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●特別講演

Clinical Anatomy for Health Care and Medical Education in the 21st Century

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Introduction

Rapid changes in both science and society in the United States in recent years have changed the emphases in both health care and medical education. Not all of these have been for the better, and both the education of health professionals and care for their patients have been substantially compromised. My purpose is to review these trends and to outline approaches to both medical education and health care that support genuine education and patient care. At the center of this proposal is the fact that anatomy is the structural basis for life, that teaching/learning anatomy involves understanding multidimensional, spatial data and that clinical anatomy is the bridge between the student/practitioner and the patient. My hope is that, by reviewing how education and health care have been recently compromised in the United States, other societies can avoid our mistakes.

The foundations for health care in the 21st century will undoubtedly be built upon the following: human genome data, advances in imaging, advances in surgery, advances in immunology and a broader view of health beyond treating disease. The sequencing of the human genome provides new opportunities to apply this information to human health and disease. Advances in real-time imaging of patients before, during and after treatment have opened new vistas for computer-assisted radiology and surgery, adding a 4th dimension (time) to the 3-dimensional human body. The unique cellular and molecular specificities of immunology open new avenues for understanding and using the precision of host defense mechanisms. Finally, health, not just the absence of detectable pathology, will be understood in a broader context, including life style with emphasis on maintenance of health and prevention of disease[21].

The foundations for medical education in the 21st century will still be learning how to take an effective history, to perform a physical examination, and to perform diagnostic and therapeutic procedures with minimal risk and maximal benefit for patients. In addition, medical education will be expanded to address the broader understanding of health described above.

Because patients are 3-dimensional objects, understanding their health and care requires spatial knowledge and wisdom, the hallmark of clinical anatomy. Thus, clinical anatomy is the key to effective health care and education.

Two developments in medical education in the U.S.

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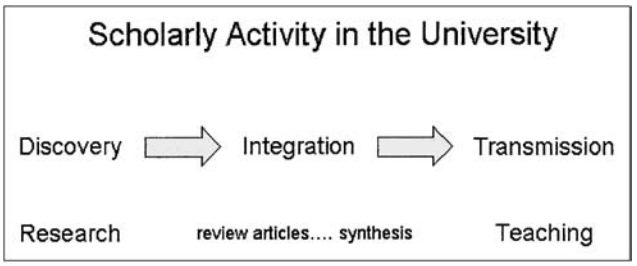

Fig. 1 Balanced scholarly activity in U.S. medical schools up to the 1960's.

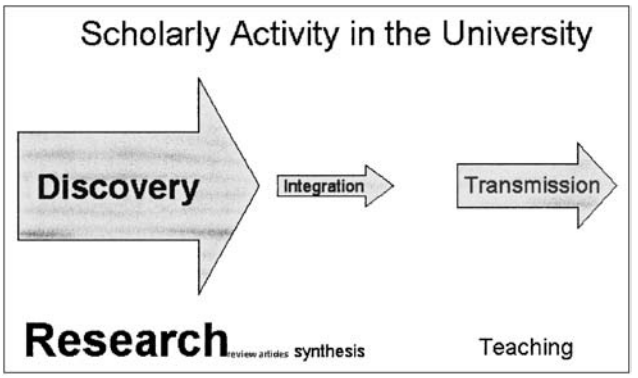

Fig. 2 Trends in the rewards for scholarly activity in U.S. medical schools since 1970.

have compromised its effectiveness. First, to make time for new information, curricular time for older disciplines, including anatomy, have been drastically reduced. As a result, students know more about molecules than tissues, organs or patients. Second, the ultimate importance of a faculty member's research funding has caused the scholarly activity in universities (Fig. 1) to effectively stop with the discovery of new data, leaving its integration and transmission to the universities' new second-class citizens, teachers (Fig. 2). Details can be found in the following[4,5,6,7,13,16,23,26]. Health care in the U.S. has been paid largely by insurance which has traditionally been a fringe benefit of employment, not of citizenship. This insurance system has been progressively reduced in both depth and breadth and increasingly taken over by "for profit" health care companies. The result has been the widespread application of business principles[9] to both health care[15] and education[25]. This has produced a health care system focused on disease treatment driven by profit not care, and medical education focused on research funding not true scholarly activity. These two entities have come to exist primarily for profit, not for patients or students.

Thus, the safe, efficient application of current and future technologies in health care has become increasingly difficult because of poor preparation in learning and using 3-dimensional (spatial) data. This, in turn, has resulted from reductions in curricular time devoted to the key spatial data about the human body (including dissection), our ignorance about the basic principles of learning complex spatial data and the devaluation of teaching. To summarize, health care and medical education are built upon the acquisition, verification and use of 3-D data. Anatomy courses are the unheralded early sources of 3-D data in medicine. Finally, business principles in health care and medical education[13,16] have shifted resources from patients and students to stockholders and research, compromising both the health of patients[2] and the education of students[7]. Not only are we unable to efficiently apply current technology to health care but we will be increasingly incapable in the future, without drastic changes.

Reconnecting health care and medical education for patients and students will require significant changes.

1. Healthcare must become universally available, not tied only to employment. A society that values its citizens will also value their health, broadly defined.
2. Teaching must be restored to its place in scholarly activity, the heart of university life (Fig. 1). This requires an academic integrity that is not subservient to business/profit motives and a commitment to academic duty[13].
3. Teachers must be students of learning, including understanding our multiple intelligences[8]

and the relevant connecting of facts[3].

4. Teachers of anatomy must be masters of learning and teaching spatial data. Currently, we know that learning 3–D data requires a perception of spatial data, forming one's own imagery of these data, and testing the validity of one's reconstructed image. Furthermore, learning and using these data increases geometrically with increasing complexity, requires considerable time, and occurs predominantly in the right side of the brain[19]. Learning more about how we learn/teach spatial data will be a prerequisite for any informed curricular change.
5. Medical education must acknowledge the abundance of information available on-line. However, the cyber university with integrity will use these resources as a means of responsible and responsive education, always assuring the accuracy of information, the quality of interactions on-line, and the effectiveness of various means of instruction[17].

Anatomy has long been a foundational science in medical education and practice. Recently, these two facets of anatomy have been united under the term clinical anatomy. The increasing development of technology capable of displaying real-time images of patients has underscored the key role of clinical anatomy in both health care and education[18]. Demand for the spatial data about the human body that only anatomy provides will undoubtedly escalate in the 21st century. Thus, the importance of clinical anatomy in both education and research can only grow. I salute and thank the Japanese Research Society of Clinical Anatomy for leading the way in clinical anatomy research (as illustrated by the following variety of studies published in Clinical Anatomy[1,10,11,12,14,20,22,24]) and look forward to their leadership in the 21st century.

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