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Thanks to Christine Eckel and her friend Karl for the artwork on the cover of this issue of HAPS-EDucator. Christine says, “We started to do wood cuts and then linoleum block carvings of anatomical subjects - and then made prints from them, just like Vesalius!” Christine is a very active member of HAPS and serves as the Western Regional Director. She is on the faculty at Salt Lake Community College, Salt Lake City, UT.
HAPS-EDucator is the official publication of the Human Anatomy and Physiology Society (HAPS) and is published four times per year. Major goals of the Human Anatomy and Physiology Society are: to promote communication among teachers of human anatomy and physiology in colleges, universities, and related institutions; to present workshops and conferences, both regional and national, where members can obtain information about the latest developments in the health and science fields; and to encourage educational research and publication by HAPS members. HAPS was established in 1989.

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CONTACT THE HAPS-EDucator Editor: Susan Baxley, HAPS, 8000 Bonhomme, Suite 412, St. Louis, MO 63105. hapsed@hapsweb.org
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Greetings from your President

Joe Griswold, HAPS President

president@hapsweb.org

I write this as many of my colleagues are in the throes of final exams before they head off to San Diego and the conference. You will be reading these words sometime in the summer. Given the disconnect in time and events, this message will focus on the future.

The immediate future is the 2007 Annual Conference where the largest group of HAPS members in history will gather to learn, renew friendships, network, participate on committees, and enjoy the great events Kevin Petti’s group has planned. Having been in the presidential “hot seat” this year has changed that scenario somewhat for me. My time of preparation remains intense because there are duties: leading the pre-conference meetings for two days, making sure the annual business meeting is organized, and communicating with the dozens of people who will be involved in various ways. The culmination is handing that gavel to President-Elect Margaret Weck who takes over officially on July 1st. The signs are good for another “best annual conference ever.”

As I began my work as president, a venerable member of our society urged me to get former presidents more involved in the life of HAPS. And what great advice that was! Here are a few of the notable efforts made by the Emeriti: Kevin Patton, whom I write more about below, heads the task force that launched our new continuing education project, HAPS Institute. HAPS-I offers its first two courses in San Diego and registration looks strong. Mike Glasgow agreed to head the search committee for a new management company, and his group is making excellent progress. Sandy Lewis organized a regional conference in the West and served on the HAPS-I task force. And Phil Tate worked hard to investigate how HAPS might launch a foundation or trust fund to raise money to support our programs. We are grateful for their continuing leadership.

While there were many highlights during the year for me, two particularly stand out as significant for the future of HAPS. “Promoting excellence in the teaching of Human Anatomy and Physiology” is the heart of our mission statement, and nothing more directly bears on that goal than the continuing education events that occur at annual and regional conferences and with the resources on www.hapsweb.org. The long-time dream of several HAPS leaders, including me, has been to take those efforts one step further with credit-bearing courses that both extend knowledge in the key content areas of A&P and offer effective strategies for teaching the materials to our undergraduates. The dream has come true this year through the efforts of Kevin Patton and his task force including Jennifer Lundmark, Ellen Arnestadt, Amy Way, and Sandy Lewis. I have been a “friend” of that group and had the pleasure of seeing it come together. They designed HAPS-I to continue for the long term and expand its offerings for regional and annual conferences and online. We now have a link with prestigious University of Washington, Seattle that enables our participants to receive one graduate credit per course, and Pierce College in Puyallup, WA, is supporting us with their Blackboard™ system. This year we will seek outside funding for HAPS-I to keep tuition costs affordable. And we are using it as a recruiting tool! After our members got the first chance to sign up, announcements went out to our partner societies urging their members to join the classes as well as to sign up for HAPS membership. The new HAPS-I logo will be worn by the more than 30 members who are taking courses in San Diego. I hope many more of you will be part of this professional development experience next year.

HAPS has operated for some time without a written long range plan that articulates the specific goals of the society for the coming years. The list of eight goals at the beginning of the constitution provides general guidelines for our activities. A combination of dedicated officers, built-in continuity of board leadership, carefully managed transitions for committee chairs, and the expert guidance of Ferguson Management has kept us from straying too far from our intended directions. While providing us with general goals, our mission statement does not provide specifics that enable us to discern among options and focus on priorities for a particular period in our history. It is very difficult to work energetically on many fronts at the same time with our limitations of size, leadership, and financial resources. For these and other reasons, we brought the leadership of HAPS together in New Orleans this past January to collaborate in developing pieces of a progress report and long term plan. Subsequently, a draft I prepared was reviewed by the Board and Steering Committee and revised. That final version was officially adopted by the Board of Directors as the document to guide our planning for the coming years. In the pre-conference meetings at San Diego, the leadership will work hard to develop specific strategies to implement the 11 goals found in the summary.

A link to the progress report and long term plan has been placed on the main members’ page of www.hapsweb.org for anyone to download. Reading it will give you a very good idea where HAPS stands today in many key areas and where we hope to go over the next several years. It is important to remember that this is a document “in progress” and will be evaluated and updated each year by the Board and Steering Committee. You are most welcome to provide input to that process by talking to your Regional Director or a committee chair.

One result of preparing the long range plan was my personal discovery of how many ways the Human Anatomy and Physiology
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Society is working to support members in delivering excellent A&P courses. We address so many of the key elements in developing and delivering courses:

   a) The Curriculum and Instruction Committee has been hard at work on the “Outcomes Project” that articulates the specifics of both course content and process skills that our students need to master in their A&P courses. One thing I really like is its flexibility. We all know that one size does NOT fit all in A&P programs because of the diversity of our students, their career objectives, and the limits that local conditions impose on our teaching. Instructors wishing to develop new courses or redesign the old ones will be able to choose from an extensive selection of outcomes for each major topic in A&P to customize their courses.

   b) Preparing and equipping instructors to teach is a central part of our mission as discussed earlier, and HAPS, working with our commercial partners, provides a great opportunity to review the latest textbooks, lab manuals, laboratory equipment, computer programs, and ancillary materials at annual and regional conferences. But now there is more coming! We are working on a web-based system for enabling our members to easily browse through vendor “salons” specifically designed for us, in order to make our choices or contact the companies for personalized help.

   c) Effective learning activities are a key to any successful course – lectures, labs, IT learning, and student tutorials. We do that very well with our updates, workshops, and the summaries that appear in each issue of the HAPS-EDucator. The experience in a HAPS Institute course will take that a step further, as participants work collaboratively to develop great learning activities and test them out on their own students. Our plan is to make these available to all members by archiving them on our web site.

   d) Running laboratories that are effective, safe, and motivating for students is always a challenge. Here too, HAPS offers help. The newly revised Safety Guidelines offer a wealth of information on procedures that protect students and avoid problems, while new documents by the Animal Use Committee deal with regulations for teaching with both live and preserved animals. Animal use can be especially daunting in the face of efforts by animal rights groups like PETA and even students who object to dissection. Help is available! If you use or plan to use cadavers in your lab, there are excellent materials available to guide you from our Cadaver Use Committee.

   e) And what about help dealing with supervisors and administrators on an entire set of topics that impacts how well we can do our job? Supervisors have key input on such issues as class size, student pre-requisites for A&P, support of professional development for our members, equipment budgets, and teaching loads. A new Board initiative this year is the Administrators Advisory Group. Consisting of HAPS members who are also in administrative positions, this group will grapple with the task of how to engage administrators at our colleges in dialogues that inform them about HAPS and the special needs of A&P instructors and students. One such need is for more instructors and programs to make use of the growing resources that HAPS offers. We hope that we can convince them to encourage faculty to join HAPS and participate in our annual and regional conferences.

   f) Good A&P courses need a strong assessment plan. That includes not only testing (summative assessment), but also strategies for giving feedback during learning that enables students to check their progress. We occasionally provide updates on assessment, and there are regular workshops that deal with this crucial issue. Our HAPS standardized exam program has been offering one way of measuring student performance in the national context, and it will become even more effective and useful as we develop new questions in each major topic area, continue our data collection and analysis, and link the exam closely with the Outcomes Project. We are strongly committed to supporting our members with a strong assessment program.

   I could continue enumerating the many other kinds of support offered by HAPS, but I hope everyone is getting the picture that the value of membership in HAPS continues to grow and grow. In the coming years I hope many more of you will consider joining the teams who work through committees and task forces to help us become the organization of which every A&P teacher needs to be a part.

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Cosmeceutical Peptides: A New Generation of Anti-aging Skin Treatment Products

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Products that contain peptides, sold as cosmeceuticals by high end cosmetic companies, are one of the hottest substances to hit the anti-aging skin care market. The baby boomers have finally grown up, and many apparently have lived to regret their early years spent in the sun and the subsequent photoaging of their skin. Demographic studies indicate that the baby boomers are a health conscious group with money to spend. They are seemingly united in their preference for not appearing to age. They have made cosmeceuticals the fastest growing segment of the skin treatment market.

The term cosmeceutical applies to skin care products that fit somewhere in what has become a very gray area between drugs and cosmetics. The FDA defines drugs as “products that cure, treat, mitigate or prevent disease or that affect the structure and function of the human body.” The definition of a cosmetic according to the Food, Drug and Cosmetic Act of 1938 is a substance that is intended to be “rubbed, poured, sprinkled or sprayed on” for the purpose of “cleansing, beautifying, promoting attractiveness or altering appearance”. According to this act, a cosmetic cannot affect the structure and function of the skin. With the discovery of Retin-A thirty years ago, it became apparent that some skin treatment products can, in fact, affect the structure and function of skin. For instance, Retin-A not only improves the appearance of photo-aged skin by reducing wrinkles, increasing firmness, reducing dark age spots, and producing a rosy glow, but also produces structural changes in the skin that include the formation of new collagen, angiogenesis, and increased mitotic activity of dermal keratinocytes. The term cosmeceutical was coined to describe skin care products that affect the structure and function of the skin, yet cannot be strictly classified as either drugs or cosmetics.

Cosmeceuticals are generally accepted as products that are developed with a scientific basis. Many boast so called “biologically active” ingredients. Though the FDA does not define or accept the word cosmeceutical, cosmeceutical companies are allowed to claim that their products affect the appearance of the skin. However, many skin care companies stop short of doing the double blind, placebo-controlled clinical trials that would catapult their products straight into the sights of the FDA, since FDA approval can be costly. Instead, some manufacturers of cosmeceuticals have opted to simply allow the consumer to become the clinical test market, reasoning that the product will be commercially successful if it improves the appearance of the skin. As long as no one is hurt by these products, cosmeceutical companies will probably continue to stay on this path, producing products that are commercially successful without incurring the costs of FDA approval. At some point, however, if true physiological changes are occurring in the skin, the largest organ of the body, the FDA is likely to take notice and step in to evaluate the safety, effectiveness, and possible toxicity of these new product ingredients.

The current interest in peptides in skin care products is an outgrowth of advances in wound healing which have occurred over the past decade or so as protein fractions isolated from fermented yeast have demonstrated that they can facilitate an improvement in collagen synthesis. Researchers have long believed that the lines and wrinkles of aged skin are caused by degenerative changes in protein of the extracellular matrix, primarily collagen. The goals of cosmeceutical peptide treatments fall into three main categories. One is to stimulate the triggers of protein synthesis in the dermal layers of the skin to puff out wrinkled areas. The second is to down-regulate human dermal skin fibroblast collagenase production, and a third is to actually decrease muscular movement in areas where deep expression lines have occurred such as in the naso-labial folds.

The etiology of wrinkles is well understood today. Though there are some differences between chronologically-aged skin and photo-aged skin, with the wrinkles of photo-aged skin being the deeper and coarser of the two, generally the underlying problems are the same. Chronologically-aged skin has two outstanding characteristics. It has less collagen than young skin, and increased proteolytic activity. Decreased collagen is the result of inactive fibroblasts producing less mRNA for type 1 collagen and the fact that the dermal fibroblasts in aged skin have decreased mitotic activity. As a result, there are simply fewer fibroblast cells, and those that remain are making fewer new collagen fibers. The increase in proteolytic activity is largely due to the increased presence of matrix metalloprotease (MMP) 1, which is also known...
as interstitial collagenase, an enzyme that breaks down collagen. Increased levels of MMP 1 activity are believed to be the most likely cause of the atrophy of the extracellular matrix which is typically seen in chronologically aged skin. One of the products currently available to the public contains a substance marketed as MMP1, a matrix metalloprotease inhibitor.

Peptides are short chains of amino acid sequences that appear to be promising in the effort to trigger the cellular chemical reactions that stimulate collagen production. Amino acid chains in specific lengths and sequences have been found to be capable of stimulating human skin fibroblast cell growth. For instance, in one study the specific sequence, valine - glycine - valine - alanine - proline - glycine (VGVAPG), was shown to significantly increase fibroblast production. Its most likely mechanism of action is through the binding of this amino acid sequence to a surface receptor located on human skin fibroblast cells. Another study showed that the amino acid sequence, tyrosine – tyrosine - arginine - alanine - aspartane - aspartane - alanine, was shown to inhibit a proteinase that would result in decreased collagen breakdown. Another specific peptide sequence, lysine - thernote - thernote - lysine - serine, which is found in type I procollagen, appears to take part in the feedback regulation of collagen synthesis, resulting in increased production of extracellular matrix proteins. This substance, known as a pentapeptide, is one of several peptide based technologies that have made their way from the laboratory into skin treatment products targeting increased collagen production.

Another contributor to the formation of wrinkles appears to be the excessive stimulation of face muscles particularly those in the area of the forehead, the upper lip, and the periorbital region of the eye. Treatment with botulism neurotoxin (BoNT A) or BOTOX has been used successfully to inhibit muscle contraction in these areas but, since it has a very high level of neurotoxicity, its use is limited to conditions under which it can be strictly medically supervised. Cosmeceutical companies are currently trying to develop safe, topical products that down-regulate muscle contraction by mimicking the action of BoNT A. BoNT’s work by blocking the exocytosis of neurotransmitter from synaptic vesicles at the neuromuscular junction, effectively inhibiting Ca2+ - dependent neurotransmitter release. Normally exocytosis at the neuromuscular junction is regulated by three synaptic proteins: the vesicular protein, VAMP, and the membrane proteins syntaxin and SNAP-25. These three proteins form a fusion complex, known as the SNARE complex, which allows the synaptic vesicle to fuse with the plasma membrane of the synaptic bulb. BoNT’s are metalloproteases that specifically cleave the three synaptic proteins, destabilizing the SNARE complex, and preventing the fusion of the synaptic vesicle with the plasma membrane of the synaptic bulb. The hexapeptide argireline, acetyl-glutamyl - glutamyl - methoxyylx - glutaminyl - arginyl - arginylamide, interferes with the assembly of the SNARE complex and inhibits exocytosis of the neurotransmitter at the synaptic knob, mimicking the action of BoNT’s. Unlike previously manufactured long-chain synthetic peptides, argireline has been shown to penetrate the epidermis to a significant degree without toxicity or irritation and to reduce the intensity of wrinkles. One skin care company advertises a peptide that goes by the name SYN-R-AKE (pronounced “snake”) that is touted to mimic the relaxant effects of snake venom on targeted facial muscles. The same company also incorporates another peptide known as SNAP-8, which is supposed to be a pain-free alternative to injected botulism toxin. Neither peptide is inexpensive. These two peptides in a skin treatment product along with other ingredients are currently selling for $120.00 a fluid ounce on QVC (a home shopping TV channel).

One of the consistent findings in peptide studies is that subfragments of the skin protein’s collagen and elastin seem to be able to act as feedback stimulators of their own recurring synthesis. That is, they can apparently signal or perhaps mimic the signals that ultimately result in the synthesis of the proteins of the extracellular matrix. If these peptides can truly be stabilized and delivered to the dermis of the skin in cosmeceutical products, they may well mimic the stimulating and regulatory steps for the production of collagen in the extracellular matrix, which would have a beneficial effect on the overall quality of aged skin.

It seems clear that a better understanding of the biology of skin aging has led to new technologies in skin treatment and will bring about new generations of treatment products in the future. The ability to produce the proteins of the extracellular matrix, diminish collagenase activity, and cause a selective decrease in facial muscle movement would theoretically lead to a smoother, more relaxed appearance of the skin surface. Short-chain peptides in very specific sequences seem to be able to mimic some basic biological repair and growth processes, and some appear to inhibit the breakdown of skin structural proteins. Though the theoretical mechanisms are becoming increasingly clear, these peptide sequences will have to be stabilized and delivered through the epidermal layers and into the viable dermis in order to be effective. Once in the dermal layers, these products have the potential to change the structure and function of skin. It is highly likely that manufacturers will attempt to side-step FDA scrutiny for as long as they can by limiting the scope of treatment claims for these new technologies.

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Studying for anatomy and physiology exams requires students to have access to large quantities of technical information. Textbooks, CD ROMs, podcasts, PowerPoint® files, The Discovery Channel, and even Wikipedia can help students differentiate their mandibles from their maxillas. Students, however, frequently confuse access to information with knowledge. The nature of knowledge is complex and is described in learning theories such as constructivism and conceptual change. (See, for example, Matthews.)

Even though teachers may not know the exact nature of knowledge, they attempt to measure it when they give exams. This investigation was inspired by the work of Jason Shaw and his advisor, Rod Seeley, at Idaho State University. Dr. Shaw’s dissertation examined students’ ability to answer different types of test questions, as classified via Bloom’s taxonomy, as they progressed through an anatomy and physiology course. Results of Shaw’s study were not surprising; students have a difficult time answering questions that require critical thinking, and designing interventions to teach critical thinking is also very difficult.

Bloom’s taxonomy has been used to classify test questions since it was developed in the 1950s. Many students focus the majority of their studying at the lowest level, i.e., knowledge and comprehension. (Where is your mandible?) Questions at the higher levels of Bloom’s taxonomy, e.g., analysis, synthesis, and evaluation, are much more difficult for students to answer. (Compare and contrast the functions of the endocrine and nervous systems.) Most educators agree, however, that what separates good students from great students is their ability to perform at the higher levels of Bloom’s taxonomy. In addition, many national reports, from organizations such as the Association of American Colleges and Universities, indicate that teachers, students, and all educational institutions should be focusing increased time, money, energy, etc., on promoting critical thinking.

For the past five years, our research group has been examining factors that predict success in college science courses. For example, we have found that lecture attendance is an accurate predictor of academic success.

The intent of this study is to expand this area of research by examining the relationships of five different predictor variables (ACT scores, lecture attendance, book reading, pretest performance, and performance on the first quiz of the semester) to student performance on easy (knowledge and comprehension) exam questions and also more challenging (analysis, synthesis, and evaluation) exam questions.

Method and Results

General College (GC1135) Human Anatomy and Physiology is a one semester survey course that attempts to cover all the body systems in one semester. During the 2005-2006 academic year, the course met in three different settings: 1) in a large auditorium where lectures were given and exams administered, 2) in a computer laboratory where students took cooperative quizzes, and 3) in a traditional laboratory where students perform activities such as dissections and basic respiratory physiology.

To be included in this study, students must have enrolled in GC 1135 in either the Fall semester of 2005 or the Spring semester of 2006, signed a consent form, and completed all three course lecture exams. A total of 215 students were included in the study: 81 (38%) male and 134 (62%) female. The students represented a diverse group with 114 white students (53%), 49 black students (African-American and African immigrants 23%), 36 Asian students (17%), 6 Hispanic students (3%), 4 American Indian students (2%), and 6 students who did not declare a race or ethnicity (3%).

Three exams were given during the course at approximately even intervals. The first two exams covered topics from the previous four or five weeks, the third exam emphasized material from the final four or five weeks of the semester, but also posed questions from specific topics of the first ten weeks of the class. All exams contained 100 multiple-choice questions which were divided into two sections. The first section (questions 1 to 80) contained questions that were written at the lower levels of Bloom’s taxonomy (e.g., knowledge and comprehension) and are labeled “easy” in
The specific goal of this study was to answer the following question: Which of the five predictor variables best predict success on easy exam questions and on challenging exam questions? Predictor variables used in this study were selected for reasons ranging from tradition (ACT scores) to pure curiosity (performance on the first quiz). The following are descriptions, and rationales, for the variables used:

1. **ACT Scores:** The University of Minnesota, like many Midwestern institutions of higher learning, requires students to complete the ACT test prior to admissions decisions. The role of ACT scores in admissions decisions has been examined by numerous studies (see, for example, Fleming and Garcia7) and its use here is an attempt to add to that body of research.

Composite ACT scores for students in this study ranged from 11 to 31, with an average score of 20.12 and a standard deviation of 4.07. General College, the site of this study, had a mission related to developmental education, i.e., helping students who are academically “at risk,” which helps clarify the broad range of ACT scores in this study.

2. **Attendance:** Previous studies by our research team have shown a very strong relationship between lecture attendance and overall course performance.7 Findings in this study further delineate the relationship between classroom attendance and students’ success on easy and challenging exam questions.

Attendance was recorded during 12 of 24 randomly selected lecture sessions each semester. In the data analysis, total attendance was used with data ranging from 1 to 12, an average of 10.43, and a standard deviation of 1.27.

3. **Book Effort:** All students in GC 1135 were required to read one trade book, e.g., “When the Air Hits Your Brain” and write a short book report. For extra-credit (10 bonus points or about 1.5% of the total points in the course) students could read a second book and complete a second report, and 5 additional points were given to those who read a third book and completed a third report. This study examines the performance of students who elect to read extra books in relation to performance on the two types of exam questions. For the data analysis, one point was assigned to each student for each extra book and report (range of 0 to 2). An average of 0.39 extra books per student were read with a standard deviation of 0.65. Very few students elected to read extra books, a choice which was likely related to very low amount of extra-credit incentive offered, e.g., too much work for the amount of reward.

4. **Pretests:** Approximately 3 days prior to every lecture exam, a “pretest” was posted on the internet via the computer program Web Vista®. Students could take the pretest as many times as they wished and were given no time limit to complete the activity. Pretests contained an average of 80 questions that covered the same topics as the lecture tests, but pretest questions and lecture exam questions were not identical. In addition, questions on the pretest were intended to be at the lower levels of Bloom’s taxonomy, i.e., knowledge level and did not provide students practice answering more challenging questions. Students’ highest scores were used for awarding bonus points. If a student scored 98 to 100% on the pretest, 2 bonus points were added to their lecture exam score, and if they scored 95 to 98% on the pretest, 1 bonus point was added to their exam score. Bonus points earned here were not included in the data analysis for the variables related to lecture exam scores. However, pretest scores were used for the predictor variable “Pretest.”

For the data analysis of the pretest variable, if a student scored 98 to 100%, they were given 2 points, and if they scored 95 to 98%, they were given 1 point. Students ranged from 0 to 6 points on the pretests with an average score of 2.26 and a standard deviation of 2.15.

5. **First Quiz:** During the second week of the course, students were given a quiz that contained knowledge-level questions covering the first week’s topics. The quiz contained 30 questions and was worth 15 points, thus representing about 2.5% of the total course grade. In unpublished research, many years of course data from GC 1135 was analyzed to examine the correlation between student performance on the first quiz of the semester and overall course performance (i.e., final grade). Results of that preliminary analysis showed strong predictive powers; students’ relative performance levels were maintained for the duration of the course. This observation was of significance in that one of the course goals was to help students improve their test taking ability – a strong correlation between performance on the first quiz and overall performances on the two types of exam questions would indicate that this goal is not being achieved; students maintain but do not improve their test taking skills. For the data analysis, students’ raw scores on the first quiz were used. Scores on the quiz ranged from 8 to 30 with a class average of 23.74 and a standard deviation of 3.88.

The two dependant variables used in this study were “easy” exam questions and “challenging” exam questions:

1. **Easy Questions:** The first 80 questions of each of the three lecture exams contained knowledge and comprehension questions (Figure 1). A maximum of 240 points could be scored on the first 80 questions (3 course exams) with real scores ranging from 73 to 226, with an average of 175.11 and a standard deviation of 27.85.

2. **Challenging Questions:** The last 20 questions of each of the three lecture exams contains analysis, synthesis, and evaluation, i.e., more challenging, questions on the course topics (Figure 1). A maximum of 60 points could be scored on the last 20 questions with real scores ranging from 11 to 55, with an average of 32.48 and a standard deviation of 8.35. All students were informed that exams would contain both easy and challenging questions, and all students were able to review their performance on both types of questions.
Analysis

Descriptive information for study variables is presented in Table 1. Multiple regression analyses were used to test the research question. Pearson moment correlations were used to check for multicollinearity, i.e., a test to examine the relationship between predictor variables. Results are presented in Tables 2 and 3.

In both the easy and challenging question analyses (Table 3), most predictors were statistically significant; number of books read was not significant in either analysis, and attendance was not significantly related to challenging questions. Pretest performance was more strongly related to the easy questions than to the challenging questions.

The R² statistic for each model demonstrated that this particular set of predictors accounted for 50% of the variance for the challenging questions and 60% of the variance for the easy questions.

Discussion

Pretest, ACT Scores, and First Quiz were all significant predictors of students’ success on the challenging questions according to the multiple regression analyses. Pretests and ACT scores provided equally high predictive power. Results support the value of ACT scores as predictors of college success in that they significantly predicted success on both easy and challenging questions. However, results also show that performance on a first quiz and the pretests also have significant predictive ability in relation to both types of questions.

The significant predictive ability of the first quiz on both challenging and easy questions was both expected and reassuring. Data here indicate that those students who could do well on the first quiz also did well on the course exams – but likewise, those students who performed poorly on the first quiz also performed poorly on the course exams, i.e., no significant changes in test taking skills were detected. It should be noted that the first quiz contained only knowledge questions, but still student performance on the quiz was strongly correlated to performance on the challenging questions.

Students in GC 1135 were given the opportunity of taking the pretest a few days prior to course exams. Results from the multiple regression analyses show that students who took advantage of this opportunity performed well on both the easy and challenging questions. Data also indicate that the pretests help students more on the easy questions than on the challenging questions. The reason for this finding is likely due to the pretest containing only knowledge and comprehension (easy) questions. It seems logical that giving students increased access to example exam questions helps performance on the real exams that contained similar types (easy or challenging) of questions.

Student attendance data were significantly correlated (Table 2) to both easy and challenging exam questions, and results of the multiple regression analyses (Table 3) show a significant relationship between lecture attendance and performance on easy exam questions. However, the multiple regression data do not show a significant relationship to student performance on challenging exam questions. Data here supports the many studies that show the strong relationship between attendance and course performance. However, data here also show that attendance alone might not be enough to help student performance on challenging exam questions.

The most surprising and confusing finding in this study was the lack of correlation between reading extra books and performance on both the easy and challenging questions (Table 2). This finding was further reinforced by the lack of significance of extra book reading in the multiple regression analyses (Table 3). Additional inspection shows significant, but negative, correlation between extra book reading and ACT scores (Table 2). Findings here in no way support the notion that students should read less, but do indicate that students who are inclined to reading possess learning styles that do not match well with the exam questions used in this particular course. It is possible that results here are a simple anomaly, but obviously warrant additional study.
The number of significant correlations in Table 2 indicates that the different variables used in this study were in fact measuring similar factors. It is our opinion that attendance, Pretest, books, and performance on the first quiz can all be lumped into the concept of “work ethic” which is obviously a large contributor to performance on both easy and challenging questions.

Figure 1

Example Easy Questions:

Cardiology is a medical profession that focuses on the …
A. brain and eye
B. kidneys
C. liver
D. heart
E. none of the above

Erythrocytes usually live for _____ days and are produced by _____ cells
A. 1000 / liver
B. 120 / stem
C. 120 / liver
D. 1000 / stem
E. 20 / pancreatic

Example Challenging Questions:

Which of the following is the smallest?
A. A water molecule
B. One human egg
C. Five bacteria found in your intestine
D. One human sperm
E. One virus

Which one of the following has physiological properties closely matching those of a hormone?
A. glial cells
B. monocytes
C. digestive enzymes
D. acetylcholine
E. DNA

References


As you may remember, HAPS members have been vitally interested in the issue of college accreditation since one of the accrediting agencies took issue with the educational background of some anatomy and physiology professors. At the time, under the leadership of Past President Ric Martini, attempts were made to establish a dialog. Since then the Public Relations Officer has discussed the issue with the US Department of Education, but neither of these efforts have had tangible success.

The big issue in higher education accrediting these days is the US Department of Education’s (DOE) push to change the way that the accrediting bodies (AB) (Middle States and SACS come to mind) make their decisions. The DOE wants the agencies to set minimal and easily comparable standards for acceptance, to assess colleges more often (once in 10 years is common now), to allow the department to have more control over the accrediting bodies, and to publicly release more information about the periodic reviews. Among the advantages to the government for such a move is greater accountability for the money it gives to students.

An additional feature is that it would give the public a basis for comparing the performances of different schools. Some would argue that a comparison between a large, selective institution versus a smaller open admissions college (think, for example, the University of California-Berkeley and Podunk Junior College) is grossly inappropriate: think of the relative degree completion rates of students with enormous SAT scores compared to those that often have only GED’s. Nevertheless such a comparison might be one of the consequences of these changes. Negotiations over these issues have been going on between the DOE, representatives of the ABs, and institutions of higher learning through this winter and spring in the Washington, DC area.

The negotiation sessions that originally had, to many, all of the sex appeal of cold mashed potatoes, have become a slug-fest with evolving clear mistrust between the parties. Of the very few news stories about this series of arguments, they all point to the extreme ennui of the sessions, but one should not forget that people’s lives and reputations might hinge on the outcomes. This is really a three-sided fight in which the colleges are underrepresented (HAPS was not invited nor allowed to present its information). The ABs seem to be willing to concede some of the points of contention to the department, but the institutions of higher learning are not giving up much: only two out of twelve original points have been decided! The latter side of this triangular argument may well tag-team their congressional representatives, since the DOE’s actions appear to be potentially alarming to both conservatives and liberals. The members of congress most likely to get into the fray are Senators Edward Kennedy (D-MA) and Michael Enzi (R-WY), and representatives George Miller (D-CA) and Howard McKeon (R-CA).

A possible approach, when talking to others about the accreditation/HAPS problem, is the impact of the shortfall on most health para-professions. With fewer professors, there will be fewer accredited schools, and with fewer schools there will be even fewer nurses, radiology technologists, surgical technicians, etc. Nurses, particularly, provide more hands-on care than any other health profession for most patients. Do we need to further endanger our health care system?

Will you need to start writing letters? Stay tuned!

On the other hand, the view is not all gloomy—the accrediting agencies can be beaten! On February 6, 2007, a U.S. District Court for the Northern District of Georgia ruled that Southern Association of Colleges and Schools (SACS) incorrectly disaccredited Hiwassee College in Madisonville, Tenn. because of alleged problems with financial stability. The college had existed for more than 150 years. The legal basis for overturning SACS, according to the judge, was a conflict of interest in SACS’ appeals board. Hiwassee is a small college but it found the will to prevail in a David-vs-Goliath-type contest. Perhaps others can use this as a model. (See the Public Relations area of the HAPS website for more information.)
Anatomy and physiology professors are accustomed to the benefits of the Internet; therefore a recent development may surprise you. It is possible to “spoof” your computer so that another person at some other location can make it seem that you are generating emails. Mostly this type of thing is merely annoying—maybe some of your correspondents and e-friends will suddenly start getting messages from you pushing a certain stock as has happened to me. However, a sufficiently maligned and talented person (e.g., a disgruntled student) can make it appear that you are sending out sexually suggestive messages to other people, and this is made even easier by using phony MySpace® accounts. There have been recent examples of just such things happening to high school teachers in several states. On the other hand, MySpace® has been very helpful in stopping these things once they start, so if this happens to you, you need to contact the company immediately. However, you will need a law enforcement official to get a subpoena to find out from MySpace® who did this to you and possibly prosecute them. You should absolutely inform your dean or department chair about this event, because there will be complaints!

In a related matter, folks have begun to use their cell phone cameras to record all sorts of events, including those that take place in the classroom. The video thus gathered can then be put out on the Internet, either in its original form or in some embarrassingly edited form. Some colleges have banned the use of cell phones in classroom except for emergency purposes partly because of this concern.

Some students have tried to protect themselves from the consequences of their actions by claiming freedom of speech, but so far, law enforcement and the courts have been mostly unsympathetic to that defense when it comes to these activities.

On the other hand, freedom of speech has covered the rights of students to wear a wide variety of apparently inflammatory messages on their clothing including political statements. For example, a student could walk into the first day of your cat dissection lab with a t-shirt proclaiming some animal rights slogan, and that student would be within his/her rights. There has been a simmering discussion in some state legislatures that would encode the right of a student to express any view they wanted in a classroom. One can imagine the impact such a law would have on several class topics.

Finally, the professor may be required to tread a fine line about the messages permitted in the classroom. Generally, anything that could be construed as being sexually harassing, racist, or puts someone’s national origin down should be discouraged. Why? The New Jersey Supreme Court has found that schools are liable for sexual harassment among students. This decision is in line with federal guidelines as well. Therefore, if you see this going on, your dean or department head will most likely require that you try to stop it. Check with your Human Resources person, supervisor, or compliance officers concerning this issue.

The HAPS Public Relations website has other issues and concerns; there really are many evolving legal problems for colleges and schools and the Public Relations Officer tries to keep up with them.

I hope this information has helped you. If you hear of anything that Public Affairs could use or if you would like to help in any way, please send me a note at devans@pct.edu.

KEN SALADIN

On January 27, Ken served as moderator (question reader) for the Georgia Science Bowl, the state competition for middle and high school students leading (for the winning teams) to participation in the National Science Bowl conducted under the aegis of the U.S. Department of Energy.

On May 30, he will be leading an ecotour group to the Galapagos Islands. His group this year includes Florida State University philosopher Michael Ruse, author of numerous books on the history of Darwinian thought; California Academy of Science illustrator John Muir Laws, author-Illustrator of field guides to the wildlife of the Sierra Nevadas; novelist-physician William Rawlings; and novelist-zoology author C. Leon Harris; and HAPS members Marsha Turrell and Vernon Wiersema (both of Houston Community College) and Linda Nichols (Santa Fe Community College, Gainesville, FL). This will be Ken’s fifth time escorting ecotourism groups in the Galapagos.

In addition, Ken is the principal sponsor of a building-remodeling project under way at the Charles Darwin Research Station on Santa Cruz Island in the Galapagos.
It’s 11:00 PM. What are these Students Doing in the Physiology Lab?

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As an educator, it is always important to start the semester with a clear message about expectations while setting a tone that demonstrates the importance of student participation and student responsibilities. Involvement and investment by students are essential components for academic success. In this article I, will present a teaching module that introduces the scientific method, engages the students in active learning, and offers an opportunity for students to interact and begin forming interpersonal relationships. During the past five years, this exercise has helped me to initiate an environment of cooperative learning without sacrificing valuable lecture time.

The exercise is built around the concept that the volume of a muscle bundle is related to the force generated by a muscle bundle. The concept is investigated simplistically using tape measures and inexpensive force-grip dynamometers. Data for the exercise are generated by the students during the first or second day of lecture, then used as a model to illustrate the principles of the scientific method. Once the data are collected, they are examined as an “observation.” Questions and suggestions are solicited from the students. The students are then required to graph the data and develop hypotheses to explain the underlying cause of their observations. Finally, the students suggest experiments that would allow them to obtain evidence to support or refute their hypotheses. Since the class activity is “hands-on,” it works as an ice breaker. And because the activity is linked to a rigorously graded home-work assignment, the students learn very early what my expectations are.

In practice, the exercise goes like this. I show up early the first day of class with my syllabi, lecture notes, the student’s lab manuals (which contain instructions for the exercise), three tape measures, three “Pneumatic Squeeze Dynamometers” (Ward’s Natural Science – catalog number 14W5060 - $50.00 each), and sheets of lined paper on which to record data. I introduce myself to the first students who enter the class, show them how to measure the forearm circumference and the grip-force, and instruct them to place their results on one of the sheets of paper. As more students enter the room, the early-arriving students introduce themselves and provide instruction on how to make the measurements. Usually, after about 20 minutes into class, all data have been collected, every student has interacted with a couple of other students, and they all are curious about what is going to happen with these data.

By the time the data collection is complete, I have usually finished with my introduction to the class, explanation of the syllabus, and some general definitions of anatomy and physiology. Next I move on to a discussion of the scientific method. The first exercise in their lab manuals (see below) contains an overview and examples to supplement my lecture. I briefly develop the concepts of observations, hypothesis development, predictions, experimentation, and interpretation of results. Their lab manual provides sample data so I can ask questions and draw the students into the discussion. As the period comes to an end, I explain that the students have just made some measurements, which together constitute an observation. Finally, I tell them that next class period we will examine the data and together attempt to develop some hypotheses.

Between the first and second class meetings, I graph the data and prepare an overhead transparency. I also place the raw data on my course web-page so the students have access to it for their homework. An example of the data is given is the graph on page 15.
During the second class-meeting, I explain the axes of the graph and then ask the students if they can identify any kind of relationship in the data. As you can see in the graph, there is a great deal of variability, but there does appear to be a trend toward increasing grip-force as a function of forearm circumference. I remind the students that this is only our initial observation and I ask what might be sources of the variability in the data. Every year someone will suggest body fat, someone will suggest bone size, and someone usually suggests sex. Then we talk about how one might attempt to control for these variables to reduce overall variability in the data. This discussion provides an opportunity to discuss sample size, control groups, etc.

In my course, I use a definition of “hypothesis” that may not be shared by everyone. We say that a hypothesis is an educated guess that attempts to explain the cause of an observation. The students sometimes offer statements such as, “the force of grip increases as the circumference of the forearm increases” as a hypothesis. A hypothesis is not a re-statement of one’s observation. So in this case, we need to suggest an underlying reason for the relationship between forearm circumference and grip-force. Eventually someone suggests something like, “the volume of muscle determines the force generated by the muscle.” This is a reasonable hypothesis because it suggests an underlying cause for the observation, and it is testable. At this point I begin to ask for predictions and possible experiments that could be performed to test the hypothesis. After a few minutes of brainstorming, I direct the students to the homework questions at the end of the first lab exercise, which are provided below.

1. Using guidelines provided in your lab manual, prepare a graph of the grip-force data.
2. Write a short paragraph to describe any relationship you see in the data.
3. Write a hypothesis that attempts to explain the cause of the relationship. Remember, a hypothesis is an attempt to explain WHY the data look the way they do.
4. Now write an “if .. .then” statement which could provide the basis for further experimentation. The goal here is to look at your hypothesis and say; “If the hypothesis is true, then I should be able to perform a specific experiment and get a particular result.”
5. If you were actually going to perform the experiment, what would you do? What would be the independent variable and what would be the dependent variable?

Overall, the class activity has worked well and I highly recommend it. You may download a copy of my “Exercise 1” class activity in Word format from my course website at: http://www.franklincollege.edu/bioweb/A&Pfiles/index.html.

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HAPS 2006 In Review

Summary of Workshop # 406-506
Using web-HUMAN to Teach Basic Classical Physiological Relationships

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This workshop consisted of four parts: 1) a brief introduction to and overview of the HUMAN model itself, 2) a hands-on learn-how-to-use HUMAN aerobic exercise simulation session, 3) several hands-on simulations in which users learned strategies for using a multiple systems model like HUMAN to isolate one system of interest, and 4) a tour of the other resources available to educators at the HUMAN website including the actual materials and simulations used in this and other past workshops. The following write-up briefly reviews what was covered in each of these four sub-sections.

Introduction and Overview:

Skidmore College’s web-HUMAN web site, now located at http://placid.skidmore.edu/human/, provides physiology educators with a no-fee, web browser-accessible full implementation of Tom Coleman’s classic systems physiology simulation, HUMAN.

a) The HUMAN model is comprehensive, encompassing six major core systems (cardiovascular, respiratory, renal, fluid balance, acid-base balance and thermoregulatory) and aspects of three other systems (nervous, endocrine and muscle metabolism).

b) The model is an integrated systems model that produces, in one-minute iterations, the linked behaviors of 137 user-assessable physiological variables. Simulated experiments can be run by changing one or more of 67 user-alterable physiological and clinical parameters.

c) Outputs from instructor or student run simulations can be displayed as either normalized or absolute value six color plots of the behavior of up to six variables vs. time in any of three available plot sizes. In addition, tabular outputs are also always generated.

d) Users can save and retrieve their experiments for later use in the folders provided on the web site or in ones that they create. Comments on and descriptions of the model can also be stored and later edited.

e) Extensive on-line help is available both for how to execute various procedures (e.g., run an exercise simulation, run an isotonic infusion) and how to manipulate all the model variables and parameters.

f) In addition to manipulation of the model itself, an extensive teaching resources section (including online lab exercises and this workshop) is also available.

The hands-on learn-how-to-use HUMAN aerobic exercise simulation session:

Experiments are set up and run in web-HUMAN in the same sequence as in the actual laboratory. In the workshop, we wished to study the effects of an aerobic exercise bout on the cardiovascular and respiratory systems of HUMAN. Thus, we needed to understand 1) how to trigger changes in the model’s exercise level, 2) how to select and measure the cardiovascular and respiratory variables we were interested in, 3) how to read the results of our experiment, 4) how to actually execute (run) the experiment, and 5) how to view and evaluate the results of our experiment. These steps are outlined in the text and in the first three figures below and are also presented at the companion HAPS ’06 section of the HUMAN website as screen-by-screen snapshots that allow the reader to actually follow each of these steps in HUMAN. The three-screen snapshot below show, in order, 1) the “Help – Run Exercise,” 2) the final setup for exercise, and 3) the graphic output resulting from that setup.

1) How to trigger changes in the model’s exercise level

a) Participants called up the Help screen “How do I? <Exercise the model>” (first figure below) where they were able to see exactly how to set up an exercise simulation. We decided to choose an exercise level (EXER) of moderate intensity (2.0 Liters of muscle O2 use above basal level) and raise the time to cessation of exercise (XERMIN) to some high value (1 hour) so that the model would continue to exercise for the entire duration of our experimental period (20 minutes).

b) We then entered these values for exercise intensity and duration in HUMAN’s Change Variable controls.
2) How to select and then measure the cardiovascular and respiratory variables of interest

Using the “Help Info on” list of variables and the links to related variables on those screens, participants decided to measure the cardiovascular variables of arterial pressure (AP in HUMAN), cardiac output in Liters/min (COL) and muscle blood flow in Liters/min (MFLOL), the respiratory variables of oxygen debt (O2DEBT) and ventilation (VENT) and also to monitor the level of exercise (EXER). Each of these are set by mouse selection via the model’s View Output: controls.

3) How to read out the results of an experiment

Participants decided to view the results of their exercise bout in both tabular and graphic form for a 20-minute period at 2-minute intervals. Tabular outputs appear by default for all the selected variables and, thus, require no further action. To graph any variable, users choose the graph option under the variable with their mouse. In this case, participants picked the “<graph>” option for five of the variables (cardiac output, muscle oxygen debt, muscle blood flow, ventilation, and exercise level). We also chose to view the graphic results in normalized form instead of as absolute values.

4) How to actually execute (run) the experiment

With the set up ready to go as outlined above, in the “Run experiment” section of the controls, participants entered values to run the experiment for 20 minutes at 2 minute intervals and then pressed “<Go>” to execute the actual run. This final setup is shown in the screen below:

5) View and evaluate the results of an experiment

Results appear almost immediately as both a table and a normalized five-variable multiple-color graph of the selected variables vs. time. From the data patterns displayed (see graph below), we noted how students should see that the response shows:

a) since ventilation (8X) increased more than cardiac output (3X), the cardiovascular system was more likely to be the limiting factor in endurance exercise

b) since muscle flow (13X) increased much more than cardiac output (3X), a vasodilation must be occurring in the exercising muscle beds to account for the extra flow increase

c) the slow but steady increase in oxygen debt indicates that this exercise bout is not fully aerobic.

We then checked selected variables (lactate and pH for oxygen debt, vascular resistance for the vasodilation) to confirm our conclusions.

Finally, many participants use the “Save this experiment” feature to save their simulation and the graphic output for future use as a lecture demonstration or as a reminder of how they set up and executed their experiment.

Strategies for using a multiple systems model like HUMAN to isolate one system of interest

Integrated comprehensive physiology simulations such as web-HUMAN are naturally best suited to teach the coordinated physiology of several systems as in the response to aerobic exercise above. On the other hand, much basic physiology teaching first entails developing student understanding of isolated, individual physiological relationships such as the effects of anatomic dead
space, the components of cardiac output, and the Frank-Starling law of the heart. An integrated systems model would seem ill-suited for the task of teaching individual physiologic relationships. Nevertheless, it IS possible to structure experiments in web-HUMAN to target such individual relationships by carefully limiting the time of the experiment to very short intervals so that the response of the remainder of the physiology does not have a chance to develop. This technique was illustrated by having participants build simulations of 1) the alveolar ventilation/dead space relationship and 2) the basic renal handling of individual substances via a balance of filtration, reabsorption, and secretion. The example of the alveolar ventilation relationship is developed below. Material related to the renal handling of substances can be found under the original HAPS ‘06 workshop materials in the Manual at web-HUMAN.

The first step was for participants to locate in HUMAN the relevant variables for an alveolar ventilation/dead space experiment. The relevant variables (located via HUMAN’s How Do I Help feature) and the relationships between them are:

- Ventilation (VENT in HUMAN)
- Tidal volume (TIDVOL)
- Respiration rate (RESPRT)
- so that ventilation = Tidal volume X Respiration rate
- Alveolar ventilation (AVENT)
- so that alveolar ventilation = (Tidal volume – Dead volume) X Respiration rate

And, using HUMAN’s artificial ventilator to control these parameters we also have:

- Artificial respirator “tidal” volume (ARVOL)
- Artificial respirator rate (ARRT)
- so that Ventilation = ARVOL X ARRT

The next step was to develop a design to have the students experimentally determine the anatomical dead space volume. This design was as follows:

- always keep total lung ventilation (VENT) at 6 L/min.
- progressively reduce respirator tidal volume (ARVOL)
- observe the effect on alveolar ventilation (AVENT)
- run for only one minute to prevent other responses.

A sample set of results from such a set of student runs is shown below:

### Effects of Progressive Reduction of Tidal Volume (TIDVOL) on Alveolar Ventilation (AVENT)

<table>
<thead>
<tr>
<th>TIDVOL (ml)</th>
<th>RESPRT (/min.)</th>
<th>VENT (L/min.)</th>
<th>AVENT (ml/min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>500</td>
<td>12</td>
<td>6.0</td>
<td>4100</td>
</tr>
<tr>
<td>250</td>
<td>24</td>
<td>6.0</td>
<td>2400</td>
</tr>
<tr>
<td>200</td>
<td>30</td>
<td>6.0</td>
<td>1500</td>
</tr>
<tr>
<td>175</td>
<td>34.29</td>
<td>6.0</td>
<td>857</td>
</tr>
<tr>
<td>160</td>
<td>37.50</td>
<td>6.0</td>
<td>375</td>
</tr>
<tr>
<td>155</td>
<td>38.71</td>
<td>6.0</td>
<td>193.5</td>
</tr>
</tbody>
</table>

From the trend in these data, either in the table above or better, via either an Excel-generated or hand-plotted graph of alveolar ventilation vs. tidal volume (see below), it becomes apparent to the student that as the tidal volume is reduced progressively towards 150.0 ml, the alveolar ventilation approaches zero.

This overall strategy of using experiments that are carefully time-limited opens up the possibility of using web-HUMAN as a teaching tool for many of the classical basic physiological relationships.
Summary of Workshop #602
Repairing Models: Case Histories

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An article describing Paul Teller’s suggestions for tools and methods used in model repair was published in the Spring ’07 issue of HAPS-EDucator. In this article, Teller describes and illustrates several model repairs.

Reviving a Somso™ Muscular Torso (Figs. 1a, b, c, d)
1. Drill out and insert dowel or rod of appropriate size (usually 1/8-3/16”) (Fig. 1a).
2. Apply glue to broken surfaces. Welder® contact glue can be used if overnight drying is possible (Fig. 1b).
3. Obtain a near-invisible repair (Fig. 1c) of considerable strength (Fig. 1d).

Repairing a Somso™ Vascular Brain (Figs. 2a, b)
Even very small parts can be repaired with proper care.
1. Drilling the artery was done here with a Dremel®, but the hand drill from Kronos® gives better control if you are new to this.
2. A matchstick was trimmed to fit the hole and superglue was used for the final step. The repair has lasted. Other breaks have left the original repair unharmed.
**In Review - continued from page 19**

*Fig. 2a Somso™ brain-pinning to repair arteries*

*Fig. 2b Artery complex glued to pin*

**Curing Nuisances** (Fig. 3)

Some models are sold in unstable condition. The solution was the addition of new pins and the replacement of original pins. Hint: To line up new holes properly in larger pieces, try putting a piece of pencil lead or a drop of ink on one side and press the parts together. Disassemble and drill at the new marks.

*Fig. 3 New pins for an old brain*

**Catastrophic damage** (Figs. 4a, b)

If one uses patience, it is possible to repair even shattered skulls of torsos or a shattered neuron, as in the following example:

1. A Bobbitt™ neuron had a shattering break in the axon. The first step was to remove the screws holding the model to the baseboard.
2. Working from the back of the model with the model on a level surface, the bottom was filled in with Bondo®, using a putty knife (Fig. 4a).
3. Cellophane was smoothed over the Bondo® and clamped to yield a smooth surface when dry (Fig. 4b).
4. The neuron was remounted on its base and is still in service. The Bondo® filled the former screw holes for better threading.

*Fig. 4a Filling dismounted neuron with Bondo®*

*Fig. 4b Smoothing wrap over Bondo® gives a smooth finish*

**Skeletons with tendons** (Figs. 5a, b, c)

Some skeletons have the lower leg hanging from the femur by the tendons only (Fig. 5a). The first problem is to get the strain off the plastic tendons. An example of how this may be done is by using a piece of copper sheeting (hardware stores) used as a support for the joint. Then, rest the entire leg on a lab table, gluing each tendon in turn (Fig. 5b).

Fig. 5c shows a different method to repair tendons. Two screws are attached to take a nylon cord to relieve the strain but still leave some flexibility in use. The next step is to back the tendons with flexible adhesive-friendly plastic and use the above method to permanently repair this knee.

*Fig. 5c shows a different method to repair tendons*
The methods outlined above can remedy many problems in the anatomy laboratory, and familiarization with them can result in many other lab problems being resolved. Shattered torso heads can be restored to usable condition, entire manikins can be brought back to life, and other scientific apparatus can be restored for other courses.

The information considered here should be useful, not only to schools in which full-time lab managers are available, but also to others who have only work-study students or no help at all to take care of the labs while repair activities fall to us. No previous knowledge of repair is necessary and maintenance of labs is limited only by one’s own imagination and willingness to try.

References
One of the challenges of teaching a large introductory course in human anatomy is structuring multiple lab sections to offer all students equal opportunities to excel. As associate instructors in Indiana University’s Basic Human Anatomy course (A215), we took the opportunity to share current practices to enhance and standardize quality of instruction across lab sections, as well as assess these efforts through student and instructor surveys. Since lab practical exams make up half of the grade in A215, we wanted to examine whether students felt they had equal opportunities for success in lab, and if the efforts implemented were making a difference in students and instructors’ experience in A215 lab.

Our study took place during spring semester of 2006. There were 11 lab sections; at the beginning of the semester there were about 34 students per section. Each lab section was conducted by three instructors, two associate instructors (AIs) who were generally Medical Sciences or Bioanthropology graduate students or medical students and one undergraduate teaching assistant (UTA), chosen from outstanding A215 students from previous semesters. Lessons and exams were coordinated and set up by a lab director, so materials were introduced at the same times for all students. Each section met twice per week for two hours. During each session, associate instructors and sometimes UTAs gave a short introduction to new material (generally 10-15 minutes); then students worked independently or in small groups to identify gross and histological structures on models, slides, and electron micrographs using a detailed laboratory manual developed for A215. During this time, all instructors were available to answer questions and provide help in connecting form-function relationships. Associate instructors also presented structures to small groups of students on male and female cadavers. Four practical exams were given over the course of the semester, including identification of 40 structures chosen proportionally to the systems and types of materials studied.

To standardize quality among A215 lab sections, several measures were taken. Before each lab, each instructor received an information sheet including announcements to make and materials to introduce. Setting up exams and making a test key was a team effort. For each exam the lab director and half of the AIs checked each testing station to assure that the questions were clear and agreed on acceptable answers and partial credit to develop the key. Several times throughout the semester, meetings were held between the lecture professor, lab director, AIs and UTAs to share teaching strategies and tips and to discuss solutions to problems that had arisen in lab. Also to help share experience, new AIs were paired with returning ones whenever possible. Switching partners each semester helped instructors pass on creative ideas and learn by modeling effective teaching strategies. There was always something new to learn from your co-AI!

Recently, the lab had been restructured to include PowerPoint® presentations for each lab introduction. These presentations were short and concentrated on diagrams, histology images, and brief definitions. Although the instructors were free to use them as they found appropriate they provided continuity in the information presented to students. Before PowerPoint® presentations were implemented, diagrams were drawn, adjusted, and erased between different sections; now the same high quality images are used for all sections. The presentations also focused the instructors on topics students have found particularly difficult in the past. In this way, instructors are aware of these tricky spots and students are prepared when they encounter them. Another benefit for students is their ability to obtain the slides online and print them for use in lab and for study outside of lab.

To assess our new and continuing efforts to keep the lab sections consistent and fair, we presented these questions in our surveys given to students and instructors: (1) What aspects of anatomy lab do and do not need to be standardized? (2) How can standardization of quality among lab sections be implemented? (3) How are current efforts for standardization perceived by both students and instructors?

Methods

Student-and instructor-questionnaires were completed in lab three-quarters of the way through the semester. Both questionnaires were anonymous and voluntary. Student-questionnaires included 25 multiple-choice questions regarding student demographics, lab introductions, lab resources, use of time in lab, and perceptions of standardization across lab sections. The instructor-questionnaires administered to both AIs and UTAs included a combination of multiple-choice and open-ended questions regarding amount of experience teaching A215 lab, teaching practices, ideas on standardization of lab, and views on current standardization practices.
Results and Discussion

One hundred sixty-five students in 10 of the 11 lab sections completed the questionnaire and these students were fairly evenly distributed among lab sections. One section of this questionnaire dealt with the 10-15 minute introductions given at the beginning of each lab. The overwhelming majority (130) of students reported that the information in lab introductions was just enough, 30 thought it was too little, and 5 felt it was too much. The majority of students felt that there were no differences (85) or only slight differences (75) in quality of introductions between AIs. Only one respondent reported many differences. Most students (60%) said they did not access the PowerPoint® presentations online, 19% said they reviewed them at home, 7% used them in lab, 9% used them in lab and at home, and 5% looked them over before coming to lab.

These responses suggest that 10-15 minutes of introduction using the PowerPoint® slides is adequate for most students, and differences among instructors are not considered extreme or problematic. Perhaps students are not highly concerned about introductions, since all the information they will be tested on can be found in the lab manual. In an instructor-questionnaire, an individual commented, “introductions students tend not to pay attention to” [sic]. Also, most students are not making use of the PowerPoint® slides for independent study, preparation, or in-class help. Perhaps a greater focus should be on assuring quality teaching throughout the rest of the session.

Another category of the questionnaire dealt with individual or small group work, where instructors provide assistance, check understanding, and demonstrate structures on cadavers. When in need of assistance in lab, most students (72%) reported that they were most comfortable asking their AIs; 15% preferred to ask the UTA, and 9% preferred to ask their peers. Four percent said they were not comfortable asking anyone for help (see Fig. 1). When asked when they feel comfortable asking for help, 41% of students responded “anytime,” 37% said “when I can’t figure it out on my own,” 15% said “after asking peers,” 5% responded “when an instructor is nearby,” and 2% responded “when I am approached” (see Fig. 2). Considering these results, it is clear that some students will not receive the help they need unless their instructors are nearby and available or actually approach them. For each section to provide a consistently high quality of instruction, all instructors must constantly circulate in the lab and offer students their help.

When asked if they felt there were differences in quality among lab sections, about half the students said they did not know (22%) or did not discuss the issue with students in other sections (23%). Sixteen percent felt there were no significant differences, 31% felt there were slight differences, and only 8% felt there were strong differences. The last responses were from students primarily clustered in two lab sections. When asked for the primary difference between their section and others, most students were uncertain (43% did not know and 29% did not discuss the issue with students from other sections). However, 4% felt that their classmates made a difference, and 6% thought the amount of time spent on introductions was an important difference, while 18% felt the approachability of the instructors varied among lab sections. Although most students did not feel there were extreme differences in quality among lab sections, these findings again show that all instructors must make an effort to be accessible for questions and show interest in their students’ learning.

Twenty instructor-questionnaires were also collected, accounting for most lab instructors in A215; most AIs teach two sections and the researchers did not complete questionnaires. When asked what strategies instructors use in introductions, 14 said they point out as many structures as possible on the diagrams, 15 said they use pictures for orientation, 16 try to point out more
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difficult structures, and 11 point out the models to be covered for the day’s lesson. This shows that instructors’ introductions vary, and sometimes important information, such as the models on which students will be tested, is omitted. When asked about strategies for helping students learn in class, all 20 said they walk around the room, 16 reported regularly asking students if they have any questions, 11 offered to quiz students, and 10 set up practice exam questions. All instructors made themselves accessible by moving around the room, but as student questionnaires reveal, some students tend not to ask questions unless they are approached.

When asked what helps to standardize quality between labs, 19 instructors indicated PowerPoint® presentations, 13 instructor handouts, 3 instructor meetings, and 3 “other” (writing in same grading criteria, same lab guide, and allowing the same amount of time in lab; see Fig. 3). Instructors commented that the PowerPoint® introductions “keep intros from going off on tangents,” and provided all sections a well-organized presentation with “the same visuals and diagrams.” They also help all sections cover material at the same pace and allow for different teaching methods. However, some instructors stressed that the PowerPoint® presentations did not ensure excellent teaching. “If the instructor just says the ‘basics’ while others use other knowledge some classes may get more info.” In order to encourage all instructors to include important information in their introductions, some instructors suggested that a notes section could be provided for each slide.

Most of the instructors also reported that the instructor handouts were useful because they point out “essential and detailed information,” list up-to-date announcements, and “help insure nothing of importance is left out.” However, instructors felt that these handouts often essentially became too detailed to be useful. Some commented that they were not functioning to standardize lab sections because they were being used differently by different instructors.

In the instructor-questionnaire responses, only three instructors found AI/UTA meetings useful. Although some said these meetings allow instructors to share their teaching tips, discuss problems, and “check in and stay on the same page,” most instructors reported that they were “unnecessary,” “inconvenient,” or “could be conducted better by email.” Still, some offered suggestions on how these meetings could be more beneficial. One instructor stated that meetings should be “more pre-emptive instead of after-the-fact,” so instructors receive tips and advice before teaching particular lessons. Another felt that meetings were often spent discussing individual problems, but little concrete advice was given.

When asked what they felt needed to be standardized, the most common instructor responses were introductions, grading, student responsibilities, and announcements made in lab. A few instructors felt that a way to standardize teaching with the cadavers was needed because “it is the most difficult part of lab.” Some felt it was important for all sections to set up the same sample exam questions for students.

When asked for other suggestions on creating a uniform high quality of teaching among lab sections, instructors suggested having scheduled times for AIs and UTAs to prepare with models and cadavers. Currently the lab is available to instructors for preparation, but setting aside a regular meeting time may encourage instructors to come. Also, preparing video or audio recordings of model introductions may be useful in preparing for lab. Some instructors also suggested increasing accountability of instructors. Undergraduate teaching assistants are evaluated by the AIs toward the end of the semester, but earlier evaluations were suggested.

In summary, student and instructor responses to the surveys suggest that current efforts for standardization of lab sections are effective, but could be improved. The study also suggests that to increase opportunities for success for all students, instructors need to be pro-active in giving help. Instructors cannot assume that if their students have questions, they will ask. It is also important to note that most instructors felt that standardization of labs is important to an extent, but must allow for a personal, creative teaching style. One instructor wrote, “standardization is important, though [a] completely identical [introduction] is unnecessary otherwise a taped lecture could be shown for introduction…” Setting standards for labs does not need to stifle creativity or expertise of individual instructors, but standards can create an atmosphere for sharing knowledge and highlight the goal of helping all students in the course succeed.

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