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COVER ART - Original Drawing by Scott Rawlins
Scott Rawlins graduated from Earlham College with a degree in biology, and holds graduate degrees in museum education and medical & biological illustration from the George Washington University and the University of Michigan respectively. For many years Scott was a museum curator, working in this capacity at the Children’s Museum of Indianapolis, the Calvert Marine Museum and the Public Museum of Grand Rapids, MI. Since 1994 Scott has been a member of the art faculty at Arcadia University where he holds the position of Professor and teaches scientific illustration and design. He regularly exhibits his artwork nationally and has served on the boards of the American Society of Botanical Artists and the Guild of Natural Science Illustrators. He will assume the role of president of the Guild in July. His illustrations have appeared in the Society of Vertebrate Zoology, the Bulletin of the Museum of Comparative Zoology, Invertebrate Biology and Acta Zoologica, among others. Scott is presently acting as a research assistant in the paleontology department at the Academy of Natural Sciences in Philadelphia.
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The HAPS-EDucator is the official publication of the Human Anatomy and Physiology Society. As such, the HAPS-EDucator aims to foster the advancement of anatomy and physiology education by facilitating the collaboration of HAPS members through the publication of a bimonthly journal. Journal articles may include, but are not limited to, those that discuss innovative teaching techniques (e.g., the use of technology in classrooms or active learning practices), original lesson plans or lab exercises, reviews of trending topics in anatomy and physiology, and summaries of newsworthy events (e.g., seminars or conferences that not all society members can attend). Additionally, an extra issue of HAPS-EDucator will be published after the Annual Conference, highlighting the update speakers, workshops, and poster presentations. All submitted articles will undergo a peer-review for educational scholarship. Articles not immediately accepted will be returned to authors with feedback and the opportunity to resubmit.

Submission Guidelines for Authors
The complete “Author Submission Packet” is available HERE.

Terms of submission
The HAPS-EDucator publishes manuscripts consisting of original material that is not currently being considered for publication by another journal, website, or book and has not previously been published. Publication of the manuscript must be approved by all of the authors and have the approval of the appropriate institution(s). Manuscripts are to be submitted electronically to both editors: Sarah Cooper and Jennelle Malcos at haps-ed@hapsconnect.org. Materials for Snippets should be submitted directly to Roberta Meehan at Edu-Snippets@hapsconnect.org.

Formatting
Manuscripts are to be submitted in rich text format (rtf.) or .docx, in Arial (10) font with 1” margins on all sides. Accompanying the text, authors should submit an Author Submission Form consisting of a title page that lists the full name, associated institution and address, and email address of each author. A short Abstract of 150 to 200 words that explains the primary thesis of the submission should be included. Photos and illustrations should not be included in the body of the manuscript but they should be submitted, clearly labeled, with the manuscript. They should be submitted in JPEG form or in some other appropriate and usable form.

References
It is the responsibility of the author to make sure that the information on each reference is complete, accurate, and properly formatted. References should be included in the body of the manuscript where appropriate using the following format: Author’s last name and date of publication, (Martini 2011). A list of “Literature Cited” should appear at the end of the paper alphabetically by author’s last name. Example references are available in the complete “Author Submission Packet”.

Submissions are accepted at all times and should be sent to haps-ed@hapsconnect.org.

Deadlines for specific issues are:
- March 15 for the Spring Issue
- July 15 for the Conference Issue
- November 15 for the Winter Issue

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Research that includes dissection and manipulation of animal tissues and organs must adhere to the Human Anatomy and Physiology Society (HAPS) Position Statement on Animal Use (Adopted July 28, 1995, modified January 2001, Approved April 29, 2012), which states that the use of biological specimens must be in strict compliance with federal legislation and the guidelines of the National Institutes of Health and the United States Department of Agriculture. The use of humans or animals in research must fulfill clearly defined educational objectives.

Experimental animals must be handled in accordance with the author’s institutional guidelines and informed consent must be obtained for studies on humans. It is the responsibility of the author(s) to secure IRB approval for research on humans.

How your submission will be handled
The editors will assign the manuscript to a minimum of 2 and a maximum of 4 members of the HAPS-EDucator editorial board for Educational Scholarship review. The reviewers will evaluate the manuscript for scientific accuracy, appropriateness to the audience, readability and grammar. The reviewers will submit their reports along with a recommendation that the manuscript be (a) published unaltered, (b) published with minor changes, (c) published with major changes or (d) not published at all. The editors will then decide what action will be taken with the manuscript and the author will be notified to prepare and submit a final copy of the manuscript with the changes suggested by the reviewers and agreed upon by the editors. Once the editors are satisfied with the final manuscript, the manuscript can be accepted for publication.

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A ‘strategic plan’ is not just a buzz phrase. Rather, strategic planning helps a growing organization clarify its mission, determine the organization’s place in an evolving society, and help focus the energies of the organization into specific, articulated goals and outcomes. These goals and outcomes may be mapped over the course of five years and reassessed at that time.

About five years ago, a form of a HAPS Strategic Plan was developed, but most members were not aware of its existence and it had since become outdated. The leadership recognized a need to develop a new plan – and this time the new plan would have input of as many members as possible. Thus, one of my charges as President of HAPS (and now as Past President) was to oversee the development of a HAPS Strategic Plan. This article describes the process of developing our recently ratified 2014-2019 Strategic Plan, and summarizes the key aspects of the document.

History and Timeline of the HAPS Strategic Plan Development

The decision to develop a new HAPS Strategic Plan was made in May 2013, at the Board of Directors (BOD) and Steering Committee (SC) meetings. Over that summer, individuals collected examples of other organizational strategic plans, so we would have examples of varying formats and foci that have been used. In October 2013, at the HAPS mid-year meeting, the BOD and SC discussed a plan for development and implementation. The BOD would take the lead, but both leadership groups would provide input at each stage. The leadership also ensured that the membership would have a chance to review and comment on a draft of the Strategic Plan at the 2014 annual meeting.
Our timeline for developing the plan is listed below:

<table>
<thead>
<tr>
<th>Time Frame</th>
<th>Strategic Plan process</th>
<th>How performed</th>
</tr>
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<tbody>
<tr>
<td>Early spring 2014</td>
<td>BOD reviews other organizations’ strategic plans, votes on the basic structure and format of the HAPS Strategic plan (e.g., should it be longer or shorter? Have visuals only or explanatory text?)</td>
<td>Via shared google docs and an e-vote</td>
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| January–early Spring 2014  | * BOD collectively works on a SWOT analysis (a listing of HAPS’ Strengths, Weaknesses, Opportunities, and Threats)  
* After collective BOD discussion, Steering Committee members add to the SWOT analysis – further | Via shared google docs and discussed during monthly BOD e-meetings and conference call |
| Spring 2014                | * BOD reviews SWOT document and teases out common themes to be viewed as a starting point for the strategic plan  
* SC reviews common themes and submits comments/suggestions to BOD | Via shared google docs and discussed during monthly BOD e-meetings and conference call |
| May 2014 (Friday prior to annual conference) | * BOD arrives to Annual Conference location an extra day early to initiate Strategic Plan Development.  
* President oversees discussion, splits individuals into groups, Secretary takes notes.  
* Draft of Strategic plan Developed by BOD | Face-to-face all-day meeting |
| May 2014 (Saturday of Annual Conference) | AM: BOD meetings to review draft of Strategic plan, make further edits if needed  
PM: BOD and SC gather for joint meeting. BOD presents draft of Strategic Plan to SC, and SC provides further input. Draft of plan further revised as needed | Face-to-face meeting |
| May 2014 (Sunday of Annual Conference) | Hour long ‘town hall’ held by President of HAPS. Draft of Strategic plan presented to membership. Input encouraged in the form of roundtable discussion, listing comments on paper provided. | Face-to-face meeting in the main presentation room at the hotel. |
| May 2014 (remainder of annual conference) | Secretary collects member input and types up responses for review by BOD. BOD meets an additional time to discuss input from membership | Face-to-face meeting with BOD |
| Summer 2014                | President (and now past-president) incorporates member input into Strategic Plan, prepares measurable Action items for each short-term objective. | Via Google-docs |
| Late Summer 2014           | BOD reviews Strategic Plan (with action items), adds further actions items, discusses evolving document | Via shared google docs and discussed during monthly BOD e-meetings and conference call |
| Late Summer/early September 2014: | SC reviews Strategic Plan and makes additional suggestions | Via shared google docs |
| September 2014             | At BOD e-meeting and conference call, BOD approves revised 2014-2019 HAPS Strategic Plan | BOD e-meeting and conference call |

The time frame listed above will serve a reference for future HAPS Strategic Plan revisions.
Organization and Terminology of the Strategic Plan

The plan is organized in both a concise visual format and in a more detailed written document. The leadership recognized early on that precise vocabulary was needed for the plan. Key definitions used in the plan are listed below:

**Overarching Goal:** Underlying theme for the 2014-2019 Strategic Plan. This theme may change with future strategic plans, as the focus of the organization evolves. The overarching goal is subdivided into **Strategic Initiatives**.

**Strategic Initiative:** Discrete components within the overall goal, each addressing the unified vision and overarching goal for HAPS.

**Outcome:** intended five-year end-product, that will be achieved through the implementation of multiple short-term objectives and action items. Outcomes are focused subdivisions of each initiative.

**Short-term objective:** tangible, measurable target that is completed in one to two years through the implementation of specific action items.

**Action item:** specific activity with explicit directions (that lists individuals and committees responsible for said items) that will achieve the short-term objectives.

Summary of the 2014-2019 HAPS Strategic Plan

The 2014-2019 HAPS Strategic Plan is summarized in the attached image. The **Overarching Goal of the HAPS Strategic plan** is as follows: Become the premiere organization for evaluation and credentialing of Anatomy and Physiology faculty and programs, and be a resource for A&P professional development.

(see graphic below)

The complete Strategic Plan (including all action items) may be found on the HAPS website at: [this link](#) (You must be logged in as a member to access the full Strategic Plan.)

**How YOU can help support HAPS’ Strategic Plan and Mission**

In order for HAPS to achieve these outcomes and strategic initiatives, we need the help from as many of our members as possible. Please consider joining a committee and helping that Committee tackle its action items. Tell your colleagues about HAPS and encourage them to become members. Consider hosting a regional or annual HAPS conference, so your colleagues and other individuals can learn more about our organization and how it can benefit them. HAPS needs YOUR help to succeed!

Many thanks go to the BOD, SC and the members who participated in our 2014 town hall meeting. Thank you for your efforts!

---

### Strategic Initiative 1: Cultivate a Thriving Membership

<table>
<thead>
<tr>
<th>Outcome A</th>
<th>Outcome B</th>
<th>Outcome C</th>
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<tbody>
<tr>
<td>RECRUIT NEW MEMBERS</td>
<td>RETAIN EXISTING MEMBERS</td>
<td>INCREASE ACTIVE PARTICIPATION OF MEMBERSHIP</td>
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### Strategic Initiative 2: Improve and Ensure the Financial Solvency of HAPS

<table>
<thead>
<tr>
<th>Outcome #A</th>
<th>Outcome #B</th>
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<tr>
<td>DIVERSIFY INCOME SOURCES</td>
<td>GROW A SELF-SUSTAINABLE HAPS FOUNDATION</td>
</tr>
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### Strategic Initiative 3: Expand Programs and Special Projects

<table>
<thead>
<tr>
<th>Outcome #A</th>
<th>Outcome #B</th>
<th>Outcome #C</th>
<th>Outcome #D</th>
</tr>
</thead>
<tbody>
<tr>
<td>IMPROVE PLANNING FOR FUTURE HAPS CONFERENCES</td>
<td>GROW A SELF-SUSTAINABLE HAPS INSTITUTE</td>
<td>FURTHER DEVELOP AND DISSEMINATE THE HAPS EXAM</td>
<td>FORMALIZE CREDENTIALING EFFORTS</td>
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Restless Legs Syndrome: An Update on the Genetics, Iron Storage Dysfunction and Dopaminergic Mechanisms in RLS

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ABSTRACT: Restless legs syndrome (RLS) is a neurological disorder characterized by an irresistible urge to move the limbs, especially the legs. Diagnosis of RLS is primarily based on clinical symptoms and family history. Though the mechanism of the disorder is unknown, there is likely a genetic component, a dysfunction in iron storage in the central nervous system, and a dysfunction in the dopaminergic synthesis and transport systems. RLS is also linked to conditions that may cause iron deficiencies such as pregnancy, anemia and renal failure. Favored treatment options for RLS are dopamine agonists, which have been successful in alleviating symptoms.

Restless legs syndrome (RLS), also known as Willis-Ekbom Disease, was first noted and described as a sensory-motor condition in the 17th century. In his assessment of the symptoms at that time, Thomas Willis, a British physician and anatomist, stated that sufferers of this condition “…. are no more able to sleep than if they were in a place of the greatest Torture.” He prescribed opioids for treatment. Karl-Axel Ekbom further characterized the condition in 1945 and fifty years later the International RLS Study Group (IRLSSG) published the generally accepted criteria for accurate diagnosis of the condition. Restless legs syndrome is distinguished by an overpowering urge to move the legs that is associated with unpleasant sensations that are usually described as originating deep within the legs. These unpleasant sensations occur most frequently during periods of inactivity or rest and are likely to be relieved by leg movement. Unfortunately, the symptoms are typically worse during the nighttime or evening hours, with peak activity taking place just after midnight; consequently, the inability to sleep is a common complaint of sufferers. It has been estimated that the average RLS sufferer sleeps an average of just five hours per day. Therefore, it is not unusual for individuals with RLS to report experiencing daytime drowsiness, depression and difficulty maintaining concentration.

As the syndrome progresses and the unpleasant sensations increase in severity, other areas of the body, such as the arms, may be affected (Ekbom and Ulfberg 2009, Nagandia and De 2013, Ryan and Slevin 2006, Sethi and Mehta 2012). Analysis of electroencephalogram evidence has demonstrated that the slowing of cerebral cortex activity has a high correlation with the motor manifestations of restless legs syndrome. Patients often report that efforts to remain alert, such as engaging in interactive activities like conversation, game playing or exercise, may help to relieve the symptoms. Unfortunately, interactive activity is most likely to alleviate RLS symptoms only in the early stages of the condition. Patients who have experienced the symptoms over many years often report that as time goes on, it takes increasingly more physical activity to alleviate fewer of the troublesome symptoms (Ryan and Slevin 2006).

Restless legs syndrome is quite common, affecting about 5% to 10% of European and US adults (Sethi and Mehta 2012). It is described as primary RLS when it is idiopathic and secondary when it arises in conjunction with conditions such as pregnancy, anemia and renal failure that may result in iron deficiency. Symptoms of RLS are seen in up to 19% of woman during pregnancy. These symptoms typically fade...
after the birth of the baby. Symptoms of RLS are reported in 50% of patients with end stage renal disease. These symptoms improve markedly following kidney transplantation. Secondary RLS is sometimes referred to as a sporadic or symptomatic form of the condition. A positive family history for RLS is reported by about 60% of patients with primary RLS. Studies of monozygotic twins in which at least one twin reported experiencing RLS suggest that the condition has high concordance and high penetrance. In families that report an early onset of symptoms, prior to age 30, there is strong evidence for autosomal dominant inheritance that is governed by a single gene. In other circumstances, the genetic component appears to be more complex and remains poorly understood (Patrick 2007, Ryan and Slevin 2006).

Genetic Component
The genetic component of restless legs syndrome is currently demonstrated in at least eight loci. Studies of the molecular genetics of families in Canada, the United States and Germany have established three of the major susceptibility loci. A locus on chromosome 12 (12q13-23) (RLS-1) was first identified in a French-Canadian family. This locus is associated with several adjacent microsatellite markers and is consistent with an autosomal recessive inheritance mode. The gene for neurtensin, which modulates the neurotransmission of dopamine, is also found in the 12q13-23 region but neurtensin is not believed to be associated with RLS. The locus at 12q13-23 (RLS-1) has been confirmed in five other families who reside in Canada but is not present in two RLS families who live in northern Italy. A second locus, 14q13-21 (RLS-2) is seen in a three-generation, 30-member family who reside in northern Italy. This locus fits an autosomal dominant inheritance pattern. Susceptibility to RLS with the assumption of autosomal dominant inheritance has also been associated with chromosome 9 (9p24-22) (RLS-3). This locus has been confirmed in two large families who reside in the United States. In addition to these three loci, research interest extends to include 2q33, 20p13, 6p21, 2p14 and 15q23. As is frequently the case with complex diseases processes, RLS may ultimately prove to be a polygenic condition that includes not only extensive gene interactions but also genes that are influenced by environmental factors (Ryan and Mehta 2005, Ryan and Slevin 2006).

Iron Storage Dysfunction
A decrease in the storage of iron and iron deficiency are seen in 75% of RLS patients. In primary RLS, for reasons that are not understood, it may even be possible for CNS iron storage to be inadequate while concentrations of systemic iron remain at normal levels. The iron deficiency connection has been known for fifty years but it is only in recent years that research has targeted this area for intensive study. Serum iron in the form of ferritin, like RLS, has a circadian variation pattern in the blood stream. Serum iron levels can drop by as much as 30-50% at night. This may be accompanied by a 68% decrease in ferritin levels in cerebrospinal fluid while the amount of CSF transferrin may increase by as much as three times the normal amount. Increased transferrin levels in CSF are indicative of low levels of iron in the brain. MRI investigations of the brain of RLS patients demonstrate decreased iron levels in the substantia nigra and the putamen, which vary in proportion to the severity of symptoms experienced by the RLS patient, with the lowest levels seen in patients with the most severe symptoms (Ryan and Slevin 2006, Sethi and Mehta 2012).

Periodic Limb Movements of Sleep and Pathophysiology
Periodic limb movements of sleep (PLMS) were documented in patients with RLS in 1965. These movements include rhythmic extension of the big toe and repetitive dorsiflexion of the ankle, which are sometimes accompanied by repetitive flexion of the knee and hip. These movements have considerable variations and to be indicative of RLS, they must be evidenced every 20-40 seconds as recorded in a sleep laboratory. Periodic limb movements of sleep, however, are not unique to restless legs syndrome. This type of movement is frequently reported in other sleep disorders such as narcolepsy and sleep apnea (Allen et al. 2005, Ryan and Slevin 2006).

The pathophysiology of primary RLS remains unknown. However, since the symptoms of primary RLS are frequently seen along with PLMS disorder and the two conditions respond to the same medications, it is likely that the two conditions share pathophysiology to some degree. It was demonstrated in 1997 that PLMS and spinal flexor reflexes share common pathways in the spinal cord. It has also been demonstrated that patients with RLS have increased spinal cord excitability. RLS patients exhibit a lower threshold for evoked spinal flexor reflexes accompanied by a greater spatial spread associated with the reflex (Ryan and Slevin 2006). Both the lower threshold and the greater spatial spread are more prominent when the flexor reflex is elicited during sleep. These data suggest that the final common pathway for both PLMS and RLS is enhanced excitability of the spinal cord. In light of this, Ryan and Slevin (2006) find it noteworthy that RLS has been reported in other spinal cord disorders such as chronic myelopathy, lumbosacral radiculopathy and peripheral neuropathy (Allen and Earley 2001, Ryan and Slevin 2006).
**Dopaminergic Mechanisms**

Dopaminergic mechanisms are involved in the control of spinal flexor reflexes. Relief from some of the symptoms of RLS and PLMS is reported with the use of dopamine agonists. This has lead to the hypothesis that dopamine is centrally implicated in RLS and PLMS pathophysiology. To date, the results of dopamine imaging studies have been mixed. Three dopamine agonist studies have demonstrated increased synaptic activity at the dopamine type 2-receptor D2 and at the site of dopamine transporters while two contemporaneous studies have shown no differences compared to the control group (Ryan and Slevin 2006). In spite of inconclusive study results, patients report a positive therapeutic effect from dopamine agonists and an increase in the symptoms of RLS and periodic leg movements in response to dopamine antagonists. It has also been observed that the specific proteins involved in the transmission of dopamine exhibit circadian rhythms in the same way that the symptoms of RLS do. This connection may ultimately provide the explanation for the circadian nature of RLS symptoms. A potential shared pathophysiology between RLS and Parkinson’s disease is suggested by similarities in treatment response reported by the respective groups of patients who are taking dopamine agonists (Allen and Earley 2001, Ryan and Slevin 2006).

The similarities in the circadian rhythms exhibited by serum iron levels, the proteins involved in dopamine transmission, and RLS symptoms, all point to a connection among these factors. Furthermore, iron serves as a cofactor for tyrosine hydroxylase, which is a rate-limiting enzyme in the synthesis of dopamine. It may be that a decrease in serum iron levels is responsible for a decrease in the synthesis of dopamine, which ultimately limits the overall availability of dopamine in the brain. Further complicating the picture is the fact that decreases in D1 and D2 dopamine receptors and a decrease in dopamine transporter function have also been demonstrated in studies using iron-deficient animals. If there is a dopamine-iron connection in the pathophysiology of RLS, it is likely to be a complex one and further elucidation will be necessary (Nagandia and De 2013, Patrick 2007, Ryan and Slevin 2006).

There are several illnesses that may be confused with restless legs syndrome including akathisia and nocturnal recumbancy leg cramps. Recumbancy leg cramps are painful, involuntary contractions of the leg muscles that have a sudden onset and are often focal and unilateral. Akathisia describes a sense of restlessness and a need to move that is associated with taking neuroleptic drugs. Akathisia, however, is not associated with rest or sleeping and it does not become worse at night (Ryan and Slevin 2006).

Several medications are reported to make the symptoms of RLS worse. These medications include the selective serotonin reuptake inhibitor (SSRI) fluoxetine and, by association, all other SSRI’s, caffeine, and lithium. The SSRI’s as a group are believed to inhibit dopaminergic neurons as they enhance serotonin transmission. Studies in animals indicate that long-term lithium treatment decreases the release of dopamine from presynaptic neurons and reduces the number of postsynaptic D2 receptors. Both of these outcomes would be expected to increase the severity of RLS symptoms (Dauvilliers and Winkelmann 2013, Ryan and Slevin 2006).

Peripheral neuropathies of small unmyelinated fibers, such as those associated with diabetes, may be confused with RLS. Peripheral neuropathies, however, are characteristically described by patients using words such as “pain, tingling, and numbness”; terms that are not associated with patient descriptions of RLS symptoms. Additionally, peripheral neuropathies are neither decreased with movement nor confined to nighttime hours. Vascular diseases, such as deep venous thrombosis, need to be ruled out prior to diagnosis of restless legs syndrome (Ryan and Slevin 2006).

**Pharmacologic and non-pharmacologic therapies**

Anecdotal reports indicate that there are a few non-pharmacologic therapies that may be helpful in decreasing the severity of RLS symptoms and the number of sleepless nights associated with the condition. Going to bed at the same time each night and getting up at the same time each morning helps some patients control the severity of their symptoms. Other patients report that it is helpful to avoid caffeine, alcohol and nicotine. Additional patient-suggested strategies include leg massage, stretching exercises, hot baths and moderate exercise (Ryan and Slevin 2006).

The pharmacologic therapy that has been the most studied is oral levodopa combined with a dopa decarboxylase inhibitor. The dopa decarboxylase inhibitor prevents the peripheral conversion of levodopa to dopamine thereby ensuring that more levodopa is available to cross the blood brain barrier. Dopamine agonists such as pergolide, pramipexole and ropinirole have been used extensively for the treatment of RLS. Dopamine agonists interact with D2 and D3 dopamine receptors. Pramipexole also interacts with the D4 dopamine receptor. Dopamine agonists have a longer half-life than levodopa and are better able to stretch the effects of treatment through the overnight hours. In general, much smaller doses of dopamine agonists are used for the treatment of RLS than would be used for the treatment of Parkinson’s disease. Of the dopamine agonists, ropinirole was the first medication to be cleared by the FDA with approval for labeling for use in RLS (Garcia-Borreguero et al. 2007, Ryan and Slevin 2006).
Although dopaminergic drugs have been shown to reduce symptoms of RLS and are the preferred treatment method, long-term use of dopaminergic drugs may cause some patients to develop tolerance or augmentation to these medications. Augmentation is the earlier onset of symptoms or increased symptom intensity associated with some drug therapies over time. In a retrospective analysis of augmentation and tolerance in 59 RLS patients treated with pramipexole for at least six months, Winkelman and Johnson (2004) found that augmentation developed in 32% of patients and drug tolerance developed in 46% of patients. Follow-up results indicated the effectiveness of dopaminergic drugs was maintained over time, but only by significant increases in dosage. The precise mechanisms of augmentation are not yet well understood, but augmentation can pose significant problems for patients with RLS if they are no longer responsive to dopaminergic drugs (Garcia-Borreguero, et al. 2007, Winkelman and Johnston 2004).

**Conclusion**

Restless legs syndrome is a common disorder that likely involves some combination of abnormal iron metabolism and the dopaminergic synthesis and transport systems. Non-pharmacologic therapy may be helpful for some patients and pharmacologic treatment is often required. Future research will attempt to elucidate the exact cause of RLS in the hope that alternative treatment therapies can be developed to replace dopaminergic drugs. Novel treatment methods may provide better relief from symptoms and eliminate augmentation and tolerance in patients who require long-term treatment. It is also possible that new treatments may lead to an eventual cure. Since diagnosis of RLS is currently based only on clinical features, finding a definitive cause may provide clinicians with more objective criteria for diagnosis, which might help to alleviate existing problems associated with under-diagnosis or misdiagnosis of patients.

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**Photo credit:** istockphoto.com

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**About the Authors**

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The list of health risks associated with cigarette smoking has grown so long over the last few decades that it is astounding that any sentient human gives smoking even the slightest consideration. The chemicals found in cigarette smoke are known to thicken blood, increase blood pressure, increase heart rate, lower HDL, raise LDL, cause cardiac arrhythmias, contribute to atherosclerosis and contribute to vascular inflammation. In addition to these relatively common conditions, almost all of the deaths from abdominal aortic aneurysms are believed to be linked to cigarette smoking or the use of other tobacco products (NIH 2014). Clearly, if cigarette smoking affected only the cardiovascular system, it would contribute to an impressive array of health risks. Factor in the known links between cigarette smoking and cancer, diabetes, immune system dysfunction and reproductive disorders and the case against smoking cigarettes is overwhelming. Nevertheless, after 50 years of aggressive public health anti-smoking campaigns, cigarette smoking remains the largest single cause of preventable death and disease in the United States, claiming the lives of over 400,000 people each year and saddling an additional 16 million people in the US with a variety of chronic illnesses (McAfee and Burnette 2014).

**Women Who Smoke: The Associated Health Risks May Be Greater Than We Thought**

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**Abstract:** Cigarette smoking is the largest single cause of preventable death and disease in the United States, even after 50 years of aggressive public health anti-smoking campaigns. Smoking contributes to negative outcomes for all types of cancer, even cancers such as breast cancer that are not directly caused by smoking. Some of the blame for the smoking epidemic that currently affects women on a global basis may be placed squarely on the cigarette companies. This increased risk for smokers today may be related to changes in the composition and design of modern cigarettes.

**Historic View**

History places some of the blame for the smoking epidemic that affects women squarely on the cigarette companies. Cigarette smoking has been declining among men since the release of the first Surgeon General’s Report (SGR) in 1964 (McAfee and Burnette 2014). This report established a causal link between lung cancer and cigarette smoking, which resulted in an immediate decline in smoking among males. Paradoxically, smoking rates among women have increased in the post-report years to the point where today, the smoking related mortality and morbidity rates for women are equal to those of men (McAfee and Burnette 2014). Complicating the current picture is a disturbing trend among young women to explore the ancient hookah pipe as a novel means of consuming tobacco and the use of hookah pipes by college age women is on the rise (Lifespan, 2012). Fielder et al. (2012) explain that many college students falsely believe that hookahs or water pipes are safer than cigarettes when in fact hookah smoking is associated with many of the same diseases that are caused by smoking traditional cigarettes. The combination of fascination with this popular new trend and the apparent lack of knowledge about its dangers is troubling (Fielder et al. 2012).
The historic view marks 1928 as the year that large numbers of women entered the smoking market. In that year, George Washington Hill, president of the American Tobacco Company, is credited with starting an advertising bonanza targeting women with the assertion that women are "a gold mine right in our front yard" (McAfee and Burnette 2014). The profits of the American Tobacco Company doubled between 1925 and 1931, riding the coattails of a Lucky Strike advertising campaign touting cigarette smoking as an aid to weight loss. Many marketing professionals view the slogan "Reach for a Lucky instead of a sweet" as the single most successful advertising promotion in history for inducing women to smoke cigarettes (McAfee and Burnette 2014). In the 1970’s, as the women's movement blossomed in the US, cigarette smoking advertisements assured women that smoking was glamorous and sophisticated. New brands, such as Virginia Slims, the cigarettes themselves longer and more slender, were clearly attempting to send a signal to women that smoking cigarettes was reflective of a slim, energetic and healthy lifestyle (McAfee and Burnette 2014, Seiminska and Jassem 2014).

**Current Evidence**

Research summarized in the Surgeon General’s Report of 2014 clearly indicates that smoking contributes to negative outcomes for all types of cancer, even those such as breast cancer that are not directly caused by smoking. Smoking is associated with increased mortality for all cancers and an increased risk of the occurrence of a second smoking-related primary cancer. In cancer patients who are under treatment, smoking has also been linked to a higher rate of recurrence of the original cancer, poor treatment response and an increase in the over all toxicity effects of the treatment (McAfee and Burnette 2014).

Current evidence suggests that smoking in the 21st century may be even more dangerous than it has been in the past. Smokers today have a higher risk of developing lung cancer than the smokers of 50 years ago. The risk of lung cancer in women has increased ten times over the risks of getting lung cancer as a smoker in the 1960’s. In 1959, women who smoked a lung cancer risk only 2.7 times that of women who did not smoke. In 2010, the risk of lung cancer in women climbed to 25.7 times that of non-smoking women while, during the same period, the risk of lung cancer in men doubled to 25.0 times the risk of non-smoking men (McAfee and Burnette 2014). This increased risk may be related to changes in the composition and design of modern cigarettes and the fact that there are demonstrably higher levels of carcinogens in cigarettes today, notably the presence of more tobacco-specific nitrosamines. Excessive exposure to toxic chemicals in cigarette smoke may be related to efforts by cigarette manufacturers to produce a more “elastic” cigarette (Kozlowski and Connor 2014).

**Cigarette Composition and Design**

Elasticity in cigarettes refers to carefully crafted cigarettes that will yield less toxic smoke to a cigarette-testing machine than they do to real life smokers. It works like this: Cigarettes must pass industry standards for maximum allowable levels of nicotine and tar. Since the industry standard tests are conducted using smoking machines that are calibrated to take in a certain volume of air per minute, manufacturers build vents into cigarette filters, which increase the air flow through the cigarette in the smoking machine test and thereby dilute the recorded nicotine and tar in the cigarette to acceptable industry standards. Real life smokers learn to compensate for the presence of the vents by taking larger puffs or by taking more frequent puffs in order to get the tobacco satisfaction they crave. Other compensation behaviors include blocking the vents with their fingers or lips, either intentionally or inadvertently. The end result is that the cigarettes pass the industry standard smoking machine tests and real life smokers end up with an overload of nicotine and tar (Kozlowski and Connor 2014).

Vented cigarettes may also foster the impression that the cigarette smoke is “lighter” and less harsh or potentially irritating. The smoke passing through a vented filter feels milder because each puff contains more air. Smokers are set up to believe that low tar cigarettes actually have less tar than regular cigarettes because the smoke feels so much milder. However, when the smoker’s compensation behaviors are factored in, the average smoker of low tar, vented-filter cigarettes may be getting as much, or more, nicotine and tar as a smoker who is smoking unfiltered cigarettes (Kozlowski and Connor 2014, Seiminska and Jassem 2014).

Smoking e-cigarettes, which are promoted as a healthier alternative to smoking traditional cigarettes, is emerging as a popular choice among smokers. Older adults typically use e-cigarettes as a way to stop smoking traditional cigarettes while younger smokers are more likely to use e-cigarettes recreationally, out of curiosity or for a change of pace. According to Sutfin et al. (2013), 4.9% of more than 8000 college students from eight different colleges in North Carolina have used e-cigarettes. It is important to note that the health risks associated with e-cigarettes remain controversial. Studies suggest that e-cigarettes deliver their own version of harmful particles that may contribute to many of the same chronic illnesses that are attributed to traditional cigarettes, including heart disease and asthma (Raloff 2014, Sutfin et al. 2013).
Links to Cancer, COPD, Diabetes and Immune Dysfunction

In addition to the clear linkage between cigarette smoking and lung cancer, smoking cigarettes is known to contribute to both liver cancer and colorectal cancer. The 2014 Surgeon General’s Report suggests that smoking may also influence breast cancer and recommendations are included in the report that call for additional research into the possible link between breast cancer and smoking. There are currently 13 separate cancers that are known to have a causal link to cigarette smoking (McAfee and Burnette 2014).

For women who smoke, the risk of getting COPD, chronic obstructive pulmonary disease, has increased dramatically since the 1960’s. Women who smoke are 22 times more likely than non-smoking women to develop COPD. More women die from COPD than men and they may be more susceptible to severe COPD at a younger age than men. Smoking exacerbates the symptoms of asthma and is a known cause of tuberculosis disease and the resulting deaths from tuberculosis (McAfee and Burnette 2014).

Cigarette smoking is known to complicate the management of patients who have diabetes and diabetics who smoke are at a higher risk of developing kidney disease, circulatory complications secondary to diabetes, and diabetes related blindness. Smoking is also a known causative agent of Type 2 diabetes. The overall risk of developing diabetes is an astounding 30-40% higher for smokers than for non-smokers (McAfee and Burnette 2014).

More than 7,000 compounds have been isolated from the smoke that occurs when cigarette tobacco is burned. Toxic chemicals in this potent mixture are associated with both immune-suppressive effects and immune-activating effects. Smoking is a known causative agent of rheumatoid arthritis and it also interferes with the overall effectiveness of prescribed rheumatoid arthritis treatments. Women are about twice as likely to be diagnosed with rheumatoid arthritis than men (McAfee and Burnette 2014).

Links to Reproductive Disorders

In spite of increased health risks, the number of teenage girls and women who smoke has continued to increase resulting in what has become a global health problem with wide-ranging consequences. Currently, there are approximately 250 million women worldwide who are daily smokers, including an estimated 30% of US women in their reproductive years. These women are fairly likely to be aware of the links between smoking and cancer and cardiovascular health, but they are often ignorant of the effects of cigarette smoking on female fertility. Prior studies have linked cigarette smoking with decreased implantation rates, which range from 12 to 12.6% for women exposed to cigarette smoke compared to 25% for non-smokers. Pregnancy rates are also decreased for women who smoke. Here the range is from 19.4 to 20% for those exposed to cigarette smoke compared to pregnancy rates of 48.3% for non-smokers (Gannon et al. 2012). Smokers also experience longer time-to-pregnancy rates, reduced success rates when in vitro fertilization is attempted, changes in ovarian steroidogenesis, reduction of ovarian reserves, impaired function of oocytes and oocyte viability, and an earlier age of menopause when compared with non-smokers (Gannon et al. 2012, Gannon et al. 2013).

Women who choose to smoke cigarettes while trying to conceive have a higher rate of obstetrical and perinatal difficulties. Such complications include: ectopic pregnancies, spontaneous abortions, placental degradation, and even Sudden Infant Death Syndrome (SIDS). Maternal cigarette smoking may also lead to significant health issues for the growing baby. Children born to mothers who smoke have increased risk of asthma, bronchitis, elevated childhood blood pressure, neurobehavioral problems, and behavioral/learning problems. Newborns may suffer from low birth weight, delayed physical development, and birth defects. Common birth defects due to maternal cigarette smoking include: altered lung development, gastroschisis (a weakening of the anterior abdominal wall that allows abdominal organs to protrude), mental retardation, and cerebral palsy. Researchers are not fully aware of why these complications occur, however they hypothesize that a lack of oxygen from mother to fetus plays a significant role. All of these reproductive dysfunctions carry a heavy price in terms of a woman’s general health, emotional well being and often, financial stability (Gannon et al. 2012, Sieminska and Jessem, 2014).

The functions of the ovary include steroidogenesis and the recruitment of follicles from the available group of primordial follicles that are laid down during fetal development. Up to two million primary oocytes are present in the ovaries of a newborn infant. However, the majority of oocytes regress during childhood so that there are roughly 400,000 at puberty. Of these, only about 400 mature into secondary oocytes and are ovulated throughout a woman’s lifetime (Moore et al., 2013). During a female’s reproductive years, the number of primordial follicles gradually decreases as ovulation occurs. Non-dormant follicles are typically lost through atresia, likely as a result of apoptosis in a process that is easily disrupted by environmental toxins and lifestyle stress (Gannon et al. 2012). Cigarette smoking, which contains the contaminant BaP, (Benz(a) pyrene), has been shown in animal studies to deplete the reserve of ovarian follicles in the resting pool by apoptosis and/or autophagy. Women who smoke one to two packs of cigarettes a day and began smoking before the age of eighteen
have the greatest risk of reduced fertility. In addition to a decreased ovarian reserve, female smokers have a lessened response to luteinizing hormone, which stimulates ovulation. Research conducted by Sobinoff et al. (2013) shows that cigarette smoke exposure also leads to significantly reduced sperm-zona pellucida binding and therefore a lower potential for fertilization. This is accompanied by the destruction of the follicular cells of the female oocyte, which makes it difficult for sperm to bind to and fertilize the egg. Cigarette smoke, even at levels seen in the average smoker, as opposed to the toxicity levels used in animal studies, is known to induce granulosa cell autophagy and depletion of the reserve of primordial follicles in the ovary. Gannon et al. (2013) see autophagy, related to exposure to cigarette smoke, as a novel and likely an additional process, which along with apoptosis, serves as the mechanism of ovarian follicle loss. In human females, the premature onset of menopause is related to depletion of the resting pool of primordial follicles since the extension of resting pool follicular depletion is a failure to ovulate associated with subsequent changes in hormone production and the termination of menses (Gannon et al 2012, Gannon et al. 2013, Sobinoff et al. 2013).

Conclusion

In general, the health of the average smoker is not as good as that of the average non-smoker. The life span of a smoker is believed to be about 10 years shorter than that of a non-smoker. Smokers are absent from work more frequently, make more frequent office visits to doctors, and are more likely to be hospitalized for treatment than non-smokers. Smokers are also more likely to suffer from some form of chronic disease. Many smoking related deaths are considered to be preventable. This fact is especially poignant when viewed in the light of 6 million American women who died from smoking related illnesses between the mid-1960’s and 2014. During that same period of time, an estimated 2.5 million people in the US died from exposure to second hand smoke and 100,000 infants died of perinatal conditions related to exposure to tobacco smoke (McAfee and Burnette 2014). Clearly the anti-smoking advertising campaigns cannot yet be stopped and effective anti-smoking initiatives with proven value, such as raising the price on tobacco products, establishing smoke-free environments, reducing the social acceptability of smoking and providing ready access to assistance for smokers who want to quit, should continue. Hopefully future generations will reap the benefits of anti-smoking education and public awareness of the risks associated with smoking, particularly for women, will cause the numbers of people affected with smoking related illnesses to slowly and steadily decline.

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The Role of Exercise Perception in Daily Physical Activity

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Abstract
This study investigated the relationship between the perception of exercise and physical activity level. It was hypothesized that people with positive perceptions of exercise would be more active, and people with negative perceptions of exercise would be less active. The participants were 40 subjects between the ages of 18 and 69 years old. Positive and negative exercise perceptions were analyzed using an Exercise Barriers and Benefits Scale (EBBS). The data suggests that a person’s positive perceptions of exercise have a greater effect on their activity level than their negative perceptions of exercise.

Introduction
Participation in regular physical activity and exercise are essential for good health and well being for people of all ages. In this century there has been a significant increase in sedentary lifestyles due in part to the expansion in technology, changing family responsibilities, lengthy commutes and longer work hours. It is estimated that only 25 to 28 percent of adults in the United States meet the daily physical activity recommendations of 10,000 or more steps per day coupled with at least thirty minutes of moderate to intense exercise. (Bassett et al. 2010, Brannagan 2010, Chandler-Laney et al. 2010, Emaus et al. 2010, Leigh and Solomon 2012,).

The main research question that guided this investigation concerned the possible relationship between physical activity and attitudes towards exercise. The authors hypothesized that people with positive perceptions of exercise would be more active and people with more negative perceptions of exercise would be less active. A convenience sample consisted of 40 subjects between the ages of 18 and 69. Each subject wore a pedometer for one week while performing normal activities in their own work, home and community settings. A minimum of five days of typical daily activities was analyzed for each subject. Positive and negative exercise perceptions were analyzed using an Exercise Barriers and Benefits Scale (EBBS). Weekly physical activity levels, measured with a pedometer, were correlated to scores from the EBBS. Significant positive correlations were found between positive EBBS scores and the number of steps taken. Negative correlations were found between the subject’s age and the time spent sedentary as well as between body mass index (BMI) and positive EBBS scores. There was no correlation between negative EBBS scores and steps taken or time spent sedentary. This suggests that a person’s positive perceptions of exercise have a greater effect on their activity level than their negative perceptions of exercise.

Perception of Physical Activity
Previous studies have shown that exercise perceptions are related to factors such as self-reported fitness levels and weight gain or loss. A frequently used tool to assess exertion during exercise is the Borg rating scale of perceived exertion (RPE). RPE measures self-perceived fitness by requiring subjects to reflect on how heavy and strenuous an activity feels. RPE also measures physical stress, effort, and fatigue. These ratings have been associated with heart rate, respiratory rate, blood lactate, and maximal oxygen consumption (Borg 1982, Brock et al. 2009, Aadahl et al. 2007, Chandler-Laney et al. 2010, Edwards et al. 1972).

Recent research has shown a myriad of influencing factors that affect RPE including exercise self-efficacy (confidence and a belief in a person’s own ability to exercise), the environment, hormonal fluctuation, obesity, anxiety, depression, and Alzheimer’s disease. Some studies found that a participant’s perceptions are not always accurate and perceptions of exercise can influence physical activity levels. For example, if a person perceives exercise as difficult they will have a higher rated perceived exertion (RPE). These inaccurate perceptions could play a role in the rising obesity epidemic and overall lack of physical activity in the United States. Continuing efforts to research physical activity and RPE may be crucial in preventing a long list of health problems that are associated with a lack of physical activity (Aadahl et al. 2007, Brock et al. 2010, Caldwell et al. 2011, Chandler-Laney et al. 2010, Lockwood and Wohl 2012, Ogden 2007, Yu and Bil 2010).

Materials and Methods
Participants
Participants were selected from a convenient, accessible population pool located within a sixty-mile radius of Endicott College. The participants, a group of 18 females and 12 males, ranged in age from 18 to 69 with a mean age of 39.5. Endicott College’s Institutional

continued on next page
Review Board approved this study prior to initiation. All participants read, signed, and dated an informed consent form (Appendix A) before beginning the study. Each participant had frequent opportunities to ask questions and receive answers prior to and throughout the study. To maintain confidentiality, the participants were coded and only the investigators had access to the data.

**Physical activity readiness questionnaire (PAR-Q)**

Participants with health concerns that might affect their daily life and physical activity were excluded from the study by filling out a PAR-Q (Appendix B). The PAR-Q was developed by the British Columbia Ministry of Health and revised by an Expert Advisory Committee assembled by the Canadian Society of Exercise Physiology (Canadian Society for Exercise Physiology and Fitness 2002). This questionnaire indicated if the participant was ready to engage in physical activity safely by asking a series of yes or no questions. Based on responses from this questionnaire, those with major health problems that could make their participation unsafe and unhealthy were eliminated.

**Exercise Benefits Barriers Scale**

Each participant filled out an exercise barriers/benefits scale (EBBS) (Appendix C). The EBBS quantifies an individual's positive and negative perceptions about exercise. Over 650 individuals participated in the initial EBBS testing, which tested for test-retest reliability, validity, and consistency (Sechrist 1987). The EBBS consists of 43 questions that can be answered from strongly agree to strongly disagree. It consists of statements pertaining to benefits of exercise and barriers of exercise. An example of a statement pertaining to benefits of exercise is "exercise decreases feelings of stress and tension for me," and an example of a statement pertaining to barriers is "exercise takes up too much of my time". Scores can range from 43-172 on the total scale, which contains both the calculations from the benefit scores and barrier scores. To determine the sum of the total score, the barriers score are reversed. For example if a participant receives a benefits score of 100 and a barriers score of 20 the total score would be the sum of 100 and the reverse barriers score. When normally calculating the barriers score strongly agree would receive 4 points and strongly disagree would receive 1 point. When calculating the total score the barriers score is reversed, strongly agree would receive 1 point and strongly disagree would receive 4 points. The higher the score the participant receives on the total scale, the more positively the participant views exercise. The scoring was also broken down to a score for barriers alone and benefits alone for comparison purposes. Permission to use the EBBS was obtained from Karen Sechrist (Appendix D).

**Fitbit device for physical activity level**

Fitbit pedometers have been manufactured by Fitbit Inc. of Sacramento, CA. since the companies inception in 2007. These pedometers use an accelerometer and digital software to detect motion and intensity of motion (Fitbit Help 2014). The Fitbit records steps taken and percentage of time spent sedentary. It also uses average stride length, based on height, weight and gender, to convert to miles and to estimate calories burned (Fitbit Help 2014). The Fitbit Zip device was chosen for its low cost and ease of use.

Each participant wore a Fitbit device twelve hours per day for seven days and recorded what time they put on and removed the device. The data for each participant was downloaded to the researcher’s computer and kept confidential.

**Activity Log**

Participants were asked to keep a written activity log (Appendix E) throughout the week they wore the Fitbit device. The activity log provided narrative descriptive information on how the participants spent their day, such as using a computer, walking, housework, watching television, or at the gym. The log allowed the researchers to indicate if a subject was ill or if they did anything out of the ordinary that skewed their average activity level. The activity log consisted of seven pages, with one page labeled for each day. Pages were made into tables, dividing up the day into sections including early and late morning, lunch and early afternoon, and late afternoon and evening. Beside each section there was a blank area for an activity description where the participant filled in what they did, such as going to the gym. Next to the activity description was a section to rate the activity as rare, sometimes, usually, or always. Lastly, on each page there was a comment section for notes and errors where the participant could mark if they made a mistake. An example of a mistake might include the participant realizing that they changed their clothes during the day and forgot to switch the pedometer to their new set of clothes; or that they forgot to put the pedometer on for two hours when they woke up. The researchers studied the activity logs to see what days were typical patterns and if there were any unusual days or time periods. Based on the subject’s ratings and comment section, the researchers excluded days that were not typical for the subject or if the participant made a mistake that would affect the results. Each participant had a minimum of five days of activity rated as usual or always.

**Data Analysis**

At the end of the week, the participant’s average number of steps, distance traveled, calories burned, percentage of time spent sedentary, and BMI were downloaded from the Fitbit onto the researcher’s computer and recorded on an excel spread sheet.
These variables were compared to exercise perceptions, based on the scores the participants received on the EBBS (total score, benefits score and barriers score). This quantitative data was analyzed using excel correlation functions to allow the researchers to determine how the participant’s perceptions of exercise correlated to their physical activity level.

Calculation of BMI

BMI for this investigation was calculated by taking the subject’s weight in pounds, dividing it by height in inches squared, and multiplying the result by 703 (Center for Disease Control 2011).

Use of Pedometer

Pedometers were used extensively in this investigation. Emaus et al. proposed that self-reported physical activity is constructed by a person’s memory, which can often be inaccurate. Devices such as pedometers and accelerometers are more accurate and can also be used to verify a person’s self-reported physical activity level (Basset 2010, Emaus et al. 2010).

Results

The exercise perceptions from the EBBS and typical physical activity level from the pedometer were analyzed for potential relationships.

The EBBS scoring was broken down into total score (ranging from 99-171), benefits score (ranging from 63-115), and barriers score (ranging from 18-50). (Table 1) The higher the score the participant receives on the total scale and benefits scale the more positively the participant views exercise, whereas the higher the score on the barriers scale indicates the more barriers the participant views towards exercise.

<table>
<thead>
<tr>
<th></th>
<th>Total Score</th>
<th>Benefits Score</th>
<th>Barriers Score</th>
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<td>Average</td>
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<tr>
<td>Range</td>
<td>99-171</td>
<td>63-115</td>
<td>18-50</td>
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Table 1: Average and range of scores from the EBBS. For simplicity the score were broken down into benefits scores and barriers scores as well as the total score. This table indicates the average negative and positive perceptions of activity among the 40 subjects.

The average number of steps taken daily by the 40 subjects, as recorded by a pedometer, was 8,303.9 with a range of 2,542 to 16,080. The average percentage of time the 40 subjects spent sedentary was 88.4% with a range of 75% to 96%. Although the pedometer recorded values for distance traveled and calories burned, those values were omitted from this investigation since they are estimates based on the subject’s height, weight, and gender.

The average BMI of the 40 subjects who took part in this investigation was 23 kg/m². Seven of the 40 subjects had a BMI greater than 25 kg/m², which is in the overweight range. One subject placed into the obesity range with a BMI that was greater than 30 kg/m². Obesity is quantified as a BMI greater than 29 kg/m² (Ogden 2007).

A positive correlation was found between average daily steps taken and benefits scores on the EBBS (Figure 1). The subjects wore the Fitbit for 7 days and 12 hours a day. There was an r-value of 0.31. These data suggest that subjects whose perception of exercise was positive took more steps per day (p < 0.05).

![Steps taken vs Benefits Score](image1)

Figure 1: Data for steps taken is plotted against the EBBS score. The correlation shows a positive relationship between steps taken and the benefits participants perceived from exercise. \( r = 0.31 \), \( n = 40 \), \( p < 0.05 \)

Similarly, a positive correlation between steps taken and total score of the EBBS was found Figure 2. There was an r-value of 0.27. These results signify that the more positively someone perceives exercise and the less negatively they perceive exercise the greater the number of steps they took per day (p < 0.05).

![Steps Taken vs. Total Scores](image2)

Figure 2: Data for steps taken is plotted against total scores on the EBBS. The correlation shows that subjects with a positive perception of exercise took more steps per day. \( r = 0.27 \), \( n = 40 \), \( p < 0.05 \)
Additionally it was discovered that there was a negative correlation between time spent sedentary and age (Figure 3). This finding suggests that the younger the participant, the more time they spend sedentary, and the older a participant the less time they spent sedentary. The r-value was -.50, which was significant with \(p<0.05\).

Finally, there was a negative correlation between BMI and total EBBS scores whereby \(r=-0.26\) (Fig. 4). This indicated that subjects with lower BMI scores had more favorable views about exercise and subjects with higher BMI scores had less positive views about exercise \((p<0.05)\).

Chandler-Laney et al. (2010) examined overweight female subjects. They used questionnaires to examine self-reported vitality, mental health, physical fitness, and weight control behaviors. The subjects ran four minutes on a treadmill while data was collected on heart rate, oxygen consumption, ventilation, and respiratory exchange. These values were compared to RPE. The results showed 49% of women over-perceived their exertion level. The data also showed that those who over-perceived exertion had less dietary control, lower vitality, and poorer mental health (Chandler-Laney et al. 2010).

**Discussion**

Recent research has highlighted many factors that affect the Borg rating scale of perceived exertion.

A person’s perception of exercise may be a significant predictor of weight regain after completing a weight loss program. Brock et al. studied a group of overweight people whose initial average body mass index (BMI) was 28 kg/m². They tracked this group as they dieted to achieve a BMI under 25 kg/m². After weight loss the individuals were monitored and weighed three to five times a week for four weeks. A year after losing weight, the participants were evaluated again. The results indicated an average weight gain of 5.46kg. The researchers found that RPE was related to weight gain, suggesting that perception of exercise is an important predictor of weight regain (Brock et al. 2010).

Similarly, Aadahl et al. (2007) used a questionnaire to determine if perceived exertion was associated with self-reported fitness. The survey contained questions related to socio-demographics, physical activity of low, moderate, and high intensity, and self-rated fitness levels. Each participant rated 42 activities based on a scale of 0-10 with zero representing no exertion and 10 as the maximum amount of exertion. The findings of this study showed that a higher level of self-rated fitness was associated with less perceived exertion (Aadahl et al. 2007).

**Recommended Healthy Physical Activity Per Day**

Many researchers have suggested that simple changes such as improving eating habits and increasing physical activity could have a significant impact on body weight. Hill et al. (2003) recommended increasing steps per day by 2,000 and cutting 100 kcal from the usual diet to decrease obesity rates (Hill et al. 2003, Wyatt et al. 2005). Bassett et al. (2010) measured the average number of steps taken per day by a group of 1,921 adults in the US, age 13 and older, who tracked their steps using a pedometer. The average number of steps recorded was 5,117, with men consistently taking more steps per day than women. This seems like a high number but it is significantly lower when compared to adults who live in other countries. For example, steps per day were recorded for 493 Swiss adults, age 25 to 74. Men in this study averaged 10,400 steps per day and women averaged 8,900 steps per day (Sequeira et al. 1995). A similar study was performed in Western Australia. There, the average adult takes 9,695 steps per day (McCormack et al. 2003). In Japan the mean number of steps per day for a male was 7,168 ± 4,580. Japanese
females averaged 6,821 ± 3,909 steps per day (Inoue 2006, Bassett et al. 2010).

Berger et al. (2013) measured the activity level in members of four ethnic groups. The subjects were white, African-American, Japanese-American, or Korean men between the ages of 40 and 49. Physical activity was measured using self-report, a pedometer, and a questionnaire that addressed leisure and occupational activities. Body weight and height measurements were also obtained. The results of this study showed that Korean men engaged in the most physical activity, most likely as a result of cultural differences in daily activities. In this study total physical activity was associated with total pedometer steps (Berger et al. 2013).

Tudor-Locke et al. (2011) suggested that anywhere from 4,000 to 18,000 steps per day are considered healthy, with 10,000 steps per day being a practical target for adults (Tudor-Lock et al. 2011).

Our study found that participants with positive perceptions regarding the benefits of exercise took more steps per day. Participants with less positive perceptions regarding the benefits of exercise took fewer steps per day. No correlation was found between the scores for personal barriers to exercise on the EBBS and steps taken. This suggests that whatever barriers a subject had towards exercise did not directly affect their activity level. This could be due to a variety of factors since the questions on the EBBS are open to multiple interpretations. For example, the statement, “I am fatigued by exercise” is meant to assess personal barriers to exercise. One person might indicate agreement with this statement because he/she becomes tired after exercise even though their over all perception of the benefits of exercise may be positive and they may enjoy the exercise activity while they are engaged in it. Another person might interpret the statement to mean they do not like to exercise because it makes them tired. Both people would indicate that they agree with the statement but for very different reasons.

Another possible explanation for these results might be that some adults understand the benefits of exercise and are able to overcome their personal barriers. For these people the benefits of exercise outweigh the barriers. For example a barriers statement on the EBBS is “places for me to exercise are too far away.” A participant may agree with this statement and simply make the choice to exercise at home.

There was a negative correlation between the percentage of sedentary time in a subject’s day and age. Older subjects actually spend more time being physically active. One explanation may be that older adults have more flexibility in scheduling daily physical activities. Another explanation might be that older adults have more health issues and are therefore more apt to actively seek the health benefits associated with exercise. It is also possible that older adults have different activity patterns when compared to a younger people. Older adults typically exercise frequently, for longer durations, and at lower intensities compared to younger adults who are more likely to do only a few, short, high intensity workouts during the day.

The negative correlation between BMI and total EBBS scores indicates that those subjects with healthier BMI’s saw more benefits and fewer barriers to exercise than those with high BMI’s.

An important limitation in this research is that the Fitbit Zip does not count all activity. The Fitbit Zip, used in this study, is not waterproof and does not count swimming. It also does not count sedentary exercise such as yoga, Pilates, or weight lifting.

There are many benefits to maintaining an active healthy lifestyle. Exercise may help a person live longer, prevent diseases such as type II diabetes, improve symptoms of depression and anxiety, strengthen bones, promote better sleep and muscle tone, and help in weight management (Center for Disease Control and Prevention 2011). A better understanding of how one perceives exercise can perhaps ultimately lead to a more active, healthier lifestyle.

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continued on next page
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Joyce Shaw, DPT, CPT, CSCS, SFSC is an Associate Professor of Biology and has been teaching Human Anatomy and Physiology, World Disease and Microbiology at Endicott College since 1999. Joyce is a licensed Physical Therapist, a certified Personal Trainer, a strength and conditioning specialist, and a certified senior fitness specialist.

Note: Copies of the informed consent, health survey, exercise benefits/barriers scale, activity scale, and permission documents used by the author and participants in this study are available from the author.
Forgotten Student Profile #443

NAME: John Mills
AGE: 19

HOMETOWN: Port Townsend, WA.

LONG-TERM GOAL: Registered Nurse

PROBLEM: Poor & failing grades due to expensive textbooks he couldn’t afford

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The Histology Challenge: how it came about, how it works now, and thoughts about the future of this dynamic HAPS-L discussion group

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Abstract
This article describes an exciting feature on the HAPS website, the Histology Challenge. This feature presents actual patient cases, in the form of photomicrographs of biopsy or surgical specimens, along with a “live” online discussion. Each case includes a series of questions designed to guide readers through the process of interpreting the photomicrographs, beginning with basic histology and progressing through the process of diagnosing the case. In this article, we review the history of the Histology Challenge, describe how it works, and describe some sample cases, to illustrate how they reinforce basic histology and introduce clinical applications. This article will also include suggestions for how these Histology Challenges can be used in A & P courses, and ways in which interested instructors can participate both in the online discussions and in production of future cases.

History of the Histology Challenge

The HAPS Histology Wiki
In March 2008, William Karkow submitted a proposal to the board of HAPS for a new image database feature to be used for educational purposes. The primary intention of this endeavor was to create a venue in which instructors of Human Anatomy and Physiology courses could share photomicrographs. Margaret Weck and that year’s board accepted the proposal, and the “HAPS HISTOLOGY WIKI” was co-founded by Dr. Karkow and Carl Shuster, who was the webmaster at that time.

For approximately two years, the HISTOLOGY WIKI published photomicrographs, with occasional contributions from other HAPS members. However, there were a number of concerns about the WIKI, including:
- some of the contributed micrographs were of mixed quality and sometimes from unknown sources, leading to copyright concerns;
- the images were accessible to the public, and the board wanted the images to be a benefit of HAPS membership, password-restricted, yet with public domain photomicrographs that could be shared; and
- there was no mechanism for feedback on the images.

The “Histology Challenge” is born
In response to the above concerns, the name, format, and presentation of the HistoWIKI underwent a change in May, 2010, when “Challenge #1” was posted on the HAPS website during spring finals week, with the title “A test for the testers”. The post received many responses via the HAPS-L discussion group. This case was followed with a 2nd case, and the Histology Challenge was formally born. The new Histology Challenge differed from its predecessor, the WIKI, in several ways.

1. Its purpose was to present histology in the context of case presentations, as would be presented by pathologists. The new goal was not so much a normal image database, but “continuing medical education” for HAPS instructors themselves. With this goal in mind, micrographs of clinical specimens are posted, with questions about both normal histology and histopathology.

2. The Challenges would be accessible through the members-only part of HAPS website.

3. The Histology Challenge would include an online discussion in which HAPS members could contribute questions and answers.
The Current Histology Challenge and how it works

Microscope slides for each case are provided by Christopher Leigh, MD, a partner in the pathology group, United Clinical Laboratories, in Dubuque, IA. Dr. Leigh provides these slides to Dr. Karkow, along with a brief background on the case. We both receive recuts of the slides and take turns “hosting” the case on the HAPs website.

To present a case, we first post photomicrographs of the relevant areas of the slides, usually showing the specimen at different magnifications, and including both a “normal” area and of the “diseased” area (sometimes added later). Along with the micrographs, we post a brief case history and a leading question that focuses on review of the relevant normal histology. Participants use the “comments” button to submit answers to the questions; then, as “host”, we respond, acknowledging correct answers or adding hints or new questions to guide participants to the correct answer. Once the initial question has been answered, we post additional photomicrographs and questions that increasingly focus on the pathology and clinical applications of the case.

The logistics of participation in the Histology Challenge “discussion blog” are easy and create opportunity for lively group discussion. Notifications of new Challenges are posted (with a teaser photomicrograph) on the HAPS-L discussion group, with a link to the post on the members-only area of the HAPS website. Email notification is also sent to a list of non-list serve “subscribers” (these names are kept as a “Histology Challenge Fan List”). The link for the Histology Challenge is easily found by going to the HAPS website HERE, and then to RESOURCES, TEACHING RESOURCES, and CURRENT HISTOLOGY CHALLENGE. Interested participants can “subscribe” to each Challenge, to get email updates when new comments are posted.

Recently, participation in the Challenges has averaged about six to ten participants per case, plus an unknown number of “lurkers”. We would love to have more people participate in these discussions! In our “advertising” and in every discussion blog we try to emphasize that all HAPS members are welcome to participate, regardless of degree of expertise! You do not have to have special training in pathology, and it is OK to guess at answers and/or to look up information. Incorrect answers are handled with gentle tact, and correct answers are given a virtual “round of applause”. Participants often respond with helpful online references, so we’re all learning as we go along. In this respect, the Histology Challenge is a great opportunity to experience again, for ourselves, things that we routinely ask of our students, such as volunteering answers in class and having to “stretch” to learn new material. Above all, if the idea of participating in this forum seems daunting, please remember, this is HAPS! We’re a friendly group, so there’s no need to feel intimidated!

Some examples of Histology Challenge Cases

For those who have not seen or participated in the Histology Challenge, we will summarize below a couple of recent cases that appear on the HAPS website under Histology Challenge Archive.

Example 1 (Challenge #69, posted 9/24/13):

The initial post said:

The patient was a 22 y/o Latino female with the lesion on her shoulder. Image A shows the entire tumor. The other images show higher magnification of the lesion (Image B), and of adjacent normal tissue (Image C and D). The core of the lesion is shown in Image E.

Three of the accompanying images are shown here as Figures I a, b, and c.

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continued on next page
The discussion began with the questions: What types of tissue are present? What organ is the sample from? What is abnormal about the tissues in the lesion? The first two questions (right out of basic histology!) were quickly answered as stratified squamous epithelium and dense fibrous irregular connective tissue, from skin. The question about what was “abnormal” also did not require advanced knowledge of pathology, but only recognition of the absence of dermal papillae and over-abundance of dermal connective tissue. That observation quickly led another participant to correctly diagnose the lesion as a keloid.

The discussion took off from there, to include lively topics, such as:

- the role of “pigment donation” by melanocytes;
- the structure and function of desmosomes;
- reference of a review article on molecular causes of abnormal wound healing;
- changes in color (“red” vs. “white”) as a wound heals;
- structure/function relationships in plasma cells.

**Example 2 (Challenge #70, posted 10/1/13):**

The initial post presented smooth muscle with the history:

_This tissue is taken from a 52 y/o WM, and is seen under oil magnification (1000x) using Trichrome stain. Questions:_

1. What are the predominant cells?
2. What are the red-stained fibers?
3. Why are they arranged in a feathered pattern?
4. What is the tissue?

We delved into all the layers and tissues of the colon to which this muscle belonged. Then we zoomed out to very low magnification / wide field composite images to ask:

_Having identified 3b as taenia coli, which is also correct, you should be able to say something about the plane of section, given the smooth muscle fiber direction. And with this in mind, why do we see an apparent lumen A, a channel B, and another lumen C where the specimen is cut off? Colons don’t normally present as double-barreled shotguns, right?_

The diagnosis of a sigmoid diverticulum led to considerable discussion summarized in the following points:

_Because the typical colonic diverticulum is a false diverticulum without the wall support of a muscularis propria, one can predict that this weak spot for resisting luminal pressure can spontaneously rupture, resulting in instant fecal contamination._

- Diverticular lumina accumulate foreign material which then irritates and abrades the mucosa, resulting in submucosal inflammation, often under pressure. This results in erosion deeper and deeper through the wall, slowly over some time. As the inflammation reaches the serosa, any nearby organ in contact begins to adhere to the inflamed serosa, resulting in continued erosion and fistula formation.
- Multiple diverticular microabscesses cause progressive wall thickening and luminal narrowing. The result is a patient who has
varying degrees of LLQ pain, starts to become more **constipated** as the lumen narrows, and then paradoxically as the constipation worsens, he sometimes develops **diarrhea**, partly from mucosal inflammation and partly from the very narrow lumen functioning as a strainer or sieve.

- Because the typical weak spot in the **muscularis propria** is where larger arterioles penetrate the **muscularis** to feed the submucosa, and the mucosa in the diverticular neck is stretched right alongside these vessels, any mucosal damage from pressure changes or particle movement through the neck has the potential to scrape open some relatively major vessels. This does not happen if the neck is pinched closed, and thus **diverticular bleeding** occurs with diverticulosis, not diverticulitis. A patient therefore presents to the ER with massive bright red bleeding per rectum (**hematochezia**) with no warning, having previously felt fine.

Histology adds so much to explain both symptoms and complications.

### The Histology Challenge as a teaching resource

Once a new Challenge has been posted on the HAPS website, the discussion blog usually runs for a week or two, and occasionally longer for a complex case. Once the case is over, an announcement is made on the HAPS list serve, briefly describing the answer and acknowledging those who have participated in the discussion.

As each new Challenge is posted, the previous Challenge gets moved to the collection of [Archived Challenges](#), which are posted on the HAPs website under “Teaching Resources” and are accessible at all times by HAPs members. Currently there are over 90 Archived Histology Challenges, complete with photomicrographs, brief case history, and questions and answers. Although the earliest Challenges have only abbreviated discussions, the more recent cases show the complete set of blog comments, including questions, answers, responses, and related references to helpful websites.

How can A & P instructors use the Histology Challenges in their classes? First, the photomicrographs, at least 3-4 per case, are freely available to be copied and used for lectures or lab presentations. The photomicrographs include images of both normal and pathological tissues, so they could become the basis of an electronic image library for normal histology, which may be very helpful if course budgets limit purchases of slides or commercially available electronic images. Second, the discussions themselves can provide information about clinical applications of the basic histology taught in undergraduate courses. For example, the case of Barrett’s esophagus vs. normal esophagus ([Challenge #86](#), posted 5/7/14) provides students with a nice review of epithelial structure, function, and categories. Additional examples of how histopathology can be used in teaching normal histology can be found in my article *Using Histopathology to teach Histology to Undergraduates*. HAPS Educator, Spring, 2005.

### How can YOU help the Histology Challenge?

So far, we have maintained the Histology Challenge as an ongoing feature from September through May, with brief breaks for holidays and especially busy times in the academic year. There are several ways in which HAPS members can become involved in helping to keep the Challenge going:

- **Participate in the Challenges!** The discussions are especially lively, fun, and informative when we have lots of people contributing ideas and looking up information.
- **We always need microscope slides (clinical specimens) for the Challenges,** so if you have a source of specimens (this will usually require a “connection” with a pathologist) and some additional information on them, and are willing to donate them to the Histology Challenge, please let us know.
- **Consider volunteering to “host” some of the Challenges.** We would love to have a few more people join the team! To contribute photomicrographs you need to have a research-quality bright-field microscope, digital camera and associated software. But, if you don’t have the photographic equipment, you still are most welcome to “host” a Challenge, by researching the disease, designing and posting questions, and facilitating the discussion, while one of us helps by providing the photomicrographs.

The rewards for participating in the Histology Challenge and- better yet- for helping to produce it are many. For one, instructors usually find that learning histopathology is fun and interesting and reinforces our own knowledge of histology, making us better teachers and better able to get our students excited about this topic. Second, the Challenges provide a great source of ideas for wowing students with “juicy” tidbits about nasty diseases that they will be glad they don’t have. Finally, for those of us who are not physicians, the Challenges provide a taste of the thrill of diagnosing a disease, without any serious consequences for being wrong (“No patients were harmed in the making of this Challenge”) and no fear of lawyers in pursuit.

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#26 HAPS Educator Winter 2015
Effects of Supplemental Instruction Teaching Styles on Student Understanding of Anatomy and Physiology

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Abstract

Instruction in Anatomy and Physiology provides challenges for both the instructor and the student. Past students can be a valuable resource for current students taking the course. Supplemental Instruction (SI) is a peer study group lead by an exemplary student who has taken the course. As a peer supplemental instruction leader I was interested in the use of interactive teaching methods to help students who had trouble with the traditional lecture setting. I was so intrigued by an article on interactive teaching published by Renee T. Ridley in 2007 that I decided to investigate the premise of the article in my SI study sessions. Two different methods of conducting the SI sessions were evaluated. A variety of measures was used to assess the effectiveness of the two variables: they included evaluation of short- term retention, long- term retention, and a student survey. As to be expected interactive teaching techniques work with some students but not all. However my research does suggest that even though there is no perfect environment for learning, repetitive exposure regardless of the learning environment produces the best learning outcomes.

Introduction

For many students, Anatomy and Physiology (A&P) is not an easy subject to master. At Concordia University Wisconsin, students who have successfully completed an A&P course often participate in a student success program, called Supplemental Instruction (SI) that is geared toward helping current A&P students. The SI program is a study group led by a peer student who has completed the course and has achieved an A in the class. As a SI leader for two years, I experimented with various teaching methods searching for a strategy that would best provide student success in A&P. This study was developed from my desire to evaluate in a more systematic manner the effectiveness of different approaches I had implemented.

The traditional method of teaching A&P with lectures and labs, followed by content driven unit exams, is the method preferred by many students. However, there are a number of students who seem to respond better to information presented in a more interactive environment. According to Ridley (2007), interactive teaching has many positive outcomes for students related to self-efficacy, critical thinking and stronger communication skills. Through my investigation I have come to believe that one must incorporate a mix of traditional and interactive instruction to ensure that the maximum number of A&P students will benefit from taking the course.

During the Spring 2014 semester I analyzed the effectiveness of two different teaching strategies. Students were free to attend sessions of SI based on their schedule and preference. One SI session per week was taught in an interactive environment and one SI session per week was a lecture setting. Students that attended both sessions each week were grouped into a combination group. The session groups were then compared to the entire A&P class of 113 students. The SI groups varied in session attendance: the interactive session attendance ranged from 5 to 9 students, lecture session attendance ranged from 5 to 12 students and attendance for the combination group ranged from 6 to 11 students.

Methods

There were three methods of evaluation utilized to assess student learning. Students who attended an interactive SI session were given pre- and post- session questionnaires. This first method was directed at evaluating the short- term understanding of the particular concept each interactive activity addressed. The actual questions in the pre- and post-session questionnaires differed, but the content being evaluated was the same.

The second method evaluated the long-term retention of the material covered in the SI session. This was accomplished by imbedding test questions in the unit exams. The imbedded test questions were based on the information in the activity from the SI session. All students were instructed on the same concepts in the formal lectures and labs. The results of the imbedded test questions were analyzed and if statistical difference were found, comparisons between the SI groups and the class as a whole were conducted.

The third method of evaluation was the use of a survey. All SI participants were given an end-of-the-semester
survey at the final SI session. The students were asked to reflect on their overall experience with the SI teaching methods and how they felt it impacted their learning. The responses were in a Likert scale from 1 to 6 as follows: (1) “SI did not help” and (6) “SI was extremely helpful”. Questions targeted conceptual understanding for individual activities, perceived value of SI, and overall study time.

Five activities were incorporated into the interactive SI session:

1. **Endocrine system- Flying Tennis Balls**
   
   **Purpose:** to explain how hormones act in the body.
   
   **Materials:** tennis balls labeled with hormones (GH, PTH, etc.), additional labeled signs with pathways the hormones travel and their target glands.
   
   **How to Play:** Each student chooses a gland or organ that s/he will represent and claims the corresponding label. The instructor then verbally facilitates the hormonal interaction as the tennis balls are thrown through the pathway to reach the target organ.

2. **Cardiac physiology- Hop-Scotch Through the Heart**
   
   **Purpose:** to explain the heart’s conduction system and the pathway blood travels through the heart.
   
   **Materials:** heart outline – an outline of the anatomy of the heart drawn on a plastic drop cloth works well. (See Figure 1)
   
   **How to play:** Students act as red blood cells and walk through the diagram heart to learn the pathway prompted by verbal cues from the instructor. To incorporate the conduction system of the heart, each student acts as an electrical stimulus traveling from node to node by moving appropriately through the heart.

3. **Immune system- Immunity war**
   
   **Purpose:** to explain how T-cells and B-cells interact to protect the body
   
   **Materials:** scrap colored paper crumpled into balls.
   
   **How to play:** One student acts as the foreign invader. The instructor divides the remaining students into B-cells, T-cells, and T helper cells. The instructor then verbally facilitates the various immune response scenarios as the students throw the paper to signal communication between the cells.

4. **Stomach- Fun with Food**
   
   **Purpose:** to visualize the various cells within the stomach and associate each type of cell with its function.
   
   **Materials:** colored candies like M&M’s or Skittles and a stomach outline printed on copy paper for each student.
   
   **How to play:** Give each student a bag of colored candies. Students will then place the different colored candies on their stomach outline while the instructor discusses what each colored candy “cell” does within the stomach.

5. **Renal system- Stroll through the kidney**
   
   **Purpose:** to explain why and where the ions and molecules get filtered in the nephron
   
   **Materials:** bananas, Cheez-its, water bottles, plastic drop cloth with a nephron outline on it (See Figure 2)
   
   **How to play:** Split the group in half. One half of the group stands inside the nephron and is tasked with filtering the ions. The other half of the group stands in the peritubular capillary and is assigned to reabsorb ions. Students will pass the various materials into or out of the peritubular capillary to simulate how filtration and diffusion work within the nephron.

Figure 1. Plastic drop cloth with heart outline

Figure 2. Plastic drop cloth with nephron outline
Results/Discussion
Interactive methods, as described above, were designed to help students who have difficulty with recalling concepts from a textbook or a lecture. Interactive methods may not be helpful to a student who is successful in the traditional environment. The effect of SI instruction on short-term retention did not yield any major differences in learning. The pre- and post- session results indicate that the objectives within the activities aided some students in understanding concepts, but did not prove helpful to others. This could be a result of my minimal experience in question writing. It could also be the result of extensive content covered in an hour- and- a half session and students struggling to grasp all of the content at once.

The imbedded test questions provided varying results. In general those students who attended a form of SI performed better on the imbedded test questions than those students who did not attend any form of SI. When comparing the interactive and the lecture styles of SI, those who participated in the interactive group generally performed better than those who participated in the lecture group. Three out of the four questions with statistically significant difference between group responses favored the interactive group. The lecture group outperformed the interactive group in the test question about blood movement in the heart. This could be a reflection of the difference in presentation styles between the two SI sessions. Interactive activity requires student participation while in a lecture setting students were listening and could take notes to further review on their own. The data did not suggest that students who attended a combination of SI sessions fared any better than the students who attended just one style of SI. Their correct responses on the embedded test question generally fell between the interactive and lecture SI groups data. This could be because in attending multiple sessions, students learned about the material from multiple SI leaders. The challenge of combining information from numerous sources may have been reflected in the answer response percentages.

The survey results offered some insight into the student perspective. It was found that SI helped decrease the study time for students who had a higher perceived value towards SI. This could be explained by several factors. The class met Mondays and Fridays, with lab times either Wednesday or Thursday. The SI sessions were held on Sundays, Tuesdays, and Wednesdays so the students had opportunities for guided instruction in A&P six days a week. It is possible that the students would first hear the content in lecture on Mondays, then again in an interactive form on Tuesdays, then work with the content in the lab on either Wednesdays or Thursdays, and receive further instruction via a form of SI on Wednesdays. This repetition of content may have helped students learn the material and better commit it to memory, thereby lessening the need for additional study time. Another explanation for the decrease in study time might be that the activities in SI answered many of the students’ questions, further cementing their understanding of the concepts and they did not feel that they needed to reiterate those concepts in private study time.

Conclusion
This study has been based on a small sample size, but it has reinforced the idea that each student learns individually. There is no perfect setting that simultaneously fulfills the learning needs of every student. This research does not demonstrate that interactive teaching benefited every student, or that interactive activities were the sole reason for any one student demonstrating a better understanding of a particular concept. This work suggests that the way to foster a constructive learning environment is to keep learning methods simple and to continuously work with students to facilitate their understanding of key concepts and to help them with their learning-related struggles.

Literature cited

Becca Ludwig is a Masters of Occupational Therapy student at Concordia University in Wisconsin. She has been a recipient of a Primal Pictures student travel award and a HAPS Scholarship and she presented a workshop at the 2014 HAPS annual conference. Her goal is to work with patients in an acute care or a spinal cord unit.
An Autopsy Demonstration: A Unique Learning Opportunity

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Abstract
This article describes a class observation of a complete autopsy. The autopsy procedure is elucidated in detail and pertinent student comments are recorded. In the course of an autopsy many opportunities exist for students to learn through direct observation and one-on-one interaction with medical professionals. It is a unique and unforgettable learning experience.

11001 Cedar Avenue, Cleveland, Ohio. 10:10AM on a cold January morning. A young female in her early thirties has been found dead by her mother. Her round body is lying in the supine position, mouth slightly open, eyelids shut, fingers crinkled as early stages of rigor mortis creep in. In contrast, the tall slender medical examiner greets us in this bright room located on the 6th floor of the Cuyahoga County Medical Examiner’s Office. Her warm smile is welcoming. The specially designated large space we walk into is located at the South/East side of the building where an entire row of windows wraps the corner of the edifice. It is a bright sunny day, and the views of downtown Cleveland are amazing. The students, a silent group of nine, quietly enter the room with solemn faces and eyes wide open. They are in shock. This young soul lying on the cart was still alive just the night before. We had agreed to pray for the one who would be the subject of our observations today. We did not know who that would be. All we knew is that someone would be expiring over night and we would be sharing a room the next morning. However, last night’s prayers were in the past. This is now and we are finally here at the medical examiner’s office. The opportunity to learn is tremendous. The moment is even more significant as these Anatomy & Physiology students are all undergraduate students studying to be in the medical field. This may be the only time in their life they will have the chance to observe an autopsy. They are appreciating the opportunity and attention is at an all time high.

Dr. Pekarski is our designated medical examiner for this autopsy demonstration. She is only in her early thirties, yet she has already testified in high profile cases such as the one against the infamous Cleveland serial killer Anthony Sowell. She introduces us to today’s case. Everyone listens with utmost attention. No one approaches the body on the cart though. Not yet. Following Dr. Pekarski’s opening remarks, the medical assistant introduces himself: Mike Vitovich, a former student of mine who specifically signed-up to help on this case in order to meet again. The atmosphere loosens up already. The history on the young female is limited: she suffered from asthma and had flu-like symptoms in the days preceding her passing. The investigation into her death is already intriguing. Everyone steps back, as Mike gets ready to perform the typical Y-cut incision to open the body and expose its cavities. Silence. A student notes the odd orange coloring of the adipose tissue. Mike is quick and skillful. Another student teasingly challenges Mike’s abilities. Mike pretends to be offended and everyone laughs, loosening up a bit more. The young woman is now just a body, organs exposed, ready for internal investigation. As Mike finishes his masterful dissection, Dr. Pekarski explains the role of a medical examiner: to determine cause of death and manner of death.
She enumerates the 5 categories of the latter: natural, accidental, suicidal, homicidal and undetermined. The concentrated thick blood indicates dehydration. Samples are taken from the aorta for qualitative measures. Quantitative measurements will be performed using peripheral, femoral blood. The students are shown the aortic arch and brachiocephalic trunk. They are excited. They just learned about these structures this semester. The vessels appear void of clots and no signs of early atherosclerosis. The lungs look hyper inflated though. Lividity is apparent with a darker coloration on the posterior surface of the lobes. The blood pooled there, as the woman was lying lifeless on the ground. Mike pulls the heart and lungs out of the chest cavity.

Mike then pulls out the remaining organs of the gastrointestinal tract for future observation. Mike then performs one of his tricks: he presses on the leg with an upward motion and demonstrates how blood moves upwards through veins by the compression of the leg muscles. The students love the demonstration. “That’s why we ask you to bend your knees if you feel you are going to faint. It helps get the blood up to your head.” Everyone smiles. No one has fainted and everyone is still at full attention.

With all the anterior organs out, the medical examiner points to the kidneys still in place. The adrenal glands are visible. The students are over the body now, excited to discover the organs they studied so hard in the preceding months. Urine is collected from the bladder. Cocaine metabolite, opiates or other drugs, if present, can be detected in that sample. At this point, the vertebral column is completely visible; so are the back muscles and parts of the skeleton.

The initial shock of being in the presence of a deceased human body is now gone. The realization that this is a once in a lifetime learning opportunity regarding the human body is at its peak. The questions are coming fast and furious. “What would the organs look like if she was alcoholic?” “Would you know if she was strangled? Asphyxiated?” “Did you observe any outward trauma prior to the dissection?”

However, everyone turns silent again as Mike prepares himself to open the skull. An incision is made in the back of the head and the scalp is forcefully peeled with a forward motion and rolled over anteriorly, covering the face like a folded sock and exposing the skull. No trauma observed. The saw is turned on and the skull is cut. The calvaria pops off, exposing a shiny, healthy looking brain. No epidural hematoma. The thick protective dura is peeled off, and Dr. Pekarski explains the difference in the vascularization between the dura and the arachnoid matter. This is very informational. Mike pulls the brain out, severing the cranial nerves and vessels at the base while Dr. Pekarski explains the need for histology sampling. Often following autopsies, additional information is required from observation at the tissue level before a final cause of death can be determined. More questions are fired from my actively participating students: “How can you see from my actively participating students: “How can you see if it’s bacterial versus viral?” The medical examiner answers patiently, armed with her knowledge and love of teaching. It is obvious she is enjoying the educational aspect of our visit.

Now that the brain is out, Mike points to the pituitary gland sitting in its sella turcica. “Cool!” I hear from the students. Mike tells them to keep an eye at the base of the cranium where the superior portion of the spinal cord is visible through the foramen magnum. He performs another one of his tricks: “now you see it, now you don’t!” He pulls the spinal cord out from below. The students are now looking down a hollow tube. The questions keep pouring in. “How come it’s so short?” they ask. “It contracts once it is pulled out of the vertebral column,” Mike answers. “Look at the caudal equina. It does look like a horse’s tail!” the students exclaim.

Mike pulls the tongue out and checks for any bite marks, which would indicate possible seizure. None here. Dr. Pekarski points to the epiglottis and the trachea. We observe evidence of pus there. At last, some indication of the condition this woman was in prior to her death. She indeed had an infection. Mike ties the vessels allowing for future embalming by the funeral home. The body is finally wheeled out. We thank Mike who leaves the room too.

11:10AM, Dr. Pekarski commences her dissection of the organs, her preservative-filled containers are neatly aligned on her metal worktable. One tub will be used to preserve the standard specimens, heart and lungs, that will be sent for histology preparation. She uses the other tub to save a section of each organ she is about to dissect, in the event she needs to examine additional tissues in the future. She observes the pharyngeal pus seen earlier. No tumors, no food bolus obstructing the airway. A section of the respiratory mucosa is sampled for histology. She removes the thyroid gland and saves that too. As the spinal cord is sectioned, Dr. Pekarski gives us a little review on its anatomy, which includes cervical and lumbar enlargements. More questions arise from the students who have not missed a second of this entire autopsy.

The brain is next. No outside trauma observed. Dr. Pekarski performs transverse sections of the organ and a student asks, “What does it feel like to cut through a brain?” “It feels like I am cutting through soft butter,” she answers. The gray mater and white mater are well proportioned, with the edge between the two regions appearing clear, unlike in cases of encephalopathy. She explains that in the case of dementia, the ventricles would look like huge bat wings as the brain tissue shrinks and allows for the ventricles to expand. She also describes the brainstem as she is sectioning it. The students ask more questions about Parkinson’s Disease and Alzheimer’s Disease. No evidence of stroke is observed here.
The pelvic block dissection follows. The bladder looks normal and the cervix presents a “fish mouth shape” opening indicating that childbirth had probably occurred. Dr. Pekarski sections the ovaries and points to corpora lutea. Everyone is in awe at the ability to observe these cells with the naked eye. Dr. Pekarski cuts the uterus open, and we observe the thickness of this muscle. Besides a large blood clot indicating menses, there is no evidence of pregnancy. The kidneys are shiny and normal looking. They are weighed and sectioned. The students observe the color difference between the cortex and the matrix and remember their lab practical given only a few weeks ago.

The gastrointestinal tract is next. The spleen and liver look healthy. Dr. Pekarski runs the intestines through her fingers and detects no abnormalities. Bile is collected and so are gastric contents, although she explains that the information there is rarely used. Dr. Pekarski explains what causes decomposition: bacterial breakdown, which is called putrefactive decomposition and enzymes leaching out which is called enzymatic decomposition. Since the pancreas is rich in digestive enzymes, we see definite signs of decomposition here. The esophagus shows signs of tear that could indicate possible vomiting might have occurred. This is consistent with her flu-like symptoms.

The chest block consists of the heart and lungs. Dr. Pekarski looks for pulmonary embolism. Nothing. The aorta is cut and looks spotless. No plaque build-up. The trachea however, is lined with pus, indicating obvious infection. The heart and lungs are weighed. Dr. Pekarski then sections the lungs, and further observation is conducted. Dr. Pekarski looks for mucus plugs that would indicate condition of asthma. Some are spotted. Dr. Pekarski sections the heart as well. It is presenting with normal valves and heart chambers. The students are immensely interested and observant. No scar tissue is seen. The heart looks completely normal.

The autopsy is over. The question has yet to be answered: How did this young woman die? Further histological evaluations are needed to determine that. It will most probably include the following culprits: the flu-like symptoms she was experiencing, combined with an underlying condition of asthma. As frustrating as it is not to have a definite answer on the spot, the students feel overwhelmingly grateful at the opportunity to have participated in such an investigation. We thank Dr. Pekarski repeatedly and leave feeling more knowledgeable about the impact death has on our human body. However, we also leave with a special appreciation for life itself, a life that has expired all too soon for a young woman who was in the prime of her life.

About the author:

Dr. Jabbour is an Assistant Professor of Biology at Franklin Pierce University. She has taught Anatomy & Physiology for over a decade and has seen numerous of her students succeed in their studies and careers.
Poster Presentation Summary

Innovations in instructional technology to enhance learning experiences of upper level biology students

Mary Vagula, Ph.D., Associate Professor, Biology Department, Gannon University
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Instructional technology is a rapidly evolving field that is intended to improve the effectiveness of teaching and learning for both teachers and students. The essential components for instructional technology systems are the following: appropriate design instruction, application of learning theory to instructional design, selection of an appropriate delivery system, process evaluation, management and adoption of innovations, and the implementation of a delivery system to learners. At Gannon University an upper level physiology course, BIOL368, is offered to undergraduate junior/senior students who have a basic background in biology. This is one of the required courses for students applying to professional health science programs such as medical school, physician assistant programs and doctorate of physical therapy programs and it is critical in preparation for the MCAT exam. We believe that a thorough understanding of physiology forms the basis for success in professional programs. However, a majority of students find the study of physiology challenging and subtle key points may evade the attention of casual students unless the instructor explains them upfront using an interactive method. For these reasons the following course objectives have been adopted for this course:

Upon completion of BIOL368, students should be able to:

a) Understand the complex nature of the functions of the human body,

b) Understand the themes of homeostasis, the integration and communication of physiological systems, and the primary structure-function relationships of physiological processes,

c) Describe the physiology of the primary organ systems and develop an understanding of the changes that occur in abnormal physiological conditions

d) Learn the skill of synthesizing numerous general physiological principles and be able to apply this skill to new situations.

In order to achieve these objectives four instructional tools, SoftChalk, student response systems, iPad case files, and Prezi, were used in teaching renal physiology, muscle physiology, and digestive physiology to approximately 45 students enrolled in BIOL368. SoftChalk is a software package that allows the instructor to create interactive lessons for students. The lessons can be uploaded in Learning Management Systems such as ANGEL and Blackboard, or published as web pages or CD-ROMs. Engaging interactive activities and quizzes can also be created using this software. Student Response Systems, known as clickers, help to keep every student engaged in class. Using them the instructor can ask questions in various formats such as multiple-choice, multiple-correct, numeric-response, true-false, or yes-no, and keep track of immediate student responses. This allows the instructor to effectively assess student comprehension and progress. Prezi is a presentation tool that makes use of one large canvas to pan and zoom various body parts and emphasize the information associated with each area. Prezi supports the use of text, images, and videos and also provides a collection of templates to help new users become accustomed to the interface. The iPad Case files application, which can be used to engage the students in discussions of physiology and pathophysiology, was developed by McGraw Hill for iPads. This application presents 51 case studies of pathological conditions. Each case study includes the symptoms, diagnosis, and treatment for the condition along with the mechanism of action of appropriate medications associated with the condition. Each case is followed by questions and clinical correlations. The pathophysiology of an affected system is then contrasted with the normal one.

Students were asked to provide feedback on these teaching tools shortly after their exposure to them. Student input was very positive, with about 90-95% of students expressing enhanced ease in learning complex concepts in physiology. The majority of students indicated that these tools helped them: a) learn the subject matter quickly, b) review the material more meaningfully, and c) appreciate the application in real life settings. Students’ suggestions

continued on next page
It was observed by the this instructor that the use of instructional technology in teaching physiology concepts helped motivate students, contributed to better student comprehension, reinforced learning, encouraged class participation, increased the quality of student-instructor interaction, and allowed the instructor to keep track of student preparation.

The following pie charts show the students’ responses to each of the instructional tools.

**Figure 1. Students’ feedback on SoftChalk (SC)**

- 19% Liked for its content
- 25% Liked SC
- 34% Enjoyed SC/Very helpful
- 12% Great links/Resources in SC
- 10% Powerpoint better than SC

**Figure 2. Students’ feedback on 'Clickers'**

- 56% Liked anonymous participation
- 29% Helped in better understanding
- 9% Helped in reviewing the material
- 6% Engaging/Interactive learning

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In summary, it was observed that the use of instructional technology in teaching physiology concepts proved to: motivate the students thoroughly, contribute to better understanding, reinforce learning, encourage participation, increase the quality of learning by interaction, and check the preparedness of students.
EDU-Snippets: Action Packed Brainiac Snippets

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

Roberta M. Meehan
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Phoenix, AZ
Edu-Snippets@hapsconnect.org

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. As a matter of fact, you have come through with flying colors and we have an action packed synaptic column here. After all, our main theme deals with the brain and central nervous system. Hopefully you will be able to utilize what our colleagues have submitted. Hopefully, too, some of the ideas presented here will spur you on so that you can either make alterations to fit your own needs or spark your imagination so that you can come up with your own Snippet idea, which you can then submit for publication.

While each of the exercises presented here was initially designed for introductory college courses, all of these ideas can easily be modified, adapted, or augmented for middle school, junior high, or high school classes. This is a good selling point for your college students with children in various other educational settings. Also, if you have students in advanced (or even graduate) classes, these projects can be modified or upgraded for them too! EDU-Snippets encourages you to take these ideas and run with them!

In September 2014, the HAPS-L discussion group got off on a BRAINY discussion. The idea for themes for different issues of this column had come up in the past and so it seemed quite natural that the theme for this edition would be the BRAIN and CENTRAL NERVOUS SYSTEM – a good theme indeed!

I. Snippet News
– (Repeat News)

This Snippet News section appeared in our column last year. It is well worth repeating. EDU-Snippets has some big news!! We now have our own email address! (Relate this to our theme because this is all information transmission.)

Edu-Snippets@hapsconnect.org is where you can send your Snippets or anything else related to the column. Don’t worry if you accidentally send something to me at my private address. (Some of you probably have that address in your address book.) Our EDU-Snippets address will be forwarding everything to me anyway. The advantages of having this address are first that it will be easy for you to reference and remember and second that everything that is sent to the new EDU-Snippets address will be automatically backed up. No one will have to worry about a lost submission or a major computer crash. The new address does work too – thanks to Peter English, whose idea it was and who set it up for us. Write up a Snippet and try the new address!

II. Short Snippets

Sometimes in the lab or lecture hall when we are teaching these CNS ideas, we need something short and to the point. Several of our members submitted short and very well-timed Snippets.

A. Two Quick Ideas

Andrew Petto (University of Wisconsin Milwaukee, apetto@uwm.edu) sent to the HAPS list two quick ideas (slightly edited) to start us off on our examination of the brain.

One of the things that my students enjoy (though it is above the level that we teach in the intro courses) is the set of quizzes on neural pathways you can find HERE. Try it! It is great fun, especially when you get something wrong.

In a similar vein, I ask students to read a short description of a common experience (hearing a siren or seeing a ball bounce across the road while driving or almost anything else with some sensory component); then they have to describe the pathway from the sensor to the primary area in the

continued on next page
brain that it serves, PLUS they have to describe how it gets to at least 3 other parts of the brain that are also involved in the reaction that they experience (easy ones are memory, emotional response, motor activity, sympathetic division activation).

For freshman working on this, the level of detail expected is low, but they have to be aware AT LEAST that there are internal links between these different parts of the brain. A lot depends on the text, so I tend to use visual and olfactory examples, since these are well illustrated in Ken Saladin’s A&P: Unity of Form and Function. Students can also be encouraged to search out their own examples and possibilities on the internet. It does get them interested and involved!

B. Also from Milwaukee
On this same topic, Pat Bowne (Alverno College, pat.bowne@alverno.edu) chimed in with this extremely useful statement.

I use a lot of stories from “The Man Who Mistook His Wife for a Hat.” (That is a terrific idea – and quite easy to implement.)

C. Anyone for a Ganglion?
Finally, Hiranya Sankar Roychowdhury (New Mexico State University, hroychow@hapsconnect.org) came up with a simple nervous system memory device.

Last week this came to me while teaching the PNS anatomy and about the ganglia. Students (for some inexplicable reason) cannot seem to remember what a ganglion represents! So, I said “can you remember a ‘gang’?” They got it. “A Gang of cell bodies!” I am not sure if anyone else used this allegory be fore, but I thought it was smart.

III. Potentially a Transmission Snippet
Once again Andrew Petto (University of Wisconsin Milwaukee, apetto@uwm.edu) came up with a solution to a problem that many of us have faced over and over and over. This Action Potential Transmission Demonstration sounds like it is well worth trying! It could even be modified for smaller classes.

How do we make nerve transmission dynamics tangible to students? In our larger classes, we use tennis balls to demonstrate why myelinated nerve neurons transmit action potentials faster than unmyelinated nerve neurons do.

Our lecture halls have theater seating (rows upon rows with aisles in between sections). In this scenario, the neuron is the row of student, and the synapse is the aisle. The movement of the action potential is demonstrated by the students’ passing a tennis ball from one end of the row to the other, along the rows and across the aisles. Those in myelinated rows use a red tennis ball, and those in the unmyelinated rows use a green tennis ball (any two colors, will work, of course).

Students who reside in the myelinated neuron rows use “saltatory conduction”—tossing the tennis ball from one student to another a few seats down the row. Students who reside in the unmyelinated rows hand the tennis ball from one student to the next. When the ball reaches the aisle in either type of transmission, the person sitting at the end of one row must walk the tennis ball across the aisle and hand it to the person sitting in the first seat of the corresponding row, simulating the diffusion of the neurotransmitter from the presynaptic to postsynaptic neuron.

When the action potential (the tennis ball) reaches the end of the last row, the last person in the row stands up, holding the ball aloft. The tennis balls in the rows using saltatory conduction should arrive ahead of those in the other rows, and this is usually the case. The larger the classroom the greater the difference in the transit time … a teachable moment about the relative lengths of different classes of neurons and their transmission speeds because students can reflect on the effects of longer rows on the differences in the time needed to travel to the end of the row.

One caveat is that this only works well if the students in the saltatory conduction rows can throw and catch effectively … which allows for another teachable moment regarding the properties of the Nodes of Ranvier and the integrity of the myelin sheaths; and this can lead to a discussion of the the effects of those properties on proper conduction and the impact of demyelinating disorders on nervous system function.

IV. Mapping a Snippet of Brain
Christine Boudrie (Lourdes University, cboudrie@lourdes.edu) sent in an interesting idea for mapping the brain. This is the way she does it. Chris even includes a suggested scoring system.

BRAIN MAP

Instructions:
1. Map a lateral profile of your head and neck onto the paper provided. You can choose whether to make a LEFT lateral or a RIGHT lateral view. Put your name on your portrait.

2. Using your A&P textbook as a guide, draw and label the structures listed below into this sketch of your head. Make a simple map of your brain that is study-worthy. Demonstrate the study techniques you have learned in your first semester of college on your map (neatness? use of numbering, upper case/lower case, color? symbols? a clear legend for your map?)
a. Title your drawing.
b. Mark ANTERIOR and POSTERIOR outside the outline of your head.
c. Label the four major regions of the brain including the 3 sub-regions of the brainstem.
d. Draw in and label the three meninges along a portion of the cerebrum (you choose where to draw these).
e. Label all lobes of the cerebrum (don’t forget the insula with a dotted line – it is deep!). Draw in and label all the sulci that delineate the lobes.
f. Draw and label the beginning of the spinal cord as well.

3. Bring your completed map to class on _____________.

**Grading:**
I am looking for the following criteria to be met:

(1) Follows directions for this assignment. ......................[1 point]

(2) All structures are correctly labeled and spelled correctly. .. [14 points]

(3) The structures are drawn in their correct relative proportions (e.g., is the cerebellum in correct proportion to the cerebrum, etc.) Use your text to guide you! .................................[5 points]

(4) The structures are placed in the correct locations within the contour of your head (e.g., is the brain situated correctly relative to your occulus, nasus, and cervicis? Does the spinal cord enter/exit your cervicis at the correct level?) Use your text to guide you! ..............................[5 points]

I am NOT looking for an artistic masterpiece, just an anatomically correct portrait.

**V. Engaging a Snippet of Brain**

And another interesting suggestion came from Janice Fritz (St. Clair County Community College, jfritz@sc4.edu). Janice is concerned about students fully engaging with specimens or models – and rightly so. This exercise is written generically and could be applied to any anatomical lesson. It is extremely appropriate for our venture into brain anatomy.

If your students are anything like mine, many of them fail to fully engage with specimens or models during lab time. They look at the models, poke at a couple of things to look busy, ask each other, "Is this the wachacalit we’re supposed to find?", and leave convinced that they now know the anatomy of the specimen. Their test scores do not support this conviction.

My new method for improving active participation in lab is to have students make video recordings. Nearly every student has a device capable of recording video and those who don’t are welcome to use mine (we have a few iPads designated for use in A&P classrooms). The students make short recordings of themselves pointing to and naming the structures on the models or specimens and upload them to a private class YouTube channel.

The amount of attention they put into their lab work has dramatically increased, their test scores have improved, and I have a mechanism to assess their knowledge apart from formal exams. Sometimes I watch the videos to grade the completeness and accuracy of their identification and other times I just check the channel to make sure that they uploaded a video. Either way, they benefit from engaging more actively with the models and specimens.

**VI. Color Coding a Snippet of Brain**

Tom Lehman (Coconino Community College, t.lehman@coconino.edu) sent in. This is the type of thing students usually remember throughout their academic and professional careers.

During the brain lecture, each group of students has a small white board and several colors of clay (or markers). I give them a list of brain functions – balance, hearing, memory, smell, somatic sensation, taste, vision – and have them determine which color best represents each function. Then, I have them build the cerebrum out of those colors and have them determine where each color goes. This helps them make connections that apply personally for them. (For instance, “Red is the most visually stimulating color, so I’ll remember the occipital lobe as red!”)

**VII. Off Topic Snippet of Brain**

Finally, based on the time of year, several people talked about what to do with leftover Halloween candy. Use the candy to teach metabolism – any type of metabolism – or anything related, such as cholesterol values. Here is what Pat Bowne (Alverno College, pat.bowne@alverno.edu) sent in. This would work equally well for leftover Christmas candy, leftover Easter candy, leftover candy of any type. (This doesn’t exactly have anything to do with the brain directly, but if you stretch your imagination a bit….)

The body eats the fat (candy) and passes it into the lacteals as chylomicrons (the large bag of candy).

The liver then receives the chylomicron and repackages it into VLDLs (smaller bags).

The VLDLs are passed around the class, each cell taking as
much as it wants. The lipoproteins become smaller and less full of fat, becoming IDLs and finally returning to you as half-empty LDLs. You can emphasize that the LDLs are the leftovers, the unneeded fat.

If you want to you can pass the LDLs around again and have people hide them away in the classroom, explaining how they will go bad there and cause problems. Then you can pass around some HDLs (near-empty bags) to collect them again and take them back to the liver.

VIII. And We Hope You Will…. Keep those cards and letters coming (right to our new address)!

Thank you all for your EDU-Snippet contributions. The influx of Snippets has been good! Please keep it up because more are always needed! Your ideas are tremendous! If you have thoughts or ideas, or any other interesting ways — any inspirations at all, great or small — 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 contributing! I would think that some of the super discussions lately on the HAPS-L discussion group ought to generate some great Snippet ideas for your own lecture or lab. If so, please share them with us.

For the next issue of the HAPS-Educator, send your EDU-Snippet experiences and ideas to Edu-Snippets@hapsconnect.org as soon as possible. You will also find a reminder on the HAPS-L discussion group. Plan ahead. You can even submit your ideas now and maybe next issue you too will see your EDU-Snippet in print! Perhaps a hormonally challenged Snippet theme would be good. If that challenges your endocrine system, send on a Snippet!! ■

REGISTER NOW:
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Current HAPS-I course offerings for SPRING 2015:

**Mechanisms of Disease: Type 2 Diabetes Mellitus** (2 credits)
Dr. Brian R. Shmaefsky

The last two decades has seen ground-breaking advances in basic and medical research, from the sequencing of the human genome to the identification of over 15 million human DNA variations, to the use of those variations to track down elusive disease genes and epigenetic factors. The wealth of genomic, proteomic, and epigenetics information combined with cutting-edge technologies has changed our past understanding of human disease. This course will examine the cellular, molecular, epigenetic basis of endocrine diseases as a model disease that connects the cellular processes with the physiology and pathophysiology at the tissue and whole organ level. The spectrum of disorders that produces type 2 diabetes will be the focus of younger population. This course uses case studies and current literature reviews in an asynchronous virtual format and will require an online coursework. The ability to interact in formal discussions will be available at the annual HAPS conference. The content of the course is directly applicable to those teaching classes ranging from physiology. This course is designed to facilitate your teaching as well as updating your content knowledge. This course will follow a completely on-line format and will require 20 hours of coursework.

**Introduction to Educational Research Methods** (1 credit)
Valerie Dean O’Loughlin, Ph.D.
May 3, 2015 - June 15, 2015

This course is for college level instructors who want to become more familiar with basic educational research methods. Participants will learn about metacognition, how people learn, the basics of quantitative versus qualitative educational research methods, how to search the educational literature database, the scholarship of teaching, and develop a foundation for implementing classroom research and assessment. Participants will learn the material through directed readings, online weekly synchronous discussion forums, and face-to-face instruction at the HAPS 2015 meetings (or additional online reading/assignment component, should the participant not be able to attend the HAPS 2015 conference). In addition, participants will apply the information they have learned in the independent development of an educational research question they want to examine in their own classroom.

Courses are continually added, watch our Facebook and Google+ pages for the latest course announcements!
Upcoming Regional and Annual Meetings

We are currently accepting poster and workshop proposals for both.

HAPS Central Regional Meeting 2015

3/7/2015 to 3/8/2015

When: 3/7/2015

Where: Galen College of Nursing, Cincinnati
100 E-Business Way
Suite 200
Cincinnati, Ohio 45241
United States

Contact: HAPS Main Office
info@hapsconnect.org
Phone: 1-800-448-4277

Online registration is available until: 3/7/2015

HAPS 29th Annual Conference 2015

5/23/2015 to 5/28/2015

When: 05/23/2015

Where: Hyatt Regency
San Antonio Riverwalk
123 Losoya Street
San Antonio, Texas 78205
United States

Contact: HAPS Main Office
info@hapsconnect.org
Phone: 1-800-448-4277

Online registration is available until: 5/8/2015

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Terry Thompson, Co-Chair
This committee develops and catalogs resources that aid in anatomy and physiology course development and instruction.
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The HAPS Foundation was established to create a mechanism by which donors could make tax-deductible contributions to projects that support professional development programs for A&P teachers and that enhance the quality of human A&P instruction.
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HAPS EDUCATOR
Sarah Cooper, Co-Editor
Jennelle Malcos, Co-Editor
This committee is responsible for publishing a quarterly edition of the HAPS-EDucator, the journal of the Human Anatomy and Physiology Society. The committee works closely with the Steering Committee and the President of HAPS.
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Kyla Ross, Co-Chair
This committee is charged with expanding our membership base to include all Human Anatomy and Physiology educators or those individuals, institutions and corporations crucial to the HAPS mission statement of “Promoting Excellence in the Teaching of Human Anatomy and Physiology.”
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Neal Schmidt, Co-Chair
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TESTING
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Click here to visit the HAPS committees webpage.