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The Anatomical Society core anatomy syllabus for pharmacists: outcomes to create a foundation for practice

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Abstract

The Anatomical Society has developed a series of learning outcomes that 'experts' within the field would recommend as core knowledge outputs for a Master's Degree Programme in Pharmacy (MPharm) within the UK. Using the Anatomical Society core gross anatomy syllabus for medical anatomy as a foundation, a modified Delphi technique was used to develop outcomes specific to pharmacy graduates. A Delphi panel consisting of medical practitioners, pharmacists and anatomists (n = 39) was created and involved 'experts' representing 20 UK Higher Education Institutions. The output from this study was 49 pharmacy-specific learning outcomes that are applicable to all pharmacy programmes. The new MPharm anatomy syllabus offers a basic anatomical framework upon which pharmacy educators can build the necessary clinical practice and knowledge. These learning outcomes could be used to develop anatomy teaching within an integrated curriculum as per requirements of the General Pharmaceutical Council (GPhC).

Key words: anatomy; curriculum; education; MPharm; pharmacy; undergraduate.

Introduction

The role of the pharmacist has changed from one that was traditionally based on dispensing to one that encompasses treatment, diagnosis and acting as the first port of call for patients (Ridge, 2015). Given this seismic shift, it has never been more important for pharmacy graduates to have a strong foundation upon which to build their pharmacological knowledge – this includes anatomy. A prime example of the need for a pharmacy graduate to understand anatomy is demonstrated by the increasing use of community-based pharmacies as a point of delivery for influenza vaccines. In such a scenario, the administering pharmacist needs an awareness of basic surface anatomy, musculature and neurovasculature of the upper limb. Similarly, drug metabolism cannot be fully understood without at least a basic understanding of the anatomy of the liver.

To date, there has been no published standardised anatomy syllabus for students studying for a Master's in Pharmacy (MPharm) in the United Kingdom (UK). The requirement for such a syllabus has never been more pertinent given the evolving clinical roles for pharmacists in the NHS as members of multidisciplinary teams and the General Pharmaceutical Council standards for the initial education and training of pharmacists (2011). All Health professionals, including pharmacists, must be able to relate form to function: a grounding in anatomy is an essential foundation on which to underpin other knowledge relevant to clinical practice, as well as other basic sciences studied as part of the Master's in Pharmacy (MPharm) Degree programme. A standardised syllabus enables institutions to map their curricula to a standard which is comparable nationally.

The Master's of Pharmacy (MPharm) is the degree in the UK required for pre-registration training for qualification as a registered pharmacists. The registration of Pharmacists is governed by The General Pharmaceutical Council (GPhC) (2017), which is the independent regulator for pharmacists, pharmacy technicians and pharmacy premises in Great Britain. Similarly, the MPharm degree programme is accredited

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by the GPhC, the professional regulatory body for pharmacists. The Programme is based on predicted objectives and standards for the students, set by the GPhC. The outcomes state that students require knowledge of 'normal and abnormal structure and function' and lists 'Anatomy and Physiology' (p. 48) as an area for competency within it (General Pharmaceutical Council, 2011). Similarly, the British Pharmacological Society (BPS) published a recommended pharmacology syllabus for pharmacy courses (2015) which indicates that anatomical knowledge is required for clinical practice. The BPS does not specify outcomes for anatomy but alludes to it within its competency statements in life sciences (British Pharmacological Society, 2015).

This lack of curricula clarity from such key stakeholders is mirrored within the literature. Literature searches returned a single article, describing an online anatomy education tool, and none that related to anatomy-specific learning outcomes (Limpach et al. 2008). The present study therefore aimed to address this evident gap by providing a guide for Higher Education Institutions (HEIs) with MPharm programmes, as to what basic level of anatomical knowledge a graduate should have in order safely to practise in Pharmacy and its associated sub-disciplines. The present paper aims to provide a guide for pharmacy educators as to the basic level of anatomical knowledge a MPharm graduate should have in order to safely practise pharmacy and its associated sub-disciplines. The study is based upon a modified Delphi approach.

Delphi is a research method developed in America in the 1950s, utilised to elicit and refine group judgements (Dalkey et al. 1969). It is frequently referred to as a process approach, technique or study and takes the form of a consensus survey (Keeney et al. 2011). In essence, Delphi enables group problem-solving and uses an iterative process with results based on the responses of questionnaires, collated by and sent by a researcher, to a panel of experts. Several rounds are sent out, and the anonymous responses are aggregated after each round and shared with the group. The overarching aim is to achieve consensus. The rationale for Delphi is often based on the adage that 'two heads are better than one' (Dalkey et al. 1969), which is especially true for areas such as anatomy syllabi for pharmacists, where information is sparse. Delphi is also based upon the premise that within practice there is collegial knowledge which is understood but not discussed. This process helps makes the implicit or tacit, explicit. Delphi approaches are popular as they afford anonymity, iterations and controlled feedback while forcing decision-making – all of which are useful in minimising potential biases from dominant opinions (Dalkey et al. 1969). Enabling communication and establishing agreement between experts on a panel without having to meet, has made Delphi a useful tool within education research. Flexibility further adds to the appeal of using Delphi (Skulmoski et al. 2007). It is frequently used to refine learning outcomes and generate syllabi (McHanwell et al. 2007; Tubbs et al. 2014; Moxham et al. 2015; Smith et al. 2016a,b).

Methods

Ethics

Ethical approval for this study was granted by the Ethics Committee at Hull York Medical School.

Study design

A Delphi approach may take one of two routes. One route is to start with a blank canvas and develop content from scratch. The other route is to refine existing materials (modified Delphi). In this study, we aimed to refine pre-existing learning outcomes from existing anatomy syllabi that had already been through a Delphi process (McHanwell et al. 2007; Smith et al. 2016a). Therefore, this study was a modified Delphi. The study design was similar to the work of Smith et al. (2016a,b) and Connolly et al. (2018) and therefore references to the relevant methodologies are made throughout. This approach was selected as it would help to ensure that no potential areas of the anatomy syllabus were omitted. The modified Delphi study design (Fig. 1) had an initial screening process, two Delphi stages and a concluding screening for typographical errors from the research team. The two-stage modified Delphi method permitted the panel of experts to suggest modifications to the original learning outcomes in the first stage, whereas during the second stage the panel were confined to a simple decision to 'accept' or 'reject' the learning outcomes.

Construction of the research group

The research group included all of the present authors. Three of the researchers (G.F., C.F., C.H.) were selected due to their roles as anatomists, with specific experience of teaching anatomy to MPharm students. Two of the researchers (G.H., B.A.) were selected as they were registered pharmacists who hold senior positions within pharmacy education; the third (P.G.) is a pharmacologist with experience of developing, leading and assessing UK MPharm programmes. One author (J.S.) was selected due to expertise in Delphi methodology but was not involved in the revision of any anatomical content. All decisions regarding content were made by the team, ensuring anatomy and pharmacy representation was consistent throughout.

Identification of the Delphi panel

Delphi panels are constructed by 'experts'. Experts are defined as persons who have knowledge and experience, as well as the ability to influence policy (Baker et al. 2006). The experts must have a sound knowledge of the 'target issue' (Latif et al. 2016), in this case anatomy. The identification of participants to be invited to join the Delphi panel was undertaken in two phases. Phase 1 sought nominations from members of both the Anatomical Society Council and the Education Committee to nominate individuals whom they deemed as fulfilling the study inclusion criteria of 'expert' within this field: at least 2 years' experience in teaching pharmacy students during their undergraduate studies or a practising pharmacist involved in pharmacy education at undergraduate or postgraduate levels. The second phase of recruitment involved identifying all

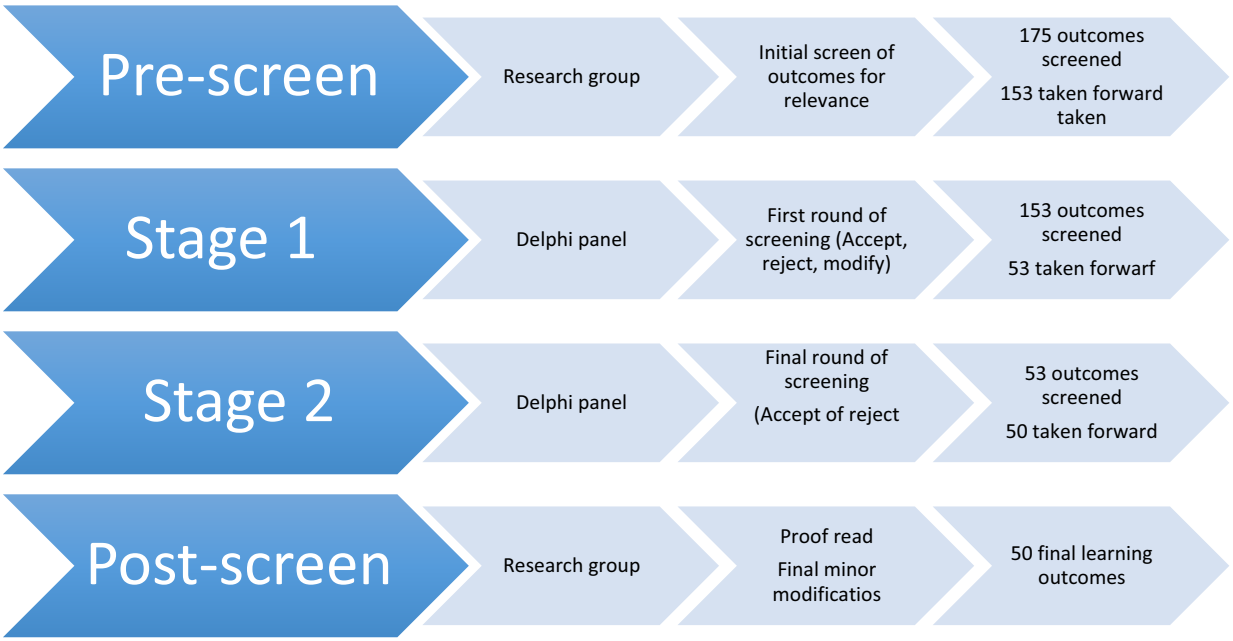

Fig. 1 The key stages of the modified Delphi process.

Heads of Schools of Pharmacy or course leaders, asking them to participate in the Delphi panel or nominate individuals from their departments who were best placed to provide feedback. Phase two mirrors that described by Connolly et al. (2018) within the context of nursing. To identify the Heads of Schools of Pharmacy, data were collated from a search of the Universities and Colleges Admissions Service database to identify HEIs offering MPharm Degree programmes and by subsequent cross-checking on institutional websites. The search returned 103 individuals who could be contacted to request nominations based upon the inclusion criteria. Members of the original research group that devised the Smith et al. (2016a, b) or McHanwell et al. (2007) syllabi were excluded from the Delphi panels, as participation could be considered to be a conflict of interest due to their investment in creating the outcomes (McHanwell et al. 2007; Smith et al. 2016a). Thirty-seven individuals were proposed and searches returned an additional 34 individuals, totalling 71 individuals who fulfilled the inclusion criteria. The nomination process and search produced some replication. Following removal of any duplicates, the final list of potential panel members was 52. These included five members of the original core syllabus group who were immediately excluded from the survey. The remaining 47 individuals were accepted and invited to participate. An initial email was sent to the nominees inviting them to join the study. Five nominees were found to be untraceable by email, making the final invited sample 42. A reminder email was sent 30 days later. Thirty-four individuals agreed at the time to participate in the study (n = 34). Literature suggests that a panel size of greater than 10 is acceptable (Adler & Ziglio, 1996; Hsu & Sandford, 2007; Latif et al. 2016).

Pre-screen – initial outcome screening before Stage 1

The content for the syllabus was generated by combining two pre-existing syllabi: Smith et al. (2016a) and McHanwell et al. (2007). The entire set of outcomes from Smith et al., n = 156 was used but only the 19 neuroanatomy outcomes from McHanwell et al. (2007). The Smith et al. syllabus was a revision of McHanwell et al. and therefore had the most up-to-date outcomes; however, it did not include neuroanatomy outcomes, so the neuroanatomy outcomes were taken from McHanwell et al. to ensure that a complete set of outcomes was presented to the panel. As the learning outcomes for both studies were from syllabi for medical students, they were initially screened by the research team to remove any outcomes that clearly would be inappropriate. Although not a typical stage in a Delphi process, this screening was performed to prevent time being wasted by inappropriate questioning.

Before the commencement of the Delphi, the following procedures were performed by the research group. If an outcome achieved 100% rejection as an outcome, it was removed. Any outcome achieving 100% agreement or less progressed to the expert panel. Of the 156 outcomes from the Smith et al. (2016a) medical syllabus, 146 went forward to the Delphi panel and 10 were removed. The excluded outcomes were mostly related to clinical imaging or specific procedural knowledge which was not relevant to the role of a Pharmacist. The 19 neuroanatomy outcomes from McHanwell et al. (2007) were reviewed; 17 outcomes proceeded to the Delphi panel. In total, 163 learning outcomes were presented for the Stage 1 Delphi. The research group performed this initial screen to ensure that the time of expert panel members was not wasted by including outcomes that were obviously redundant. The outcomes that were removed typically referred to medical procedures that were not applicable to the role of Pharmacist.

Setting a consensus level

Before data were collected, the level of consensus was set. The appropriate level of consensus varies within the literature (Latif et al. 2016) but these typically range from 70 to 100%. Consensus was set at 80%, as the inclusion of anatomy teaching in MPharm programmes is variable (as evidenced by the information provided

by the Delphi panel). The lower consensus was agreed in order to compensate for the variable amounts of anatomy taught across MPharm programmes.

Generation of the survey

The survey set-up replicated that described in Smith et al. (2016b) and Connolly et al. (2018) but using the Hull York Medical School Survey Monkey Account. Instructions for completion, a statement of consent and contact information for the research team were also included ahead of the outcomes for consideration. In addition, there were four demographic items. Participants remained anonymous but were asked to indicate their institution, their principal role and whether they were also a registered Pharmacist. This information was recorded in order to report the range of expertise within the panel.

Inviting participants

Participants were invited as per the protocol described in Smith et al. (2016b). At each stage, the Delphi survey was open for 4 weeks to maximise participation.

Stage 1 – first round Delphi

Stage 1 asked participants to 'accept', 'reject' or 'modify' each learning outcome. Learning outcomes achieving a consensus level of 100% were accepted outright. Learning outcomes achieving a consensus level of between 81 and 100% were accepted but modified if there were suggestions to up the level of agreement. Learning outcomes achieving a lower level than the pre-agreed consensus level of 80% (decided by the researchers) were rejected unless modifications or comments were made in the free-text box indicating how these could be refined. Modifications were considered by the entire research group to ensure expert anatomical and pharmaceutical input.

Each comment was read and classified by the team as a modification, a supportive statement, a contextual remark or irrelevant, which was the screening method developed during our previously published study (Smith et al. 2016b). The research group also acted upon free-text feedback from the Panel that within an undergraduate pharmacy programme, anatomy would not be taught by regions of the body; thus, the outcomes were arranged into 11 sections (one focused on terminology and 10 body system – see Table 2). The significant amount of modifications and comments ($n = 580$) reflects the engagement of the panel and serves to demonstrate the validity of our proposed syllabus.

Stage 2 – second round Delphi

Stage 2 followed a similar process to Stage 1. The 53 outcomes, now presented by systems, were made available by an email link to the survey. The same panel members were invited to participate. The second stage only allowed participants to 'accept' or 'reject' the outcomes. Free-text comment boxes were available for recording of any typographical errors. Data analysis followed the same process as for Stage 1.

Post-screen – final proofing post Delphi

The final step in this procedure was reviewing the final outcomes by the research group only. This process was undertaken to correct typographical errors not picked up by the Delphi panel, and to refine and standardise formatting.

Results

Delphi panel demographics and participation rates

A total of 34 individuals participated in the Stage 1 Delphi panel. Not all participants provided full demographic information. Within the panel, 58% were identified as being a registered pharmacist. Respondents were asked to provide a free-text description of their role (see Table 1). Of those who participated, 73% were employed by HEIs with 16 different institutions being represented and some institutions represented by multiple panel members. Participants represented a wide geographical spread across the UK and Ireland. Percentages of representation from different sectors are also reported in Table 1. Sixty-two per cent of respondents reported that the HEIs to which they were affiliated covered anatomy within their Master's curriculum. Stage 2 was completed by 31 participants (91%) of the original participants.

Results for each Delphi stage

Table 2 presents a summary of the number of learning outcomes within the original syllabi used as the framework for this study (McHanwell et al. 2007; Smith et al. 2016a,b) and the number of outcomes retained following each stage of the MPharm Delphi process.

Stage 1 results

Following Stage 1, 53 learning outcomes were accepted and modified to go forward to Stage 2 and reclassified by systems (refer to Table 2).

Stage 2 results

Following Stage 2, 49 learning outcomes were accepted, as well as a table containing supplementary contextual

Table 1 Demographics of respondents by role and sector.

Principal role	% of respondents
Head of Department/Professor	33%
Pharmacist/Clinical Pharmacist	18%
Senior Lecturer/Lecturer/Teaching Fellow	46%
Information not provided	3%
Sector	**% of respondents**
Higher Education Institution	73%
Professional/Regulatory body	14%
Industry	5%
Information not provided	4%

Table 2 A summary of the total learning outcomes across each stage and their organisation.

Smith et al. (2016a,b) syllabus			MPharm syllabus		
Original syllabi & sections	Initial number of learning outcomes	Number of learning outcomes after author screening	Section	Number of learning outcomes after stage 1	Number of learning outcomes after Stage 2
Anatomical terms	5	5	Anatomical terms	3	3
Head and neck	37	30	Lymphatic*	1	2 (sections combined*)
Vertebral column	7	7	Regional*	2	
Thorax	24	24	Cardiovascular	11	11
Upper limb	21	18	Respiratory	3	3
Abdomen	21	21	Urinary	2	2
Pelvis and perineum	19	19	Digestive	8	7
Lower limb	22	22	Integumentary	1	1
Total	156	146	Musculoskeletal	2	2
McHanwell et al. (2007) syllabus			Endocrine	4	3
Neuroanatomy	19	17	Reproductive	2	2
Total	175	163	Neuro/sensory	14	13
			Total	53	49

*= sections combined

information (refer to Tables 2 and 3). The majority of changes were to subsume some learning outcomes into another outcome. Learning outcomes were reconsidered if the wording was changed significantly.

In total, 477 comments were made during Stage 1. Of these, 65% were modifications, 22% supportive, 7% contextual and 6% deemed irrelevant. Stage 2 comments totalled 103, of which 52% were supportive, 24% modifications, 14% contextual and 10% irrelevant.

After consideration of the free-text modification comments throughout Stages 1 and 2 of the Delphi process, a table was constructed to accompany the final learning outcomes. This table provides contextual information to assist in the implementation of the outcomes within curricula. Links are provided to clinical conditions, drug administration and relevant procedures that could prove useful in integrating outcomes into a curricula, thus signposting clinical relevance to staff and students alike. In addition, within the suggested modifications, debate between expert Delphi panel members persisted as to the appropriate action verbs, and thus level, at which the learning outcomes should be presented. The predominant view was that outcomes should be at the lower levels of Bloom's taxonomy and therefore utilising the verb 'describe' was appropriate (Bloom & Hastings, 1971). The rationale for this decision was based on the role of the pharmacist in clinical practice and how their anatomical knowledge would be utilised within that role.

The final recommended core anatomy syllabus for Pharmacy is outlined below and comprises 49 learning outcomes. Following the outcomes, some suggestions for clinical relevance are provided (Table 3) that indicate conditions, procedures or clinical context relevant to the practice of pharmacists or that an MPharm student would encounter. This contextual information is provided to help educators signpost the clinical relevance of the anatomy to students.

The Anatomical Society core anatomy syllabus for undergraduate pharmacy students

The Anatomical Society and the expert Delphi panel of pharmacists and pharmacy educators recommend that the following learning outcomes should be achieved by all students upon graduation, to demonstrate a basic level of competence in the anatomical sciences:

Anatomical terminology

1. Describe the following anatomical terms relative to (i) the anatomical position: medial, lateral, proximal, distal, superior, inferior, deep, superficial, palmar, plantar, anterior, ventral, posterior, dorsal, cephalic and cranial; and (ii) the planes: axial, transverse, horizontal, sagittal and coronal.
2. Describe the basic terms used to describe movement: flexion/extension, abduction/adduction, medial/lateral rotation.
3. Describe the anatomical differences between a neonate, child and adult.

Cardiovascular system

4. Describe the major arterial pulse points including femoral, carotid, brachial and radial.

Table 3 Contextual information to accompany each outcome to aid their integration into the curriculum.

Outcome	Clinical context/condition/procedure/system
Anatomical terminology	
1	Frequently used when describing relationships and injuries
2	Important for understanding and describing joint movement and related injuries (musculoskeletal system)
3	Important for drug dose calculations and choice of administration route in different patient populations
Cardiovascular system	
4	Heart rate and blood pressure assessment and interpretation
5	Ischaemic heart disease, myocardial infarction (cardiovascular system)
6	Ventricular hypertrophy due to resistance in blood outflow
7	Mitral valve failure
8	ECG
9	Aortic aneurysm, coarctation of the aorta
10	Thrombus
11	Trauma, venepuncture
12	Trauma, varicose veins, diabetic foot
13	Central lines
14	Stroke, haemorrhage, headache, migraine
Digestive system	
15	Abdominal pain location
16	Ulcerative colitis, disease, peptic ulcers, drug absorption and delivery
17	Oral absorption of drugs, ulcers, dental pain/trauma
18	Drug metabolism, gall stones, hepatitis, portal hypertension, alcoholic liver cirrhosis, fatty & hepatic liver disease
19	Haemorrhoids, suppositories
20	Splenomegaly
21	Drug absorption and excretion
Nervous & sensory system	
22	Links to physiology, origin of pain (nervous system)
23	Stroke, epilepsy
24	Vision impairment
25	Bell's palsy, trigeminal neuralgia
26	Meningitis, encephalitis, drug distribution
27	Parkinson's, pituitary tumour
28	Schizophrenia, dementia, drug/substance abuse
29	Conjunctivitis, drug delivery via eyedrops
30	Hayfever, sinusitis, drug delivery via nasal epithelium
31	Ear infection, vertigo
32	Referred pain
33	Stenosis, lumbar puncture, epidural, back pain
34	Herniated disc, nerve root impingment
Respiratory system	
35	Asthma
36	Asthma, COPD, pneumothorax
37	Lung cancer, smoking cessation
Urinary system	
38	Kidney failure, dialysis, drug excretion, kidney stones
39	Overactive bladder, incontinence, cystitis
Reproductive system	
40	IVF, contraception & emergency hormonal contraception, STIs
41	IVF, contraception, STIs
Integumentary system	
42	Cellulitis, burns, topical medication
Endocrine system	
43	Adrenocarcimoma, anaphylaxis
44	Diabetes, pancreatitis
45	Hypothyroidism/goitre/calcium metabolism
Musculoskeletal system	
46	Frozen shoulder, tennis elbow, ankle sprain, knee pain, carpal tunnel syndrome, hip replacement
47	Intramuscular injection, shingles pain

(continued)

Table 3 (continued)

Outcome	Clinical context/condition/procedure/system
Lymphatic system & regional anatomy	
48	Drug delivery in cancer, Hodgkin's disease
49	Mastitis, breast cancer, lactation

5. Describe the origin, course and main branches of the left and right coronary arteries and discuss the functional consequences of their obstruction.
6. Describe the major anatomical features including the inflow and outflow vessels of each chamber of the heart and explain their functional significance.
7. Describe the structure and position of the atrio-ventricular, pulmonary and aortic valves and describe their function in the prevention of reflux of blood during the cardiac cycle.
8. Describe the anatomical course of the spread of electrical excitation through the chambers of the heart.
9. Describe the major branches of the aorta and the structures they supply.
10. Describe the major tributaries of the vena cavae and the structures they drain.
11. Describe the main arteries and veins of the upper limb.
12. Describe the main arteries and veins of the lower limb.
13. Describe the major branches of the common, internal and external carotid arteries, and the tributaries of the internal and external jugular veins.
14. Describe the blood supply and venous drainage of the brain and explain the functional deficits which may occur.

Digestive system

15. Describe the four quadrants of the abdomen.
16. Describe the anatomy, histology and function of the different structures of the gastro-intestinal tract: oesophagus, stomach, duodenum, ileum, jejunum, colon, rectum and anal canal.
17. Describe the major features of the oral cavity and its epithelial lining in relation to swallowing and drug delivery.
18. Describe the position and functional anatomy of the liver, portal venous system, gallbladder and biliary tree.
19. Describe the blood supply and venous drainage of the rectum and anal canal.
20. Describe the position and functional anatomy of the spleen.
21. Describe the parotid, submandibular and sublingual glands and their role in saliva production.

Nervous & sensory system

22. Describe the nervous system and explain the terms: visceral, autonomic, somatic, central and peripheral nervous systems.
23. Describe the structure and divisions of the brain including: regions of grey and white matter, the cerebral hemispheres (frontal, parietal, occipital and temporal lobes), limbic system, thalamus, hypothalamus, midbrain, pons, medulla oblongata, basal ganglia and cerebellum.
24. Describe the major special functions of the cerebral cortex (motor, somatosensory, visual, auditory, memory and behavioural).
25. Describe the functions of the cranial nerves specifically including: optic, trigeminal, facial and vagus.
26. Describe the meninges, ventricles, blood–brain barrier and the role of cerebrospinal fluid.
27. Describe the function of the thalamus, hypothalamus, pituitary gland, basal ganglia and cerebellum.
28. Describe the principal components of the limbic (hypothalamus, fornix, mammillary bodies), aminergic and cholinergic systems.
29. Describe the anatomy of the eyelid, conjunctiva and lacrimal gland regarding maintenance of corneal integrity.
30. Describe the paranasal sinuses, nasal septum and the epithelial lining of the nasal cavity.
31. Describe the anatomy of the ear including the tympanic membrane, ossicles, external auditory meatus and neurovascular supply.
32. Describe the sympathetic chain and splanchnic nerves, and their role in referred pain.
33. Describe the regions and functions of the vertebral column, spinal cord and meninges in relation to common spinal conditions and drug administration.
34. Describe the anatomy of a typical spinal nerve, its main motor and somatosensory (cutaneous) branches and sympathetic components.

Respiratory system

35. Describe the muscles involved in ventilation and the role of the phrenic nerve.
36. Describe the anatomy of the lungs and pleura including their neurovascular supply, lymphatic drainage and the pulmonary circulation.
37. Describe the anatomy of the bronchial tree and bronchopulmonary segments.

Urinary system

38. Describe the position and functional anatomy of the kidneys and ureters.
39. Describe the anatomy and function of the bladder and urethra (male and female), including the sphincters and mechanism of micturition.

Reproductive system

40. Describe the anatomy and function of the female pelvic organs and external genitalia including their innervation, lymphatics, arterial supply and venous drainage.
41. Describe the anatomy and function of the male pelvic organs and external genitalia including their innervation, lymphatics, arterial supply and venous drainage.

Integumentary system

42. Describe the anatomy and function of the skin.

Endocrine

43. Describe the position and functional anatomy of the adrenal glands.
44. Describe the position and functional anatomy of the pancreas.
45. Describe the position and anatomy of the thyroid and parathyroid glands.

Musculoskeletal system

46. Describe the major bones and joints that make up the skeleton.
47. Describe the anatomy of the gluteal region and the course of the sciatic nerve.

Lymphatic system & regional anatomy

48. Describe the anatomical arrangement of the lymphoid tissue in the body and the potential routes for the spread of infection and malignant disease.
49. Describe the anatomy of the breast in relation to lactation and malignant disease.

Discussion

In healthcare education, the ability to practise safely is of utmost importance; a practitioner's knowledge and understanding of the human body underpins this safe practice. Defining how much time, what breadth of content, what resource or assessment weighting a subject such as anatomy should be given is a challenge for educators regardless of the context. Within medical education, clinicians may blame anatomists for teaching students too much detail and not enough clinically relevant structures (Pabst, 1993). Such an issue is most certainly a product of a lack of clear anatomy guidance within the curricula of many vocational programmes under the remit of health professions' education (Smith et al. 2016a,b). We would argue that one can better understand the challenges facing anatomical study by looking to the medical education literature. Heylings noted that in the period following the publication of Tomorrow's Doctors in the UK (Heylings, 2002; General Medical Council, 2003) there has been a loss of gross anatomy teaching time for medical students. However, there had been greater integration between anatomical disciplines and clinical skills. If one considers that medical students are struggling to get enough time for anatomy, then for professions such as pharmacy, where anatomy might be deemed to have less significance, this challenge will be even more significant. It is for these reasons that our proposed syllabus for MPharm programmes is useful – it provides a basic framework that institutions can adapt, build upon and integrate into their own curricula. Such a framework can be developed to build a curriculum; it provides a mechanism for institutions to ensure that the course learning objectives are aligned with course assessments. Possession of a definitive list of anatomical learning outcomes makes tasks such as blueprinting significantly less troublesome. Within the sphere of vocational training, any associated lack of constructive alignment could compromise accreditation with regulatory bodies. We do not propose how to teach, when to teach or for how long to teach – this is a decision for the curriculum developers. Specifically considering MPharm programme accreditation, our study enters a new terrain for specific life science outcomes within the discipline.

We would hope that this syllabus is not only useful for the educator and the HEI. As a syllabus is a method of communicating the intentions of the course, it also provides guidance for students on what to learn and consequently enables planning for faculty and students alike. The learning outcomes that we present achieves face validity with these Delphi panelists. HEIs have contributed from across the UK, involving experts from a range of environments and backgrounds. Each outcome achieved consensus at over 80%, in most cases over 90%. We do not claim these outcomes to be definitive as evidenced by the volume of

modification comments, multiple and conflicting viewpoints exposed by the Delphi process. Some panel members wished for broader outcomes that would provide academics with the scope to integrate, expand or abridge as they saw fit and as per the demands of their institutional curricula. Others voiced preference for more specific learning outcomes, discrete units that exhaustively listed content to be covered. The advantage of using a Delphi approach is that single dominating biases are avoided, but we were cognisant that the learning outcomes produced may not suit all purposes. However, what the resultant findings do is serve as a starting point, a foundational framework to build upon existing collegial knowledge and permit discussion of shared best practice. Educators can then utilise and adapt as they see fit. Such adaptations may include changing the action verbs based on their perceptions of how a pharmacist would utilise the anatomical knowledge in question. Similarly, splitting outcomes into further discrete units or, conversely, adding more detail and granularity to individual outcomes may be necessary to contextualise these findings. What we offer here is an inaugural framework for anatomy within MPharm programmes that over time, like all curricula, will evolve alongside the discipline and as best practice develops.

The challenge for anyone creating a syllabus is pitching it at an appropriate level. The authors and Delphi panel made a number of changes to the learning outcomes through the iterations of the syllabus during the Delphi process. As alluded to earlier, outcomes were eventually presented at the lower levels of the cognitive domain in Bloom's taxonomy (Bloom & Hastings, 1971), which is a hierarchical model used to classify educational learning objectives into varying levels of complexity and specificity. The classification of our outcomes is evidenced by the action verbs within the outcomes; these are almost entirely 'describe'. Institutions can of course revise these statements to make them more appropriate for their own teaching and learning environments. In this vein, a point of contention was the separation of form and function, whereby we present only anatomy learning outcomes. The remit of this project was only the consideration of anatomy, but additional contextual information that may support the integration of form and function within the curriculum was provided. Future iterations of the syllabus may indeed address the physiology gap – if this were to be the consensus of any future panels.

As with all research, our study has limitations. Subjective decisions had to be made, although we were rigorous in how we approached such decisions – ensuring decisions-makers were skilled and representative of both pharmacy and anatomy. We had an attrition of the panel, with a loss of three members between rounds of the Delphi; however, the majority of learning outcomes were accepted or changed minimally at Stage 2. We did not start with a blank canvas, instead opting for a modified Delphi approach – this of course could steer the Delphi panel by utilising outcomes that were generated for medicine. However, it also provided the advantage of ensuring regions of anatomy were not omitted and all aspects were given careful consideration. The syllabus created is, of course, time limited – it may require revision over time to be reflective of the pharmacy and anatomy education landscapes.

In conclusion, we present the first core anatomy syllabus for MPharm graduates, developed through a Delphi process. The syllabus, consisting of 49 learning outcomes, is a conceptual building block from which the anatomy for pharmacists can be developed, as well as a physical document for use and development by stakeholders in Pharmacy – from students to accrediting bodies and HEIs.

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