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Professor William Moody, University of Washington

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Robert S. Stinson, Jenna Miley, and Jill D. Stinson

Summary of a Poster Presentation: Incorporating a Book Club Into a Human Anatomy Course: Student Responses And Relevance to Curriculum

April Collins Potterfield

Summary of Workshops #108 and #612 Creating Visual Anatomy Exams on Blackboard™

Todd C. Shoepe

Cover art is the back of the quilt that will be raffled at the HAPS Conference in New Orleans. (See article on page 8).
**HAPS-EDucator**

**Editor** ................................................................. Susan Baxley
**Committee Chair** ................................................................. Marsha Sousa
**Committee Members** ................................................................. Mary Lou Bareither, Pat Bowne, Elaine Chapman, Barbara Cocanour, Jorge Cortese, Jennifer Eastwood, David Evans, Richard Faircloth, Chaya Gopalan, Valerie Harper, Nancy Kincaid, Don Kisiel, Richelle Laipply, Crystal Lemmons, Pat Mansfield, Roberta Mechan, Karen Murch-Shafer, Mary Orff, Judith Osborn, Liz Perez, Hiranya Roychowdhury, Kathy Starr, Maria Squire, Caryl Tickner, Tony Weinhaus, Robert Yost, Nina Zanetti

**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.

Annual membership dues are $65 for full-time faculty, $50 for retired, part-time faculty, and students. Annual membership renewals shall be due on January 1 or July 1. New members shall renew on whichever date most closely follows the date of their initial membership. Information on additional membership categories, meetings, and more can be found at: http://wwwhapsweb.org. Correspondence should be directed to: HAPS, PO Box 2945 LaGrange, GA 30241 or (800) 448-HAPS (4277) or 706-883-8215 (fax).

**SUBMISSIONS TO HAPS-EDucator**

Papers for publication, requests for information, positions available and wanted, and letters to the editor are welcomed. Articles may be submitted to the editor as a Microsoft Word or Word Perfect file as an e-mail attachment. If references are included, please follow the methods suggested in Scientific Style and Format: The CSE Manual for Authors, Editors, and Publishers 7th Edition, Style Manual Committee (Council of Biology Editors) Cambridge, Cambridge University Press 2006 or see the reference guide on the HAPS-EDucator page of The HAPS website (hapsweb.org).

It is the policy of the Human Anatomy and Physiology Society (HAPS) that any advertising appearing in its publication(s) must be related to the teaching of anatomy and physiology. The HAPS-EDucator Editor and HAPS-EDucator Editorial Advisory Panel jointly determine whether an advertisement meets the criteria of HAPS. Any advertisement that is deemed not to meet the needs of the organization will not be printed, and the advertisement plus any monies collected from the advertiser will be returned. The opinions reflected in advertising that appear in this publication do not necessarily represent the opinions of HAPS. Advertisement of a product in the HAPS-EDucator does not represent endorsement of that product by HAPS. Contact the Editor for information on advertising rates, advertisement size, and the procedure for submitting an advertisement to HAPS-EDucator for publication.

**DEADLINES FOR SUBMITTING MATERIAL TO HAPS-EDucator:** August 1 (Fall issue); November 1 (Spring issue); February 1 (Spring issue); April 15 (Summer issue).

**CONTACT THE HAPS-EDucator Editor:** Susan Baxley, HAPS, PO Box 2945 LaGrange, GA 30241 orhapsedhapsweb.org.
Hello! It seems as though I just finished my last letter and here I am again. The momentum of the year keeps rolling, pulling us forward to New Orleans.

I would like to report on the long-range planning of the Board this year. Let me provide a little context for newer members. The HAPS Board of Directors meets monthly by way of a discussion forum on the website and twice a year in person. One of these face-to-face meetings occurs right before the annual conference and the other is in January. Since the inception of the January face-to-face meeting of the Board of Directors, the focus has been on strategic planning. January is a good time for this activity as the President has a better feel for the current needs of HAPS. The President-Elect has finished collecting nominations and can begin thinking about what she/he would like to accomplish during her/his presidency. As many of the committee chairs and appointed officers as possible are invited to join the Board of Directors in this strategic planning work. This year financial constraints determined the total number of individuals who were asked to participate.

The HAPS long-range planning document is not a static 5-10 year plan. It is being revised based on the discussions at the January planning meeting to reflect last year’s activities and to help guide the agenda for the next year, moving our goals forward. By the time you read this, the document will be finished and loaded onto the web page for everyone to see by following the link to the “HAPS Progress Report and Long-Term Plan.”

In thinking back over our January planning meeting this year, the most striking theme was the level of general agreement that HAPS is an organization that is qualitatively different from other professional organizations. This difference is our sense of community and spirit of genuine helpfulness that allows tenured full professors to sit down with first-time community college instructors and talk as colleagues about the issues of teaching/learning that we all face. This difference is that HAPS is most visible during our conferences. We share an honest desire to help all of our students engage in meaningful learning. We come to our annual meetings and regional conferences to learn from one another, not to prove ourselves better than everyone else. This is perceived as one of our most precious attributes. It is also a major factor in keeping people involved in HAPS for many years. Our regional and annual conferences provide the initial personal bonds that are maintained through the listserv, the web presence, and HAPS-EDucator.

Like all organizations, especially volunteer organizations, we must be ever vigilant about maintaining our routes of internal communication. Some slight changes to the organizational structure of HAPS are being deliberated. The importance of the position of the Steering Committee Chair is being formally recognized and a new job description is being constructed. The primary impact is intended to be an increased ease and regularity in communicating among committees and between the committees and the Board of Directors.

As an organization, the scope of our own activities and our interactions with other organizations is increasing. The Board of Directors keeps an eye on the financial resources of the organization, but the committees that do the work of implementing our initiatives. We are always in need of helping hands, so please take this as your invitation to become involved in the projects and initiatives of our committees, the real work of HAPS. As President, I cannot thank our group of hard-working committee chairs enough. I can, however, remind you to look at the inside back cover of this HAPS-EDucator and recognize all of the people who are volunteering their time to help the organization. I do want to take the time to personally thank Tom Lehman who has been the Chair of the Steering Committee over the past two years. He took on a large, ill-defined job and created some order where little order has previously existed. I am grateful for his ongoing commitment to HAPS.

Please remember to vote for the next round of HAPS leadership when the on-line polls open this year. The affirmation of a vote is a strong motivator for those who have agreed to step up into leadership positions. Please show our incoming officers your support. There is much work to keep us all busy and knowing that we do this work for a great organization makes it worth while. Keep up the good work, everyone!

Thanks for all you do in service to HAPS. See you in New Orleans!
2008 HAPS Conference New Orleans
Tentative Schedule of Events and Proposed Activities

Saturday, May 24th

Registration  - Westin Hotel Canal Place 1:00 PM - 5:00 PM
HAPS-I Orientation  - Westin Hotel Canal Place (Sponsored in part by McGraw-Hill Publishers) 3:00 PM - 5:00 PM
Welcome Reception  - Westin Hotel Canal Place (Sponsored in part by McGraw-Hill Publishers) 5:30 PM - 7:30 PM

Sunday, May 25th

Registration  - Westin Hotel Canal Place 7:00 AM - 1:00 PM
Exhibits  7:30 AM - 5:00 PM
First Timers Breakfast  - Westin Hotel Canal Place (Sponsored in part by ADInstruments) 7:30 AM - 8:30 AM
Continental Breakfast  7:30 AM - 8:30 AM
Opening Remarks  8:30 AM - 8:45 AM
Updates  - Westin Hotel Canal Place
  Update Seminar I  8:45 AM - 10:00 AM
  Charles O’Brien, MD, PhD
  Genomic Medicine: The future of addiction medicine
  University of Pennsylvania School of Medicine
Refreshment Break  (Sponsored in part by John Wiley and Sons Publishers) 10:00 AM - 10:30 AM
Exhibits and Poster Session  10:00 AM - 10:30 AM
Update Seminar II  10:30 AM - 11:45 AM
  John Hunt, MD
  Oxygen transport in the setting of high altitude
  LSUHSC, New Orleans
Lunch  (on your own) 11:45 AM - 2:00 PM
  Update Seminar III  1:30 PM - 2:45 PM
  Kimberly Topp, PhD (AAA Sponsored Speaker)
  Painful peripheral neuropathy induced by cancer chemotherapy
  preventable with a better understanding of anatomy and physiology?
  University of California, San Francisco
Refreshment Break  2:00 PM - 3:15 PM
Exhibits and Poster Session  3:15 PM - 3:45 PM
  Update Seminar IV  3:45 PM - 5:00 PM
  Seth Pincus, MD (AMS Sponsored Speaker)
  Biodefense: How ricin toxin kills and how antibodies protect
  Children’s Hospital, LSU Health Sciences Center
Exhibits  5:00 PM - 6:00 PM

Sunday Event - Riverboat Natchez Jazz and Dinner Cruise
Board  7:00 PM
Dinner and Cruise  8:00 PM - 10:00 PM
### Monday, May 26th

**Registration**  
8:00 AM - 1:00 AM

**Continental Breakfast**  
7:30 AM - 8:30 AM

**Exhibits and Poster Session**  
7:30 AM - 5:00 PM

**Business Meeting**  
Westin Hotel Canal Place (open to all HAPS members)  
8:30 AM - 10:00 AM

**Refreshment Break**  
10:00 AM - 10:30 AM

**Exhibits and Poster Session**  
10:00 AM - 10:30 AM

**Updates**  
Westin Hotel Canal Place  
10:30 AM - 11:45 AM

**Update Seminar V**  
Darwin Prockop, MD, PhD  
Tulane University, New Orleans  
*Stem/progenitor cells from bone marrow and their amazing potential to repair most tissues*

**Lunch**  
(on your own)  
11:45 AM - 1:45 PM

**Update Seminar VI**  
Michael Levitsky, PhD (APS Sponsored Speaker)  
1:45 PM - 3:00 PM

**The mechanics of breathing**  
LSUHSC, New Orleans

**Refreshment Break, Exhibits, and Poster Session**  
Westin Hotel Canal Place  
3:00 PM - 5:00 PM

**Door Prize Drawings**  
Westin Hotel Canal Place Exhibit Area  
4:30 PM - 5:00 PM

**Banquet and Reception**  
Westin Hotel Canal Place  
6:00 PM - 10:00 PM

**Reception**  
(Sponsored in part by John Wiley and Sons Publishers)  
6:00 PM - 7:00 PM

**Banquet, music, and dancing**  
7:00 PM - 10:00 PM

**Banquet Speaker**  
Mary Manhein, LSU, Baton Rouge  
*Forensic anthropology in Louisiana: From modern and historic New Orleans to ancient Egypt*

### Tuesday, May 27th

**LSU Health Sciences Center (LSUHSC)**

Buses load at hotel for trip to LSUHSC  
7:00 AM - 7:30 AM

Continental Breakfast at LSUHSC  
8:00 AM - 9:00 AM

Welcoming Remarks  
9:00 AM - 9:15 AM

**Workshops**  
9:30 AM - 12:30 PM

Lunch  
(Sponsored in part by Benjamin Cummings Publishers)  
12:30 PM - 1:30 PM

**Committee Meetings**  
4:30 PM

### Wednesday, May 28th

**LSU Health Sciences Center (LSUHSC)**

Buses load at hotel for trip to LSUHSC  
7:00 AM - 7:30 AM

Continental Breakfast at LSUHSC  
8:00 AM - 9:00 AM

**Workshops**  
9:30 AM - 12:30 PM

Lunch  
(Sponsored in part by ADInstruments)  
12:30 PM - 1:30 PM

**Workshops**  
1:30 PM - 4:30 PM

**Buses begin loading at LSUHSC for return to hotel**  
4:30 PM

### Thursday, May 29th

**Bus tour of Oak Alley Plantation**  
9:00 AM

**Return to the Westin New Orleans Canal Place**  
1:30 PM

### Friday, May 30th

**Optional Volunteer Day** with Habitat for Humanity/ National Wildlife Federation

Please see HAPS website for registration information

(Not HAPS sponsored! HAPS assumes no responsibility of liability if you chose to participate.)
Candidates for 2008-2009

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For the Office of President-Elect 2008-09
Will Serve as President in 2009-2010 and then Past-President in 2010-2011
John Waters

I am excited to be nominated to serve you as President-elect. HAPS has been such a large part of my professional life that I am unsure where to begin. I joined HAPS in 1994, after meeting with the Board of Directors to discuss creating the first HAPS’ website. With the exception of the ’95 meeting in Portland, OR, I have attended every annual conference and have presented workshops on virtual reality in the classroom, peer-led team learning, electromyography, performing rodent survival surgeries in a large undergraduate course, the efficacy of dissection and prosection in teaching labs, and a literature review of animal versus non-animal approaches to laboratory education. In addition to conference presentations, I have also served on HAPS committees and on the Board of Directors as Treasurer.

Shortly after joining HAPS, the Board of Directors appointed me Webmaster, and, while our first website was modest compared to our current site, it marked the beginning of HAPS’ web presence. In 2000, I stepped away from the website when I was elected to the Board of Directors as Treasurer. During my term as your treasurer, I learned how hard the members of the Board and Steering Committee work year round to serve the membership. We consulted with financial professionals and debated our expenses to make certain the annual budget was balanced and that HAPS remained financially secure. After my term as Treasurer ended in 2002, I served on the Animal Care and Use Committee until 2005. Since that time, I have become increasingly involved in education research, collaborating with HAPS members on a variety of projects, and presenting our findings in published articles and at HAPS conferences.

My experiences in the classroom, on HAPS committees, with the Board of Directors, and in research have convinced me that HAPS’ greatest strength is its potential to improve every aspect of our teaching careers. As President, I will work with the Board and committees to continue supporting our members. I believe that HAPS members are uniquely suited to test assumptions about education to evaluate new possibilities, and to speak out in support of fellow A&P educators as we promote excellence in anatomy and physiology education. This is our mission as an organization, and that will be mine if you choose me as your president.

For the Office of Treasurer 2008-10
Elizabeth Becker

Over my nearly 20 years as a HAPS member I have gained so much. With that in mind I want to return something to HAPS and serve as the HAPS Treasurer. I have previous HAPS Board experience as the HAPS Central Regional Director in 2003-2007. Those four years were busy ones and it was my pleasure and my privilege to assist in the maturation of the HAPS website, to participate in long range planning, and to assist in the day-to-day processes that keep HAPS going. I was a member of the Board when the SACS accreditation issues came up. Under the leadership of Ric Martini and with the cooperation of so many members of HAPS, we were able to make a difference. That is an amazing testament to this organization. Not all professional organizations are willing or able to respond so quickly and effectively to the needs of their members. I was proud to be part of that effort and I welcome future opportunities to serve HAPS.

Here at Elgin Community College (ECC), I have twice served as my department’s coordinator. I have overseen the ordering of supplies, budgeting, and the allocating of resources. These are skills I bring to the role of Treasurer. I also served for several years as the Chair of our Faculty Development Committee. At ECC, this is the committee that (among other activities) oversees the allocation of professional development funds to ECC faculty. As committee chair, I kept watch over the books, made certain that paperwork was in order and submitted properly, and I signed all the checks. I worked closely with our business office and became familiar with a number of budgeting procedures.

It is my hope to continue the sound fiscal management that we have come to expect from HAPS and its Board. I was part...
of the budgeting process for four years as a Board member and am familiar with many of the issues facing the Treasurer. Responsible spending while helping HAPS to grow and continuing to serve its membership would be my main goal as Treasurer.

My communication skills are strong. I listen well and am able to process financial information quite well. I work hard and am willing to learn any specific skills that would make me an effective Treasurer.

I appreciate the honor of being nominated for this very important position. I thought about this position and the commitments that go with it long and hard before accepting the nomination. Being Treasurer for HAPS is a job that I truly believe I can do well. This is an organization that I believe in, and I hope to serve both HAPS and its individual members as Treasurer. Thank you for considering my candidacy.

For the Director of the Eastern Region 2008-2010

Amy Way

In 2002, I had the good fortune of receiving a Robert Anthony Scholarship that allowed me to attend my first HAPS meeting. That first meeting was an eye-opener for me. I was struck by the friendly and FUN people I met. During the update seminars and workshops, I realized how much more I had to learn about teaching anatomy and physiology and that I was fortunate to be among those who could help me become a better educator. Is that not why we first come to HAPS? Of course! Is that the only reason we return? Of course not! We come back year after year to visit old friends and to meet new ones, and we come back to contribute.

My first opportunity to give something back was when I joined the Grants and Scholarships Committee in 2003. Shortly after joining, I became chair of the committee. It has been my pleasure to help administer the grants and scholarships that HAPS offers its members. As chair, I participated in collaborative endeavors between the Board and Committee chairs and learned about the governance of HAPS. These experiences gave me the chance to give back to HAPS and to encourage the next generation of A&P instructors to attend HAPS and join this fantastic group of colleagues.

Now, I ask that you give me the opportunity to serve HAPS as your next Eastern Regional Director. I look forward to the challenges of the position and to becoming more involved in this society that has already given so much to me.

For the Director of the Western Region 2008-2010

Glenn Yoshida

One of my first rewarding and enjoyable experiences as a Los Angeles Southwest College Anatomy and Physiology instructor was attending a national Human Anatomy and Physiology conference in 1988 at Triton College in Illinois. After 12 years of teaching, that conference was an eye opener—I never met so many like myself (teaching A & P) all in one place! The update seminars and hands-on workshops, the camaraderie and collegial atmosphere, together with networking opportunities, gave me a sense of pride and excitement as an instructor. As a result, I have attended every annual HAPS conference since then and I look forward to renewing friendships and growing professionally each year.

Over the last 5 years, I have been a member of the HAPS Safety Committee. At last year’s HAPS Conference in San Diego, I worked at the registration desk and was able to meet and greet so many HAPS members. I am also a member of the HAPS Administrators Advisory Group, an ad hoc committee on barriers to first-timers attending the HAPS Annual Meeting. This committee held its initial meeting last year in San Diego. The purpose of this group is to make recommendations to the Board regarding what the group sees as barriers to new people attending HAPS conferences.

If elected as the Western Regional Director, I plan to continue the HAPS’ spirit of promoting teaching excellence in a friendly, collegial environment. I will communicate with my constituency and promote an increased involvement of the region’s membership in HAPS activities. I will also work with the Board of Directors to ensure continued success and to develop collaborative activities through planning and evaluation. I will explore possibilities of a western regional HAPS conference.

I am honored to be a nominee as the Western Regional Director and I will strive to maintain the mix of professionalism and excitement that has continued since the inception of HAPS.
HAPS members have a once-in-a-lifetime opportunity to win a quilt made of HAPS t-shirts from previous meetings. The chances for this raffle are $1.00 each and may be purchased through HAPS Headquarters if you are not attending the meeting in New Orleans. The address is Shanan Molnar, HAPS/Membership Services, P. O. Box 2945, LaGrange, GA 30241. If you are planning to attend the meeting, raffle chances may be purchased when you pick up your registration packet. The proceeds will go to support the Robert B. Anthony Scholarship fund. For newer members who may not know the history of the organization, Bob Anthony is one of the founders of HAPS.

This one-of-a-kind piece of artwork was created by Jackie Butler, a HAPS member, whose hobbies definitely include quilting. The dimensions of the quilt are 68 inches by 82 inches. The pictures included show both the t-shirts on one side and the swirling skulls on the other (see front cover of this newsletter). The oldest t-shirt, and to the best of our knowledge, the first time HAPS t-shirts were sold, was at the Portsmouth, New Hampshire, meeting in 1994. The last t-shirt included was Skully, who first appeared at the San Diego conference in 2007. The edges are not shown because the quilt has not yet been bound. The idea for the quilt was developed at the 20th anniversary conference in Austin in 2006. Since quilting is a labor intensive hobby, it has taken two years to finish the project. Look for the quilt on display in New Orleans. There may even be opportunities to have your photo taken with it, as there can only be one winner. Good luck!
Many of you have already signed up for our new slate of HAPS Institute (HAPS-I) courses this year! By time you read this, there may not be many spaces left. So I suggest you hop on over to wwwhapsweborg as soon as you can and click on the HAPS Institute link in the left menu bar. At the top of the page, click the List of Courses link to see what is going on—and to register. For your convenience, we have also included the catalog of 2008 HAPS-I courses in this issue of HAPS-EDucator.

As you can imagine, the HAPS-I team has been keeping up with the field of continuing professional education. And what we see is very encouraging.

First, it seems to us that many administrators who have some control of the purse strings are increasingly aware of how cost-effective it is to fund faculty professional development. This seems especially true of the kind of focused courses offered by HAPS Institute. We are noticing that some adjunct faculty are finding it easier to get funding for all or part of such courses. Here are some proven tips for securing funding for HAPS-I courses:

1. Your institution may have a mechanism for funding courses of which you are not aware. For example, your Human Resources Department may fund courses separately from department funding for workshops and travel.
2. Most administrators have funds that they can tap for a worthy cause. But you have to ask! Lay out a good case for how your HAPS-I course will help you, what you can bring back to the other faculty, and how it will ultimately benefit students. If one administrator says no, then move up the line to the next one—they each have access to money.
3. Look for other funding sources. For example, does your institution have a foundation? They may have some funds for which you could petition. What about your local or state union? Local community organizations? Your school’s financial aid officers may have some good tips for your hunt!

Second, we are finding that our developing course model for HAPS-I courses is on par with other cutting-edge programs. In other words, our efforts to use “best practices” seem to be taking us along the best road available. Our model has several important components:

1. Our curriculum focuses on concepts that are perceived to be hard to understand, hard to learn, and hard to teach. These are common, relevant issues, and concerns that we all face.
2. We use “backwards” course design, starting with course goals and objectives and working backwards from there to develop our course design and strategies. This is a type of outcomes-based approach.
3. We use course and curriculum assessment tools to adjust every course every time it is taught, to ensure maximum effectiveness.
4. Our courses are presented in collaborative, active learning environments. All HAPS-I courses include some online interaction. Many also include face-to-face collaboration as well. The learning community formed by each cohort of students facilitates continuing collaborative learning throughout the course and beyond.
5. HAPS-I courses stimulate creativity as participants build learning objects that they can use in their own courses. They facilitate the application of concepts to practice.
6. Participants engage themselves more deeply in their profession by extending their peer network and publishing in a peer-reviewed archive of learning objects.

7. HAPS-I courses incorporate many different experts and resources from around North America in a manner not available in traditional graduate courses. We have active partnerships with many organizations to provide many experts and other resources.

Third, our courses provide the credentials—graduate biology credit from the University of Washington (Seattle)—needed to document your successful learning achievements.

Of course, the best confirmation that we are headed in the right direction comes from our HAPS-I scholars themselves. They are a mix of professionals from different schools, teaching at different levels, with varying experiences and credentials, who have formed a growing network of “deeper learning” within the larger HAPS community. And they uniformly agree that HAPS-I has been a useful learning adventure for them. And, HAPS-I courses are FUN!

As always, we welcome any input, advice, questions, complaints, or other messages at HAPS-Institute@hapsweb.org

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2008 HAPS-I Course Catalog

Courses at the Annual Conference in New Orleans LA:

**Topics in Anatomy & Physiology** (2 graduate biology credits) Course fee: $350
*Faculty:* Ellen Arnestad and Kevin Patton
Similar to last year’s popular “sampler” course in format, but with ALL NEW topics, based on the 2008 Update Seminars in New Orleans. Explore the seminar topics more deeply with preliminary readings and online discussions with peers. [Note: The “topics” course will be a recurring course.]

**Advanced Renal Physiology** (2 graduate biology credits) Course fee: $350
*Faculty:* Jennifer Lundmark
Back by popular demand, this is a slightly modified reprise of the hit kidney course from last year. A full day workshop at the conference offers a variety of interactive, collaborative learning opportunities. [Note: We do not plan to offer this course again next year.]

**Advanced Respiratory Physiology** (2 graduate biology credits) Course fee: $350
*Faculty:* Dee Silverthorn  *Guest Faculty:* Mike Levitzky
Building on the presentation of Dr. Levitzky’s seminar (sponsored by APS), this new course will tackle some of the intricacies of respiratory function. The full-day workshop portion of the course features interactive pulmonary testing in the Levitzky lab at LSU.

Courses at Workshop in Grand Rapids MI:

**Using Cadavers to Teach Anatomy & Physiology** (3 graduate biology credits) Course fee: $450
*Faculty:* Paul Krieger and Joe Griswold
Explore the use of human remains in teaching A&P, including practical and pedagogical issues. Excellent for those curious about using cadavers, those proposing or planning the use of cadavers, as well as those already with a cadaver program. Administrators will also find the course useful. (March 28-30, discount hotel rates available)

Fully Online Course:

**Best Practices in Distributed (online) Teaching of Anatomy & Physiology** (2 graduate biology credits) Course fee: $350
*Faculty:* Tom Lancraft, Carl Shuster, Dan Lemons
This course will address ALL levels of online teaching, from using one or two online resources to web-enhanced courses to hybrid courses to fully online A and/or P courses. Whether you are doing it now, are planning some online course components, or are just curious about how it can be done, you will benefit from this interactive course. Administrators are welcome in this course.

All HAPS-I courses require the creation and publication of a learning object based on the course content. These are peer-reviewed within each course and published in the APS Teaching Archive as part of the coursework.

Course fees are in addition to annual conference fees (if applicable), transportation, lodging, and textbooks (if any).

Credit granted by University of Washington (Seattle) Department of Biology.
Visit us at [hapsweb.org](http://hapsweb.org) (click HAPS Institute on menu) or email us at HAPS-Institute@hapsweb.org.
Congratulations to this Year’s Robert Anthony Scholarship Recipients!

- Teresa Alvarez
- Elaine Brunschwig
- Aron Drake
- Jared Gilmore
- Amanda Nelson
- John Okpe
- Thomas Pefok

Please congratulate these individuals and welcome them to their first HAPS meeting when you see them in New Orleans!
Inflammatory Mediators in Cardiovascular Disease

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According to the Centers for Disease Control, over 70 million Americans currently live with cardiovascular disease and almost one million die from this disease each year! Understanding the various etiologies of cardiovascular disease is paramount to our ability to find a cure. Over the last 15 years, the scientific community has come to the realization that there are many contributing factors leading to the progression of the disease and that there is no single magic bullet in its treatment. This article will present a look at one of these major factors and discuss its role in the development of our nation's greatest killer.

Inflammation serves as one cornerstone of tissue regeneration after injury, whether from internal or external trauma or invasion by pathogenic microbes. Heat, pain, swelling, and redness associated with this condition signal the initiation of the path toward healing. As local tissue factors are released from damaged cells, capillaries dilate increasing blood flow to the region, setting in motion a chain of events that end with the return to normal tissue functionality. Only recently was it discovered that this process, while vital in the acute stages, can create systemic vascular damage when left to smolder for extended periods of time.

**Inflammatory mediators**

Inflammatory mediators produced by damaged cells serve as chemical red flags, alerting the immune system to mount a response that brings various white blood cell populations to the area within minutes. Injured endothelium, macrophage reactive oxygen species, bacterial endotoxins, and damaged smooth muscle of the tunica media all serve as capable initiators of inflammatory mediator release. Interleukin-1 and tumor necrosis factor are two of the more potent inflammatory mediators released from antigen-producing cells and other immune system cells after exposure to trauma or infectious agents. A number of other mediators, including histamines, kinins, C5a, platelet activating factor (PAF), prostaglandins, and leukotrienes, work to induce endothelial cytoskeletal changes leading to dramatic increases in localized vascular permeability and retention of fluids within the interstitial tissue space. These mediators, commonly known as cytokines, also activate intracellular pathways that result in the production of adhesion molecules by the assaulted endothelial cells.

PAF, produced by many different cells including macrophages, neutrophils, mast cells, and platelets, is an especially potent cytokine, that creates bronchoconstriction and vasoconstriction effects 10,000 times more powerful than histamine. Classified as an ether lipid, PAF induces vascular permeability and the adherence of platelets and neutrophils to the vascular endothelium. PAF also serves as an agonist, along with many other mediators, binding to the G-protein coupled receptor of the arachidonic acid pathways. Once activated by cytokines, these pathways produce many products synergistic to the chronic cellular inflammation that leads to cardiovascular disease.

**Arachidonic acid pathways**

Derived from the phospholipids of the cell membrane, arachidonic acid (Figure 1) is an eicosatetraenoic acid created when phospholipase A2 (PLA2) cleaves fatty acids off phospholipids in the cell membrane. Interestingly, many synthetic catabolic steroids including prednisone, inhibit the activation of arachidonic acid by blocking the activation of PLA2, preventing the formation of a number of the downstream inflammatory products.

Figure 1 Arachidonic Acid

Two main pathways lead to the formation of arachidonic acid – direct and indirect. As previously mentioned, specific chemical mediators produced by damaged tissue, as well as physical and chemical stressors, bind to G-proteins releasing the alpha subunit to initiate the inflammatory cascade. The alpha subunit in the direct pathway (Figure 2), in the presence of calcium, activates PLA2 cleaving arachidonic acid from phospholipids in the cell membrane.
Chemical mediator agonists such as histamine and PAF bind to the G-protein, activating the alpha subunit, which in turn activates phospholipase C (PLC). PLC splits cell membrane phospholipids into diacylglycerol and inositol triphosphate (IP3). Traveling through the cytoplasm, IP3 binds to endoplasmic reticulum receptors bringing about the release of calcium which also serves as a co-activator of the indirect pathway. The remaining diacylglycerol is further broken down into monoacylglycerol and arachidonic acid.

The presence of two enzymes determines the eventual products created from the appearance of arachidonic acid. Cyclooxygenase oxidizes arachidonic acid to produce the first of the prostaglandins, prostaglandin G2 (PGG2). Non-selective COX inhibitors like aspirin and acetaminophen decrease inflammation by blocking the production of PGG2 (Figure 4). However, it is well known that a decrease in specific prostaglandins within the COX-1 pathway can lead to gastric mucosal damage by impeding the formation of protective, hydroxyl-rich mucous. The COX-2 pathways are responsible for the mediation of prostaglandins involved in pain and inflammation. Vioxx™, a drug introduced by Merck Corporation in 1999, targeted the COX-2 pathways, but was pulled off the market in 2004 when studies showed its linkage to increases in cardiovascular disease. It is surmised that cardiotoxicity was the direct result of the inhibition of the COX-2 pathways leading to a reduction of in prostaglandins involved in vasorelaxation along with inhibition of platelet degranulation. Other research speculates that Vioxx™ metabolites within heart muscle tissue may damage the heart muscle.

PGG2 is quickly converted to prostaglandin H2 (PGH2), and, at this point, thromboxane synthase in the platelets converts PGH2 into thromboxane A2 (TXA2). This molecule serves an important function after damage to blood vessels by triggering small vessel vasoconstriction and platelet aggregation immediately, slowing the flow of blood through injured or severed vessels, thus, preventing further blood loss.

PGH2 is quickly broken down into thromboxane B2, its inactive form. PGH2 can also be converted to prostacyclin (PGI2) by prostacyclin synthase found in endothelial cells. Release of this molecule causes local vasodilation and inhibits platelet aggregation. Studies have shown that homocysteine blocks the formation of prostacyclin synthase possibly contributing to cardiovascular disease by increasing platelet accumulation after vascular intimal injury. Additionally, PGH2 forms several other prostaglandins including PGD2, PGE2, and PGF2 (Figure 5), all operating as vasodilators creating generalized edema.

Leukotrienes

A second major enzyme leads to the production of 5-hydroperoxyeicosatetraenoic acid (5-HPETE). Next, enzymes within the neutrophil transform 5-HPETE into leukotriene A4 (Figure 6) (LTA4), the first of the cysteinyl leukotrienes, named because of its derivation from conjugated cysteine. LTA4 quickly converts into LTC4, enhancing platelet and white blood cell aggregation and adhesion of neutrophils to the vascular endothelium. This is one of the most powerful initiators of localized inflammation. LTC4 entering the platelet undergoes
conversion to lipoxin A4 and B4, both assisting in monocyte adhesion and local vasodilation. Without 12–lipoxygenase, found only in platelets, the conversion to lipoxin A4 and B4 does not occur.

Figure 6 Transformation of HPETE into Leukotriene A4

**Slow reacting substance of anaphylaxis**

Considered life-threatening emergencies, extreme allergic reactions require a swift medical response. The predominant molecules released in the allergic patient, LTC4, LTD4, and LTE4, form a group of leukotrienes collectively known as the slow-reacting substance of anaphylaxis (SRS-A). Derived initially from LTA4, LTC4 synthase found in platelets adds glutathione to the LTA4 molecule leading to the formation of LTC4. LTC4 is converted to LTD4 via the removal of glutamic acid and, finally LTD4 is converted to LTE4 by the removal of glycine.8

Much more potent than histamine, these molecules create powerful vasoconstriction, bronchospasms, and increased vascular permeability with an eventual decrease in respiration and circulatory shock, leading to death.10 While leukotrienes are best known for their effects in conditions such as anaphylaxis and asthma, they are still potent inflammatory mediators. As triggers of chemotaxis and by assisting production of endothelial adhesion molecules, leukotrienes and other chemical mediators attract white blood cells aiding in local inflammation and tissue repair.

**Conclusion**

The scientific community is now just beginning to understand the factors contributing to the development of cardiovascular disease. Fat metabolism must certainly fit into this puzzle. High blood pressure and endothelial shearing must also play a part, but the role of long-standing inflammation and its integral association with the immune system cannot be overlooked. Patients with periodontal disease, auto-immune diseases, and other diseases that create chronic inflammatory conditions within the body exhibit increased incidences of cardiovascular disease over the incidences in the generally healthy populations. The question is why? Research into the causes of chronic inflammation continues, could lead to finding cures to other diseases as well. Inflammatory mediators like tumor necrosis factor and nuclear factor-kappa B, a control for switching on inflammatory genes, have recently been under scrutiny regarding their link not only to inflammation, but also to cancer.11 Discovering effective treatments for one disease may lead to other promising breakthroughs in the field of medical science.

**References**

EDU-Snippets

Making the Point

A column that survives because you, the members, send us your Snippets

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EDU-Snippets is a column designed to let you, the members of HAPS, share your “ways to make sure your students get it.” During these past few years of putting together your ideas into our EDU-Snippets column, we 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 issue’s column is no exception! We did, however, decide to start this edition of EDU-Snippets by asking our HAPS Board members to share their favorite Snippets with you. As always, we have done a bit of editing so that these ideas blend together.

I. Board Points

From Board Members, present and past, we received several dynamic and interactive Snippet ideas.

A. Powerful Points

Judi Nath (Lourdes College, jnath@lourdes.edu), Central Regional Director, sent us some ideas for using PowerPoint™ slides.

The overarching theme during my lecture is “See It, Hear It, Say It, Read It, Write It, Learn It!” In order to bring this to life in the classroom, I use interactive PowerPoint™ slides as a means for conveying information, encouraging discourse, allowing for concept checks, and aligning the lecture content with the textbook material.

The PowerPoint™ program was originally designed for presentations; however, students in the classroom should be active, not passive, participants in their education and knowledge acquisition. Thus, interactive PowerPoint™ slides can become a tool for enhancing attention, alleviating classroom boredom, encouraging an arena for comprehension, and creating an environment for active learning.

Before lecture, students are provided with a CD of the student lecture series, which corresponds with the instructor PowerPoint™ slides used in class. The student slides contain fill-in-the-blank, labeling, and other interactive exercises that are completed by participating in each week’s PowerPoint™ lecture. After covering several slides and completing a topic, a concept check slide is embedded so that students “go to conference to think, pair, and share.” This activity takes approximately 3 minutes: students read the concept check question, think about it, discuss the idea with their classmates, and then report to the class. Each lecture then wraps up with summary slides designed to tie the textbook and lecture material together.

B. Map Points

We had two submissions on concept mapping – each with a very different focus.

1. Concept Points

Mary Lou Percy (Navarro College, marylou.percy@navarrococlegue.edu), Southern Regional Director, told us about two different ways she uses concept mapping.

Concept mapping is required in Anatomy and Physiology II. I start the class in A & P II with a concept map of the tunics of the eye. I usually explain concept mapping by using a sandwich analogy. Students are required to do the mapping using a computer program; C-map is the one I am currently using. It is designed for concept mapping and the whole program can be downloaded free for educational purposes. Correct spelling is stressed and I take off a point for each misspelled word. The student must also write a short paragraph explaining the map or relationships between the parts. (This also helps in grading because the paragraph may include a point they did not map.)

Another way I use concept mapping is in the lab with bags of hormone cards. I let the students work in small groups without a book to sort the cards. After a few minutes of seeing how much they have learned, I let them use the book to finish. One bag contains the hormones of the hypothalamus, anterior pituitary, posterior pituitary, target organs, and hormone functions. The other bag breaks the hormones up into smaller groups such as the adrenal gland and pancreas. The students have all they need to construct concept maps.

2. Questioning Points

Roberta Meehan (Rio Salado College, biology@ctos.com), former Board Secretary, wrote up a few ways she uses concept mapping.

I have been intrigued by concept mapping for almost thirty years. Early on, I noticed the relation between concept mapping and flow charts. I have used this correlation in much of my professional writing. But, it is really in the classroom that relating A to B comes to life. I have also been entranced by the use of Socratic objectives (questions, rather than statements). So, I have put these two ideas together. I write my objectives as questions and, as the lesson progresses, I focus on putting the Socratic objectives into a sequential format so that the students can construct either a concept map or a flow chart.
Concept maps and flow charts have a common objective. Both try to show a unity between all the facts (or factoids) presented.

I present the essentials of concept mapping and the essentials of flow chart construction. I try to do this in a nonchalant manner. I then ask the students to put the ideas into a flow chart or a concept map—whichever method is best for them. I use this method as an encouragement in lecture but I also use it very seriously in lab. The students can see and plot what is happening.

II. Bonding Points

When we finished with our Board Members, we shifted to our other HAPS members. Jacqueline Brehe (Carroll College, jbrehe@carroll.edu) sent us a great way for engaging students in that perennial problem of bonding.

Hydrogen bonding is a concept difficult to grasp for some students because electrons are neither being surrendered nor shared. To explain the weak electrical attraction that is actually a hydrogen bond, I ask two young men to come to the front of the room and stand facing the class about 15 feet apart. I link my arm to one of the young men’s arms and explain to the group that I am covalently bonded to him by “marriage.” However, I am a “desperate housewife” and I have an attraction to the guy across the street, at which time I wave and wink at the other young man. I explain that while I am covalently bonded, I can still have a weak electrical attraction to another atom. The students find the analogy helpful and amusing.

It is possible that some faculty who might find this demonstration uncomfortable to undertake. (I am an older woman. Some of the students could be my grandchildren!) With a little coaching, the demonstration works well with any woman from the class who is willing to be playing the “desperate housewife” role.

III. And We Hope You Will…

Keep those cards and letters coming! We thank you all for your EDU-Snippet contributions. For the next issue of the HAPS-EDucator, send your EDU-Snippet experiences and ideas to rfaircloth@aacc.edu as soon as possible. Plan ahead. You can even submit your ideas now and maybe in the next issue you too will see your EDU-Snippet in print!

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**Studying Human Anatomy Just Got Easier…**

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- Definitions, spellings, audio pronunciations and detailed photos for optimal comprehension
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- Quizzes validate student knowledge with short answer and multiple choice problems.
The history of WebAnatomy goes back to the beginning of the World Wide Web when our university administrators were encouraging instructors to do something with this new mode of information delivery. Teaching an entry-level anatomy and physiology course, we started using the web to post short “drill and kill” quizzes for our students. (“Drill and kill” is a phrase educators use to describe teaching and learning methods used to master a set of items, e.g., a list of muscles or bones. Many educators dismiss drill and kill because it promotes memorization, or rote learning, as opposed to deeper, conceptual learning.) Students’ responses to the web-based activities were very positive, so we added more and more each semester and located them all on a web page entitled WebAnatomy.

The initial goals of WebAnatomy were two-fold: to introduce students to the World Wide Web and to help them learn a few anatomical structures. The goals were accomplished by creating simple activities that novice computer users could perform and by limiting the size of each activity to 10 or fewer anatomical structures. Because the site did not limit attempts or record student data, students could repeat the activities over and over again without the embarrassment of poor performance and eventually master a set of anatomical structures (again, drill and kill.)

The World Wide Web is now much less novel and students have a wide array of sites to help them learn anatomy and physiology. Additionally, WebAnatomy has evolved into four distinct domains: the original self-test activities, a set of timed-tests, a collection of Jeopardy-like games (which can be used by groups of students in a competitive setting), and an image-bank that features line-art of a wide array of anatomical structures.

Two events in the past five years have prompted us to seriously think about WebAnatomy. First, a physiologist at the University of Minnesota (U of MN) stated, “I’ve tried that WebAnatomy site. Frankly, I found it to be quite boring.” Ouch! But after thinking about his comment, we concluded that WebAnatomy should be boring to a research physiologist. It is analogous to a math professor rehearsing addition and subtraction tables. The target audience is key, and for WebAnatomy, the target is students enrolled in entry-level A & P courses. The second event came via an unsolicited e-mail from a freshman student outside the U of MN, “Your site is awesome! I’ve quit going to class because everything I need to know about anatomy and physiology can be learned by using WebAnatomy.” This may sound like high praise, but it is in fact evidence that there is at least one lousy A & P course out there. If everything students need to learn can be found in WebAnatomy, they should get their tuition money returned. There is much more to anatomy and physiology than sets of anatomical structures to be memorized. There is a whole set of concepts, homeostasis mechanisms, interactions, etc. that could and should be taught in a freshman course. (For more details on what could, and should, be taught in A & P courses, see the HAPS Curriculum Committee’s guidelines (wwwhapsweb.org).) These two events caused us to think Who is using WebAnatomy? Why are they using it? And what other features can be added to make it more useful? To find out, we decided to track the use of the site and survey users.

Evaluation Methods and Results
To measure the use of WebAnatomy, we installed two web counters: StatCounter™, a free web counter (StatCounter.com), and Urchin™, a counter licensed by the U of MN. Data collected from the counters was vast and could be used to answer such cockamamie questions as “How many hits did WebAnatomy receive from Latvia between January 1 and January 7, 2008?” (The answer is 5.) But buried in the huge quantities of data was useful information. For example, the WebAnatomy site receives about 4,000 visitors per day (more during weekdays and fewer on weekends), and accommodates about 50,000 page-loads per day.
Educational Issues - continued from page 17

The important information here is that our university web servers easily handle this traffic, and we can still keep WebAnatomy free to users globally with minimal annoyance to our technical staff. The counters also indicated that the majority of new visitors to WebAnatomy viewed only the first page and then left the site. (“So long, thanks for shopping WebAnatomy.”) We also learned that the most popular sections of WebAnatomy, in terms of use, are muscles, followed by bones, the nervous system, and the cardiovascular system.

Web counters are very good for measuring bulk traffic to a site, but provide little information on user profiles and motivation. To further evaluate WebAnatomy, we created and implemented a short user survey. The survey contained items to gather more descriptive information about WebAnatomy users. The survey was linked to the WebAnatomy home page and was available during March and April 2007. Along with basic user profile questions (gender, age, program of study, etc.), survey questions queried about issues such as “ease of use” and suggestions for modifications and improvements (e.g., “What topics or body systems should we further develop?”). We received 148 anonymous and unsolicited responses. The survey instrument and results can be accessed from the WebAnatomy homepage: http://msjensen.cehd.umn.edu/webanatomy/Default.htm. Because the target audience for WebAnatomy is freshman college students, survey responses were interpreted based on program of study. We had similar numbers of users who reported being a freshman or sophomore in college (24%), professional school (22%), or “other” (22%). There were a few users from high school and a few who are juniors or seniors in college (see Table 1 a and b). An interpretation of the data indicated that the typical WebAnatomy user was a non-traditional student, typically a female over 25 years old, and returning to school to enter an allied health profession, such as nursing. Surprisingly, we found several users from the “other” category who were not enrolled in anatomy and physiology courses, but rather were employed in areas such as massage therapy or as athletic trainers and were using the site to review muscles, bones, etc. We did have a few users who were browsing the Internet and were using WebAnatomy just for fun.

Table 1a: WebAnatomy: Gender and age by program of study

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<th>Question</th>
<th>Year in School</th>
<th>professional school (n=33)</th>
<th>none (n=7)</th>
<th>other (n=32)</th>
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<td>female (57.1%)</td>
<td>female (80%)</td>
</tr>
<tr>
<td>What is your age?</td>
<td>over 25</td>
<td>over 25 (78.1%)</td>
<td>over 25 (71.4%)</td>
<td>over 25 (68.8%)</td>
</tr>
</tbody>
</table>

Table 1b: WebAnatomy: Gender and age by program of study

To gather more information about who is using WebAnatomy, we included survey items about how those who answered the survey discovered WebAnatomy, whether or not it was easy to use, and how frequently they visit the site. Freshmen and sophomores in college (66%) and professional school students (64%) reported they were regular users. The remaining groups reported being occasional or first time visitors. Overall, the majority of users found WebAnatomy through web searches. Users from college and professional student groups reported they discovered WebAnatomy through both teachers and web searches. All groups reported that WebAnatomy was easy to use.

With the “Who is using WebAnatomy?” question answered, we moved to the question, “What are they using it for?” Most frequently, users were reviewing material in preparation for tests (72%) or lab exams (50%). In addition, freshman and sophomores and the “other” group used WebAnatomy for general information and to view images. Of the four WebAnatomy divisions, self tests were found most useful (67%). Users described how they used WebAnatomy as a learning tool to aid them in their studies or professional practice. One student commented “The study guide and book are my primary study materials; WebAnatomy is a great place to test what I know and what I need to study.”

Looking towards the future of WebAnatomy and to answer the question “What other features can be added to make it more useful?”, we asked a number of questions such as: What is WebAnatomy missing?, What do users want more of?, and What level of activities should be provided? With the exception of users not in school or in a professional program, all groups would like to see more intermediate level activities. The group that reported the highest need for intermediate level activities was made up of freshman and sophomore college students (71%).

All response groups reported they wanted to see more color images and lab models. This was particularly true of freshman and sophomores, who also wanted to see more images of human cadavers and real specimens. Coupled with the requests for more images, were multiple requests for expansion of the knowledge base, i.e., more details for bones, muscles, body systems, and cell biology. In addition to the content-based requests, there were requests to expand the testing options. Multiple responses asked...
that tests be provided in alternative formats and at multiple levels of difficulty. Comments included “Please add some fill-in-the-blank self tests” and “Perhaps making the website similar to a lab practical (type in the answer) and having the computer help verify correct spelling.” A final request was to add some visual enhancements; one student commented that “…some animated movies or some short videos on things would be great.”

We did get a couple of the former “physiologist’s” comments (“This was really stupid.”) but most comments were positive and most users appreciated WebAnatomy as an easily accessible and useful study aid. A typical comment was “WebAnatomy is a tremendously valuable resource, and has made studying easier and more interesting. Thanks!”

Overall, the results were encouraging. With limited bells and whistles, users found WebAnatomy to be a useful and fun learning tool. To improve the site, the majority of feedback indicated this should be done by expanding the content base and testing options.

Conclusions and Next Steps
An important fact when interpreting the survey data is that it profiled only those users who chose to complete a survey – leaving out the users of WebAnatomy who chose not to complete a survey. Web users are harangued by surveys, imposing banners, and advertisements that distract from the central message of a site. We believe one of the essential features of WebAnatomy is the lack of distractions such as banners, ads, and other extraneous noise found on many web pages. This feature of WebAnatomy, coupled with recognizing our limited user profile, was taken into consideration when planning the next steps.

Results of the evaluation showed the need for three modifications to the site. First, an additional feature to the self-tests requiring users to enter answers via typing should be added as opposed to pull-down menus, thus emphasizing correct spelling. Many instructors require correct spelling on lab practical exams and promoting spelling within WebAnatomy appears to be a feasible option. The second modification involves identifying activities according to their level of difficulty, e.g., easy, medium, and hard. This option is feasible, but “easy” to one set of students may in fact be “difficult” for a different set. The third modification is on a larger scale. We’re starting to develop a new section of WebAnatomy that will be directed at our original target audience, i.e., 17-19 year old college freshman. With funding from a College of Education and Human Development technology grant, we were able to secure the services of a professional programmer who specializes in “Flash” programming to develop a new learning activity for WebAnatomy. The new activity will have a look that is hopefully more appealing to students in our target audience. It will also include features that allow students to measure their progress and print performance data. This data can be used by instructors and students to monitor progress.

Even with the new activity, WebAnatomy will not provide everything a student needs to know in a freshman A & P course, and it will not replace an instructor. One of the best uses of WebAnatomy is that it can help students with simple activities such as learning bones and muscles, thus freeing up course time for instructors to focus on more complicated concepts, e.g., homeostasis mechanisms, organ interactions, pathophysiology, etc.

The target audience of WebAnatomy is, and always will be, our freshman students at the University of Minnesota. Along with tuition, University of Minnesota students pay tech fees that provide funds to purchase servers, fund tech personnel, and even support our Flash programmer. However, because of the robust nature of the Internet and computer technology, we are still able to keep WebAnatomy free and open to anyone in the world who wishes to learn some basic human anatomy.

Drill and kill at will!

Reference
It would be hard to imagine a word less likely to conjure up images of 21st century medicine than “maggot.” For much of human history, keeping a certain distance from maggots has been a high priority. However, in the wake of increasing bacterial resistance to antibiotics and the emergence of super-bugs like methicillin resistant *Staphylococcus aureus* (MRSA), some doctors are taking a new look at the larval form of the common green bottle blowfly, *Lucilia sericata*, in the hope of finding a safe, effective wound treatment that promotes healing painlessly and without reliance on antibiotics. Maggot therapy has a long and interesting history, and modern science is just starting to confirm the healing properties of nature’s diminutive decomposition specialists, whose chief advantage lies in their ability to clean wounds by scavenging necrotic tissue while leaving healthy tissue intact.5

For much of human history, the battlefield has been the primary place for the intersection of humans with maggots. It has often been impossible to get to battlefield casualties before flies arrived on the scene. By the time wounded soldiers could be located, their wounds were typically filled with maggots. In the late 1700’s, in the time of Napoleon, medical doctors started to document the great frequency with which wounds became infected with maggots. Additionally, they pointed out that maggots, though “troublesome,” seemed to shorten the healing time of battlefield wounds.5 During the Civil War, J. F Zacharias, a surgeon in the Confederate Army, reported using maggots to remove “the decayed tissue in hospital gangrene with eminent satisfaction.”2

William Baer, an orthopedic surgeon at Johns Hopkins in the early 1900’s, is known as the father of modern maggot therapy. In his writings, he describes treating two soldiers during World War 1 who had been injured in an engagement with enemy soldiers and overlooked when the wounded from that battle were picked up. They lay on the battlefield for seven days without food or water, fully exposed to the elements and the native insect populations. Their injuries included compound fractures of the femur and large flesh wounds of the abdomen and scrotum. When they were finally located and brought to the hospital for treatment, they were suffering from exposure and dehydration and their wounds were covered with maggots. Much to his amazement, instead of finding wounds filled with pus when the maggots were flushed from the wound sites, Baer found “beautiful pink granulation tissue.”2 His surprise and interest were heightened by the fact that he lived in a time when mortality rates for compound fractures of the femur were 75-80% under the very best of conditions. He commented on the fact that both soldiers healed rapidly in spite of the fact that “we had removed their friends which had been doing such noble work.”2 In the post-war years, Dr. Baer attempted to duplicate battlefield conditions when he specifically added maggots to the wounds of four children suffering from osteomyelitis at the Children’s Hospital in Baltimore. Even using un-sterilized maggots, the wounds were reported to have healed within six weeks.2

On the heels of Baer’s success, the use of maggots spread quickly during the 1930’s. By the mid-1930’s, there were at least 54 published articles on maggot therapy, and many attempts had been made to isolate “maggot active principle” for use in wound healing without the use of live maggots.6 Typical of this time period, Dr. L.K. Ferguson, an associate in Surgery at the University of Pennsylvania, wrote in 1935, that he had successfully used maggots in treating “13 cases of osteomyelitis, 8 carbuncles, 6 sloughing ulcers of the leg, 7 cases of gangrene, and 13 other soft tissue lesions” in a three year period. In the conclusion of his paper, Dr. Ferguson observed that, other than excision, maggot therapy was the most rapid method of removing infected soft tissue; the results were more complete than those obtained through manual excision, and there was no injury to underlying healthy tissue.7

Today, the term “maggot therapy” has largely been replaced by “larval therapy,” “maggot debridement therapy,” or “biosurgery,” and researchers have set out to discover the science underlying the three primary actions that are attributed to maggots in wound healing. These actions are:

1. Maggots, when introduced into wounds, are known to debride maggots, the wounds by actually feeding on necrotic tissue.
2. Maggots seem to be able to disinfect wounds either by excreting antibacterial substances or by destroying bacteria in their gut.
3. Maggots can speed up the healing process by promoting the growth of granulation tissue in the wound.9

Though the exact antibacterial mechanisms of maggots are not yet fully understood, research from the 1930’s suggests that bacteria are destroyed in the alimentary canal of maggots. When maggots were allowed to feed on bacteria cultures and later...
dissected, the anterior region of the maggot’s digestive system had the greatest bacteria populations while the posterior digestive tube remained bacteria free. More recently, there is evidence that many insects are able to release powerful antibacterial agents into their hemolymph following injury. If it can be shown that these agents are produced in the gut, they may account for the type of antibacterial activity that was documented in the 1930’s. In 1999, Thomas, et al. were able to demonstrate that secretions of Lucilia sericata killed or prevented the growth of a wide range of bacteria in vitro, notably Streptococcus A and B and Staphylococcus aureus. Additionally the researchers detected more limited antimicrobial activity against Pseudomonas and a clinical isolate of MRSA. They were unable to document antibacterial activity against E. coli or Proteus. In their conclusions, the researchers proposed that maggot therapy should be considered as a standard technique for infected wounds, and increasingly for those that have shown resistance to other types of treatment.

In the early years of larval therapy, bacterial contamination of maggot eggs was a problem that sometimes led to the development of tetanus or gangrene. Today Lucilia sericata is specifically bred for medical use. Sterile maggots are cultured and the eggs are constantly screened for the presence of both aerobic and anaerobic bacterial contamination. Larva, 1-2 mm in length, hatch from eggs in 12 to 24 hours. With a wound full of necrotic tissue to feed on, they grow rapidly. Researchers have calculated that 200 maggots can consume up to 15 grams of necrotic tissue per day. Armstrong recommends using no more than 10 maggots that 200 maggots can consume up to 15 grams of necrotic tissue per day. Armstrong recommends using no more than 10 maggots per square centimeter of wound to allow for freedom of movement and growth. After feeding for four to five days, the maggots must be removed from the wound either by rinsing them off or picking them off with tweezers. They will have reached a size of about 10 mm by this time and they will stop eating and start to form pupa in preparation for their metamorphosis into adult flies. If the wound needs further debridement, new maggots can be introduced into the wound. Maggots that have finished feeding should be disposed of in a standard biohazard receptacle.

Maggots have very few requirements for life. Their optimal temperature is the body temperature of humans; they need oxygen, and they prefer a wound that is moist. Under these conditions, they release a variety of substances into the wound including allantoin, urea, calcium carbonate, trypsin, chymotrypsin, carboxypeptidase, and a variety of proteases. Two specific antibacterial agents have been isolated by researchers from maggot secretions; phenylacetic acid and phenylacetaldehyde. In 1997, Prete demonstrated that digestive secretions of maggots and their hemolymph are able to stimulate the growth of human fibroblasts in vitro. Both of these materials also increase the growth rate of epidermal growth factor-stimulated fibroblasts and interleukin-6-stimulated fibroblasts. A great deal of clinical evidence supports growth stimulation in chronic wounds in addition to the effects of debridement, which is primarily accomplished by the feeding of the maggots.

There are three problems that must be overcome if larval therapy is to be successful. The larva must be made to stay in the wound, they must have sufficient oxygen, and the wound must be kept moist for the duration of the feeding process. The website for the European Tissue Repair Society (www.etrso.org) recommends that the maggots be completely contained within a cage so that they can be brought into contact with the wound but kept separate from the patient. The website for Monarch Labs (www.monarchlabs.com), a primary supplier of medical grade maggots in the U.S., contains directions for constructing maggot dressings that will prevent maggots from crawling away, allow for plenty of fresh air to circulate around them while they are in the wound and allow waste material, liquefied necrotic tissue, to drain from the wound easily.

As larval therapy continues to gain in popularity, there are two areas in which most promise is seen. One is in the treatment of diabetic foot ulcers and the other is in the treatment of full thickness burns. Physicians who treat foot ulcers in diabetic patients today see an increasing incidence of MRSA in these wounds. Some doctors report that the number of MRSA-containing diabetic foot ulcers has doubled in the last three years. A diabetic foot ulcer clinic in Manchester, England, reported finding that gram-positive bacteria were the most common microorganisms found in wound swabs of their patients. Forty percent of these gram-positive infections were MRSA which was usually associated with previous antibiotic treatment. Larval therapy is being investigated as a way to promote the healing of diabetic foot ulcers by successfully removing the necrotic tissue and eliminating MRSA from these wounds in low-cost effective treatments.

In 2007, physicians in Manchester, U.K., and the University of Miami School of Medicine reported that they successfully treated 12 out of 13 consecutive diabetic patients with MRSA-colonized ulcers with a mean of three larval applications and a mean treatment duration of 19 days. The physicians report that the mean three-week treatment period for larval therapy is far shorter than the normal 28-week duration of treatment for conventional MRSA decontamination of diabetic foot ulcers. They believe they have satisfactorily demonstrated “the potential of larval therapy to eliminate MRSA-colonization of diabetic foot ulcers.” If their results can be confirmed in future testing, larval therapy would offer “the first noninvasive and risk-free treatment” for MRSA contaminated diabetic foot ulcers. The advantages of this type of treatment include the absence of side effects and low cost. The physicians report that their nursing staff, after first refusing to take part in larval therapy, became extremely interested in it after seeing patient results and now take an active part in the treatment.

In a web-based article from the Journal of Clinical Nursing (www.jcn.co.uk) Jacky Edwards, a nurse specialist, reported on the use of larval therapy with burn patients. Her research group concluded that larval therapy provided a quick, inexpensive treatment for wound debridement which could be carried out on an outpatient basis. After successful larval treatment, skin grafting can be done or special dressings can be applied to the affected regions. Larval therapy was initially developed by this group for the treatment of burns in elderly patients, since manual debridement of burn tissue can be fatal in the elderly. However, Edward’s research quickly found that many younger patients requested larval treatment when it was presented as an alternative to surgery.

Public interest in larval therapy has been increasing for the past ten years, especially “in progressive, high volume wound care centers in Europe and Asia.” The antibiotic crisis, including
the increasing presence of MRSA, has fueled interest within the medical community. Physicians are finding that if patients are well informed about the life cycle of the blowfly and are supported by an actively engaged staff, larval therapy can be performed easily, inexpensively, and effectively. There is a small learning curve for health care professionals as they experiment with the techniques of manipulation of the larvae and management of the dressings. Larval debridement is seen by many today as an inexpensive, low-tech means of treatment for chronic, intractable wounds of the lower extremity and, increasingly, for treatment of soft tissue wounds of other types.

References


4 Edwards J. Larval therapy in full thickness burns. South Manchester Univ Hospitals Trust 2006: www.jcn.co.uk/ArticleID=984


Summary of a Poster Presentation:
The Use of Learning Styles in Designing Teaching Methodology
For Anatomy and Physiology

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It has been shown that over 95% of new learning enters the brain primarily through the senses of visual, tactile, and auditory experiences.1 Two questions are therefore raised: “Should a course in anatomy and physiology be designed so that all types of learners have an equitable chance of success? Are there enough differences in learning to warrant designing a course incorporating material appropriate different learning styles?” There are a number of tools available to evaluate the learning styles of students; we chose the Learning Styles Inventory developed by Soloman and Felder from North Carolina State University (http://www.engr.ncsu.edu/learningstyles/ilsweb.html). We compared the learning styles of over 200 students in anatomy and physiology classes at Bainbridge College (Bainbridge, GA) (Group 1) and the Community College of Southern Nevada (Las Vegas, NV) (Group 2). Group 3 was composed of Introductory Computer Applications students (Bainbridge College) and was used as a comparison to the anatomy and physiology students. The vast majority of A&P students are in the allied health fields, while the computer application students are from a more general student population.

Soloman and Felder’s survey is a forced-choice inventory divided into four categories. The students were classified as active vs. reflective, visual vs. verbal, sequential vs. global, and intuitive vs. sensing. There was a difference between the two A&P courses at Bainbridge and CCSN (Community College of Southern Nevada). The CCSN course was more rigorous, and the textbook used was more detailed and difficult overall.

Student success was measured for the three groups. Success was determined as either an A or B grade since a C grade is not competitive in the allied health application process. A number of conclusions can be drawn from the analysis:

• There were significant differences in the visual/verbal scores, with Group 2 being more heavily visual and Groups 1 and 3 being more heavily verbal.

• There were significant differences between course successes between groups, with less course success in Group 2.

• However, students in Group 2 fared better if they were sensing, verbal, and sequential learners and did worse if they were intuitive and global learners.

• Learning style has less effect on performance in the computer science application course.

• In general, students were predominately sensing, visual, and sequential learners.

Strategies for students to be successful regardless of learning preferences include the following:

• Learn facts and their relationships

• Do application and case history problems

• Summarize notes and highlight

• Use the PowerPoint™ presentations

• Use the written outlines

• Read the text and outline the major topics

In the courses used for this study students had a number of resources available including PowerPoint™ lectures, chapter outlines, publisher CDs, study guides, numerous web links, and separate web pages.

Although students do show preferential learning styles, resources available to the instructor are numerous and varied. It is possible and desirable to give the student every opportunity to be successful.

Summary of a Poster Presentation
Incorporating a Book Club Into a Human Anatomy Course: Student Responses and Relevance to Curriculum

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Introduction
In an undergraduate liberal arts institution with a cadaver anatomy program, it is imperative to set a tone of respect for the anatomical gift. Westminster College’s mission statement includes the directive to “challenge [students] to be critically aware, lifelong learners and leaders of character, committed to the values of integrity, fairness, respect, and responsibility.” With this in mind, our cadaver facility has a detailed policy addressing these values. As a new addition to the program, Mary Roach’s book Stiff: The Curious Lives of Human Cadavers has been added as the book club component of the human anatomy classes.

The book club was implemented with several goals in mind: 1) to increase the awareness of the need for human cadavers, 2) to enhance student understanding of the uses of human cadavers, 3) to provide students with an historical perspective of the anatomical sciences, and 4) to engage students in student-initiated conversations about the use of cadavers.

The Book
Mary Roach’s book chronicles the many uses of human cadavers in the United States and abroad. She begins with a chapter discussing the use of cadaver heads for surgical practice in plastic surgery. She then includes a chapter on the seedy history of the anatomical sciences. Also included are the uses of cadavers in fields such as forensics, car safety research, and the development of ammunition and protective devices for the US military. The author then includes a final chapter discussing whether or not she will donate her body on the basis of her research. This chapter entitled “Remains of the Author: Will She or Won’t She?”

Sample Chapters
• A Head is a Terrible Thing to Waste
• Crimes of Anatomy: Body snatchers and other sordid tales from the dawn of human dissection
• Life After Death: On human decay and what can be done about it
• Dead Man Driving: Human crash test dummies and the ghastly, necessary science of impact tolerance
• Beyond the Black Box: When the bodies of the passengers must tell the story of a crash
• Holy Cadaver: The crucifixion experiments
• Remains of the Author: Will she or won’t she?

Incorporation into Human Anatomy Course
The book club concept was simple. All students were required to read the book and to answer questions about it on the examinations. Students were put into groups of two and then either were assigned or chose a chapter of the book to cover for class discussion. Students then led the group in a discussion that was to include a summary of the chapter to be followed by discussion questions. The course discussions were lively, as were the presentations. Presentation format varied, from vivid narration, to PowerPoint™ presentations. The groups were graded on their presentation as well as on whether they engaged the audience in a productive discussion of the material. The book club meetings were during regular course times and limited to 15-20 minutes. Most discussions had to be called because of time, meaning that the student-led discussions were lively and most often ventured past the time boundaries allotted. Sample student discussion questions follow:

• Should cadavers be used instead of dummies to test the injuries caused by a plane crash? How does this chapter make you feel about flying? Would you want your body to be used to test the results of extreme water impact?
• After reading this chapter, has your opinion about donating your body to science vs. being embalmed and buried changed? Do you think that embalming and air tight caskets are really necessary in today’s world, given that they do not completely prevent the decomposition process?
• After seeing the results of car safety improvements, do you think that the use of cadavers in automobile testing is justifiable? Why or why not? If you donated your body to science would it make much difference to you if it were used in a car crash or in a gross anatomy lab and why?
• If you had the choice to work with a whole cadaver or one separated into sections, which would you pick and why?
• Is the use of cadavers for religious purposes justifiable and necessary? If you donated your body to science, would you allow it to be crucified? Is verifying the authenticity of the Shroud of Turin as important as preparing future physicians when using cadavers? In your opinion, is the use of cadavers an appropriate measure, either from a religious view or a scientific one, to prove the validity of the Shroud of Turin?

Student Responses to the Book Club

Student responses were assessed using a Likert scale. The graph demonstrates student responses to the following statements:
1. I would recommend this book to a friend
2. I would recommend this book be used in human anatomy again
3. I enjoyed the class presentations on the book
4. I enjoyed the class discussions about the book
5. I found the book to be irrelevant to the course
6. I found the book to be an unhealthy distraction from the course material

Conclusions
Based on the presentations and course discussions, these goals were met. In addition, post-term assessment suggested that the students responded positively to the book and class discussions. Of the 93% of students responding positively (“Agree”), 73% strongly agreed that the book should be used again. An additional 20% agreed, for a total of 93% of students responding positively. Seventy-three percent of students enjoyed the class presentations on the book chapters with the same percentage enjoying the class discussions. A single student found the book to be an unhealthy distraction, while 90% of students disagreed with this. Based on these results, the book club was found to be a valuable component of the human anatomy course and will be continued at Westminster College.
Introduction and Rationale
When I began teaching anatomy and physiology two years ago, I quickly became reacquainted with the difficulty of presenting the volume of information that we, as instructors, deem necessary for our students to learn. For example, I have decided that students should be able to identify all 206 bones and 90 major muscles along with their accompanying origins, insertions, and actions in a mere four weeks. In total, this represented approximately 650 pieces of information alone! On my first attempt, I simply went through the muscular and bone chapters like all others and assumed that the introductory anatomy and kinesiology that accompanied these sections would be a nice accompaniment to the physiology and that students would then study appropriately. What I found was that on entering these sections, students were overwhelmed with the volume of material and inadequately prepared come exam day. It was not unusual to have students simply accept a low grade on the muscular or bone portion of class due, in large part, to poor performance on the memorization aspects despite having relatively good scores on the physiology component. The daunting task of the musculoskeletal list in combination with the physiology content seemed to be excessive to the point that students could not even get started.

I, therefore, set out to remedy this situation and came up with an idea born from the requisite criterion-referenced exams of the allied health field. Here, when seeking certification, licensure, or professional registration (as is common practice in medicine, nursing, athletic training, personal training, physical therapy, dietetics, etc.), one is required to demonstrate an organizationally-approved minimum standard of knowledge. I wanted to require that every student, receiving a passing grade, would be able to demonstrate a minimum level in gross musculoskeletal anatomy and kinesiology before moving on to their upper-division science courses. These courses include biomechanics, kinesiology, upper-extremity evaluation, lower-extremity evaluation, and exercise physiology where the perquisite anatomical knowledge is tantamount to future success. In order to allow students multiple attempts at passing, while ensuring varied examination questions and exam security, the creation of an online examination using Blackboard™ ensued.

Creating the Questions
In corroboration with an undergraduate teaching assistant over the summer months, I selected the examination content by creating a comprehensive list of objective bones, muscles, and landmarks and, then, sought out all of the necessary images to be able to test each item on the list at least once. The images were selected (using the Anatomy & Physiology Revealed™ software from McGraw-Hill) to best replicate a cadaver experience and, thus, avoid the possible memorization techniques that can be found when using colorful textbook animations. These images were then imported into PowerPoint™ where textboxes, arrows, and numbers were drawn over the existing image to indicate each of the intended anatomical structures. Using the “Select All” function, we then saved these new images for later import to Blackboard™. Additional multiple-choice, true/false, and fill-in-the-blank questions were then created to complete at least one question for every item on the master list. At this point, the project evolved to the creation of an exam format using the Blackboard™ software.
1. A question pool was created under the control panel where every question was written into electronic format. One of the keys here is to be sure to allow the inclusion of images under the “Creation Settings” tab of the toolbar so that the previously created images can be attached (when necessary) to the appropriate question. The current question pool for our class stands at 200 where only 52 were selected for each exam. These were then copied into subsets of question pools based on the type of question. (This process allows for tighter control on the types and numbers of questions selected when Blackboard™ is randomizing each exam.)

2. The exam itself was created in the “Test Manager” section of the control panel. The important step here is to add questions via “random block” from the desired question pool. For our exam, we have decided on four random blocks of questions where 20 multiple-choice questions, 15 true/false, 12 matching, and 5 fill-in-the-blank questions are selected from the larger question pools. With the exception of the matching exercises, which rewarded partial credit for each response up to five points, each question was worth one point for an exam total of 100 points.

3. The last step is completed in the “Assignments” section and requires the selection of “Add Test” from the toolbar and then the selection of the desired testing parameters. These parameters might include the passwords, gradebook options, date restrictions, and student access.

Testing Procedures

Students signed up for one-hour sessions during office hours. They were allowed to access and complete the password-protected exam under supervision ensuring moderately high security. Students were required to take the exam until successful at attaining an 80% accuracy mark. The first exam was passed or failed with no reward or penalty. However, a second failure resulted in the student receiving a 10% overall deduction from all other points earned in the class. This decision was made with the intent of increasing student concern for the ramifications of this test, to promote motivation, and, we hope, to improve study habits. Students who failed the first time were scheduled for additional office hours and study groups and ideally not allowed to re-take the exam until the instructor subjectively felt that they would have no difficulty passing the test, thus avoiding the 10% grade penalty. The results of this exam were 37/45 first-time passers and 7/8 on the second attempt resulting in only one student receiving the grade penalty despite a successful third attempt.

Student Feedback

The student comments on the evaluation forms included some expressing concern over the weight of this assignment and the lack of reward for exceptional achievement. Other students cited stress and subsequent attempts, as being critical for the emphasis and attainment of this knowledge.
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