An increased emphasis on skills in both medical and graduate education in the USA

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Aspiring educators have to understand the forces shaping the teaching and learning process in order to become effective instructors. In the USA, those forces include an increased emphasis on integration, self-directed learning, and using the educational process to develop professionals. These changes are only the most recent in over a century of educational evolution.

In the 20th century, physiologists in the USA embraced the changes recommended in the Flexner report emphasizing the scientific underpinnings of medical instruction. In the first half of the 20th century, the link between bench physiology research in the laboratory and the improvements in clinical care was immediate and obvious. By the late 20th century, physiologists placed a greater emphasis on the knowledge fund necessary for the intelligent practice of medicine, and participation in research was no longer a required activity for many future physicians[1]. At the turn of the 21st century, preclinical medical physiology instruction focused primarily on teaching and assessing the knowledge fund of the aspiring physicians. A joint project of the American Physiological Society and the Association of Chairs of Departments of Physiology codified this knowledge fund, and 2001 published the "Medical Physiology Learning Objectives"[2].

USA medical education in the late 20th and early 21st centuries also saw a shift away from discipline based educational approaches to those that emphasized organ systems, and/or those where students actively set their own learning goals[3]. In this new integrated curriculum model, physiologists were challenged to identify their role based on organ system expertise rather than as physiologists. Currently, many schools have settled on some form of hybrid curriculum[4], where lectures, laboratories, and student directed small group sessions such as problem based learning approaches are intertwined, with each teaching approach being used for its particular pedagogical strength.

During this time, medical education was also reconciling the marked difference between the activities occurring in undergraduate medical education and the expectations of the medical residents in their graduate medical education. Undergraduate medical education emphasized primarily knowledge. In contrast, the education of residents (post-graduate medical students) is assessed around the 6 core competency domains of the Accreditation Council for Graduate Medical Education (ACGME), only one of which emphasized knowledge[5]. Most USA medical schools have migrated that framework into the undergraduate medical curriculum, creating in theory a seamless educational experience. This

Table 1. A comparison of North American Competencies and Skills for Physiology Educators [5, 9, 10, 11]

	USA Graduate Medical Education (ACGME)	CanMEDS 2005 Framework (Medical Education)	Graduate Physiology Education (APS)
What you know	Medical knowledge	Scholar	Core biomedical science knowledge
How you act	Professionalism	Professional	Professional ethics
What do you do	Patient care	Medical Expert	Laboratory related skills
			Research and analytical skills
How you interact with others	Interpersonal and communication skills	Communicator	Communication skills
		Manager	Personnel and management skills
			Teaching and mentoring skills
How you work within the system	Systems based practice	Health Advocate	Career development skills
How you get better	Practice-based learning and improvement	Collaborator	Lifelong learning skills

shift toward competencies presented a unique challenge to physiology instructors who emphasized only knowledge.

Competencies are the knowledge, skills, or attitude that enables an individual to learn and perform in practice and to meet or exceed the standards of a profession[6]. "Learning Objectives are statements that focus on the instructional process...that are...focused on the specific content of a course or a lecture....What distinguishes a competency from a goal or objective is that it focuses on the end-product of the instructional process itself, or that it embraces the larger picture rather than the content of a single course."[7]. Competencies and Objectives are related in that learning objectives can be used to collect data related to the achievement of competency. For every competency, there are *many* objectives that must be met over the course of a longitudinal curriculum.

As medical schools adopt a competency based paradigm, physiologists need to shift their focus from the content that is taught to the development of the students[8]. For instruction to be relevant to the program educational objectives, physiologists have to look beyond medical knowledge into the other competency domains and determine how their activities contribute to the development of the knowledge, skills and attitudes of a professional student. One advantage of the competency based educational approach is that the entire educational process is viewed as a continuum, where knowledge, skills and attitudes acquired in the university setting are foundational for subsequent training[6].

Physiology Graduate Education

Interestingly, graduate physiology education in the USA adopted a comparable competency framework in the early 21st century. In 2003, The American Physiological Society and the Association of Chairs of Departments of Physiology compiled a list of nine important professional development skills for physiology graduate students and trainees (Table 1)[11]. The overlap with the ACGME competencies and the CanMEDS framework[10] is notable, and reflects the shift in educational focus away from knowledge and toward the development of a professional.

The primary purpose of the list of professional skills is to serve as a professional development tool for physiology trainees and their mentors. Along those lines, the American Physiological Society is using this list of skills to guide the development of a series of professional skills work-

shops, offered both in live courses and on-line[12].

On the Horizon—Core Entrustable Professional Activities

Medical educational reform in the USA is continuing. In a further move towards emphasizing the professional development of future physicians, the Association of American Medical Colleges has compiled a list of activities that graduating medical students should be entrusted to do without direct supervision on their first day of residency training[13]. This move toward core trustable professional activities will strengthen the emphasis on professional development as the key goal in medical education.

Implications for Physiology Educators

For medical physiology, physiologists have emphasized the content or the knowledge fund as the endpoint of the instructional process, most often assessed by multiple choice examinations. In contrast, multiple efforts to identify the knowledge fund expected of PhD physiology graduates were unsuccessful, as the goal of doctoral education extended beyond knowledge into the skills and attitudes. As medical schools adopt a competency framework, physiology educators need to take responsibility for developing the professional characteristics of medical students, a role that they already play in educating graduate students and postdoctoral fellows.

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