

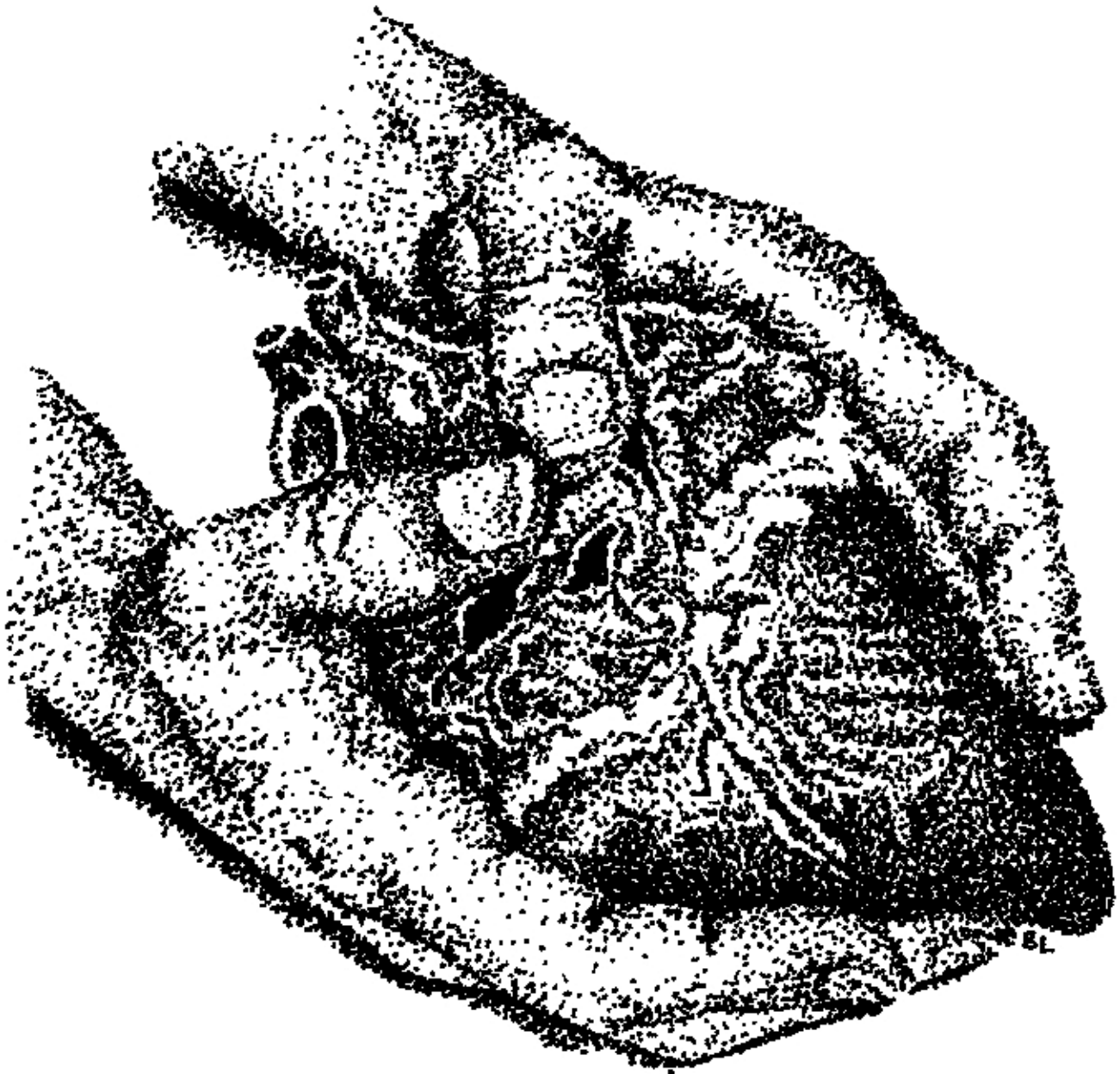
Fall 2007

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Margaret Weck
4588 Parkview Place
St. Louis, MO 63110
(314) 446-8483
(314) 446-8460 fax
pres@hapseweb.org mweck@stlcop.edu

PAST-PRESIDENT

Joe Griswold
The Science Learning Workshop
2322 Hagen Road
Brigantine, NJ 03203
(609) 264-9142
(609) 264-7278
jgggris@comcast.net

PRESIDENT-ELECT

Kevin Petti
San Diego Miramar College
10440 Black Mountain Rd.
San Diego, CA 92126-2999
(619) 388-7491
(619) 469-4847 fax
vp@hapseweb.org kpetti@sdccd.edu

SECRETARY

Mark Bolke
Clark College
1800 E. McLoughlin Blvd.
Vancouver, WA 98663
(360) 992-2116
(360) 992-2860 fax
mbolke@clark.edu

TREASURER

Gail Jenkins
Department of Biology
Montgomery College
7600 Takoma Avenue
Takoma Park, MD 20912
(301) 946-1581
(301) 942-3671 fax
gwjenkins1@verizon.net

REGIONAL DIRECTORS

Central: Judi Nath
Lourdes College
6832 Convent Blvd.
Sylvania, OH 43560-2898
(419) 824-3689
(419) 882-3987 fax
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US: IA, IL, IN, MI, MN, OH, WI, MO
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101 College Pkwy.
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(410) 777-2272
(410) 777-2525 fax
RFaircloth@aacc.edu
US: CT, DC, DE, MA, MD, ME, NH, NJ, NY,
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Southern: Mary Lou Percy
Navarro College
3200 W. 7th Ave.
Corsicana, TX 75110
(903) 875-7519
(903) 875-7525 fax
marylou.percy@navarrocollege.edu
US: AL, AR, FL, GA, KY, LA, MS, NC,
OK, SC, TN, TX; Territory: PR

Western: Christine Eckel
Salt Lake Community College
4600 S. Redwood Rd, DNS
Salt Lake City, UT 84130
(801) 957-4640
(918) 631-2762 fax
christine@latissimus.com
US: AK, AZ, CA, CO, HI, ID, IS, MY, NE,
ND, NM, NV, OR, SD, UT, WA, WY
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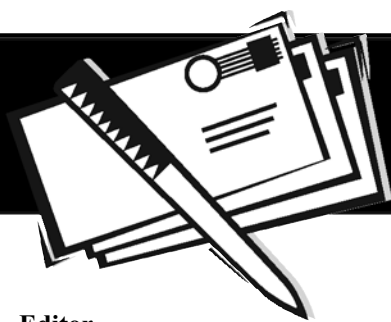
Fall 2007

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Thanks to Brynn Lastovica for the artwork on the cover of this issue of HAPS-EDucator. Brynn says, "I graduated from Dana College in May of 2006. At Dana College I took several courses taught by [HAPS member] Dr. Murch-Shafer. I have spent the year following graduation gaining experience working with patients in physical therapy inpatient and outpatient settings. In addition, I am helping a pediatric cardiothoracic surgeon start a research project. In the fall I will be attending Medical School at the University of Nebraska Medical Center. I have enjoyed drawing since I was a child and I continued to develop my artistic talents through high school. Unable to further pursue my artistic education, I now draw as a hobby and form of relaxation.



HAPS-EDucator

Editor	Susan Baxley
Committee Chair	Marsha Sousa
Committee Members	Mary Lou Bareither
	Pat Bowne
	Elaine Chapman
	Barbara Cocanaur
	Jorge Cortese
	Jennifer Eastwood
	David Evans
	Richard Faircloth
	Chaya Gopalan
	Nancy Kincaid
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	Pat Mansfield
	Roberta Meehan
	Karen Murch-Shafer
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	Liz Perez
	Janet Sherman
	Kathy Starr
	Caryl Tickner
	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://www.hapsweb.org>. Correspondence should be directed to: HAPS, 8816 Manchester Road, Suite 314, St. Louis, MO 63144 or (800) 448-HAPS (4277).

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 an e-mail attachment as a Microsoft Word or Word Perfect file. 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 (Winter issue); February 1 (Spring issue); April 15 (Summer issue).

CONTACT THE HAPS-EDucator Editor: Susan Baxley, HAPS, 8816 Manchester Road, Suite 314, St. Louis, MO 63144 or hapsed@hapsweb.org.



GREETINGS



FROM YOUR PRESIDENT

Margaret Weck, HAPS President

president@hapseweb.org



I hope your summer activities have left you refreshed and energized for the academic year to come. It is going to be a year of opportunity, growth, and change for HAPS. I am honored to be your President during this exciting time for the organization. The rest of the Board for this year are Kevin Petti (President-Elect), Joe Griswold (Past President), Gail Jenkins (Treasurer), Mark Bolke (Secretary), Richard Faircloth (Eastern Regional Director), Mary Lou Percy (Southern Regional Director), Judi Nath (Central Regional Director), and Christine Eckel (Western Regional Director) all energized for the academic year.

This past year saw our most successful annual conference to date. Kevin Petti and his greater San Diego - area organizing committee did a marvelous job and hosted a fantastic conference. They are all to be thanked for the hard work that paid off so handsomely for those of us able to attend. The San Diego conference had a record number of "First Timers" and we are glad you all chose to join us. If you have never attended an annual conference, I urge you to get the full HAPS experience by attending the first annual conference that you are able to attend. Each is different and distinctly wonderful. HAPS 2008 will be in New Orleans, LA.

One of the changes you may notice this year is the first dues increase in five years. At the annual business meeting during the San Diego conference the membership increase in dues of \$15 per year in all categories. The Board has been careful to maintain a constant dues rate for as long as possible, but circumstances have made this increase unavoidable. Those who chose the multi-year renewal option are feeling pretty clever right about now, as they will not experience the increase until their membership is actually up for renewal in a future year.

One of the major factors contributing to the need for increasing the organization's dues is the imminent retirement of Tonya Ferguson, our Business Manager. For over 10 years Tonya has been the highly personable human presence at HAPS Headquarters. We will miss her, but we have to let her move into a well-deserved retirement with our best wishes. One result of Tonya's retirement is that we will finally realize everything that Tonya has been doing for us at less than the market rate. We project that our management costs will more than double over the next year. We are in the process of searching for a new management company. The management search committee of Gail Jenkins (Treasurer), Valerie O'Loughlin, and Tonya Ferguson is ably

chaired by President Emeritus Mike Glasgow. We are planning to finish the search in as timely but careful, a manner as possible.

Another exciting change that started last year was the inaugural offering of the HAPS-Institute (HAPS-I). Classes receiving graduate credit from the University of Washington were designed and presented by HAPS members in conjunction with the San Diego conference. Kevin Patton took the lead in bringing HAPS-I from concept to reality in one very short year. If you have not done so, I recommend that you read the summary of HAPS-I Year One that is available on the website (hapseweb.org) by following the HAPS Institute link. The organizing team members, Ellen Arnestad, Joe Griswold [Pres. 2006-07], Sandy Lewis [President Emeritus, or is it Emerita?], Jennifer Lundmark, Kevin Patton [President Emeritus], Amy Way, and Mary Pat Wenderoth [Liaison with University of Washington], are all to be congratulated on a huge success. This was a bit of a gamble at the time the Board approved moving forward, but a gamble that has turned out to be worth the risk. HAPS-I now has some momentum and we will continue the development of new courses and additional means of delivering those courses in the coming year.

Committees and the Board will be moving a variety of projects forward consistent with the Long-Range Plan developed collaboratively by the Steering Committee during the January 2007 Planning Meeting under the leadership of Joe Griswold (now Past-President). Much of the direction for our work this year has already been charted by this long range plan. While we are moving forward with a plan, we will also keep our eyes open for opportunities that may present themselves without advanced warning. As I said, it is going to be an exciting year. I am glad you are along for the ride. Have a great Fall!



Come to New Orleans and "Get Jazzed!"



Judith M. Venuti

HAPS 2008 Conference Coordinator
 Louisiana State University Health Sciences Center
 1901 Perdido Street
 New Orleans, LA 70130
 (504) 599-0157
 jvenut@lsuhsc.edu

The 22nd Annual HAPS Conference will be held at the Louisiana State University Health Sciences Center in Downtown New Orleans, May 24th through May 29th, 2008. The Conference Committee is organizing an exciting schedule, which takes advantage of all that New Orleans has to offer! So save the dates and start planning all the jazzy things you will see and do in New Orleans.

Update seminars and Exhibits will be held at the Conference Hotel, the Wyndham New Orleans at Canal Place, located in the French Quarter. The Wyndham New Orleans at Canal Place is the perfect address to savor the Crescent City's zest for living. The guest rooms and suites are elegantly appointed and provide breathtaking views of the Mississippi River and downtown New Orleans.



The Wyndham New Orleans is only steps away from many of the city's famous restaurants, galleries, and antique shops and centrally located to the business district, the famous French Quarter, and shopping (the Shops at Canal Place and the Riverwalk are just next door).



The Wyndham is a perfect setting for exploring the sights and sounds of the Big Easy. The Wyndham is located only a short walk to landmarks such as the Aquarium of the Americas, Jackson Square, Bourbon Street, The French Market, and Harrah's Casino. You will also be close to the D-Day Museum, Contemporary Arts Center, and the Ogden Museum of Southern Art. There will be plenty of opportunities to take a relaxing stroll or catch one of the city's wonderful streetcars, have coffee and beignets at the Café Du Monde just up the street, try an authentic muffaletta at the Central Grocery a few blocks away, or enjoy a carriage ride through the Garden District.



The Louisiana State University Health Sciences Center (LSUHSC) is the site for workshops and HAPS-I and is only about a mile up the road from the Wyndham Canal Place. Although shuttle busses will be provided, those of you who do not mind the walk can easily get yourselves to and from the University. Since LSUHSC is also across from the Tulane Medical Center, we are encouraging many of the local scientists and educators to participate in the Conference.



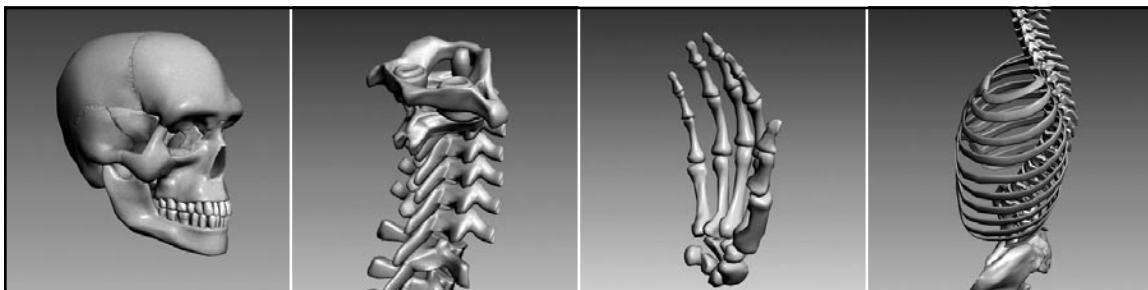
We are excited that one of our confirmed speakers is Dr. Mary Manhein, director of the Forensic Anthropology and Computer Enhancement Services (FACES) Laboratory at LSU Baton Rouge. She is a forensic anthropologist and author of the book, *The Bone Lady*. She will discuss many fascinating cases and the science underlying her analyses. To learn more about Dr. Manhein see: <http://s50780.sites40.storefront-hosting.com/detail.aspx?ID=338>.

In the next *HAPS-EDucator* we will tell you about all the special events we have planned. The problem for us is choosing among all the possibilities that you all might enjoy.

Laissez le bon temps rouler!!



Dr. Mary Manhein

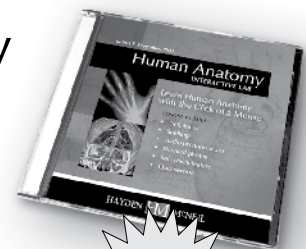


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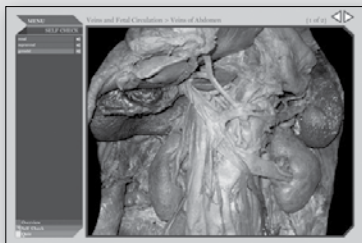
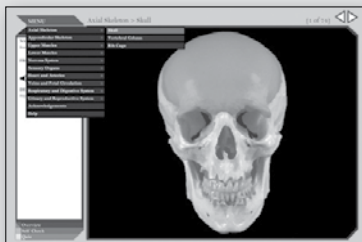
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Call for Nominees to Elected Offices

Kevin Petti, President-elect
San Diego Miramar College
10440 Black Mountain Rd.
San Diego, CA 92126-2999
(619) 388-7491
(619) 469-4847 fax
kpetti@sdccd.edu

Have you ever considered serving HAPS in a capacity beyond your current level of participation? Do you know of someone whom you believe to be a leader and should therefore be nominated for office? If you answered "yes" to either of these questions, now is the time to act.

HAPS is officially calling for nominations for the following offices: Eastern Regional Director, Western Regional Director, Treasurer, and President-elect. Elections will be held next spring and results will be announced at the 22nd Annual Conference in New Orleans in May 2008. Terms begin July 1, 2008, and will run for two years. President-elect, however, requires a three-year commitment.

Serving HAPS as an elected officer is a rewarding experience. You will have the opportunity to contribute to the future direction

of a professional society that has served us all well. As you know, HAPS is a member-driven organization and it relies on volunteerism from dedicated professionals for leadership and inspiration. Please consider contributing your time and talent by running for an elected office if the Nominating Committee contacts you.

It is the intent of the Nominating Committee to assemble a slate of contested elections, so the committee will need at least eight members to accept nominations. If you have any questions about the process or any names for nomination, contact Kevin Petti at 619-388-7491, or at kpetti@sdccd.edu.



The 2006-2007 Board of Directors and Steering Committee

The HAPS Grants and Scholarships Committee WANTS YOU To Apply for Grants and Scholarships!

Amy Way, Chair
Lock Haven University Clearfield Campus
201 University Drive
Clearfield, PA 16830
(814) 768-3431
away1@lhup.edu

The Robert Anthony and Adjunct Faculty Scholarships will be available for the 2008 HAPS Conference in New Orleans. Applications are due November 15, 2007. Information about these scholarships can be found on the HAPS website right now! Applicants must be HAPS members who have never attended a HAPS conference, and they must be in their first three years of teaching A&P.

HAPS also awards one additional faculty grant and one additional student grant each year. The application deadline is

February 1, 2008, and full details can be found on the HAPS website. If you are conducting research either in pedagogy or some area within anatomy and physiology, please consider applying for these grants. Full details can be found at hapsweb.org. Look for "Resources" in the menu on the left side of the page. Under Resources, select "Grants and Scholarships". Go check it out!



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Co-Chair, HAPS Membership Committee
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(812) 855-7723
(812) 855-4436 fax
vdean@indiana.edu

HAPS membership has been and continues to be the best deal in town. Our very reasonable dues provide for numerous membership benefits such as regional and annual HAPS meetings, publications including the *HAPS-EDucator* and the HAPS website, and our new faculty development program, HAPS-Institute. I am happy to announce that, beginning January 2008, HAPS members will have another valuable membership benefit – FREE online access to the *Anatomical Sciences Education* journal!

Anatomical Sciences Education (ASE) was initiated by co-editors Richard Drake and Wojciech Pawlina and will be published by Wiley, Inc. This journal will be the official pedagogical publication of the American Association of Anatomists. As the title page states, the journal is published in cooperation with the American Association of Clinical Anatomists (AACA) and the Human and Anatomy Physiology Society. The goal of *Anatomical Sciences Education* is to provide an international forum to disseminate new ideas, innovation, and research related to education in anatomical sciences. *ASE* will encompass all levels of anatomical education-including undergraduate, medical, dental, graduate, and postgraduate. *ASE* will also cover all anatomical sciences disciplines, including gross anatomy, embryology, histology, and neuroscience. It is the goal of the editors that *ASE* will become one of the premier journals for anatomical science educators wishing to learn about and publish rigorous, scientifically-based educational research projects. Further information about the journal and information regarding manuscript submission may be found at www.asejournal.com.

For the next two years (2008 and 2009), *ASE* will be available online FREE to all HAPS members. The details of how this online subscription will work are still being sorted out, but likely will involve gaining access to the journal through the HAPS website. We will notify members once these details are decided. We are hopeful that after 2009 we will be able to continue to offer this benefit free to members. (Future free access is contingent on the success of the journal, which is why online access has initially been granted for two years.)

The co-editors are especially interested in receiving undergraduate anatomical education articles and hope you will submit many manuscripts to your colleagues.

As many of you may remember, in the fall of 2006, the HAPS Membership Committee vetted applicants interested in being HAPS-representative Associate Editors for the journal. Mark Terrell (Terrell.55@osu.edu) of Ohio State University was selected

by the Board of Directors for this position. If you are interested in and have questions about submitting a manuscript to the journal, please contact him.

The HAPS leadership is very enthusiastic about being able to offer this benefit to members and about becoming a part of a groundbreaking educational initiative. We are excited that members now have two excellent publications available to them, *HAPS-EDucator* and *Anatomical Sciences Education*. It is our wish that HAPS members are not only avid readers of *ASE*, but also that they will submit manuscripts to the journal. We encourage you to submit manuscripts and tell your colleagues about the additional benefits to being a HAPS member!



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EDU-SNIPPETS

VERY Diverse – Snippets

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

Richard Faircloth
Anne Arundel Community College
Arnold, Maryland 21012
Rfaircloth@aacc.edu

Roberta Meehan
Rio Salado College
Tempe, Arizona 85281
biology@ctos.com

EDU-Snippets is a column designed to let you, the members of HAPS, share your ways of making sure your students get it. Some of these Snippets are longer than others. We have done a bit of editing to keep the column on task. 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. The following Snippets have come in over the last few months and we think you will enjoy them.

I. Boney Snippets

The skeletal system always lends itself to creative ways to learn the multitudinous facts that form both the backbone and the appendages of this critical anatomical structure. Two members of HAPS sent us their bone-shaking ideas for helping their students learn those osseous names and numbers.

A. Jump Start on Skeletal Anatomy

Deborah Temperly (Delta College, dstemper@delta.edu) sent us a fun way to jump start the learning of skeletal anatomy.

One way to get students involved in starting to learn skeletal anatomy at any age level is to have them “Wire Up” the skeleton. In order to do this, I have created sets of “bone name flags.” I simply take address labels, type the bone names on them, fold them over on chenille stems (found at any craft store), and put them in a zip closure bag. I have one set for each articulated skeleton and/or team in the class. Now the students are ready to “Wire Up” their skeletons.

Here is a hint for how to keep your sanity. Buy different colored chenille stems so that each team bag has a different stem color for the respective skeleton. This also makes clean up and sorting a breeze!

This activity works well with adults as well as with the school groups that often visit the campus and may need an “anatomical demonstration.”

The second activity I use is called “Play Ball.” Once the students have “Wired Up” their skeletons, they get out the disarticulated skeletons. My directions are to lay the bones out in anatomical position making certain that their skeleton can “play ball” and “take a walk.” This helps them focus on a more accurate placement of the scapulae and pelvic bones. I allow them to have the articulated skeleton there as a reference.

If you do this exercise, do not be surprised at how hard it may be for some students! I have used both “Wire Up” and “Play Ball” as warm-ups before we start to deal with the details. I have found both to be very useful in helping the students to focus and to see the total skeletal picture.

B. Vertebrae Song

Herbert Matthews (Pulaski Technical College, Hmatthews@pulaskitech.edu) had a great idea for putting the vertebrae to music. Here is his jingle. Do this to the Oscar Mayer Bologna melody.

The Vertebrae Song

My vertebrae have a first name, it's A-T-L-A-S
My vertebrae have a second name, it's A-X-I-S
The rest of the cervical three through seven
The thorax is one plus eleven
The lumbar's five
The sacrum's one
Then to the coccyx and now we're done!

II. Enzymatic Snippet – Pac-Man™ Style

Jackie Carnegie (University of Ottawa, jcarnegi@uottawa.ca) thought we might be interested in using Pac-Man™ to demonstrate digestive enzymes.

The study of gastrointestinal physiology involves learning the names and actions of a large number of enzymes responsible for the digestion of carbohydrates, lipids, and proteins. Carboxypeptidase and aminopeptidase are proteolytic enzymes that act within the small intestine to help reduce polypeptides to their building blocks. Aminopeptidase removes amino acids one at a time from the amino end of polypeptide chains while carboxypeptidase recognizes carboxyl groups and therefore removes amino acids from the opposite end, the carboxyl end of the chain.

While looking for a means of dramatizing the simultaneous action of these two enzymes (I wanted to emphasize how quickly a polypeptide chain could be broken down into its subunits if both enzymes were attacking it at the same time), I decided to make use of the popular game character, Pac-Man™. Fig. 1 shows a Pac-Man™ animation that I downloaded from the Internet. (There are many Pac-Man™ animations available online; this particular one was downloaded from a USDA site dealing with nutrition, <http://www.ars.usda.gov/is/kids/nutrition/story3/carbout.htm>.)

I copied the downloaded animation then flipped the copy into its mirror image so that I could set up a polypeptide chain with a Pac-Man™ at either end (Fig. 2a). The left Pac-Man™ represents aminopeptidase while the right Pac-Man™ represents carboxypeptidase. Figs. 2a-c show sequential screen shots of the animation while it is running; the two Pac-Men™ quickly gobble up amino acids from both ends of the chain.

While not a 100% accurate copy of the activities of these two enzymes (it would be better if the two Pac-Men™ spit out the amino acids one by one), the animation grabs student attention and demonstrates a physiological process using a context with which all students are familiar. The spheres remind students that polypeptide chains are constructed of strings of amino acids, each one oriented with the amino group to the left and carboxyl group to the right. The animation can keep running over and over while the actions of these two enzymes are explained.



Fig. 1

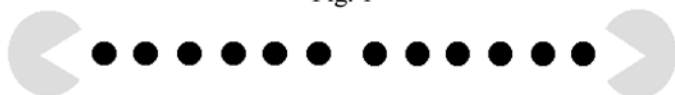


Fig. 2a



Fig. 2b



Fig. 2c

III. Carry On, Hemoglobin Snippet!

Often times our students have a difficult time comprehending the various roles of hemoglobin. To overcome these problems, Jason LaPres (North Harris College, jason.h.lapres@nhmccd.edu) came up with a novel comparison to help the students with these hemoglobin concepts.

Students often have trouble understanding hemoglobin's allosteric interactions with oxygen, carbon dioxide, and hydrogen ions. To help the students understand the interactions, I first explain to them that although hemoglobin's main function is to transport oxygen, it can also carry carbon dioxide and hydrogen ions. I add that hemoglobin is "always full", meaning that if hemoglobin unloads one substance, it is because something else is loaded. To help with this concept, I use this analogy:

Hemoglobin is like an 18-wheeler that is always full of cargo. The cargo could be all oxygen, or a mixture of oxygen, carbon dioxide, and hydrogen ions. The key is that if a cargo truck full of oxygen goes to a warehouse full of carbon dioxide, the driver will have to "unload" some oxygen to make room to pick up the carbon dioxide. Similarly, if the driver takes the truck to the acid factory, that driver will also have to "unload" oxygen to make room for the

hydrogen ions. It is possible that the trucker would have to unload all of the oxygen if there were a lot of carbon dioxide and/or a plethora of hydrogen ions.

I go on to remind the students (because they should already know) that in the human body there are many sources of both carbon dioxide and hydrogen ions. As hemoglobin passes through capillaries in areas of the body where there are many oxygen molecules, i.e. the lungs, it "loads" oxygen (i.e. external respiration). As the hemoglobin passes through capillaries where there is less oxygen and more carbon dioxide and/or hydrogen ions, it will tend to "unload" oxygen to pick up the carbon dioxide and/or hydrogen ions (i.e. internal respiration).

That is just my introduction. You can imagine where we were able to go from there! And you can go there too!

IV. Immuno-Snippet

While we were busily being ingested by Pac-Man™ and unloading our oxygen-laden 18-wheelers, we learned about a theatrical presentation by Patrick Truszkowski (Delta College, patricktruszkowski@delta.edu). This drama is entitled, *The Specific Immunity "Show."* We know you will be glued to your seats during this performance!

Purpose: Learning the step-by-step phenomena of the specific immune system (acquired immunity) requires the student to use abstract / higher level thinking. Abstract learning of a concept usually requires prior concrete learning of the concept. *The Specific Immunity "Show"* uses hands-on participation from the students as they use concrete learning while observing the instructor (director) throughout the lesson.

I have used this method for high-school and college level students with a great deal of super success; I still have students telling me they remember acting like a T-cell or B-cell and they still remember how the specific immunity works.

So, on with *The Specific Immunity "Show!"*

Starring: The Lymphocytes and the Antigen-presenting cell.

Special guest star: Pathogenic microorganism.

Materials: 31 paper-size card-stocks, hole puncher, thick string, permanent marker, different colored Lego™ blocks, and spongy or Styrofoam™ balls.

Set-up: Label each card-stock, in large print, with the following: five cards with "Pathogen," five cards with "Helper T-cell," eight cards with "B-cell," eight cards with "Cytotoxic T-cell", and four cards with "Memory cell." At the top of each card punch two holes near the corners. Insert a thick string through the holes and make the string long enough to wear the card around the neck, then tie the string to make a loop. All 30 cards will be ready to be worn by the students. Make one more card with the following: "Macrophage" or "Antigen-presenting Cell."

Procedure: A transition from non-specific immunity to specific immunity occurs as you put on the "macrophage" card. Every student has a card around his or her neck and the classroom is the lymph node. Students on one end of the classroom are the pathogens and one of them is holding a stack of different colored Lego's™. The middle of the classroom has Helper T-cells. To the left are B-cells and some Memory cells and to the right are

Cytotoxic T-cells and some Memory cells. Give one B-cell a bunch of spongy or Styrofoam™ balls.

The pathogens enter the room, looking “bad.” You, the macrophage, approach them and recognize the antigens. As you proceed to dismantle the stack of Lego’s™, you leave to ask the Lymphocytes for help. You specifically keep one of the colored Lego’s™ in your hand as your ‘receptor.’

You leave the infected area and enter a lymph node, which is the classroom (I walk out of the classroom and re-enter). As I walk around the classroom acting like I am flowing through a maze, I am trying to get a Helper T-cell to recognize my Lego™. One Helper T-cell recognizes my Lego™ and grabs the Lego™ from my hand. The Helper T-cell then chooses a B-cell to respond to the antigen and proliferate. Clonal Selection is explained. This B-cell throws the spongy or Styrofoam™ balls in the vicinity of the pathogens to imitate antibodies. Those Memory Cells are now explained.

The procedure will be done again, but this time a Helper T-cell chooses a Cytotoxic T-cell. This killer T-cell moves to the pathogens to imitate direct host cell (virus infected) cell-death. The difference between antibody-mediated and cell-mediated response is explained, as well as the role of antibodies.

Afterwards, I pick a student to be the macrophage, and then the whole procedure is performed again, but without instructor guidance. Once my students have the concrete basics down, abstract thinking occurs as I show pictures while I lecture about specific immunity.

V. Protein Snippet

Diana Sturges (Georgia Southern University, dsturges@georgiasouthern.edu) sent us a very interesting way to help everyone teach that very complex concept of protein synthesis.

Diana is right on target when she says:

In my experience teaching A&P at the college level, I find that many students have trouble understanding how and where protein synthesis occurs. I designed an activity that involves students in the discussion and makes them get out of their chairs while being part of “protein synthesis.” The beauty of this game is that it can involve as many students as the instructor wants, making it possible even in large A&P classes. Students evaluated the activity as fun, interactive, and useful, especially in helping them differentiate between transcription and translation. The majority of students would pick this activity over the lecture anytime.

You will need letter paper in three different colors. I use yellow, purple, and green. Group I (yellow) is the DNA and is represented by a base triplet on each page. Group II (purple) is mRNA and there is a codon on each page. Group III (green) is the tRNA and each page has an anticodon on one side and the name of an amino acid on the other side. I use a big font (36) in bold, so that even students in the last row can see the letters on the cards. I also laminate these pages, to be able to reuse them later. You can make as many triplets, codons, and anticodons as you want depending on how many students you plan to involve or how much patience you have with laminating all the pages.

I distribute the cards to the students in the classroom and tell them that our classroom represents a cell separated from the

outside by the walls and the walls that are the plasma membrane. I assign roles of organelles to different groups of students and I have several couples of students holding hands representing the “ribosomes.” The little stage upfront is the “nucleus.” (NB! This is a good time to review the major functions of the organelles and the plasma membrane).

I call the yellow group to the front of the class into the “nucleus” and the students form a row to play the role of one DNA strand. They hold their yellow cards up so everybody can see them. (NB! Review what a base triplet is, how it is connected to a gene, and what DNA is).

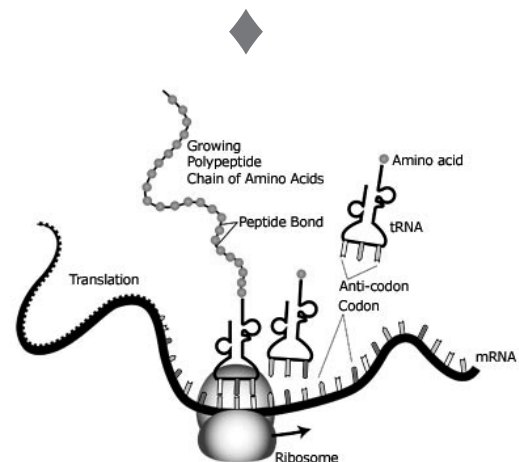
It is now time for group II, the mRNA codons (purple), to travel into the “nucleus” for transcription. Based on the base triplets on the DNA, students-mRNAs arrange themselves across the base triplets with the respective codons. (NB!! Review the complementarity of bases, including the replacement of T with U in RNA.) Once they all find the correct place, I declare the transcription over and explain that during this event that happens in the nucleus, the information from the DNA is copied into the mRNA.

Now the mRNA group can leave the “nucleus” and look for the ribosomes in the classroom. Once the first “codon” of the mRNA reaches the “ribosomes” and passes through, I call out for the tRNA that carries the anticodon. (As an instructor, you can arrange so that the first person passing through the ribosomes carries a start codon).

As all the mRNA students pass through the ribosome, respective tRNA anticodons are running from the classroom to the corresponding codon. The last codon is usually a stop codon and at the end of translation we have two lines of students. In the back, the mRNA with its codons and in the front the tRNA with the anticodons. This is the time to turn the green tRNA cards over and show the amino acids that are coded by them. The result is the synthesized polypeptide held by the tRNA group. Voilà!

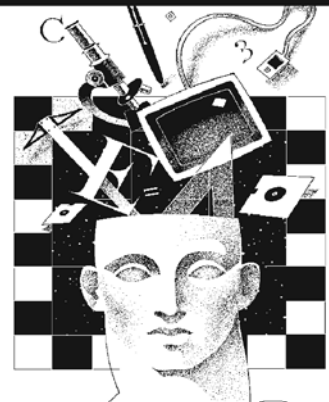
VI. And We Hope You Will....

Keep those cards and letters coming! We thank you all for your EDU-Snippet contributions. To be included in a future issue of the *HAPS-EDucator*, send your EDU-Snippet experiences and ideas to Rfaircloth@aacc.edu.



TEACHING

Tips



Model Repair: Useful White Ink and Painting Tips

Paul F. Teller

Central Carolina Technical College
506 N. Guignard Dr.
Sumter, SC 29150
(803) 778-6628
(803) 778-7868 fax
pteller@ftc-i.net

This is the third report in a series on model repair tips. The new data presented here on recently discovered functional white ink for technical fountain pens and painting should be adaptable for use on all models.

Functional white ink

Before writing the previous articles (*HAPS-EDucator* Spring 2007 and Summer 2007), I had not found useful white ink for technical pens. Since then, I have found Koh-i-noor Trans-mix® media “opaque white” (9065F) ink to give excellent results with Koh-i-noor® pens. The Koh-i-noor® 0/0.35 mm point has given good white results for several months without signs of clogging.

Painting

The final touch to any repair would be to hide it, which usually involves sanding and painting. The latter has always posed a problem, but a few patient hours spent recently at our local Sherwin-Williams store has resulted in acquisition of paints that are an almost perfect match for muscles and tendons on Somso® legs. The only difference between the recent paint job and the original seems to be a shinier appearance to the new paint.

Bondo repair - gastrocnemius muscle

The new paint was used in conjunction with a massive Bondo® repair on a gastrocnemius. The first step was to wipe the exposed model plastic with alcohol to remove any grease. After the Bondo® was prepared by mixing its hardener and resin in a plastic cup (weighing boats are excellent!), it was ladled into the triangular gap with a tongue depressor and the assembly was allowed to cure overnight (Fig. 1).



Fig. 1 Initial Bondo® repair

The next day, a scalpel was used to cut and scrape the Bondo® flush to the surface of the model (Fig. 2). The finished repair was sanded smooth using 180-220 grit papers (Fig. 3). I tried using 600 grit sandpaper, but this left the surfaces too smooth for paint to adhere well.



Figure 2. Shaving to contour

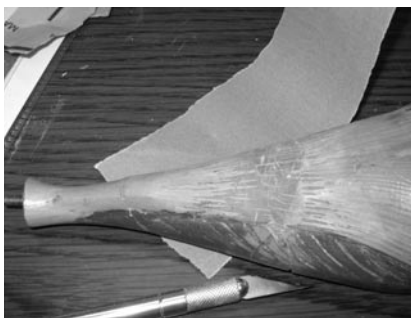


Fig. 3. Sanding



Fig. 4. Masking, stage 1

The model was masked with blue painter's masking tape (Fig. 4) to enable sharp delineation between tendons and muscles. The models were painted with two colors of Sherwin-Williams All-surface Enamel®, “Rich Chestnut” for muscles and “Dressy Rose” for tendons. Fig. 5 shows how close a match of colors was obtained.

Striations in tendons were reproduced using a “painter's comb” (Fig. 6), but a dissecting needle would probably do as well. Be sure to groove before painting.



Fig. 5. Paint matches: new paint (bottom) vs. old (top)



Fig. 6 A typical painter's comb

Using the following data, your local paint shop should be able to make an exact color match. It is also useful to take a part of the model with you to the paint shop. This approach to matching model colors should be applicable to virtually any model in your inventory and it should fill a major gap in repair methods.

The Sherwin-Williams All-Purpose Enamel® paints were mixed starting with “tinting white” in the following proportions according to the information listed on my cans. The shop had only quarts, which could probably repaint our models a number of times.

Dressy Rose

BAC colorant oz	32	64	128
B1- Black	6		
R4-New Red	14	1	1
Y3-Deep Gold	6	1	

Rich Chestnut

COMP(B001) 2090-20 Rich Chestnut			
BAC Colorant oz	32	64	128
R2- Maroon	13	1	
R3- Magenta	23	1	1
R4- New Red	11	1	1
Y3- Deep Gold	30	1	

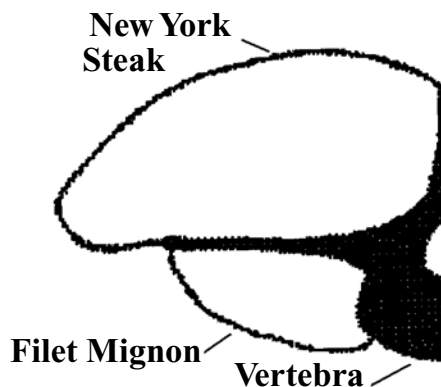


Correction to *Meat Is Muscle* Article

Mark Eberle

Central Oregon Community College
2600 NW College Way
Bend, Oregon 97701
(541) 383-7553
(541) 317-3064 fax
meberle@cocc.edu

The diagram included in the article, *Meat is Muscle* (HAPS-EDucator Spring 2007) was, unfortunately, upside down. This error was mine and not that of Professor Howard Swatland from whose excellent online source, www.aps.uoguelph.ca/~swatland/ch3_0.htm, the information for my article was taken. Here is the diagram in the correct orientation.



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in the NEWS

Beware! Returning Student Papers May Be a Dangerous Activity

David Evans, Public Relations Officer
Department of Natural Sciences
Pennsylvania College of Technology
Williamsport, PA
(570) 326-3761
(570) 327-4500 fax
devans@pct.edu

A professor in Indianapolis wrote on the HAPS-L (the HAPS listserv) about an incident that is instructive to many of us. Allegedly, a faculty member dropped a paper with sexually suggestive central nervous system rhymes upon a desk in front of a student. The paper had someone else's name on it but the instructor was officially accused of harassment and received a knuckle-rapping from human resources.

It may be legally significant to establish whether the dropping of the paper was accidental because of the following: The US Supreme Court ruled, in a case involving Bono, Paris Hilton, Nicole Richie, the Billboard Music Awards, and the FCC, that letting slip (i.e., accidentally using) the "f-bomb" on live TV holds no liability so long as there is no sexual context. The Supremes noted that both George W. Bush and Dick Cheney have used the words publicly and on broadcast media, apparently at times when they thought they were speaking in private. Therefore, since other public figures made the same mistakes, the two Simple Life actresses, Billboard, and the rock star could not be fined. What does this have to do with you as an anatomy and physiology instructor?

I asked two attorneys about the applicability of the Hilton/FCC case to the situation in Indiana or in our classrooms. They both were unsure of how this might be pursued in the courts. The property lawyer (paper is property) said that the Supreme Court ruling might NOT help the faculty member since the offending paper had BEEN LAST IN THE FACULTY MEMBER'S HANDS and it was, therefore, to the professor's liability. Another locally respected barrister said that there might be grounds for the part time instructor to sue his/her institution on the grounds of reputation damage when/if the reprimand is ever revealed publicly. However, even that might be iffy unless actual monetary impact occurs at that time. On the other hand, should you let a little nasty sneak out when you drop the dictionary on your toe, you seem to be covered—just do not do it every day.

I realize that almost anything involving Paris Hilton and the Supreme Court suggests parody, but look at the news link on this

subject on the HAPS-Public Relations section (HAPS-PRO) of our HAPS Homepage (www.hapsweb.org). Possibly the whole paper expletive thing might percolate through the federal courts, but right now it looks like there may be a distinction between the spoken and the written word.

Have fun teaching but remember the admonition of the *Hill Street Blues*' captain: "Be careful out there."

Short Notes:

Animal rights vs. animal research: According to news reports, the University of Utah has refused to release the name of researchers doing animal investigations and its decision has been backed by a state oversight committee. Decisions about the privacy of researchers have vexed an animal rights worker, Katie Patterson, often working with Utah Primate Freedom. In another article, there are allegations that animal rights extremists have tried to bomb animal researchers linked to UCLA; one apparent attempt was in the latter part of June.

Accreditation: The US Department of Education's hearings on the accreditation process ended in early June absolutely inconclusively. The parties could not even agree on what to call the meetings. The American Council of Trustees and Alumni released a report entitled "Why accreditation doesn't work and what policymakers can do about it" in mid-July which criticizes the process with some of the same points HAPS has been making.

I continue to monitor events related to the accreditation problems and post these on the HAPS-PRO page as I find them. I believe the whole mess is either going to be resolved by congressional action or through the courts. Stay tuned.

I would like to renew my plea for help: anyone who wants to pitch in with the public affairs work of HAPS is welcome aboard!

Acknowledgement to Steve Noe: always helpful!

Milestones

David Evans, Public Relations Officer
Department of Natural Sciences
Pennsylvania College of Technology
Williamsport, PA
(570) 326-3761
(570) 327-4500 fax
devans@pct.edu

HAPS members visit the Southern Hemisphere

HAPS members Vern Wiersema, Marsha Turell, Linda Nichols, and Ken Saladin returned from 10 days in Ecuador on a trip led by Ken and California Academy of Sciences wildlife illustrator, John Muir Laws. The group ascended the Cotopaxi Volcano in the Andes near Quito, Ecuador, cruised the Galapagos Islands for 7-1/2 days, then spent a day in the coastal city of Guayaquil before boarding that “midnight plane to Georgia.” Vern and Marsha also spent a few days at the Bellavista Cloud Forest preserve in the Andes before joining the rest of the group in Quito for the flight to the islands. Members of the group included textbook authors, scientists, novelists, health-care professionals, a renowned science philosopher-historian, a retired forest service firefighter, two spouses, and three children. The entourage had a very nice motor yacht, The Tip Top II, to itself.

A good time was had by all. Events ranged from a long stroll on the cold, high alpine meadows of Cotopaxi to hiking at fourteen sites in the Galapagos, some in Darwin’s footsteps. They marveled at the other-worldly volcanic landscape and the courtship and other behaviors of boobies, albatrosses, tortoises, marine iguanas, Darwin’s finches, frigate birds, sea lions, and other animals – nonchalantly going about their lives’ business at one’s very feet, seemingly oblivious to a circle of HAPS members and friends standing within arm’s reach.

With Galapagos ecotourism mushrooming, it is now necessary to charter a yacht as much as two years in advance. Ken has already chartered Tip Top II again for mid-May 2009. Although there is already a waiting list of more than thirty for this trip (and the yacht only carries 16), Ken hopes to enroll some students and recruit a local faculty colleague or two. HAPS members who may be interested in the trip can still get on the list or get more information by emailing Ken at ken.saladin@gcsu.edu. Charters are filled not necessarily in order of request but with a mix of people aimed at assembling a compatible, diverse, and interesting travel group. HAPS members rank high on the list of “compatible, diverse, and interesting,” and there are hopes that at least a few more can be included in 2009.

Elizabeth Pennefather-O’Brien

Congratulations to Professor Elizabeth Pennefather-O’Brien, Instructor of Anatomy and Physiology (and a first-timer at the 2006 HAPS meeting in Austin) for being chosen Instructor

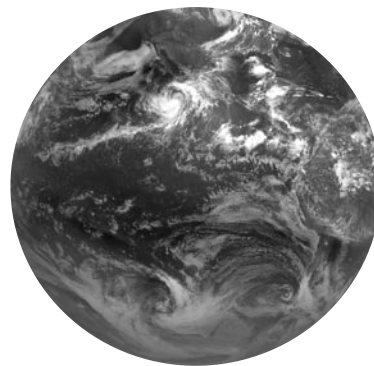
of the Year at Medicine Hat College in Alberta, Canada. This was only her second year teaching at Medicine Hat so the honor is especially striking since students are part of the nomination process.

Javni Mody

Congratulations to Professor Javni Mody of Anne Arundel Community College in Maryland who received the Teaching Excellence award this year for fulltime faculty. She is also the HAPS Marketing Manager. She started her professional life as a dentist but later continued her graduate work in anatomy and found her passion in teaching. Javni uses many innovations in student motivation and instruction and these techniques helped earn her the award.

Susan Capasso wins grant!

Susan McReynolds Capasso, EdD, CGC, of St. Vincent’s College won a grant from the Connecticut Department of Higher Education, Health and Education Initiatives and will offer online review courses in Anatomy & Physiology and Microbiology. Susan is currently a Professor of Science and Chair of the General Studies Program at St. Vincent’s College. She graduated from Mary Institute in St. Louis, MO, and then received a BA in Zoology from the University of Vermont, an MS in Biology from Georgetown University, and an EdD from the University of Hartford. Capasso has taught nursing, allied health, and physical therapy students for thirty years. She received her certification in genetic counseling in 1982 and is a Charter Member of the American Board of Genetic Counseling. She is a member of the American Board of Medical Genetics, HAPS, and the American Society of Human Genetics.



The HAPS-I Report



HUMAN ANATOMY & PHYSIOLOGY SOCIETY INSTITUTE

Kevin Patton

Chair, HAPS-Institute Committee
St. Charles Community College
4601 Mid Rivers Mall Dr.
Cottleville, MO 63376
(636) 922-8338
(636) 447-6159
kpatton@stchas.edu

What a year! At this time last year, HAPS Institute (HAPS-I) was just a twinkle in the eye of the HAPS Board of Directors and then-President, Joe Griswold. HAPS-I is the new continuing professional education arm of HAPS. Our mission is to “take HAPS to the next level” of what HAPS does best: provide opportunities for achieving excellence in the teaching and learning of human anatomy and physiology.

After a year of cooperative efforts among many individuals and institutions from all over North America, we have arrived at that next level! OK, it is just the first step of the next level—but it is still very exciting.

As I write this in late July, our two pilot courses are just now beginning to wrap up. Seventeen scholars in the *Topics in A&P* course and twenty-one scholars in the *Advanced Renal Biology* course began their adventures in May 2007. First, our fearless “guinea pigs” worked through some assigned readings and workbook projects. Then, at the annual conference in San Diego, they participated in update seminars and special HAPS-I workshops. All summer they have been working together online as they discuss concepts of their courses and how to teach them. And they have been helping each other to create learning modules that are now part of the HAPS-BEN online archive—making them available to all of you to use or adapt for your own courses! By the time you read this, the scholars will also have an extra one or two graduate biology credits from University of Washington on their transcripts.

So who *ARE* these guinea pigs? They are a highly diverse group: some teach high school, some community college, and some are at a university or medical school. Some teach 1-semester A&P, some 2-semester courses, some teach anatomy only, and some just physiology. Some are near the beginning of their careers, some

are, well, er, not near the beginning of their careers. Some have master’s degrees, some MDs, and some PhDs.

Why did they decide to join one or both pilot courses? The same reason we are all members of HAPS! To better ourselves in terms of what we love to do, teach A&P. And how did that work for them? I will let a few of them tell you!

One HAPS-I scholar said, “As a first time HAPS attendee (and a shy person), I found it very helpful to ‘belong’ to a group. Beyond having that entry point to HAPS, I also found it extremely helpful to be able to talk with other instructors about specific course topics, methods, and general classroom issues. Of course, this can be done one on one with people you meet at the conference, but being in a small group of people that have the same desire to improve their teaching skills made the experience extremely valuable. . . . The discussions that have been occurring in the A&P Topics course have all been very informative and supportive.”

Another said, “The HAPS-I Renal course has prompted me to retool an old, tired lab-based assignment into a more dynamic, thought provoking project for my students. Can’t wait for Fall semester to try it out on them. Count me in for future HAPS-I courses.”

Still another, “The HAPS conferences always revitalize me, not only with new information and activities to improve my teaching, but also by the supportive discovery of many common challenges and potential solutions with colleagues from all over the country. For me, one of the greatest parts of Topics was the continuation of this collegiality through the online discussions and sharing of ideas and activities, long after the HAPS conference was over. The opportunity to share with so many creative instructors was like being in a candy shop, without the calories; I want to try each of these treats in my own classes.”

And, “[In the Renal course] I especially appreciated the preparatory use of a workbook and text readings before the conference. The all-day conference workshop was intense and a great experience to be so immersed in the topic. It has given me the information and inspiration to re-organize and strengthen my whole renal unit. I hope similar courses on other body systems will be offered in the future. . . . I would encourage anyone interested in these in the future to try one or more of these courses.”

Another said, “The aspect I liked most about the advanced renal biology course is that it held me accountable for my own learning. Many of us have books by our desk that we will read eventually, or topics we will learn more about someday, but other deadlines come first. In Adv. Renal Biology, I had to finish the renal reading before our class, because now we had

a deadline and we were going to be held accountable. Enrolling in the course provided me with the gentle encouragement to finish the reading and learn more about a topic that had always interested me (but I never seemed to have time to examine further).”

Want to know more? Visit us at hapsweb.org (click *HAPS Institute* on the left menu) where we have all the details (and more feedback from our guinea pigs, HAPS-I faculty, and others) or email me at haps.institute@gmail.com. In the next issue of the *HAPS-EDucator*, I will tell you more about our upcoming courses. If there is any urgent breaking news, I will email you!



HAPS Institute scholars and faculty take a break from their day-long session in the Advanced Renal Biology course during the workshops at the Annual Conference in San Diego.

HAPS 2007 *In Review*

Reflections on the 2007 HAPS Annual Conference From the Robert Anthony Scholars

This year's conference in San Diego was a huge success and another record year for First Timers to HAPS. Among these First Timers were the Robert Anthony Scholarship recipients. Each year the Grants and Scholarships committee asks these first timers to reflect on their first HAPS experience. Here is what they had to say:

"My initial reaction when asked to reflect on the 2007 HAPS Annual Conference was, 'I had a GREAT time!!'" says Kim Hansen. "I just keep coming back to that initial response. I really had a terrific time. The HAPS members and annual conference attendees were the friendliest people I have ever met at a conference.... Everyone I met was equally enthusiastic about teaching as they were about anatomy and physiology. I felt right at home and in addition to getting great ideas, possibly the best benefit I received from the HAPS Annual conference was all of the contacts and connections I made with people. I think that I have really made some good friendships and I look forward to attending many more HAPS Annual conferences and sharing many more ideas!!"

Valory Thatcher first expressed her sincere thanks to Robert Anthony and HAPS for providing this scholarship. "I was very

honored to be a recipient of this award. The conference was delightful, informative, and a great way to meet fellow HAPSters. San Diego was lovely. I especially enjoyed sitting around the dinner table with a dozen fellow anatomists who don't mind a little gross conversation. It was fantastic. Thanks again."

April Collins-Potterfield also appreciated the scholarship because it provided her with the opportunity to attend the conference. "The most rewarding part of the conference for me was the opportunity to meet colleagues at other institutions with the same frustrations and goals.... Additionally, it was comforting to understand that the obstacles I face in my teaching are not uncommon, and to have others share their wisdom in confronting these obstacles."

It sounds as though these three First Timers stand poised to be next year's Second Timers! Do you know of someone who would benefit from attending a HAPS meeting? If so, please encourage that person to apply for the Robert Anthony or Adjunct Faculty Scholarships. Information can be found on the HAPS website, and the deadline for both applications is November 15, 2007.



*Enjoying the Opening Night reception and
the First Timers Breakfast*

The 2007 HAPS First-Timer Scavenger Hunt

Tom Lehman
Steering Committee Chair
Coconino Community College
2800 S. Lone Tree Rd.
Flagstaff, AZ 86001
(928) 226-4282

Once again, the HAPS Steering Committee hosted a Scavenger Hunt for the First-Timers at the HAPS Conference in San Diego. First-Timers were encouraged to find each of the Committee Chairs, learn a little about their committee, and see if there were any committees that they would like to learn more about (maybe even join). As with last year, it was a rousing success, giving many people an opportunity to learn about each other and forge new friendships and contacts.

Congratulations to the nineteen (19) First-Timers who successfully completed the 2007 Scavenger Hunt, listed below. You demonstrated the enthusiasm and dedication that we like to see in our profession. Congratulations also to the First-Timers who turned in their cards (an additional 44 HAPSters!) and expressed interest in various committees and activities in HAPS. We held a drawing for a 2008 Conference Reeregistration as a thank you for completing the 2007 Scavenger Hunt. We look forward to seeing each of you at New Orleans in 2008.

THE 2007 SCAVENGER HUNT WAS COMPLETED BY:

David Balfour
Abdulai Barrie
Pat Clark
Slavica Covert
Elaine Fanini
Rose Goble
Juan Guzman
Kim Hansen
Candi Heimgartner
Raymond Herndon

Mary Lee Lusby (Winner of the 2008 Conference Registration)
Luis Martinez
Debra Rajaniemi
Leslie Reiman
John Rowe
Leah Royce
Hiranya Roychowdhury
Zarina Tchinibekova
Max Weber



***Mary Lee Lusby, winner of the 2008 Conference Registration
is congratulated by Tom Lehman, Steering Committee Chair***

HAPS Membership Dues

By this time next year we will have a new management firm because our devoted Business Manager, Tonya Ferguson, is retiring. The audit required for the new firm to assume responsibility of our books will likely cost between \$5000 and \$7000. We expect the annual fees for the new management firm to be as much as triple what we have been charged by Tonya. Several new initiatives that are of benefit to our members, yet increase expenditures, are website improvements such as electronic voting, HAPS-Institute development, and interactions with partner societies. In addition, inflation raises the costs of such daily operations as printing, mailing, and insurance.

Membership dues contribute about 28% of HAPS income. Dues have not been raised in over five years, even though the costs of running HAPS continue to increase. HAPS dues are a great bargain and are significantly lower than most dues for comparable associations. At the business meeting of the HAPS 2007 Annual Conference in San Diego, members unanimously agreed to increase membership dues in all categories by \$15

per year. Effective September 1, 2007, membership annual dues will be:

US & Canadian Members

Regular (Full-Time Faculty) \$65/year
Three-year Regular Membership \$185, a 5% savings
Five-year Regular Membership \$309, a 10% savings
Adjunct (Part-Time Faculty) \$50/year
Student \$50/year
HAPS President Emeritus Membership \$45/year
Retired Faculty \$45/year

International Members (outside the US & Canada)

International Regular \$75/year
International e-membership \$37/year

All membership dues are in US dollars. Membership renewals are collected annually on either January 1 or July 1, whichever date is closest to your initial membership.



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Susan Baxley Recipient of The 2007 Presidential Medal!

Joseph G. Griswold
HAPS Past-president
The Science Learning Workshop
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Brigantine, NJ 03203
(609) 264-9142
(609) 264-7278
jggris@comcast.net

Susan Baxley, Editor of the *HAPS-EDucator*, is the 2007 Presidential Medalist. She received her award at the annual conference in San Diego on May 28th during the annual business meeting. The HAPS Presidential Medal was established in 2005 to recognize a HAPS member who has provided outstanding and exemplary service to HAPS over an extended period of time. This award carries with it not only the honor and respect of the award itself, but also an engraved medal with the HAPS logo on one side and the recipient's name and year of the award on the other. It includes conference registration and annual banquet fees paid by HAPS for a future annual conference. An article announcing the recipient is written by the awarding President for the Fall Edition of the *HAPS-EDucator*, and a formal letter of appreciation is sent to the administration of the recipient's home institution. Previous awardees include Webmaster Carl Shuster (2005) and long-time Marketing Manager Donna White (2006).

It can be a difficult task selecting a Presidential Medalist for two reasons. First there are many HAPS members who might fairly receive this honor. Second, it is very hard to get complete information about all the deserving candidates. This year, however, it was quite easy for me to gather information, because working

with information is our medalist's primary contribution. She has given workshops at HAPS conferences every year for many years, served on a number of committees, and for seven years has been editor of the *HAPS-EDucator* doing a consistent, professional job at publishing our quarterly journal.

Susan retired from Troy State University, Montgomery, Alabama after winning a number of awards for teaching excellence, coordinating Troy State's entire Anatomy and Physiology laboratory operation, and finally serving as chair of the Science Division. She was highly respected by colleagues and students alike for her organizational ability, innovation in the laboratory, and the high standards of performance she modeled and expected from those around her.

Beyond all the hard work she does for HAPS throughout the year, Susan Baxley has been a terrific spokesperson for our Society. Her friendly, outgoing approach to meeting new people and making them feel welcome exemplifies what we hope to project in this organization. Thank you, Susan, for your outstanding service. We hope you will continue to be a vital part of HAPS for many years.



Summary of Update Seminar #6 Biological Basis of Aging

Sponsored by the American Association of Anatomists

Suzette F. Chopin, Ph, MA, presenter
Texas A&M University-Corpus Christi, TX

Jorge D. Cortese, summarizer
Durham Technical Community College
1637 Lawson Street,
Collins Bldg., Room 293
Durham, NC 27703
(919) 686-3426
(919) 686-3737 fax
cortesej@durhamtech.edu

Dr. Suzette F. Chopin is a Regents Professor and Professor of Biomedical Sciences at Texas A&M University-Corpus Christi (A&M-CC). She also is the director of the Office of Professional Education and Special Programs, which she founded in 2001, and leads efforts in increasing undergraduate research and attracting of women and minorities to careers in the sciences. She has a Ph.D. in Anatomy from Louisiana State University College of Medicine and an MBA from A&M-CC. In her HAPS presentation, she discussed aging throughout biology and human endeavor, delving into theories, experimental evidence, and practical recommendations. Her goal was to provide overarching concepts of aging that faculty can use in the classroom. The following comments attempt to give a summary of her overview of aging-related science.

A first distinction should be made between the definitions of life expectancy and life span. Life expectancy is a statistical calculation of the average amount of time before death remaining for a population with the same birth; lifespan is the maximal age to which an individual could live, barring accidents and diseases. For humans, the estimated lifespan is currently 122 years. Looking at changes in life expectancy through history and around the world, Chopin mentioned differences that are not consistent with a progressive increase during human history. In older agrarian societies, life expectancy was sometimes higher than after the establishment of modern cities, which, with their greater accumulation of inhabitants, led to easier dissemination of disease. Nevertheless, life expectancy has increased with improvements in sanitation and medicine in general, and also with the implementation of social programs that support those living at the lower socioeconomic levels. Scientists lack an understanding on how all these variables are linked: for instance, for no apparent reason, Andorra is the country with the longest life expectancy in the world.

Gender also influences life expectancy, with females outliving males by about five years (2004 Federal Government data).¹ Chopin blames this – with her characteristic sense of humor – on the effects of testosterone (e.g., leading to greater risk-taking behavior) rather than on the protective effects of estrogens, which act as cardioprotectants or general antioxidants. The gender bias is observed experimentally in differences for male to female ratios in human populations. The male to female

ratio at conception (115:100) approaches equal gender numbers at birth (104:100), and finally favors females in a 25 year-old population (106:100).

Finding ways to increase life expectancy is not simple since causes of death vary even between different U.S. states.² However, there is an online test that can give the reader some practical ideas about how to add a few years to her/his personal life expectancy (see www.livingto100.com). More difficult and perhaps impossible is to add years to the human lifespan. Scientists have found that no cell is immortal, even in artificial cell culture environments, and that there is an inherent limit to the number of cell divisions that any cell can undergo (known as the Hayflick's limit). This means that cells obtained from older humans divide fewer times than those from younger donors. Perhaps in a dramatic demonstration of this biological limit, when the Roslin Institute's scientists cloned a sheep, the famous daughter clone Dolly died at a very young age (about 6 years), not very different from the projected life expectancy of the mother at the time of Dolly's conception.

Chopin also reflected on what aging is by looking at its various definitions. Aging can be construed as a series of cumulative, universal, progressive, intrinsic, and deleterious changes (with an acronym of CUPID), which are irreversible losses in normal biological function that occur after sexual maturation, culminating in the death of the organism. These processes constitute what we call aging, but no single theory can account for all aspects of a predictive model of aging. In fact, there are many competing theories trying to explain aging, and Chopin considered four of them to be of the greatest significance.

The first, theory of aging is the *theory based on catastrophic errors*, errors involving mistakes in transcription and translation that do not necessarily involve somatic mutations or DNA damage and cannot be easily reversed. Second is the theory of accumulation of *biological cross-linkages* that create a developing population of abnormal chemical bonds in DNA and proteins (e.g., protein glycosylation such as what occurs with hemoglobin). A third popular theory is *aging based on oxidative damage driven by free radicals*, which suggests that the accumulation of un-repaired oxidative injuries triggers conditions that increase susceptibility to death. (This form of damage is known to affect all biomolecules including nucleic acids.) With

oxidative damage, there is substantial experimental evidence about a link between a longer lifespan and a decrease in levels of free radicals. For instance, a longer lifespan occurs wherever there is an increase in the antioxidant biomolecules or enzymes that quench free radicals such as SOD (superoxide dismutase). Finally, the *genetic theory of aging* explores the link between expressed genes and aging.

Although there is no single aging/death gene, a familial correlation on lifespan has been observed, and some specific isoforms of molecules implicated in accelerating the aging process may be involved (e.g., the apolipoprotein E variants acting in Alzheimer's disease development). Another form of the genetic theory links chromosomal ends or telomeres with the effective Hayflick's limit discussed above, hoping to establish a biological clock of life span that can be modified. Since interventions here will involve basic structural modifications of chromosomes in germ-line cells, this last aspect of aging theories is more speculative for anti-aging interventions.

Regarding useful anti-aging interventions, Chopin mentioned a few such as behavioral modification (e.g., avoiding smoking and risk-taking behaviors), plus a judicious intake of antioxidants and vitamins. Some more drastic anti-aging methods involved substantial caloric intake restrictions and multiple hormone replacement as we age. Finally, Chopin discussed an additional dimension of anti-aging interventions, the social aspect. Social networks support the elderly who then enjoy an improved physical and mental health. Family, friends, and support groups can thus provide incentives for the aging subjects to interact, adding years to their lives. This effect is important when considering the increase in numbers of older people who are living alone.

Studies have looked into the connection between increased longevity and mental or social health.³ A stronger brain is more efficient, and in studies tracking lifelong records of medical histories – such as those from nuns in Minnesota used by Snowdon – some correlations are apparent.³ There is an apparent effect of education (obtaining a college degree), intellectual abilities (e.g., possessing a rich vocabulary), and emotional maturity in increasing survival into old age. From Snowdon's longitudinal study, there is a potential link between an increased brain “reserve,” augmented by added use of the brain during our lives, and a decrease in long-term damage coming from neurodegenerative diseases such as Alzheimer's. This study also suggests that the individual structure of the aging brain

may increase life expectancy, as there is a connection between the absence of strokes – common in age-dependent, multi-stroke dementia – and an increased longevity. A last factor in these studies may be related to the social element that underlies adding years to our lives, and Snowdon praises the power of community and deep spirituality of the nuns being studied.³

Chopin concluded her overview of the biology of aging with a summary of theories and studies, highlighting the potential increase in life expectancy by prevention and treatment, and the lack of a single theory of aging or magic anti-aging drug. She also gave information about books (references 3-9) and websites (references 10-12) that can be used for further reading and in the classroom.

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- 9) National Institute on Aging at <http://www.grc.nia.nih.gov>
- 10) Baltimore Longitudinal Study of Aging at <http://www.grc.nia.nih.gov/branches/blsa/blsanew.htm>
- 11) Statistical Information on Country Ranks at <http://www.photius.com/rankings/index.html>
- 12) U.S. Department of Labor, Bureau of Labor Statistics at



HAPS COMMITTEES AND BOARDS

ANIMAL USE

Donald Kelly, Chair
Mohawk Valley Community College
1101 Sherman Drive
Utica, NY 13507-5394
(315) 369-6614
(315) 792-5363 fax
dkelly@mvcc.edu

Distributing the HAPS policy statement, developing animal use Internet links on the HAPS Home Page, monitoring relevant legislation, and creating a resource packet for HAPS members.

ANNUAL CONFERENCE

Izak Paul, Chair
Mount Royal College
4825 Mount Royal Gate SW
Calgary, AB T3E 6K6 Canada
(403) 440-6173
(403) 440-6095 fax
ipaul@mtroyal.ca

Formulates conference guidelines, assists the annual conference coordinators, and generates a list of conference sites.

CADAVER USE

Paul Krieger, Chair
Grand Rapids C.C.
143 Bostwick Ave. NE
Grand Rapids, MI 49503
(616) 234-4250
(616) 234-3592 fax
pkrieger@grcc.edu
Develops guidelines for the use of cadavers in anatomy instruction.

CURRICULUM AND INSTRUCTION

Carol Veil, Chair
Anne Arundel Community College
101 College Parkway
Arnold, MD 21012-1895
(410) 777-2848
(410) 777-2525 fax
cbveil@aacc.edu
Currently developing learning outcomes for the A&P content modules in HAPS Human Anatomy & Physiology Course Guidelines

EXECUTIVE

Margaret Weck, Chair
4588 Parkview Place
St. Louis, MO 63110
(314) 446-8483
(314) 446-8460 fax
pres@hapseweb.org or mweek@stlcop.edu
Composed of the HAPS President, President-Elect, Past President, and Treasurer.

GRANTS AND SCHOLARSHIPS

Amy Way, Chair
Lock Haven University Clearfield Campus
201 University Drive
Clearfield, PA 16830
(814) 768-3431
away1@lhup.edu
Reviews all grant and scholarship proposals, selects proposals to receive funding, and submits its recommendations to the BOD for approval.

HAPS-EDUCATOR

Marsha Sousa
University of Alaska Fairbanks
PO Box 758040
Fairbanks, AK 99775
(907) 455-2867
(907) 455-2863
ffmcs@uaf.edu
Provides advisory and support services to the HAPS-EDUCATOR Editor i.e. soliciting and reviewing articles, and proofreading final draft of the HAPS-EDUCATOR before it goes to press.

Susan Baxley, Editor
8000 Bonhomme, Suite 412
St. Louis, MO 63105
hapsed@hapseweb.org

MARKETING

Javni Mody, Chair
Anne Arundel Community College
101 College Parkway
Arnold, MD 21012-1895
(410) 777-2265
(410) 777-2525 fax
jmody@aacc.edu
Promotes HAPS and functions as the liaison between HAPS and A&P vendors.

MEMBERSHIP

Jon Jackson, Co-Chair
University of North Dakota School of Medicine
PO Box 9037
Grand Forks, ND 58202-9037
(701) 777-2101
(701) 777-2477 fax
jackson@medicine.nodak.edu

Valerie O'Loughlin, Co-Chair
Indiana University-Bloomington
Jordon Hall 104
Bloomington, IN 47405
(812) 855-7723
(812) 855-4436 fax
vdean@indiana.edu
Recruits new members, provides service to members, focuses on membership retention, and compiles membership information.

NOMINATING

Kevin Petti
San Diego Miramar College
10440 Black Mountain Rd.
San Diego, CA 92126-2999
(619) 388-7491
(619) 469-4847 fax
vp@hapseweb.org or kpetti@sdcdd.edu
Recruits nominees for HAPS' elected offices.

PARTNER ASSOCIATIONS

Kevin Petti, Chair
(see Nominating Committee for information)
Coordinates the pursuit of common goals, information exchange, and sharing of resources between HAPS and other professional societies.

PRESIDENTS EMERITI ADVISORY BOARD

Ric Martini, Chair
University of Hawaii-Hilo
5071 Hana Highway
Haiku, HI 96708-5954
(808) 572-2113
(808) 572-2114
martini@maui.net
An experienced advisory group including all Past Presidents of HAPS. Advises and adds a sense of HAPS history to the deliberations of the BOD.

PUBLIC RELATIONS OFFICER

David Evans
Department of Natural Sciences
Pennsylvania College of Technology
Williamsport, PA
(570) 326-3761
(570) 327-4500 fax
devans@pct.edu
Provides updates on media and governmental developments impacting HAPS members, tries to get media coverage for HAPS events and members attempts to make HAPS better known by the public.

REGIONAL CONFERENCE

Ewa Gorski, Chair
Community College of Baltimore County-
Catonsville

800 South Rolling Road
Baltimore, MD 21228-5381
(410) 455-4314
(410) 719-6547 fax
egorski@ccbcmd.edu
Mentor coordinators of regional conferences.
Contact the Chair if interested in hosting.

SAFETY

Rema Suniga, Chair
Ohio Northern University
525 South Main
Ada, OH 45810
(417) 772-2323
(419) 772-2330 fax
r-suniga@onu.edu
Develops standards for safety in the laboratory.

STEERING

Thomas Lehman, Chair
(see HAPS Web site Committee for information)
Consists of all Committee Chairs, coordinates activities between committees, and represents collective committee activity to the HAPS BOD.

TESTING

Chris Farrell, Co-Chair
Trevecca Nazarene University
333 Murfreesboro Rd.
Nashville, TN 37210
(615) 248-1631
(615) 248-1747 fax
cfarrell@trevecca.edu

Eric Sun, Co-Chair
Macon State College
100 College Station Dr.
Macon, GA 31206
(478) 471-2752
(478) 471-2753
esun@mail.maconstate.edu
Completed, tested, and approved the HAPS Comprehensive Exam for Human A&P. HAPS members may obtain a copy by writing Chair.

WEB SITE

Thomas Lehman, Chair
Coconino Community College
2800 S. Lone Tree Road
Flagstaff, AZ 86001
(928) 227164
tom.lehman@coconino.edu

Carl Shuster, Web Editor
Madison Area Technical College
3550 Anderson St.
Madison, WI 53704
(800) 322-6282
(608) 246-6203
(608) 246-6880 fax
cshuster@matcmadison.edu

HAPS INSTITUTE

Kevin Patton, Chair
St. Charles Community College
4601 Mid Rivers Mall Dr.
Cottleville, MO 63376
(636)922-8338
(636)447-6159
kpatton@stchas.edu

CONFERENCE COORDINATOR

2008 in New Orleans, Louisiana
Judy Venuti, Coordinator
Louisiana State University Health Sciences Center
1901 Perdido Street
New Orleans, LA 70112
(504) 599-0157
(504) 568-4392 fax
jvenut@lsuhsc.edu

The Committee Chairs invite input from HAPS members and willingly provide information on the activities of their committees.



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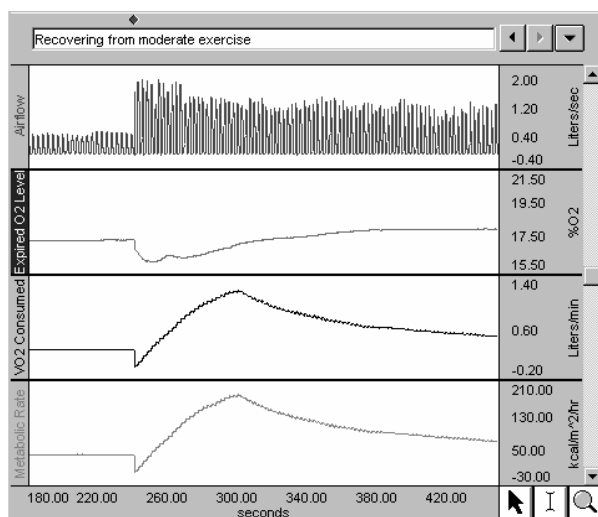


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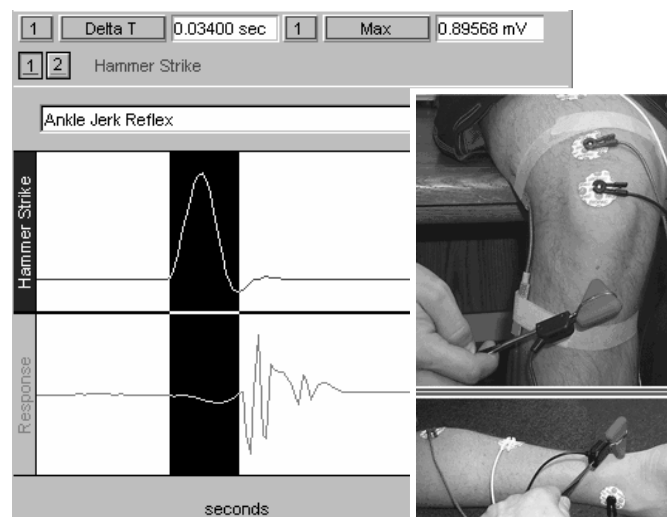
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