your students “get it.” For this one, use any music you would like – or make up your own ditty – or ask a musically inclined student to come up with a simple melody. And, obviously, you can modify this for any system in the body! The students will not forget it!

NEPHRON HIP HOP by David Evans and students, who hope nobody revokes their poetic license

Here comes inulin
An unwanted guest
In the kidney residence
Chorus: An unwanted guest in the kidney residence
Out through the fenestrae!
Can’t come here say the PCT
Not here from the loop of Henle
No home in the DCT
Collecting ducts yell:
Go to pee!
Chorus: An unwanted guest in the kidney residence

Clearly, this is deathless verse!
Roberta Meehan routinely uses “Phredd” to pull together all that the student has learned in anatomy and physiology course. She suggests that you modify it to meet your needs.

Phredd’s Problems

Work through this problem and try to come to a conceptual understanding of what homeostasis is all about. Also take a serious look at how all the systems and sub-systems of the body work together and compensate for one another.

Phredd lives in some beautiful coastal town somewhere in the USA or Canada. He has not been out of his sea level area in more than a year. Well, Phredd is in his mid-40’s and when he was in college he liked to hike. Although he is not particularly out of shape, he hasn’t been on a trail in ages. Phredd has some time off so he decides to go hiking in the Rockies. Actually, he plans on climbing Mt. Evans, Colorado – elevation 14,265 ft (4,348 m).

Phredd flies out to Denver. He picks up his rental car and heads for Mt. Evans, stopping first to buy a 12-pack of beer, several bags of pretzels and chips, and a half dozen ham and cheese sandwiches.

Phredd stops at a rest area and, despite the laws and warning signs to the contrary, he drinks two beers. He also eats some chips and one of the sandwiches. He puts the rest of the food and drink in his backpack.

At the base of Mt. Evans, Phredd parks the car in the lot reserved for hikers, drinks a couple of more beers, eats a few more “things” from his cache, and sets out for his trapse up the mountain.

Phredd stops several times along the way to drink some more beer and eat some more from his goodies’ bag.

By some gift of fate, Phredd does reach the top of Mt. Evans. His beer and snacks have all been consumed. He collapses and, fortunately, a ranger is there and the ranger promptly calls for an airlift.

OK – Here is a summation and a series of questions. Some of these questions may be answered together – instead of separately.

The major problems Phredd has faced are: oxygen deprivation, vascular insufficiency, sodium/potassium imbalance (which can have an effect on which systems??), renal difficulties, neuromuscular difficulties, endocrine difficulties, integumentary problems, and dehydration.

Go back to your FIRST SEMESTER of A & P and think about Phredd’s basic chemistry and basic biochemistry, his cellular response, his tissue response, his skeletal response, his muscular response, and his nervous system response.

After that, start thinking about Phredd’s problems in connection with the systems covered in SECOND SEMESTER A&P. You are, however, welcome to look ahead and integrate these problems at any time because something might stand out as important to you in your discussion of Phredd’s difficulties.

These are all critical questions.
1. What OTHER problems or systemic problems do you see?
2. Aside from Phredd’s utter stupidity, what is the cause of each of these problems?
3. Look at each of the systems of Phredd’s body and explain what is happening? Why???
4. How is Phredd’s body trying to compensate for each deficiency?
5. What, in particular, are aldosterone and ADH doing?
6. What about the hydrogen/bicarbonate action – renal and respiratory?
7. Assume Phredd is not dead by the time the evacuation unit gets there. What are the paramedics going to do? Why?
8. Phredd does not need a lecture on being an idiot. He’s figured that part out. How would you educate him on getting ready for his next hike up Mt. Evans?

The Beat Goes ON!

Oh, and don’t forget to keep those cards and letters coming! Your EDU-Snippet ideas are what fuel this column. Thank you for a good 10 years. Now, let’s head for 20!

The HAPS 26th Annual Conference will be a GUSHER of information you won’t want to miss!
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