

Moving Beyond Vesalius: New Approaches to Anatomy Education

by Mark Willis

Keeping pace with the ever-expanding knowledge base in the biomedical sciences is a challenge for medical students and faculty alike. Teaching time in the medical school curriculum cannot expand as quickly. The anatomy faculty at Wright State University School of Medicine have met the challenge by completely re-structuring the first-year gross anatomy course. Their innovative strategies for packing more learning into the same course schedule include the use of an interactive computer program designed at Wright State and the anatomic images of a convicted murderer from Texas -- a.k.a. the Visible Human.

Beginning the first day in medical school, the anatomy course traditionally has been a student's introduction to the rigors of medical education. It has been taught much the same way -- with large group lectures and dissection of human cadavers -- since the time of Vesalius, the Renaissance physician who wrote and illustrated the first anatomy textbook. Until a year ago, Wright State's anatomy course followed the traditional pattern. The 90-student class met either in the lecture hall or the dissection lab, where students worked in groups of four.

Last year the course was re-structured to minimize didactic lectures and maximize small group interaction and problem solving. "We're trying to make the most of the time allotted to anatomy in the curriculum," explains Gary Nieder, Ph.D., associate professor of anatomy and course director. "We started by reducing the number of lectures by two-thirds."

Laboratory time now is divided into three types of activities. Whole dissection of the human cadaver remains the foundation of the learning experience. Teams of six students are assigned to a cadaver for the duration of the course. Two of the six work in the dissection lab in rotation every third day. Each day's dissectors are responsible for teaching what they learned to other team members.

"When students worked in groups of four in the past, there was always the issue of who will actually dissect and who will just watch. Now everyone gets the same hands-on experience, and it's a more effective use of the lab time," says Frank Nagy, Ph.D., associate professor of anatomy.

While one-third of the class works in the dissection lab, another third participates in small group discussions led by Drs. Nagy, Nieder and Jane Scott, Ph.D., associate professor and chair of anatomy. Each professor works with a group of 15 students to provide intensive instruction on complex topics. “The groups are small enough that we can have effective visual demonstrations using prosection material and models,” Dr. Nieder says. “It’s more faculty-intensive than providing one big lecture, but we can have more problem-solving interaction with questions and answers among the students.”

While their classmates work in the dissection lab and small groups, the final third of the class can make use of self-directed study time through computer-based learning and evaluation. The School of Medicine’s computer lab contains 20 work stations equipped with an interactive computer program developed by Drs. Nieder and Nagy for the gross anatomy course.

“Beyond Vesalius,” as it is called, is designed to teach cross-sectional anatomy. This perspective of the human body was unimagined by Vesalius and other early anatomists, whose elucidation of three-dimensional anatomic structures led to the advances in visual perspective of the human form in Renaissance painting. Today, however, the cross-sectional perspective has become fundamental knowledge for physicians when they interpret CT (computer tomography) scans produced by cross-sectional imaging of the body.

“Cross sections are hard to learn, and they’re expensive to obtain,” Dr. Nagy says. “A lot of medical schools don’t offer the cross-sectional approach. But as diagnostic imaging advances, how we teach anatomy must change, too.”

“Beyond Vesalius” includes photographic images of 110 cross sections of a male human cadaver, together with corresponding CT images. They were selected from a digital cadaver known as the Visible Human, which is comprised of 1,700 cross sections stored in 15 gigabytes of computer memory. The Visible Human project was developed by the National Library of Medicine (NLM), and its images are distributed over the Internet for NLM-authorized projects by medical researchers and educators.

The cadaver now preserved in cyberspace was frozen in gel and sectioned from head to foot at one-millimeter intervals. By comparison, embalmed human cross sections preserved in plastic are typically 1.5 to 2 inches thick.

“The anatomic detail in those sections is extraordinary,” Dr. Nagy says. He explains that what the NLM makes available are “raw images” of the sections -- no structures are identified. Dr. Nagy labeled the sections used in “Beyond Vesalius” and prepared text boxes that explain key features of each labeled structure. Dr. Nieder constructed the computer program’s interactive functions.

“Beyond Vesalius” enables computer users to navigate throughout six regions of the body ranging from the head to the extremities. The computer screen can display a section’s photographic or CT image, which also can be compared side by side. The images can be viewed with or without labels and explanatory texts. The computer user can test his or her knowledge of each section by selecting the program’s self-testing mode, which highlights various structures for identification and poses sample test questions.

Questions about cross-sectional anatomy now comprise 20 percent of the evaluation for the gross anatomy course. Computer images from “Beyond Vesalius” are used during tests. As a result, Dr. Nagy says, “The students’ comfort level with cross sections is higher than it’s ever been before. Everyone comes away with a better understanding of interpreting CT scans.”

Internet browsers can view an interactive demonstration of “Beyond Vesalius” at Wright State University School of Medicine’s World-Wide Web (WWW) site. The Internet address is: <http://www.med.wright.edu/som/academic/anatomy/beyond.html#beyondvesalius>.