The Doctorate in Clinical Laboratory Science: CLS Education beyond the Baccalaureate

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ABBREVIATIONS: ASCLS = American Society for Clinical Laboratory Science; CLS = clinical laboratory science; DCLS = doctorate in clinical laboratory science; NAACLS = National Accrediting Agency for Clinical Laboratory Sciences.

INDEX TERMS: clinical doctorate; clinical laboratory science; evidence-based practice; professional doctorate.

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The American Society for Clinical Laboratory Science (ASCLS) has clearly articulated the responsibilities of the Doctorate in Clinical Laboratory Science (DCLS):

"Missing within the continuity of healthcare are enough scientists and physicians within the clinical laboratory or elsewhere on the healthcare team, who are totally dedicated to and who have the breadth of knowledge and assigned authority essential to the ordering of appropriate laboratory tests, the effective use of laboratory test information, effective consultation with other healthcare team members, direct communication with patients, review of patient records, and interpretation/application of laboratory generated information in reference to clinical signs and symptoms. A clinical laboratory science professional holding a doctoral degree (DCLS) is needed to provide the critical interface across the healthcare system in order to assure improved patient outcomes and cost effective patient care."[1]

At some level, all who have needed healthcare recognize the need for an individual to function in our healthcare system as described above.[2] In fact, the need for interpretation of laboratory information related to appropriate patient assessment is a growing need worldwide. In a recent publication in an online global news service, the point was made and supported with survey data that confusion over test-ordering practices in Great Britain places patients at risk.[3] Blame for the confusion was attributed to lack of clinical pathology education in the medical curriculum.

With the design and implementation of the DCLS, the clinical laboratory science profession has claimed and accepted responsibility for the quality of the information provided by the clinical laboratory and for assuring its effective use in patient care. We have recognized that ours is the profession best prepared, by education and practice, to speak to total quality and advancement for the clinical laboratory. With this step, the profession has also completed its "career ladder" with positions identified to address all areas of the laboratory industry including its leadership.

Believing CLS to be the profession best suited to lead the clinical laboratory is just the first step toward meeting the growing needs of patients worldwide. Obviously if medical education is assessed to be inadequate in clinical pathology, much more content must be added to the baccalaureate CLS curriculum in preparation for the burgeoning need for quality leadership and patient care roles. DCLS leadership groups have approached the definition of the required additional education in several ways.

First, task forces of the ASCLS and the National Accrediting Agency for Clinical Laboratory Sciences (NAACLS) developed competencies in an iterative process referencing an extensive review of competency requirements of other doctoral-level healthcare practitioners. These competencies

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were validated by a qualitative process involving thematic analysis of interviews with current practitioners self-identifying as "advanced practitioners" functioning in patient care roles for which they were prepared by experience and formal education.

Standards for accreditation of DCLS programs were then written by NAACLS and reviewed by the profession in open hearings throughout the country. Considering the scope of the DCLS competencies as well as doctoral curricula from other healthcare disciplines and biomedical science programs of comparable rigor, the DCLS program of study was set at a minimum of 90 semester credit hours beyond the baccalaureate CLS degree. Additional admissions requirements, e.g., minimum scores on standardized proficiency examinations, minimum grade point averages, and prerequisite course work, are not specified but are to be addressed by individual institutions and their program admissions committees. Practice and expertise areas addressed by the competencies are given in Table 1.

An ASCLS task force concurrently developed the DCLS model curriculum comprised of course descriptions, instructional objectives, and a course sequence based on the baccalaureate CLS foundation. The DCLS curriculum is not technical in the traditional CLS interpretation. Rather, the doctoral curriculum is based on new competencies related to post-graduate biomedical sciences; patient interactions, communication, and patient case management; CLS diagnosis and therapies; evidence-based practice; and clinical services delivery as shown in Table 2.[4]

Together, the five curricular areas describe content designed to prepare practitioners with an educational base of science, technology, communication skills, diagnostic decision-making tools, and research applied to practice (evidence-based practice). Tables 3 through 7 summarize examples of content addressing DCLS competencies and curricular areas.

The model curriculum materials developed by the ASCLS task force were disseminated for review and comment by a sample of individuals in other healthcare professions with knowledge of clinical laboratory science responsibilities in healthcare delivery, interest in furthering the quality of the clinical laboratory, and expertise in clinical healthcare education. A total of 22 sets of curricular materials were distributed with a response from 12 reviewers (55% response rate). Table 8 summarizes reviewer response categories.

Some general observations can be made from preliminary data analysis of the reviews. The PhD/MD reviewers' comments expressed different perceptions. One reviewer suggested more services delivery and clinical content, the other consistently commented that curricular content was outside the scope of practice of the CLS. Comments from the PhD reviewers were consistently favorable with one suggesting more public health exposure and another (PhD, RN) suggesting more interdisciplinary team interactions. All MD comments were favorable but inconsistent in the nature of suggestions for improvement. One MD found the curriculum lacking traditional CLS technical content while the other suggested more clinical (patient-related) content. The PharmD (also MT-credentialed), while assessing the DCLS curriculum favorably overall, commented that the objectives related to pharmacology overlapped those in the pharmacy curriculum. The physician assistants (PA-C, both BS and MS prepared) shared detailed suggestions for more clinical experiences. One PA-C in particular, who is also CLS-credentialed, was able to suggest specific clinical experiences to teach competencies directly applicable to the CLS practice and knowledge base. These clinical experiences were tailored for CLS practice having been modified from the more gen-

Table 1. DCLS competency areas

Area I	Scientific/medical knowledge
Area II	Patient care (assessment, management)
Area III	Interpersonal/communication skills
Area IV	Professionalism (ethics, regulatory)
Area V	Outreach (professional promotion)
Area VI	Continuous practice improvement
Area VII	Services delivery (administration, financial)

Table 2. DCLS curriculum content areas

Group I	Advanced basic sciences
Group II	Patient interactions
Group III	Clinical laboratory diagnosis and therapies
Group IV	Statistics, research methods, evidence-based practice
Group V	Ethics, policy, and clinical services delivery

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eral (non-CLS related) clinical curriculum of the PA. These comments will undoubtedly prove valuable in structuring educational clinical experiences for the DCLS.

The CLS profession has known from the inception of the DCLS that it represents a new healthcare practitioner. In fact the competencies of DCLS practice are designed to address existing specific needs in the clinical laboratory industry and the CLS profession. As such, it was recognized that aspects of some clinical competencies in the DCLS curriculum (and needed in practice) might be shared by other health professions and thus taught by representatives of non-CLS health professions. The primary purpose of the curriculum review process was to garner the input and educational strategies of those non-CLS health professions vested in the quality of clinical laboratory information who could contribute to the education of the DCLS. More extensive analysis of data from DCLS curriculum reviews continues and will be

Table 3. DCLS biomedical science content

- Clinical pharmacology and therapeutics (drug classes and delivery)
- Integrated systems biology (genetics, anatomy, physiology)
- Cancer biology and immunology (epidemiology, chemotherapy)
- Molecular and cell biology (genomics, gene regulation, drug discovery)
- Disease mechanisms (immunology, microbiology, pathophysiology)

Table 4. DCLS patient interactions content

- Patient interactions
- Healthcare communications
- Healthcare education principles
- Health assessment
- Clinical patient management

Table 5. DCLS diagnosis and therapies content

- Disease processes (symptoms/laboratory findings)
- Hematopathology
- Immunohematology/transfusion services
- Issues in public health
- Health informatics/epidemiology

Table 6. DCLS research content

- Biostatistics/research design
- Evidence-based practice
- Scientific communications/research ethics
- Grant writing
- Final scholarly treatise

Table 7. Clinical services delivery content

- Healthcare policy
- Licensure/ethics
- Professional advocacy
- Administration (private/government/education)
- Human resource management/finance

Table 8. Curricular review response categories

Degree/Credential	Contacted	Responded
PhD, MD	3	2
PhD (2 MT*)	6	3
PhD, RN	1	1
MD	5	3
MD, MPH	2	0
PharmD	1	1
Masters, PA-C (2 CLS*)	3	1
Bachelors, PA-C	1	1
TOTAL	22	12

* Number of respondents with clinical laboratory science degree and credential

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reported when completed. However, even from the preliminary review some guiding tenets for curriculum development have emerged.

First, other healthcare disciplines are not necessarily able to identify clinical competencies from their scopes of practice that relate to the proposed scope of practice of the DCLS. Though the reviewers, in the main, saw a need for the DCLS, the clinical competencies they prescribed for the practitioner are in general the ones they teach their own practitioners. Extrapolating from the sample of responses, one can conclude that other health professions would, without specific guidance, train DCLS students clinically in a manner similar to their own professions. This conclusion is supported by the comments from physicians and the pharmacist that the education of the DCLS infringed upon their professional scopes of education and practice. Therefore, even though other disciplines may participate in the DCLS educational process, the CLS profession will, in the end, be responsible for identifying specific clinical experiences necessary to meet clinical competencies we have defined in the DCLS scope of practice. The CLS-relevant comments of the one PA-C who is also CLS-educated and credentialed corroborated this notion. While other practitioners recognize that there are needs specific to clinical laboratory services delivery,[5] only CLS has defined these needs and can fashion appropriate clinical experiences to address them.

The continuing task of CLS educators involved in DCLS program implementation, therefore, is to identify content and instructional methodologies in the curricula of other health professions that must be modified for and incorporated into the DCLS curriculum in order to adequately enable our keystone practitioner to maximize benefits of laboratory services to our client groups. Continue to monitor our professional literature and the ASCLS website (www.ascls.org) for progress updates on the latest developments. Please post general comments to the ASCLS Forums. (You can find the Forums from the "About" link on the title bar of the ASCLS homepage). Your comments can help shape the future of our profession!

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