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

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Michael Mestan, D.C.
NYCC Executive Vice President of Academic Affairs
The Emerging Interface of Entomotoxicology, Forensic Entomology and Decomposition in Modern Crime Scene Investigation

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Abstract: Insects and other arthropods are by far the largest biological group on earth, which is why they are found in such a wide variety of places, including crime scenes. For many years, maggots crawling on dead bodies were considered to be just another disgusting element of decay to be washed away during the autopsy, but now forensic specialists have discovered the true importance of the presence of these insects. This revelation led to the development of forensic entomology, the investigation of insects and other arthropods recovered from corpses and crime scenes. Currently, researchers worldwide are using entomology to aid in their criminal investigations. This article examines the emerging interface of entomotoxicology, forensic entomology and decomposition in modern crime scene investigation.

AUTHOR’S NOTE FROM ALLISON GAINES: My interest in studying human decomposition and the biological processes that are associated with death began with the start of my work at the Southern Regional Medical Examiner’s Office in Woodbine, New Jersey. As an intern, I was fully immersed in the field, shadowing autopsy technicians and medico-legal death investigators as they analyzed death scenes and performed examinations. I instantly became more familiar with the anatomy of the human body than ever before, seeing first-hand how injury and disease contributes to death. Following the internship, I was hired as a death investigator for the Medical Examiner’s Office, which meant that I had cases of my own to examine. Of all the cases I worked on, I was always most fascinated by those that involved advanced stages of decomposition. I was curious to discover what caused the decomposition process because I could see how important a thorough understanding of decomposition was to a death investigation. The study of death and decay is often unpleasant, but understanding the immediate and consistent processes of decomposition is essential for determining the most likely sequence of events to have occurred at a crime scene. Once established, this sequence of events forms the basis of the medico-legal prosecution of the crime.

Criminal investigations can be wide-ranging activities that draw upon the expertise of many people from seemingly unrelated disciplines. In modern crime solving, a team of forensic investigators might include police personnel, medical doctors, meteorologists to assess historical weather conditions, statisticians to compile and analyze data, biologists and chemists. Most people are familiar with the duties of police personnel and medical examiners in criminal investigations but many are not as well acquainted with an emerging sub-specialty of forensic science known as entomotoxicology or with the use of insects to help establish the post mortem interval. Entomotoxicology deals with the detection of drugs and toxins in insects that feed on decaying organisms and the impact of a variety of drugs on insect development. Knowledge of the post mortem (Continued on next page)
interval may be enhanced by the ability of forensic entomologists to make accurate inferences about the time since death based on the size and developmental stage of insect larval harvested at the crime scene. This article examines the interface of entomotoxicology, forensic entomology and decomposition in modern crime scene investigation.

When a person dies, flies are attracted to the body in a matter of minutes. The types of flies vary from region to region, but as a general rule, the metallic blue and green flies commonly seen wherever garbage has accumulated are the first to arrive. Others are attracted soon after by the smells associated with decomposition. As soon as the flies arrive, they deposit their eggs in natural openings in the body such as around the eyes, nostrils, and mouth. If the body happens to be naked, eggs will also be deposited around the genitals and anus. If there are any open injuries present on a body, such as knife or gunshot wounds, additional eggs will be deposited in the exposed soft tissue areas. As maggots hatch, they cluster and feed on the soft tissues, often reaching such high numbers that they are referred to as “maggot masses.” As they feed on the corpse, maggots progress through a series of life stages called instars. Larva shed their skin as they grow through the first, second, and third instar stages. Once maggots have reached the third instar and are ready to pupate, they leave the body, often in such large numbers that they leave track marks on the ground as they go (Campobasso et al. 2001, Ferlini, 2002).

One of the newest techniques to emerge in crime scene investigation is the detection of toxic substances in entomological specimens harvested at the crime scene. Decedents in suspected drug-related deaths are not always discovered in a timely manner and by the time the remains are found biological substances, such as urine, blood and soft tissue organs, which are traditionally used for drug analysis, may no longer be present at the crime scene or suitable for analysis. In circumstances like this, living adult insects, insect larva and even the chitinized remains of insects, such as cast-off larval and puparial skins, may serve as rich reservoirs of the materials found in the drug-laced cadavers upon which they have fed. Insects recovered from badly decomposed cadavers or skeletal remains can be homogenized and processed using traditional chemical extraction techniques to reveal the substances they have ingested. The most common analytic procedures used for processing insects that have been removed from cadavers are gas chromatography, gas chromatography-mass spectrometry (GC/MS), radioimmunoassay (RAI), thin-layer chromatography (TLC) and high-performance liquid chromatography-mass spectrometry (HPLC/MS). The drugs most frequently encountered in forensic entomotoxicology cases include well-known substances of addiction and drugs of abuse such as morphine, cocaine, heroin, diazepam (valium), phencyclidine (angel dust), amitryptiline (elavil), and a range of major and minor antidepressants. The most common insects used in entomotoxicological investigation are true flies, representatives of the insect order Diptera. (Bourel 2001, Campobasso et al. 2001, Campobasso et al. 2004, Goff 2000, Verma 2013).

Current investigative efforts in entomotoxicology seek to determine the effect of drugs on the development of insects, particularly blowflies and fleshflies. These studies attempt to minimize the potential errors that can arise during forensic investigations by developing techniques that measure drug-related alterations in insect larval stages. Results have shown that there is a statistically significant increase in the rate of development in maggots feeding on tissues containing a lethal dose of cocaine. Drug related variations in the developmental rates of insects could be enough to make a difference of up to several days in the estimate of time of death. The reason for this discrepancy can be understood when comparing the effects of cocaine on maggots with its effect on humans. Humans who take moderate doses of cocaine initially become euphoric and quite talkative. They display increased energy, appear more alert, and become hyperactive due to an increase in heart rate. As the drug metabolizes in the body, however, these effects diminish. With maggots, it is their feeding behavior that changes. As the level of cocaine increases maggots become more active. They feed more rapidly, thus ingesting more of the drug. This behavior, in turn, increases the rate of development through the larval stages until the third instar stage. Once maggots reach this point in their development, feeding and therefore ingestion of cocaine ceases. The cocaine is metabolized and, by the beginning of the pupal stage, the rate of development returns to normal. This process is not unique to maggots; drug ingestion also affects the adult beetles, wasps, and other organisms that feed on the cadaver (DeCarvalho et al. 2012, Campobasso and Introna 2001, Goff 2000).

Illicit drugs are of major concern to forensic entomotoxicologists and death investigators because death due to drug overdose is becoming more and more prevalent. Cocaine is of particular interest to scientists performing studies in this field. It is one of the most widely consumed drugs of abuse in the world, with the highest rates of use reported in North and South America. An estimated 50,000 people die as a direct result of cocaine use in the US each year. In the year 2006, there were 2.4 million cocaine users in the US alone. Cocaine is one of the most
potent CNS stimulants but its potency depends on the form of intake. When taken orally, the drug is quickly metabolized, which is why most people choose to inhale the drug through the nose or to inject the drug intravenously. The lethal dose of cocaine when inhaled is a mere 20-30mg whereas, when ingested, 1g may not even be fatal. Death by cocaine overdose or hypersensitivity to the drug can occur very rapidly due to rapid increases in blood pressure that can cause the brain to hemorrhage. Current investigations indicate that fly larvae exposed to cocaine start and end the pupariation process much earlier than drug free larvae. They consume more cadaver tissue and gain body weight faster than drug free larvae. Current data suggests that all species of fly larvae may respond differently to the consumption of drugs, even species within the same family. Future studies that look at the variation in the effects of cocaine on the development of a wide variety of cadaver insects will be extremely helpful to forensic investigators (DeCarvalho et al. 2012).

Today, the most common use for entomological evidence is in the determination of the post mortem interval (PMI), or minimum time since death. The PMI is defined as the elapsed time from death until discovery. The true usefulness of insects in determining time since death is often under-rated, but the accurate estimation of the PMI is extremely important to medicolegal death investigations. Currently, there are two approaches to estimating time since death using insect evidence. The use of either method depends on the state of the decomposing body when it is found. The PMI can be narrowed down by analysis of the stages of development of the immature flies that are present on the remains and it can be further refined using the principles of insect succession (Verma 2013, Turchetto 2001).

Insect succession is a phenomenon in which each organism or group of organisms that feeds on a body changes the body itself in some way. The changes that take place make the body more attractive to another group of organisms, which changes it for the next group and so on until the body has been reduced to a skeleton. This is a predictable process, with different groups of organisms occupying the decomposing remains at different times. For example, during the first week or two of decomposition, blow flies and flesh flies are usually the only uniformly reliable indicators of the post mortem interval. Maggots of these flies remove the soft tissues of the body causing the corpse to dry out, attracting species like hide beetles that feed on dried skin and cartilage. Forensic entomologists recognize four ecological categories that can be identified in a carrion community: necrophagous species that are feeding on carrion, predators and parasites that feed on the insects present, omnivorous species such as wasps, ants, and beetles that feed on the corpse and the colonizers, and other species such as spiders, which use the corpse as an extension of their environment. Each member of this community has an important role in the decomposition process and any imbalance can cause significant variations in the patterns of decay (Ferllini 2002, Goff 2000).

There are several factors that complicate the determination of the PMI using insects, making it difficult to use standard methods of estimation. Depredation, or the significant reduction of the necrophagous population by social insects such as ants and wasps, is a common cause of altered decomposition patterns. When a corpse is left near a colony of social insects, they may prey upon the fly larvae at an extraordinary rate, significantly altering maggot feeding rate and therefore the rate of decomposition as a whole. Changes in temperature and geographic location alone can alter the growth rate of the maggots feeding on a decomposing corpse. For instance, flies are unable to lay their eggs at temperatures below 40 degrees and they do not seek out bodies after sundown; both of these circumstances can effect the estimation of the PMI. Differences in time of day, season, humidity, and even whether the body is located in the sun versus the shade can have drastic effects on the developmental rate of feeding maggots, which also effects PMI determination (Goff 2000, Verma 2013).

Temperature directly interferes with insect activity and development. Below a certain temperature threshold, insects are too cold to fly and therefore do not lay eggs or deposit larvae. Development ceases altogether at approximately ten degrees Celsius. Heat, on the other hand, speeds up development. Warmer temperatures increase the number and type of carrion insects found in association with the cadavers, and the more insect activity, the faster the degradation process will be. Increased humidity appears to be correlated with higher levels of fly and maggot activity whereas bodies found in arid environments may show very little bodily destruction by insects (Campobasso et al. 2001, Goff 2000, Mann 1990).

Insects can provide valuable clues as to whether a body was moved from one location to another following death. Even though insects are found in virtually every habitable part of earth, not all insects are found in every habitat. Some are specific to a given type of climate, vegetation, elevation, or time of year. If investigators find insects that are typically active during the fall on a body that is discovered in the spring they know that this is indicative of a death that took place in the fall. If an insect that is specific to an urban habitat is found infesting a body discovered in a rural area, investigators can be fairly certain that the crime was not committed at the scene of discovery, and that the body was moved after death. Insects can also provide

(Continued on next page)
valuable information about bodily injuries. If maggots are found covering an area of the body that is not a natural opening, this indicates that trauma has been inflicted on that area. Antemortem and perimortem injuries are more attractive to insects than postmortem injuries because they are accompanied by profuse bleeding whereas injuries inflicted after death bleed very little. The timing of apparent injuries can be helpful in determining cause of death and can shed light on possible homicide or suicide cases (Goff 2000, Ferllini 2002).

Critical to the process of crime scene analysis is an understanding of decomposition, the predictable sequence of biological and chemical events that is initiated by the death of an organism and attracts insects to the cadaver site. Even though studying human decomposition is often dirty, unpleasant work, it is critical that the decomposition process be understood because of the impact it has on forensic investigations. Studies into human decomposition can help answer the four most important questions in any death investigation: Who is the decedent? How did the decedent die? Where did death take place? When did death take place? The process of human decomposition begins approximately four minutes after death occurs and takes place in four major stages: fresh decomposition, early decomposition, advanced decomposition, and skeletonization. The first processes that occur in the fresh stage of decomposition are algor mortis, livor mortis, and rigor mortis. Algor mortis is the reduction in cadaver body temperature that occurs after death. It is characterized by a steady decline until it matches the ambient temperature. The rate of decline is approximately two degrees Celsius during the first hour and one degree Celsius per hour thereafter, dependent on existing environmental conditions. The gravitational pooling of blood in the body of a decedent is known as livor mortis. It is marked by a reddish discoloration of the skin in certain areas where there is blood settling internally. After a few hours, the color will begin to change from red to purple as oxygen gradually dissociates from the hemoglobin of the red blood cells. Approximately four to six hours following death, lividity is said to be fixed because the fat in the dermis solidifies in capillaries. The final immediate sign of death is rigor mortis, the stiffening of the body that occurs when the last myosin-actin cross bridge has been formed and there is no more ATP available to release it. The last cross bridges will break down only as a result of the decomposition process. The accumulation of lactic acid and the breakdown products of glycogen also influence rigor mortis. Overall, these beginning stages of decomposition are governed by autolysis, which is promoted by the chemical breakdown of cells and the activity of bacteria and fungi within the body. It normally takes a few days before the effects of autolysis are visually apparent. It is first observed by the appearance of fluid-filled blisters on the skin and is followed by skin slippage, drying of the extremities, and a greenish discoloration around the abdominal area, which is brought about when abdominal fat reacts with the breakdown products of hemoglobin. The processes that characterize the fresh stage of decomposition can persist for as long as seven days following death (Amendt 2004, Campobasso and Introna 2001, Clark et al. 1997, Galloway 1989, Vass 2001).

Putrefaction, the destruction of soft tissues of the body by the action of microorganisms, begins during early decomposition. During this process, which is arguably the most important process for the destruction of organic matter, tissues are digested to a fluid consistency and will eventually liquefy to the point where the skeleton is exposed. This stage is usually associated with moderate insect activity and the production of large amounts of foul-smelling gas that results in bloating. Hydrogen sulfide is a major component of the gas that causes bloating. It is a small molecule that moves easily through body tissues and reacts with hemoglobin to form a green pigment called sulfhemoglobin. This pigment initially shows up in the outlines of superficial blood vessels, but later is seen in the gastrointestinal region and in areas of the body where lividity was most marked. As more and more gas is released into the body cavities, the body itself becomes physically enlarged and distorted making identification of the decedent more difficult. Putrefaction can begin as early as two days after death and can last as long as thirteen days after death (Amendt 2004, Campobasso et al. 2001, Clark et al. 1997, Galloway 1989, Vass 2001).

Advanced decomposition is a state of active decay. It is characterized by changes indicative of accumulating moisture, such as sagging of the tissues and extensive maggot activity, or changes indicative of the extreme dryness that leads to mummification. Mummification occurs in tissues that have survived the active decay process because they are so dry that they possess little or no nutritive value for the organisms attempting to feed upon them. Mummification is most likely to occur in arctic regions and deserts where environmental conditions are characterized by dryness and low humidity. In these conditions, the skin rapidly becomes desiccated before it has time to slough off completely. The alternative to mummification is skeletonization, an end stage of decomposition in which the majority of the bones are exposed. The most favorable conditions for decomposition are high heat coupled with high humidity. When these conditions are present, it takes about four weeks for a body to become skeletonized (Ferllini 2002, Galloway 1989, Mann 1990, Vass 2001).
The four stages of human decomposition should not be regarded as clearly identifiable, separate occurrences. Instead, they represent a general sequence of overlapping phenomena that combine in an uninterrupted progression until all of the organic matter is destroyed. The rate of decomposition is extremely variable and can be affected by several different factors. Ambient temperature appears to have the greatest effect on the decay rate of the human body. During cold and freezing weather, for example, the decay process is greatly reduced, or may even cease completely. The most difficult times of the year to determine how long someone has been dead are during the months when the temperature fluctuates between warm and cold frequently. Humidity and air ventilation also play a role in decomposition and can be correlated with different patterns of decomposition. Bodies found in places with little or no airflow, such as houses and trailers, often show a slower onset of early decomposition. Dry environments dehydrate the corpse rapidly impairing bacterial proliferation whereas humid environments soak tissues and may slow down cadaver degeneration. Coverings such as clothing, bedding, or other similar items may change the decomposition rate because they can slow down postmortem body cooling that favors the onset of the putrefaction process (Campobasso et al. 2001, Galloway 1989, Mann 1990).

Another major factor that affects the rate and pattern of decomposition is the type of environment the body is left to decompose in. In a terrestrial environment, bodies lying on the surface of the ground tend to decay much more rapidly than those that are buried. Remains left directly in the soil frequently show signs of moist decomposition such as fungal growth. The depth of burial plays an integral part in the decay rate. Bodies buried deeper in the soil, even by a difference of a few feet, may take many years to decompose fully whereas those buried at shallower depths may only take a few months. The rate of decomposition is so variable that, in the same environment, a body left in the sun will decompose significantly faster than one that is left in the shade. Bodies that are submerged in water have completely different rates of decomposition than those buried on land. A corpse immersed in water first sinks and then re-emerges during the bloating stage when there is enough gas released to lift it to the surface. In water environments, fish and crustaceans can ravage cadaver tissues, which can severely disfigure the body and make it seem as though decomposition is progressing more quickly than it actually is (Campobasso et al. 2001, Ferllini 2002, Galloway 1989, Mann 1990, Vass 2001).

There is growing interest in cadaver decomposition, and the analysis of insect remains that so often accompanies it, not only as it relates to crime solving but also as it affects the local ecology. In a terrestrial ecosystem, a decomposing body is a temporary microhabitat and a rapidly changing food source for a wide variety of organisms, returning carbon and a variety of high quality nutrients to the soil. In ecological terms, a decomposing cadaver is an island of fertility known as a cadaver decomposition island (CDI). Cadaver decomposition islands in the natural world are associated with a huge increase in prokaryotic biomass, increased microbial activity and an influx of nematode species into the immediate area. The overwhelming majority of soft-tissue destruction is due to the presence of feeding insects and their larvae. Insects are major players in nature’s recycling effort, and in nature, a corpse is simply organic matter that needs to be recycled. There are over 500 species of insects that take part in the decomposition process on a daily basis. In the future, a combination of toxicological and entomological information will be needed in order to make the most effective use of the information gathered from a death site to enhance the autopsy results. The combined efforts of experts in multiple disciplines are required in order to perform the most accurate death investigation possible.

**Literature Cited:**


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2013-2014 HAPS Foundation Fund Drive

In Spring 2013, the HAPS Board of Directors awarded a record number of scholarships, grants, and awards to deserving HAPS members - now is the time to donate so it can happen again in 2014:

- Three Robert Anthony Awards
- Two Adjunct Faculty Awards
- Two Sam Drogo Technology Award, funded by ADInstruments
- Eight Graduate Travel Awards
- One Faculty Grant
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The funding of these scholarships, grants, and awards is the task of the HAPS Foundation. As the Foundation grows, HAPS will be able to assist more and more of its members in their scholarly development. This benefits us all, as the recipients share their work with us at our HAPS conferences and in HAPS publications.

Now the time has come to generate the funds to support next year’s HAPS scholars. We began with a leadership fund drive during which the HAPS leadership- officers, Board members, and Steering Committee members, demonstrated their unanimous commitment to the mission of the Foundation with their financial support. They believe in leading by example! Now it’s time for all of us to do what we can to help the Foundation grow and support our members.

Please donate today and help us achieve our goal of $100,000! No donation is too small (or too large!). Your contribution is fully tax-deductible, as allowed by law. You will receive a receipt for tax purposes.

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Vision and Change (2011) is the latest document from the American Association for the Advancement of Science intended to promote the transformation of undergraduate life-science education. The document, like many before it, states that science students at all levels of undergraduate education should engage in inquiry. The recently completed NSF POGIL project (http://www.cehd.umn.edu/phys/pogil/) was one endeavor that attempted to promote inquiry in the A & P classroom, and a new project hopes to continue with that theme.

Background
For many years, researchers in science education have stated that the gold standard for inquiry is for students to be engaged in a genuine scientific study; to be active participants in the scientific process. For example, undergraduate students should identify a scientific problem, design an experiment to address the problem, run the experiment and collect data, interpret the data and develop claims that are backed-up by evidence, develop and communicate findings in a public forum such as a poster session or peer-reviewed journal. The steps are so easy to recommend, but for those of us who teach entry-level students, especially in large enrollment courses, we know they are far from feasible. Reasons for this are many, but include a student’s lack of background knowledge to pose researchable questions, a lack of lab equipment to collect data, too many students to supervise, and an overall lack of time in the course schedules. A recent project at the University of Minnesota, however, is attempting to overcome some of these limitations and promote inquiry.

Project Description
The recently completed NSF POGIL curriculum project involved several activities where students were provided raw data from a physiological study. Students were required to use the data to construct graphs and then make interpretations, such as the relationship between glucose and insulin. The activities are proving quite effective at promoting a conceptual understanding of human physiology. The positive reviews from that project prompted Dr. Amy Lee, Director of the Department of Postsecondary Teaching and Learning, to fund a Doctoral Candidate, Erik VanIterson to engage in the next logical step. Working with Murray Jensen, Erik is tasked with generating realistic data sets from various activities that are germane to human physiology. Many of the data sets involve collaboration of the fundamental principles of exercise physiology and human physiology. For example, changes in blood glucose, pH, ventilation, etc., during a one-mile run. The data sets will be accompanied by illustrations that show, for example, the runners at different sections of the race where data has been “collected.” The final component of the curriculum will be guided-inquiry questions that require students to use the data to generate graphs and engage in questions that promote a conceptual understanding of the topic. For example, the topic of one-mile run activity will be on lactic acid and how humans manage changes in blood pH.

A second example activity involves a babysitter who is watching a four-year old child who does not want to go to bed – a scenario that is communicated via a short graphic novel. “Let me stay up or I’ll hold my breath!” says the bratty child. “Go for it” says the babysitter who is holding a physiology textbook. The artwork then shows the child holding his breath, and the accompanying data set shows changes in blood glucose, pH, etc. After 45 seconds the child gives up and gasps for breath, and the babysitter says, “Never mess with a babysitter who is studying physiology.” The student activity will again require the use of the data-set to construct graphs and engage in guided inquiry.
inquiry questions that help to figure out the relevant physiological changes that are occurring during the time that the child is holding his breath. This activity could fit in many different areas of a course curriculum. However, we intend to focus on homeostasis and negative feedback mechanism and hope it could be used in the first couple of weeks of an entry-level anatomy and physiology course.

Data Generation
The data presented in this curriculum project albeit not collected prospectively from experimental study, is reflective of plausible real-world physiological and blood biomarker responses caused by specific tasks (e.g. 1-mile run or breath holding). The generated data is organized around the project’s learning concept of what homeostasis is, how it is affected because of a physical stressor (e.g. exercise), and how the body responds to changes in homeostasis that permits maintenance of this condition at resting and exercising conditions. Each dataset shows the response of specific variables respective of the task at hand that at some point within the body of literature has been examined in human subjects. Therefore, the decision to stratify datasets into respective tasks, time, and distance splits was based on contributions of many researched peer-reviewed studies related to this project’s specific objectives.

The decision to generate data to model particular tasks of a wide range of actions was to further illustrate that despite the variability in the response to a disruption in homeostasis, mechanisms are intrinsically present to sense and respond with the primary goal of preventing catastrophe to the system (e.g. death via excessive carbon dioxide accumulation shown in the breath holding experiment). Therefore, the data is presented to show the progression from systemic homeostasis to where the disturbance of this condition originates and at what point the regulatory mechanisms can no longer overcome system-wide disruption resulting in cessation of behavior (e.g. reduce exercise intensity or cease breath holding). Thus, as an entirety, the data supporting each unit of this project provides objective evidence that the human body is self-regulatory and that it can withstand and adjust to extreme relative changes to its internal environment.

Strengths and Weaknesses
The strength of this curriculum project is that it will provide educators and students materials that promote inquiry. Students will be required to analyze data sets and construct their own understanding of the concepts involved. This approach is consistent with the recommendations of the Vision and Change (2011), and many other policy documents aimed at improving life science education.

The major weakness of the materials, of course, is that students do not actually collect their own data; it is not a real lab. Students do not use lab equipment, and they did not design any experiment. Students learning how to use lab equipment to collect valid and reliable data is indeed important and is a critical component of any reputable program.

Conclusion
Like the anatomy and physiology POGIL project (link: http://www.cehd.umn.edu/phys/pogil/), our aim here is to provide materials for instructors who are looking for an alternative to traditional lecture by developing materials that promote guided inquiry. The final products should in no way be considered substitutes for traditional hands-on lab activities, but can promote inquiry in the traditional classroom setting.

As this project develops we will be looking for site testers. Interested parties should contact Murray Jensen at msjensen@umn.edu.

Reference
Laboratory Data Collection and Sharing Amongst Post-Secondary Institutions

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Abstract: In order to increase first-year anatomy and physiology students’ interpretation and analysis of data, we need to stimulate their interest. One approach could be to have students compare their own physiological measurements (e.g., EKG, lung volumes, hematocrit) obtained in lab to data shared by students from other institutions around the world. This pooled data would not only permit them to look at the effect of altitude on hemoglobin values, but also allow them to look at the effect of less common variables such as asthma or smoking on lung volumes, when normally there may be just a small number of subjects at their institution in these categories. This article describes how this student data can be collected and shared through the HAPS website.

Background:
For years I have heard many of my anatomy and physiology students say “I can’t do math”. This is usually accompanied by requests for a calculation of their interim grade. I inform them that they have their grades on tests and quizzes and they can look up the weighting of each on the lab syllabus. This is all they need to calculate the grade themselves. However, I end up giving a basic math tutorial on calculating percentages. The fear of anything mathematical is worrisome and it is not an isolated problem. Prior to the start of HAPS 2012 in Tulsa, Oklahoma, I participated in the Cyberlearning in Community Colleges (C3) workshop where this subject came up. We discussed ways of incorporating the Vision and Change (in Undergraduate Biology Education: A Call to Action) competency by applying the process of science into our classes, specifically interpretation and evaluation of data. We concluded that a first step with these reluctant first year students would be to find ways of increasing their interest in data collection and statistical analysis. The idea of students collecting their own physiological measurements (EKG, blood pressure, lung volumes, hematocrit, etc.) in labs and sharing this data with their cohorts from other colleges was suggested. We thought that students may be more invested in data analysis if they were comparing their own results to those of students their age and gender living in different locations around the world. Furthermore, sharing data might result in larger pools of data for under-represented groups such as male students, students of non-traditional age, smokers, asthmatics, and elite-level athletes.

Like many amazing ideas generated at conferences, this one languished for a while. I finally decided to get the ball rolling. I contacted the C3 workshop coordinator, Sam Donavon, with a proposal for presenting a workshop at HAPS 2013 in Las Vegas to further develop this idea. Along with my colleague at Okanagan College, Bruce Campbell, I presented a workshop entitled Laboratory Data Collection and Sharing Amongst Post-Secondary Institutions. As a group we discussed which physiological measures and demographic information should be collected by the students in their labs and the methods that should be incorporated to ensure confidentiality. The HAPS president at the time, Dee Silverthorn, was in attendance and she suggested that the data be submitted to the members only section of the new HAPS website.

Physiological Measurements for the Data Collection
The choice of physiological measurements incorporated into this data collection is based on the labs we run at our institution and suggestions from those who attended the HAPS 2013 workshop. Any type of physiological equipment may be used for data collection. There is a column for inputting the type of equipment such as Vernier with Logger Pro, BioPac, iWorks, etc.

- **Electrocardiogram** – heart rate, PR interval, P wave duration, QRS duration, T wave duration (before and after exercise)
- **Blood pressure** – systolic and diastolic before and after exercise
- **Respiration rate**
- **Lung volumes** – tidal volume, inspiratory reserve, expiratory reserve, vital capacity, FEV1, FVC
- **Demographic information** – age, gender, ethnicity, BMI, waist circumference, and others

(Continued on next page)
How to Record Class Data

All the information you need to participate in this activity is posted on the HAPS website. From the homepage select the Resources tab, then Teaching Resources and finally Lab Data. On this Lab Data page you can email me to receive unique templates for the spreadsheets you wish to use. Use these web-based Google Docs spreadsheets for recording class data by following the directions supplied on the Lab Data page. Periodically the data submitted by the various participating colleges will be “curated” or further examined for erroneous results and moved to an Excel file located on the Lab Data page. This Excel file of pooled date can be downloaded a used for statistical analysis.

Laboratory Data Collection Process

When we started to collect student physiological measurements at our college with the purpose of sharing the data, we were not sure how our students would feel about revealing some of their demographic information. Therefore, we made inclusion of some parameters (ethnicity, BMI, and weight) optional. We felt it was important to include age and gender, but in small lab sections this information could quickly single out individual students. The solution was to add these details at the end of lab after class data was presented and discussed with the group. To collect as much data as possible and to engage the students, students were required to upload their data to the Google Docs spreadsheet as part of their lab participation mark. To allow for anonymous data entry, I set up one computer at my desk for this purpose and this also afforded me the chance to scan their data as it was entered. Any erroneous values were quickly identified and students could check to ensure they submitted values in the correct columns or repeat the measurements if necessary. Values for lung volumes often deviated substantially from normal values. Students could also upload their data from their own computers as long as the instructor shared the link to the web-based spreadsheet.

Analyzing Class and Shared Data

Once all of the student data has been submitted to the spreadsheet, the instructor can examine it with the group to point out questionable results, calculate average values, and discuss any trends. Descriptive and inferential statistics could be applied to the class or curated data. Templates for these tests are included on the HAPS website courtesy of my colleague Erin Radomske.

How Can You Contribute to this Laboratory Data Sharing Process?

Besides uploading your class data to the Google Docs spreadsheets, you can also add your comments and suggestions to the forum found on the HAPS webpage dedicated to this Student Lab Data project. Please feel free to share any interesting findings and/or make suggestions for assignments utilizing this data.

http://www.hapsweb.org/?page=LabData
The mission of the Human Anatomy and Physiology Society is to promote excellence in the teaching of anatomy and physiology. That phrase is at the top of our web page, and we generally do a good job of working towards the goal. But there is one group of anatomy and physiology instructors who has been largely absent from HAPS conferences – high school teachers. To begin opening the door to that group of educators, the Fall Regional HAPS Conference in Minneapolis will make attempts to develop a program that will interest high school teachers as well as the usual HAPS crowd. The meeting will take place over two days, October 19 and 20, and we have already lined up some terrific keynote speakers:

Dr. Paul Iaizzo, Professor of Surgery and Director of the Visible Heart Laboratory (link: http://www.vhlab.umn.edu) at the University of Minnesota, will start off the conference with a historical look at medical innovation at the University of Minnesota. Dr. Iaizzo is in a unique position for this topic in that his lab inhabits the same space where Earl Bakken, founder of Medtronic, and his team developed the first pacemakers.

Dr. Cynthia Clague, one of Dr. Iaizzo’s former graduate students, will be our second speaker and will talk on “Anatomical Foundations of Structural Heart Device Design.” Dr. Clague is a biomedical engineer who works at Medtronic where she is the Director of Research and Advanced Technology.

On Friday night we will have HAPS’s own Dr. Kevin Petti give an after-dinner talk titled Anatomia Italiana: Art and Anatomy in the Italian Renaissance.

The conference committee is working on securing other keynote speakers to address topics such as best practices for teaching students who are English Language Learners and developing academic programs to promote more women and students from underrepresented student populations to pursue careers in science and technology.

Workshops at the conference will feature topics such as cooperative learning, POGIL, and a roundtable session where instructors can share their favorite lab activities. One unique workshop already scheduled will feature material engineers from a local company, Stratasys, who will bring in a three dimensional printer and show how they “print” anatomical structures using real clinical data.

The conference will be taking place at Eastview High School, a large suburban school in Eagan, MN, which is about a 10 minute drive from the Mall of America. The school is providing us access to the science labs, auditoriums, and even their large cafeteria where we will have ample space for vendors and social functions.

Our goal for this meeting is to provide a program of speakers and workshops for anatomy and physiology educators from all realms of academia, and also provide ample time for informal conversations. So while this is a “regional” HAPS conference, we invite educators from everywhere to join us in Minneapolis this fall.

For more information on this conference, contact Murray Jensen

mjsjensen@umn.edu
Springfield College sponsored the Human Anatomy & Physiology Society Eastern Regional Meeting on 3/15/2014 which drew approximately 75 attendees from numerous colleges from the East coast. The meeting provided an opportunity for A&P faculty to share and compare ideas for teaching as well as for vendors to present new software and textbooks to supplement the traditional instructional methods. Earlier this year, HAPS taskforce on Laboratory Learning Outcomes had conducted an Online survey of instructors for undergraduate-level courses in human anatomy and physiology for the nursing and allied health students. Preliminary data on HAPS Laboratory Instructor Survey was presented during one of the workshop sessions. Multiple workshops included infusion of new and cutting edge technology in classrooms using special equipment sold by various vendors. Certain schools are providing iPads or other tablets to all entering freshmen students. To address that new trend, one of the workshops included lots of free resources on teaching anatomy and physiology with the ipad.

Many faculty were new to the HAPS organization and appreciated the time to attend the meeting while networking with other HAPS members. Faculty members included Jeannette Hafey, Hai Kinal, and Dustin Vale-Cruz from the Biology/Chemistry Department, Elizabeth O’Neill from the Department of Exercise Science and Sport Studies, and Kathleen Pappas from the Physical Therapy Department, all of whom collaborated to bring their expertise in the form of planning for the 13 workshops, presenting workshops.

The first Update Seminar speaker was Dr. Samuel Headley, Professor of exercise Science and Sport Studies at Springfield College. His talk, “The Impact of Exercise on Chronic Kidney Disease”, described some of the research that he has done with patients who suffer from chronic kidney disease caused by hypertension and diabetes. His results show that moderate intensity aerobic exercise is well tolerated in the CKD population and there are hints that there are beneficial changes to endothelial function. The second Update Seminar was presented by Dr. Martin Kluger, research scientist from Yale University School of Medicine who presented the topic “Endothelial Cell Structure and Function in Vascular (Hyper-) Permeability”.

Dr. Elizabeth O’Neill presented a workshop entitled “Experiential Learning of A&P Through the Use of Exercise Science”. She led students in a demonstration of Exercise Science related assessments utilizing BOD, POD, EMG and Metabolic Cart. Dr. Kathy Pappas led a workshop in the cadaver lab entitled “Respect, Dignity and Chemicals? Considerations in the Human Anatomy Lab”. Dr. Gina Semprebon, from neighboring Bay Path College, presented a workshop entitled “How Forensics and Comparative Anatomy Offers a New Dimension to Learning Osteology” in which she described a technique for including anthropology and comparative & evolutionary anatomy as well as forensics into skeletal anatomy labs to make labs more interesting and interactive. To address the trend towards the use of apps in the classroom, one of the workshops included demonstrations as to how these apps are applicable in teaching anatomy and physiology.
Update from the Marketing Committee:
by
Prof. Elizabeth Hodgson, M.S.
Nuclear Medicine Technology Coordinator
Radiography Coordinator
York College of Pennsylvania

I have been the Marketing Chair for just about a year having previously chaired and co-chaired the Membership Committee for four years. During the Annual Meeting in Las Vegas in May 2013, the Board of Directors recreated two committees, the Marketing Committee and the Membership Committee, and created a new committee, the Communications Committee. While these committees have separate charges, they work closely to increase the exposure of HAPS to other A&P educators, increasing membership while keeping the message or “brand” of HAPS consistent. In order to do this, the Marketing Committee uses Twitter to market the Annual and Regional Conferences, HAPS-I courses, HAPS member accomplishments, and other events associated with the “Happenings” of HAPS (follow us on Twitter! @HumanAandPSoc).

Since this is a fairly new committee, we are interested in recruiting members to help market HAPS and we are interested in new ideas in order to do this! If you have ideas, had previous experience with PR, and would like to join this committee, please email me, Elizabeth Hodgson, at ehodgson@ycp.edu. We’d love to have you!

Update from the Communications Committee:
by
Wendy Riggs
wriggs@hapsconnect.org

The Communications Committee is helping HAPS establish its voice in a technological landscape shaped by social media. We are a relatively new group and work closely with the Marketing Committee to facilitate connections within HAPS as well as recruiting potential members via social media.

I am excited to be the new chair of the Communications Committee. I inherited this position from Pat Bowne, who continues to offer amazing perspective and advice. I am honored to contribute to the Society that has been so profoundly supportive of my own growth as an educator and professional.

If you’re interested in helping us share amazing things about HAPS with the world, consider joining the Communications Committee. There are many easy ways to help! I’d love to grow an army of social-media-savvy HAPSters to promote HAPS on Facebook, Twitter, LinkedIn, and the HAPSblog. Your participation could be as simple as “liking” updates on Facebook or re-tweeting HAPS tweets. If you wanted to put in a little more effort, you could help write Facebook updates and tweets. And if you’re really ambitious, you could even help compose posts for the HAPSblog.

Participating in the Communications Committee is a great way to learn more about HAPS and support its growth and sustainability.

Please contact me (wriggs@hapsconnect.org) if you want to join the Communications Committee. We have lots to share.
Forgotten Student Profile #443

NAME: John Mills
AGE: 19
HOMETOWN: Port Townsend, WA.
LONG-TERM GOAL: Registered Nurse
PROBLEM: Poor & failing grades due to expensive textbooks he couldn't afford
SOLUTION: OpenStax College - free online textbooks

Forgotten no more...because OpenStax College understands. We improve access by offering free textbooks and learning resources for your students. Texts like Anatomy and Physiology—a two semester textbook organized by body system, including links to external learning tools that address critical challenges in the course.

Written by recognized faculty, and peer-reviewed by college instructors nationwide, this free online text meets standard scope and sequence requirements. It's also fully customizable, available in print at low cost and free online.

Visit OpenStaxCollege.org today to see how you can adopt, adapt, or recommend this textbook to help your students. OpenStax College texts are now in use at over 350 schools, have been downloaded more than 300,000 times, and viewed more than 2.5 million times.

EDU-Snippets: Student Built Snippets

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

Roberta M. Meehan
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Edu-Snippets@hapsconnect.org

EDU-Snippets is a column designed to let you, the members of HAPS, share your “ways to make sure your students get it.” Since EDU-Snippets began, our members have been continuously amazed at how many teaching and demonstration ideas pop up and are easily transferred from one instructor to another through Snippets. This edition is no exception. Hopefully you will be able to utilize what our colleagues have submitted. Hopefully, too, some of the ideas presented here will spur you on so that you can either make alterations to fit your own needs or spark your imagination so that you can come up with your own Snippet idea, which you can then submit for publication.

As a fitting follow up on our last edition, this issue of EDU-Snippets continues with the hands-on theme for working with some very basic foundational concepts – concepts that traverse much of anatomy and physiology. While each of the exercises presented here was initially designed for introductory college courses, all of these ideas can easily be modified or adapted for middle school, junior high, or high school classes. This is a good selling point for your college students with children in various other educational settings. Also, if you have students in advanced (or even graduate) classes, these projects can be modified or upgraded for them too! EDU-Snippets encourages you to take these ideas and run with them!

I. Snippet News

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

II. Modeling Snippet

Janice Fritz (St. Clair County Community College, jfritz@sc4.edu) thought about some of the problems connected with student-built models and she came up with a unique solution. This solution could be modified to work well in numerous situations.

Having students build models gets them actively engaged in learning structures, but I have found that many students are more interested in making a copy of a figure or of another model to suit me rather than in actually learning the identities, locations, and interactions of the structure. The question so many ask, “Is this what you want?” becomes nearly as annoying as the age-old inquiry, “Is this going to be on the exam?”

My new approach requires students to critique each other’s models. The students complete a good deal of the work on their models on their own time and we use class time for the critiques. Times vary with the system, region, or body part(s) being studied. I provide a list of the structures that should be on the model and the reviewing students must identify each structure and make any appropriate suggestions for improvement. By the end of the activity, the students have identified the structures on a variety of different models with much more attention to detail than they had used when making their own models. After the critiques are complete, I give the students some time to improve their models before turning them in to me.

(Continued on next page)
Now modeling is not about what I want. It is about learning the structures by building a model that benefits their fellow students. This method also works well when groups of students build different parts of a model. Critiquing each other’s work makes sure everyone is familiar with the whole.

III. Selfie Snippet

Meanwhile, Christine Boudrie (Lourdes University, cboudrie@lourdes.edu) decided to utilize social media technology to enhance the students' understanding of facial musculature. This tool might well have other educational applications.

I have co-opted the contemporary practice of snapping a ‘selfie’ for the purpose of promoting engagement in the learning of facial muscle A&P. Students have easy access to camera phones and gravitate to this technology. Photographs of their own faces provide a convenient canvas to identify, label, and name muscles acting synchronously to produce a variety of facial expressions.

Here are the project instructions:

1. PAPARAZZI PHASE:
   You need TWO close-up photos of YOUR beautiful face!
   Take two pictures of yourself – or have someone take them for you – with your cell phone.
   *You’ll need to see your face and neck clearly!
   *Assume a different bold expression of some kind in each photo (your choice, but can’t be ‘vanilla’!)
   Print off your photos in color.
   Affix your photos to a larger piece of white paper.

2. VIRTUAL DISSECTION PHASE:
   Head to your A&P text and lab manual.
   Look up and label ALL the muscles that are active in your face to produce the two different bold expressions you are wearing.

Use a ruler to draw neat, clear label lines from your photos to the white paper behind the photos.
Write your muscle labels on the white paper.

3. ANALYSIS & APPLICATION PHASE:
   Next to each muscle name, write in parentheses the meaning of the muscle name.
   Referring to the vocabulary in your text place the ▲ symbol next to the name of the prime mover(s) for the expression in each photo. Place the ● symbol next to the names of the synergists for that expression.
   Provide a key on your paper that explains what those terms mean.

4. FOLLOW UP:
   Projects can easily be displayed on a bulletin board in the classroom, the laboratory, or a convenient hallway. For privacy reasons, some students may choose to opt out of showing their work.

IV. Blood Vascular Snippet

Hilary Engebretson (Whatcom Community College, hengebre@whatcom.ctc.edu) came up with a great idea to help students understand cranial vasculature. Again we see an idea that can be adapted as a hands-on tool for countless situations.

My students struggle with the blood vasculature to and from the brain, especially in naming the bony markings of the skull that can be used as landmarks to trace that vasculature. I developed the following exercise as a way for students to practice naming the relevant markings and three dimensionally mark out both the arterial supply into the skull and the venous drainage from it.

**Blood vasculature of the skull exercise**

**Arterial supply:**
I give each group of students several red 12-inch pipe cleaners. In addition, I give the students a skull to work with. It should be noted that unless you have very good skull models, the carotid foramen will be a dead end and the carotid canal will not be a true passageway. We use our real skulls for this exercise so that students can actually use the carotid foramen and carotid canal to create an arterial supply that enters the cranial vault. I allow the students to use their textbooks as a guide to bend the pipe cleaners and form the path of the internal carotid arteries. I go to each table and have the students name the bony landmarks along this path: carotid foramen → carotid canal → superior aspect of the foramen lacerum.

If the students are ambitious, I also have them construct the vertebral arteries and their pathways to meet the internal carotid arteries at the circle of Willis.

**Venous drainage:**
I give each group of students several blue 12-inch pipe cleaners and a skull. For this exercise, even a simple model skull will do. I have the students start by creating the superior sagittal sinus, diverging it into the two lateral sinuses, and then building the sigmoid sinuses, which leave at the jugular foramen. I go to each table and have students name the sinuses and bony sulci along the pathway.

V. Nervous Snippet

Anne Geller (San Diego Mesa College, ageller@sdccd.edu) discovered a very interesting solution to a problem many have faced to a greater or lesser extent in most of our classes. Sometimes toys aren’t just for kids!

I teach a one-semester A&P course (with no prerequisites) and a one-semester anatomy course. In the A&P course especially, I find students appreciate simple visual analogies to help them understand the A&P concepts. When I teach the nervous system, I use a stack of Lego® blocks to represent the (Continued on next page)
structure of the spinal cord. Each Lego® represents a spinal cord segment, and as they stack on top of each other, they create a column; 31 Lego® pieces = 31 SC segments, that must “fit” between the foramen magnum and L2 within the vertebral canal. I often tape some pipe cleaners to some of the segments to represent the dorsal and ventral roots (using two different colors to illustrate sensory and motor axons), which can then unite at the IVF to create a mixed spinal nerve. Finally, I can even create a very simple conceptual understanding of a nerve plexus by twisting some of the pipe cleaners from a few levels around each other to illustrate the basic idea of a plexus.

To explain tracts within the spinal cord and the concept of sensory and motor pathways, I use the analogy of escalators in a department store. (I grew up in New York where the Macy’s in Herald Square has seven floors!) You have up escalators (ascending sensory tracts), and down escalators (descending motor tracts) built into the building structure. And just like the escalators in Macy’s, if you get on one, you end up in a very specific department. (This is like ending up in particular place in a particular thalamic nucleus, resulting eventually in the interpretation of a particular sensation via an “escalator” to the primary sensory cortex department.) Another toy that comes in handy during nervous system discussions is the yo-yo. I use this as a visual analogy to represent the structure of the thalamus. Since most standard brain models show the thalamus primarily as a sagittal section, it is sometimes difficult to understand the organ’s three dimensional shape. Enter the yo-yo, with each half representing either the left and right thalamus and the dowel going across the middle representing the interthalamic adhesion (intermediate mass). The space where the string wraps represents the area where the third ventricle is located.

Each of these “toy stories” can be used as a teacher-lead demonstration and that can be followed by student explanations, student projections, and countless imaginative follow-up ideas.

VI. Snippets with a Mechanical Advantage

Andrew Petto (University of Wisconsin Milwaukee, appetto@umw.edu) promised to send another interesting and informative Snippet. He certainly did not let us down with this very innovative way of helping the students understand the principles of mechanical advantage.

Our A&P students should have learned in high-school physics about levers and the relationship between the length of the lever arm and the relative magnitudes of the forces applied versus the forces produced. However, it is often difficult for A&P students to apply these in the real world … and often even more difficult to apply them to the actions of the musculoskeletal system.

We use a guided inquiry exercise to have students begin with familiar concepts and then apply those to the issue of mechanical advantage in the movement (or resistance to movement) in the joint-link system of the skeleton.

We distribute a meter stick and several mirror clips to each team of students in the lab. Their task is to “balance” the meter stick on one mirror clip (which most intuitively will place at or near the middle). This is the fulcrum (slight inconsistencies in the meter sticks or the mirror clips will mean that the fulcrum will be near, but not always exactly at, the 50-cm point) then we call the distance from their location to the fulcrum the “effort arm,” and the distance from the fulcrum to the other clip(s) is the “resistance arm.”

In the next exercise, students are making similar measurements on articulated skeletal materials, models, or diagrams and asked to relate these to their observations with the clips-and-meter-stick models.

We combine this activity in lab with an interactive problem set in lecture. If you are interested in either the lab or lecture activity, please write for details.

(Example of mirror clips we used can be found at http://www.enasco.com/product/SB28855M).

(Continued on next page)
VII. And We Hope You Will….  
Keep those cards and letters coming (right to our new address)! Thank you all for your EDU-Snippet contributions. The influx of Snippets has been good! Please keep it up because more are always needed! Your ideas are tremendous! If you have thoughts or ideas, or any other interesting ways – any inspirations at all, great or small – to help our students understand anatomy and physiology, EDU-Snippets would love to hear from you! Once again, EDU-Snippets encourages new submitters to submit – and regulars to keep on contributing! I would think that some of the super discussions lately on the HAPS-L list ought to generate some great Snippet ideas for your own lecture or lab. If so, please share them with us.

For the next issue of the HAPS-Educator, send your EDU-Snippet experiences and ideas to Edu-Snippets@hapsconnect.org as soon as possible. You will also find a reminder on the HAPS-L list. Plan ahead. You can even submit your ideas now and maybe next issue you too will see your EDU-Snippet in print!
ANIMAL USE
Nicholas Despo, Chair
Thiel College
Greenville, PA
724-789-2067
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Distributing the HAPS policy statement, developing animal use Internet links on hapsweb.org, monitoring relevant legislation, and creating a resource packet for HAPS members.

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Click here to visit the HAPS committees webpage.