A Core Syllabus for Histology within the Medical Curriculum – The Cell and Basic Tissues

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ABSTRACT

The International Federation of Associations of Anatomists (IFAA) are developing core syllabuses for the anatomical sciences by means of Delphi panels. In this paper, we provide the core subject matter for the teaching of the cell and of basic tissues within a medical histology course. The goal is to set an international standard providing guidelines for such a core syllabus. The Delphi panel, comprised of members across multiple countries, required two rounds to evaluate 257 relevant items/topics approved by the IFAA. Based on the perception of the core knowledge of histology, the items were to be rated by each member of the Delphi panel as being 'Essential', 'Important', 'Acceptable', or 'Not required'. Topics that were rated by over 60% of the panelists as being 'Essential' and 'Important' are provided in this paper and are recommended for the teaching of medical histology.

INTRODUCTION

Histology, or microscopic anatomy, was once one of the most fundamental anatomical sciences taught in the early years of a medical course. The teaching of this subject not only provided medical students with knowledge, and understanding, of the normal structure of the human body but also went alongside facilitating the notion of a learnèd medical profession. Furthermore, much anatomical research relied upon microscopic technologies and histology was regarded as a prerequisite subject for the understanding of pathology. In 2018, McBride and Drake published their article on the status of the anatomical sciences in US medical education. They reported that only 2% of responding medical schools had stand-alone histology courses, with 51% of schools stating that histology was fully integrated within the medical course. In addition, they found that contact time ranged between 0 and 124 hours (average 51h $\pm$ 30 SD) and that the average number of hours devoted to laboratory practicals in histology was 22h $\pm$ 17SD. The use of microscopes was said to be in sharp decline and there seemed to be little teaching from clinically qualified members of the faculty. They also reported that, compared with a similar study by Drake et al. in 2014, there had been a significant decrease in the total number of hours devoted to the teaching of histology. Anecdotally, what was reported in the US appears to be happening in other parts of the world. Despite the decline in histology tuition in the medical course often brought about by curriculum review, Moxham et al. (2017) reported that students in Europe nevertheless considered histology to be clinically important.

In contrast to the earlier model for medical education of preclinical and clinical curricula, marked diversity in pedagogic philosophies across the world means that there now exists no standard, and transparent, model that is universally accepted. This, together with little (or no) teaching of histology taking place, underpins the necessity of developing core syllabuses for histology that are independent of pedagogic philosophy and do not dictate where in the medical course the subject should be taught. Presently, two approaches are being adopted to develop core syllabuses for the anatomical sciences. The Anatomical Society (AS, formally the Anatomical Society of Great Britain and Ireland) has published core syllabuses consisting of a series of 'learning outcomes' for medicine, nursing, pharmacy and dentistry (Smith et al., 2016; Connolly et al., 2018; Finn et al., 2018; Matthan et al., in press). The International Federation of Associations of Anatomists (IFAA) is publishing more specialized core syllabuses that provide lists of topics that are to be considered core, recommended or not required. To date, the IFAA have published syllabuses for head and neck anatomy for medicine (Tubbs et al., 2014, 2015), neuroanatomy for medicine (Moxham et al., 2015), embryology and teratology for medicine (Fakoya et al., 2017), specialized oral anatomy for dentistry (Moxham et al., 2018), musculoskeletal anatomy for medicine (Webb, et al., 2019) and thoracic anatomy for medicine (Moxham et al., 2020). Both the AS and the IFAA are employing Delphi Panels to devise the syllabuses (see Moxham et al., 2014). In this paper, under the auspices of the IFAA, we report on the deliberations of a Delphi Panel upon core subject matter for the teaching of the cell and of the histology of the basic tissues within the medical curriculum.

METHODS

The Delphi panel approach was used for the current project under the auspices of the IFAA. The Delphi panel was comprised of basic science teachers and clinical educators from 13 different countries. There were in total 21 Delphi panel members: 2 from Austria; 1 from Australia; 1 from Canada; 1 from China; 1 from the Czech Republic; 1 from Greece; 2 from Grenada; 2 from Germany; 1 from Hong Kong; 1 from Italy; 1 from Spain; 1 from Switzerland and 4 from the United States. More than 1/3 of members have both basic science (Ph.D.) and medical (MD) degrees and backgrounds. 60% of members have taught histology for more than 20 years, 26% taught histology between 11 to 20 years, and 14% taught histology for less than 10 years. Most of the panel members were either authors of textbooks and/or authors of papers related to the histology. More than 50% of the members had reviewed manuscripts related to histology or had organized histology workshops.

257 topics relating to the cell and the histology of basic tissues were generated. These were based on the most commonly used topics in medical education, from the contents of internationally recognized histology textbooks (Hagerstown 2008; Cui et al., 2011; Junqueira and Carneriro, 2013; Meyer, 2014; Gartner and Hiatt, 2017; Stevens and Lowe 2019; Pawlina, 2019), and from the IFAA's Federative International Programme for Anatomical Terminology (2008). The Delphi Panel method was used to review these topics (Fig. 1), as outlined by Moxham et al. (2014), and involved two 'rounds' of assessment. For ***Round one,*** the 257 original items were sent to the panel members to review and each topic was rated according to four categories: 'Essential', 'Important', 'Acceptable', or 'Not required'. The panellists were asked to provide comments for each topic and suggestions for any topics that might have been excluded from the initial list. For ***Round two***, the additional topics suggested from *Round one* were sent to members for review. The complete list of topics comprised 66 topics related to the Cell; 33 topics related to the Epithelium and Glands; 46 topic related to the Connective Tissue; 51 topics related to the Cartilage and Bone; 28 topics related to the Muscle Tissue; 55 topics related to the Nervous Tissue; and 43 topics related to the Blood and Hemopoiesis.

From the Delphi panelists' responses, every topic/item was analyzed by the project's coordinators in accordance with general rules followed for other core syllabuses published through the IFAA. Where more than 60% of the panelists considered an item as being essential, this was categorized as being 'core'. Where between 30% and 59% of the panelists classified an item as being essential, the topic was designated as being 'recommended'. Classification of 'just acceptable' or 'not required' came when the panelists only recorded essential designations between 20% and 29% and less than 20% respectively.

RESULTS

The results of the Delphi Panel's deliberations for different topics related to the cell and basic tissues are presented in Tables 1 to 7. Note that, where topics are near borderlines (e.g. 59% or 60% 'Essential'), this is indicated in the Tables of Results by the two categories at the borderline being highlighted.

If instead of using a threshold of greater than 60% to categorize a topic as being 'core', a 50% threshold was employed, 'core' topics would then include an introduction to histological slide preparation, peroxisomes, membrane associated proteins, stereocilia, large versus small and euchromatic versus heterochomatic nuclear features, regulation of the cell cycle, regulation of the structures and secretions of glands, glandular intercalated, striated and secretory/excretory ducts, embryonic connective tissues (mesenchyme and mucous

connective tissues, cartilage renewal, bone canaliculi, Sharpey's fibers in bone, mechanism of skeletal muscle contraction, types of skeletal muscle fibers, histology of the meninges, histology related to cranial presynaptic parasympathetic neurons, enteric division of the autonomic nervous system, erythroblast precursor cells, and promyelocytes. Presently these topics are in the 'recommended' category but, with advice from other stakeholders (e.g., anatomical societies, clinicians) may change categorization in further stages of the development of the core syllabus.

If instead of using a threshold of greater than 60% to categorize a topic as being 'core', a 70% threshold was employed, the following 'core' topics would become 'recommended' topics (with advice from other stakeholders at further stages of the development of the core syllabus): cell differentiation, cellular activity, intermediate filaments and microtubules, the centrosome, membrane receptors and transport action of the membrane, different cellular shapes, the nuclear envelope and pores, the mitotic nucleus, phases of the cell cycle, mitosis and meiosis, cell death (including apoptosis), the transient (intraepithelial) cell, keratinized and parakeratinised epithelium, glands classified by secretory mechanisms, intralobular glandular ducts versus interlobular ducts, proteoglycans of the extracellular matrix, correlation of connective tissue types with function, brown versus white adipose tissue, cartilage elastic fibers and collagen fiber types, water content and ground substance of cartilage, mechanism of cardiac muscle and smooth muscle contraction, cardiac and smooth muscle innervation, injury and repair of cardiac muscle, information transfer in the central nervous system, structure and general organization of the brainstem, cerebellum and cerebral cortex, general histology of the meninges and the choroid plexus, Meissner and Pacinian corpuscles, Merkel cells, histology of most topics relating to the autonomic nervous system, life span and duration of blood cells in the circulation, hemopoietic stem cells, progenitor and precursor blood cells (CFUs/CFCs), reticulocytes, megakaryoblasts, and granulocytopoiesis.

DISCUSSION

Histology is traditionally a basic component of the anatomical sciences in the medical curriculum, focusing on the study of normal cells and tissues. A core syllabus for the teaching of oral histology for the dental curriculum (Moxham et al., 2018) and a survey of dental histology instruction (Dorothy et al., 2013) have already been published. However,

this is the first record in the literature of the publication of core subject matter for the teaching within the medical curriculum of the cell and of the histology of the basic tissues by means of an international appraisal. Future papers will provide Delphi Panel views on core syllabus for organ histology.

In commissioning the development of core syllabuses for the anatomical sciences through its international educational program (FIPAE), the IFAA is committed to producing detailed, topic-based, syllabuses rather than adopting a 'broad brush' approach. Furthermore, the IFAA advocates that the material/topic recognizing as 'core' represents international norms that should be covered in a university's/medical school's curriculum to help assure the public about the quality of healthcare provision. In this regard, there are implications for the belief that the biomedical sciences should be made more clinically relevant. This of course presupposes that there is a clear understanding of what can be considered core material within the medical syllabus. It is our firm belief that this can only be properly accomplished by having internationally recognized core syllabuses.

The IFAA is aware that teams of experts cannot dictate what should, or should not, be taught and the IFAA follows the principle that a core syllabus must be flexible in order to permit regular review and change. Thus, while input of 'experts' in a Delphi Panel is important initially to formulate a core syllabus, there has to be regular updating from the whole community of stakeholders (including anatomists, scientists, clinicians, students, administrators and those politico-educational forces that govern medical schools). Moreover, syllabuses must evolve over time as new material appears and as old material ceases to be academically or clinically relevant. Consequently, we welcome comments that will be passed to FIPAE for their consideration as the syllabus enters further phases of evaluation. In this regard, the core syllabus devised from the assessments of the Delphi Panel is only

stage 1 in the process of producing the IFAA core syllabus (see Moxham et al., 2014). This cannot be overemphasized since other stakeholders (e.g., anatomists, anatomical societies, clinicians and national and international medical educational authorities) can have an input into further developments of the syllabuses. Thus, the an IFAA syllabus will not be 'set in stone' but remains flexible and reviewable as new medical and educational advances occur. Nevertheless, even at this first stage, the publication of the core syllabus following the deliberations of the Delphi Panel provide an important background for the develop of curricula and for discussion.

One of the advantages of employing a Delphi process is that interesting questions can arise when, following analysis, lack of consensus is discerned. Indeed, during stages 2 and 3 of the IFAA process, the reasons for the failure to agree consensus on a question, or series of questions, can be explored. In the present case, consensus above 60% of the panellists was clearly evident for most topics. However, in contrast to some other IFAA syllabuses already published, we were surprised that so few topics in the list presented to the panellists proved to be regarded as 'not required'. This finding should be put in context with data showing that the time provided for the teaching of histology with US medical courses is only on average 51 hours, with some schools having zero hours teaching (McBride and Drake, 2018). Two explanations for this can be offered. First, that in the absence of core syllabuses for the medical curriculum, designers of medical courses are insufficiently informed. Second, that the panellists, being histologists, value too greatly their discipline in terms of its clinical relevance. In response to this, it should be noted that the panellists are also experienced educators. Moreover, even if the politico-educational authorities downplay the relevance of histology, the students certainly do not. From a large-scale survey of medical students across Europe, Moxham et al. (2017) reported that the students considered histology to be an important, and relevant, part of their medical training. This also accords with the attitudes of laypersons in Europe who consider that the anatomical sciences are highly clinically

relevant and who would have a diminished respect for the medical profession if the disciplines were undermined (Moxham et al., 2016). Indeed, if histology is to play an insignificant role in the medical curriculum how does this play out with the relevance of pathology (and histopathology in particular)? More generally, in the absence of histology, how does this affect the view of the medical profession as being a learned profession?

In previous papers on the core IFAA syllabuses (Tubbs et al., 2014, 2015; Moxham et al., 2015, 2018, 2020; Fakoya et al., 2016), the question was raised: what is the purpose of a core syllabus? We acknowledge that, while universal agreement on the details is hard to obtain, a core syllabus provides the minimum level of knowledge expected of a recently-qualified medical graduate in order to ensure that students are not overloaded with facts and can carry out many clinical procedures safely and effectively. Nevertheless, it is not to be understood that ONLY core material should be taught and examined as the strength of universities lies in the possession of different schools of thought. Indeed, if a university education to be worthy of its name, students should in some areas be taken to the frontiers of knowledge. Furthermore, if ONLY core knowledge is examined then it follows logically that the pass mark impossibly approaches 100%! This situation is to some extent ameliorated by courses where important material is returned to at different stages of a course (e.g., in a 'spiral course'). In view of this, our aim is to set international standards not impose them. Thus, the core syllabus does NOT dictate WHEN or HOW the syllabus is delivered. The IFAA's goal therefore is to provide the international community with detailed SUGGESTIONS AND RECOMMENDATIONS concerning topics relating to the cell and basic tissues. It is hoped that such information will be of particular use to educators who are redesigning curricula for the teaching of histology to medical students.

The authors confirm that there is no conflict of interest

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345 **FIGURES**

346 **Figure 1 The IFAA Delphi Process for Developing a Core Syllabus for Histology**

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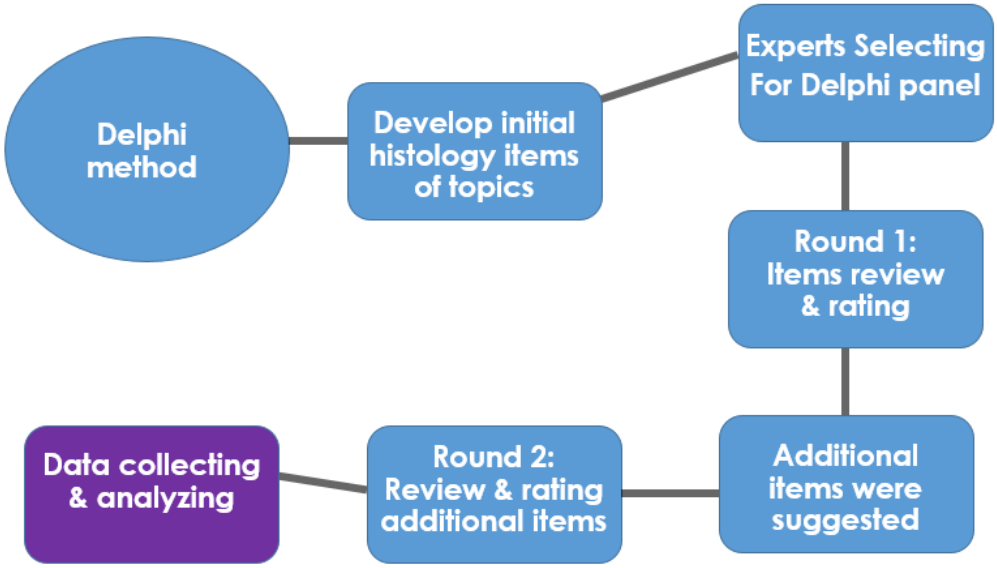

Figure 1

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TABLES

Table 1. Rating Results for the Cell (percentages show the responses of the Delphi Panel to topics being regarded as 'core')

TOPIC	CORE	RECOMMENDED BUT NOT CORE	NOT RECOMMENDED	NOT REQUIRED
Cell Cytoplasm				
Cell differentiation	65%			
Blastomeres	50%			
Stem cells	70%			
Cellular activity	60%			
Cell organelles	92%			
Ribosomes	85%			
Rough Endoplasmic Reticulum (rER)	85%			
Smooth Endoplasmic Reticulum (sER)	80%			
Golgi Apparatus	90%			
Secretory granules	80%			
Mitochondria	90%			
Lysosomes	75%			
Proteasomes	50%			
Peroxisomes	55%			
Intracellular inclusions	40%			
Cytoskeleton	87%			
Actin filaments	75%			
Intermediate filaments	60%			
Microtubules	65%			
Centrosome	60%			
Myosin filament	75%			
Cell membrane				

Membrane associated proteins	55%			
Membrane receptors	60%			
Transport action of membrane	60%			
Lipid layers	75%			
Cell surface	100%			
Cilia	95%			
Microvilli	90%			
Stereocilia	53%			
Tight junction/Zonula occludens	85%			
Adhering junction/Zonula adherens	75%			
Desmosome/Macula adherens	75%			
Hemidesmosome	75%			
Gap junctions	85%			
Basolateral folds	50%			
Basal lamina	80%			
Cell shapes	77%			
Squamous	65%			
Cuboidal	65%			
Columnar	65%			
Spherical/ovoid	50%			
Fusiform	50%			
Polyhedral	45%			
Cell Nucleus				
Nuclear components	67%			
Nucleus	80%			
Chromosomes	75%			
Heterochromatin	75%			

Euchromatin	75%			
Nuclear envelope	65%			
Nuclear pore	65%			
Nucleus features	45%			
Large versus small	55%			
Euchromatic versus heterochomatic	55%			
Nucleoli prominent	50%			
Mitotic nucleus	65%			
Simple versus segmented	50%			
Cell cycle	67%			
Cell cycle phases	65%			
Regulation of the cell cycle	55%			
Mitosis	65%			
Meiosis	65%			
Cell death	65%			
Apoptosis	60%			
Cell renewal	75%			
Reprogramming of cells	33%			

355

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Table 2. Rating Results for the Epithelium and Glands (percentages show the responses of the Delphi Panel to topics being regarded as 'core')

TOPIC	CORE	RECOMMENDED BUT NOT CORE	NOT RECOMMENDED	NOT REQUIRED
EPITHELIUM				
Features of epithelial cells				
Shape of the epithelial cells	75%			
Renewal of epithelial cells	75%			
Metaplasia and dysplasia	33%			
Lateral domain (Junctional complexes of epithelial cells)	80%			
Basal domain	70%			
Basal cell, Transient (intra-epithelial) cell	60%			
Basal lamina and basement membrane	73%			
Apical surface of epithelial cell	90%			
Surface specializations: Cilia, Microvilli,Stereocilia	73%			
Keratinized and parakeratinized epithelium	60%			
Classification of the epithelium				
Simple epithelium Vs. stratified epithelium	95%			
Squamous epithelium	95%			
Cuboidal epithelium	85%			
Columnar epithelium	90%			
Pseudostratified columnar epithelium	90%			
Transitional epithelium	90%			
Functional specialization of different epithelia	80%			

Organ-epithelial type correlation	50%			
Special named epithelium: Respiratory epithelium Urithelium Mesothelium Endothelium Neurothelium Olfactory epithelium	87%			
GLANDS				
Exocrine vs. Endocrine glands	86%			
Regulation of the structures and the secretions	53%			
Cell types of the glands	80%			
Classification of glands				
Classified by product	85%			
Classified by mechanisms	65%			
Classified by morphology	70%			
Unicellular and multicellular glands	73%			
Duct system of exocrine glands				
Intralobular ducts versus interlobular ducts	65%			
Intercalated duct Striated duct Secretory/excretory duct	53%			
Introduction to routine slide preparation	53%			

359

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361 **Table 3. Rating Results for the Connective Tissue (percentages show the responses of the Delphi**
362 **Panel to topics being regarded as 'core')**

TOPIC	CORE	RECOMMENDED BUT NOT CORE	NOT RECOMMENDED	NOT REQUIRED
Connective Tissue Cells				
Cells arising from undifferentiated mesenchymal cells	86%			
Fibroblasts	90%			
Myofibroblasts	80%			
Adipocytes	85%			
Chondrocytes	90%			
Osteocytes	90%			
Cells arising from hematopoietic stem cells	100%			
Plasma cells	90%			
Macrophages	90%			
Mast cells	85%			
Basophils	80%			
Neutrophils	80%			
Lymphocytes	73%			
Eosinophil	80%			
Extracellular Matrix				
Connective tissue fibers	100%			
Collagen fibers and type of collagen	85%			
Basal lamina	87%			
Elastic fibers	89%			
Reticular fibers	83%			
Ground substance of connective tissue	80%			
Glycosaminoglycans (GAGs)	70%			

Proteoglycans	60%			
Multiadhesive Glycoproteins	55%			
Classification of Connective Tissue				
Correlation between type of CT and tissue function	60%			
Dense connective tissue	86%			
Dense regular connective tissue	86%			
Dense irregular connective tissue	90%			
Wound healing	33%			
Loose connective tissue (areolar connective tissue)	88%			
Specialized connective tissues	84%			
Adipose tissue	85%			
Brown vs white adipose tissue	60%			
Adipose derived stem cells	13%			
Reticular tissue	75%			
Elastic tissue	80%			
Embryonic connective tissue (mesenchyme and mucous CT)	53%			
Supporting connective tissues	100%			
Cartilage (see Table 4)	100%			
Bone (see Table 4)	100%			
Hematopoietic tissues (see Table 7)	100%			
Bone marrow (see Table 7)	100%			
Blood (see Table 7)	100%			

363

364 **Table 4. Rating Results for the Cartilage and Bone (percentages show the responses of the Delphi**
365 **Panel to topics being regarded as 'core')**

TOPICS	CORE	RECOMMENDED BUT NOT CORE	NOT RECOMMENDED	NOT REQUIRED
CARTILAGE				
Perichondrium	80%			
Cartilage matrix				
Collagen fibers: types of collagen found in the cartilage	65%			
Elastic fibers	60%			
Ground substance	60%			
Other materials (e.g. water, organic compounds)	65%			
Isogenous groups	60%			
Territorial matrix	47%			
Cartilage cells				
Chondrogenic cells	80%			
Chondroblasts	95%			
Chondrocytes	95%			
Types of cartilage				
Hyaline cartilage: (characteristics, function and location)	100%			
Articulate cartilage	80%			
Elastic cartilage: (characteristics, function and location)	90%			
Fibrocartilage: characteristics, function and location	95%			
Cartilage growth and development				
Appositional growth	70%			
Interstitial growth	70%			
Cartilage renewal	53%			

BONE				
Periosteum and endosteum	93%			
Synovial organ	33%			
Bone suture/synarthosis	40%			
Bone matrix				
Organic components	75%			
Inorganic components	80%			
Osteoid/prebone	40%			
Bone canaliculi	53%			
Structure of osteons	93%			
Resorption canals	40%			
Sharpey's fibre	53%			
Bone cells				
Osteoprogenitor cells	90%			
Osteoblasts	95%			
Osteocytes	90%			
Osteoclasts	95%			
Types of bone				
Classified by microscopic observation	85%			
Classified by gross appearance and density of the bone	85%			
Compact bone	90%			
Cancellous bone	90%			
Woven bone	40%			
Bone growth and development				
Intramembranous ossification	94%			
Endochondral ossification and zones	94%			
Epiphyseal (apophyseal) growth plate	80%			

Bone remodeling and repair	80%			
Osteoporosis	33%			
Different bone diseases and their genetic, aging, dietary causes	47%			

366

367

Table 5. Rating Results for the Muscle Tissue (percentages show the responses of the Delphi Panel to topics being regarded as 'core')

TOPICS	CORE	RECOMMENDED BUT NOT CORE	NOT RECOMMENDED	NOT REQUIRED
Contractile muscle cells	82%			
Myoepithelial cells	75%			
Myofibroblasts	70%			
Pericytes	75%			
Classification of muscle tissue	92%			
Skeletal Muscle				
Organization of skeletal muscle	100%			
Connective tissue layers of skeletal muscle (epimysium, perimysium and endomysium)	85%			
Muscle units (fascicle, muscle fiber and myofibril and myofilaments)	85%			
Sarcomere organization	80%			
Ultrastructure of the muscle fibers	80%			
Arrangement of actin and myosin filaments	80%			
Sensory innervation; Muscle spindles & Golgi tendon organ	70%			
Motor innervation; Neuromuscular junction (motor end plates)	80%			
Muscle-tendon junction	33%			
Development of skeletal muscle	50%			
Mechanism of skeletal muscle contraction	55%			

Types of skeletal muscle fibers (type 1, type IIa and type IIb fibers)	55%			
Cardiac Muscle				
Structures and organization of cardiac muscle	95%			
Purkinje fiber	71%			
Ultrastructure of cardiac muscle	80%			
Intercalated disks	80%			
Mechanism of cardiac muscle contraction and nervous innervation	60%			
Cardiac muscle injury and repair	60%			
Smooth Muscle				
Structures and functions of smooth muscle	95%			
Ultrastructure of smooth muscle	70%			
Dense bodies	47%			
Contraction of smooth muscle and nervous innervation	60%			
Renewal and repair of smooth muscle	50%			

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372 **Table 6. Rating Results for the Nervous Tissue (percentages show the responses of the Delphi**
373 **Panel to topics being regarded as 'core')**

TOPIC	CORE	RECOMMENDED BUT NOT CORE	NOT RECOMMENDED	NOT REQUIRED
CENTRAL NERVOUS SYSTEM				
Neurons and synapses				
Structures of neurons	95%			
Types of neurons	85%			
Elements of the synapse	70%			
Types of synapse	75%			
Information transmission in the nervous system	65%			
Supporting cells (neuroglia)	95%			
Neural stem cell	33%			
Adult neurogenesis and synaptic plasticity	27%			
Spinal cord				
Structure and general organization of the spinal cord	89%			
Brainstem				
Structure and general organization of the brainstem (Tracts, nuclei and reticular formation)	61%			
Cerebellum				
Cellular layers of the cerebellum (structure and function)	67%			
Cerebral cortex				
Cellular layers of the cerebral cortex (structure and function)	68%			
Other structures				
Meninges (general aspects)	67%			

Dura mater	56%			
Arachnoid	56%			
Pia mater	56%			
Choroid plexus	67%			
Blood-brain barrier (structures & function)	78%			
Hippocampus	20%			
Optic tract	20%			
Neuron injury and degeneration	42%			
PERIPHERAL NERVOUS SYSTEM				
Schwann cells and myelin sheath	100%			
Myelinated axon	95%			
Unmyelinated axons	90%			
Myelination of PNS axon	90%			
Axon & Nodes of Ranvier	80%			
Connective tissue layers of peripheral nerve				
Epineurium	85%			
Perineurium & blood-nerve barrier	95%			
Endoneurium	80%			
Peripheral sensory receptors				
Encapsulated axon endings & nonencapsulated (free) nerve endings	75%			
Meissner corpuscle	65%			
Pacinian corpuscle	65%			
Ruffini corpuscles	20%			
Merkel cells	60%			
Hair follicles	50%			

Muscle spindles	75%			
Other features				
Sensory ganglia	71%			
Peripheral nerve injury and regeneration	47%			
AUTONOMIC NERVOUS SYSTEM				
Sympathetic division	65%			
Visceral afferent and visceral efferent neurons	61%			
Sympathetic ganglia	72%			
Parasympathetic division	65%			
Presynaptic parasympathetic neuron and CN III, VII, IX and X	56%			
Parasympathetic ganglia	66%			
Enteric division	59%			
Meissner/submucosal plexuses	61%			
Auerbach/myenteric plexuses	61%			

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376 **Table 7. Rating Results for the Blood and Hemopoiesis (percentages show the responses of the**
377 **Delphi Panel to topics being regarded as 'core')**

TOPIC	CORE	RECOMMENDED BUT NOT CORE	NOT RECOMMENDED	NOT REQUIRED
PERIPHERAL BLOOD				
Blood composition	85%			
Blood plasma (Plasma cells Table 3)	79%			
Cellular inclusions	36%			
Percent of each elements	75%			
Complete blood count values	70%			
Hemostasis	50%			
Blood smear and stain	70%			
Blood cells				
Structure and function of blood cells	85%			
Duration in circulation	60%			
Blood cell count	75%			
Life span of blood cells	65%			
Type of blood cells				
Erythrocytes	95%			
Structural flexibility of RBCs	36%			
Platelets/thrombocytes	95%			
Lymphocytes	95%			
Monocytes	95%			
Neutrophils	95%			
Eosinophils	95%			
Basophils	95%			
HEMOPOIESIS				
Hemopoietic stem cells	65%			
Progenitor and precursor cells (CFUs/CFCs)	65%			

Bone marrow and hemopoietic cells	85%			
Stem cell niche and vascular niche	29%			
Growth factors that influence the differentiation of the formed elements	29%			
Erythropoiesis (Erythrocyte development)				
Stem cells and progenitor cells (CFUs/CFC-Es)	60%			
Precursor cells/ proerythroblasts	60%			
Basophilic erythroblasts	55%			
Polychromatophilic erythroblasts	55%			
Orthochromatophilic erythroblasts	55%			
Reticulocytes	60%			
Thrombopoiesis				
Megakaryoblasts	60%			
Promegakaryocytes	45%			
Megakaryocytes	80%			
Demarcation membrane system of thrombopoiesis	50%			
Granulocytopoiesis				
Myeloblasts	65%			
Promyelocytes	55%			
Myelocytes (neutrophilic, eosinophilic and basophilic)	65%			
Stab (band) cells (neutrophilic, eosinophilic & basophilic)	65%			

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