TRANSFORMING INSTRUCTION

An Integrative Course in Cell Biology, Histology, and Pathology for First-Year Medical Students

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PURPOSE
The challenge facing basic science teachers of first-year students is illustrating the relevance of basic material to clinical medicine. We sought to design an integrative course that would introduce, early in the curriculum, the link between healthy cellular structure and function and mechanisms of basic pathologic processes. This introduction of disease as the systemic response to perturbed normal physiology has always been an effective teaching tool in systemic physiology courses. Our plan was to develop that mindset in students at the outset of their course of study.

METHODS
A new 5-week “Cellular and Pathologic Basis of Disease” course was designed that followed a “Medical Anatomy” course in which students often observed structural evidence of disease processes in their cadavers. This subsequent course covered topic areas in general pathology (e.g., ischemia, infection, neoplasia, inflammation) in the context of basic histology, introductory biochemistry and pharmacology principles; cell structure, organization, and function; and cell signaling. While lectures and small-group learning sessions were included within each subject area, the course also contained unique integrative features. At the course beginning, students were given three clinical cases. Different aspects of these cases were sequentially referred to and discussed by lecturers and small-group instructors as the course progressed. Normal tissue structure and function were presented at the beginning of the course, followed by topics in biochemistry, molecular biology, cellular biology, and general pharmacology. At intervals, pathology facilitators conducted workshops where the students completed sets of computerized, case-based, multiple-choice-format, learning exercises in practical pathology. Students were able to apply what they learned to make diagnoses, draw clinical implications, recommend therapeutic interventions, and appreciate the molecular mechanisms of disease.

RESULTS
Customized course materials were created by a collaborative team that included basic scientists with expertise in histology and cell biology and clinical pathologists. Additional special course-learning aids included virtual microscopy images that specifically demonstrated both normal and abnormal tissue structure. The integrative clinical case studies with images of pathological specimens and case-based questions further strengthened the link between the cell physiology material and the pathological process. The approach of repeatedly returning to these three clinical cases during this course served as a terrific platform for student learning. For example, when introduced to the cases during the initial, structural material in the course, students recognized connections between cell type and cell function. As the course progressed to considerations of cell death and the relationship of the cell-cycle stage to disease processes, the case studies led to an appreciation of process. Later, the students reconsidered structure and came to understand why diseased tissue took on the appearance it did.

CONCLUSIONS
This new integrative course improved medical students’ mastery of basic principles and their understanding of the important links among the structural organization of cells and tissues, their function in normal physiological contexts, and their dysfunction in disease states. This immediate link between basic concepts and disease processes enhanced student interest and focus. It is hoped that this approach will challenge students to begin to seek such links in subsequent first-year course work by making it clear that the basic science courses serve an important role in students’ ability to understand human medicine and are not simply a final “hurdle” to clear on their way to the study of medicine.

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