FY08 Innovations in Teaching with Technology Awards: Incorporating CT-based Technology in Undergraduate and Graduate Instruction in Human Evolutionary Studies

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<th>Proposal Title:</th>
<th>Incorporating CT-based Technology in Undergraduate and Graduate Instruction in Human Evolutionary Studies</th>
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| Department(s): | Anthropology |
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The field of biological anthropology is increasingly relying on computed tomography (CT) technology in many aspects of research. At the same time, very few biological anthropology programs across the country have the ability to formally train their undergraduate and graduate students in CT technology and its myriad applications to the study of human variation and evolution.

The goal of this project is to develop a training program in CT technology to be taught as units in two, existing upper-level undergraduate lab courses, Human Evolutionary Anatomy (113:169:001) and Human Osteology (113:190:001). This will be accomplished by establishing an Osirix Medical Imaging Software workstation designed for the navigation and visualization of two-dimensional and three-dimensional anatomy from CT scans as well as other imaging modalities (e.g., MRI). This workstation will serve as both core lecture and practical exam evaluation tools, and will also significantly enhance the research practicum opportunities for both undergraduate and graduate training commensurate with the skill sets at leading research institutions.

Students will learn how to accurately interpret anatomy from a CT scan, including internal structures not accessible otherwise, and will more readily master the complex relationship between skeletal and soft-tissue anatomy. These course units will also help guide students as they learn CT scan data collection procedures. These will include both the collection of standard osteometrics as well as the collection of three-dimensional coordinate landmark data. This will then be used to introduce students to
the application of advanced quantitative methods that rely on CT scan technology including the analysis of complex shapes and biomechanical properties.

The proposed Osirix work station will further serve to enhance current course material. For example, while the study of the internal structure of bone is important in human osteology courses, it is difficult to examine internal structure in sufficient detail in lieu of CT technology as it requires the destruction of skeletal specimens. This project will allow the internal structure of bone to be studied in detail by our students without harming our extensive (and irreplaceable) human skeletal collection. This significantly enhances the value and training impact of an existing and singular resource.

As biological anthropology enters the 21st century, there is a clear division between the educational foundation students receive and the necessary research tools and methods that are now commonly employed in sophisticated research. As such, many undergraduate students trained in biological anthropology in the U.S. do not have the full suite of skills necessary for conducting high-end research at the graduate and professional level. Lecture and lab instruction in CT technology using the Osirix workstation will provide undergraduate and graduate biological anthropology students at the University of Iowa with a unique educational opportunity found at few universities. Furthermore, our graduate students are increasingly incorporating CT technology as part of their graduate training. Currently, they must rely upon the schedules and good will of other departments, such as Biomedical Engineering and Radiology in order to learn these skills. This is currently a clear impediment to effective training.

The ability to accurately interpret three-dimensional anatomy from a two-dimensional surface is, in and of itself, a valuable skill that one cannot obtain simply though the study of actual anatomical specimens. The addition of a CT-based approach will afford students significantly enhanced opportunity to study the complexities of anatomy and learn the necessary techniques for data collection needed to address more advanced research questions. A permanent CT workstation would ensure that students have the time necessary to become confident in their ability to navigate through a virtual reconstruction of the human body.

Furthermore, a CT-based approach will provide students with the ability to examine in detail the relationship between the skeleton and surrounding soft-tissue. While skeletal material is normally used in biological anthropology courses the skeleton alone does not provide students the ability to understand the precise nature of the relationship of musculoskeletal and other soft-tissue anatomy. CT scans can be virtually dissected repeatedly so that students may appreciate the nuances of human anatomy that can normally be achieved only through the dissection of multiple human cadavers, a resource with extremely limited access.
Osirix Medical Imaging Software is freeware developed, in part, with Apple Computers and therefore will run only on a Macintosh computer running MacOS X. Thus, we are seeking a MacPro computer that is capable of running this computationally and visually demanding software, as well as one that provides enough storage space for large CT scan files. The specifications of the computer are based, in part, on the recommendations of the developers of Osirix as well as ensuring that this workstation will remain viable for years to come.

Computer Specifications
- 1) MacPro computer
- 2) Dual 3.0 GHz Quad-Core Intel Xeon Processors
- 3) 16 GB Ram
- 4) Dual HD 30” Flat Panel Displays

To include the Osirix workstation in course lectures we are also seeking an Epson Powerlight 1705c LCD projector. This projector will provide high resolution images from a flat panel display to a large screen necessary for teaching the details of skeletal and soft-tissue anatomy in a larger classroom setting.

Rough estimate of costs

The estimated cost of the project is:

1. Osirix Workstation: $16,500.00
2. Epson Projector: $1500.00

Total: $18,000.00

IT Support Information