The Anatomical Society’s core anatomy syllabus for undergraduate nursing


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Abstract

The Anatomical Society has developed a series of learning outcomes in consultation with nursing educators delivering anatomical content to undergraduate (preregistration) nursing students. A Delphi panel methodology was adopted to select experts within the field that would recommend core anatomical content in undergraduate nursing programmes throughout the UK. Using the Anatomical Society’s Core Gross Anatomy Syllabus for Medical Students as a foundation, a modified Delphi technique was used to develop discipline-specific outcomes to nursing graduates. The Delphi panel consisted of 48 individuals (n = 48) with a minimum of 3 years’ experience teaching anatomy to nursing students, representing a broad spectrum of UK Higher Education Institutions. The output from this study was 64 nursing specific learning outcomes in anatomy that are applicable to all undergraduate (preregistration) programmes in the UK. The new core anatomy syllabus for Undergraduate Nursing offers a basic anatomical framework upon which nurse educators, clinical mentors and nursing students can underpin their clinical practice and knowledge. The learning outcomes presented may be used to develop anatomy teaching within an integrated nursing curriculum.

Key words: anatomy; core syllabus; curriculum; education; human; integrated learning; learning outcomes; nursing; preregistration; syllabus; undergraduate; United Kingdom.

Introduction

The World Health Organization defines nursing as: ‘encompassing autonomous and collaborative care of individuals of all ages, families, groups and communities, sick or well and in all settings. It includes the promotion of health, the prevention of illness, and the care of ill, disabled and dying people’ (WHO Europe 2009: p. 5).

There are four main divisions of nursing taught at undergraduate level in the UK: Adult nursing – the care of people aged 18 or over; Children’s nursing – the care of children and young people from birth to late adolescence; Learning disabilities nursing – the care of people of all ages who have learning disabilities; Mental health nursing – the care of people of all ages who have mental health problems (NMC, 2010: p. 147).

Despite the existence of these distinct branches of nursing, a knowledge, understanding and application of human anatomy alongside other basic sciences, collectively known as ‘biosciences’, falls under the remit of generic competency which all undergraduate nurses must be able to demonstrate by the end of the bachelor’s degree programme (NMC, 2010: pp. 95 and 147).

The biosciences required by nurses are anatomy, physiology, biochemistry, pathology, pathophysiology, genetics, microbiology, pharmacology and biophysics. A working
knowledge of these areas is deemed to be required for safe
and competent practitioners (WHO Europe, 2009; NMC,
2010).

With regard to anatomical knowledge and understand-
ing, at present, the guidance by the UK Nursing and Mid-
wifery Council (NMC) to academics teaching nurses within
accredited nursing programmes simply states that a knowl-
edge, understanding and application of human anatomy is
essential to ensure eligibility to register to practise upon
graduation (NMC, 2010). Despite anatomy being deemed a
fundamental requirement for safe clinical practice, there is
evidence since 1980 documenting a widespread ‘bioscience
problem’ affecting anatomy and other elements of nursing
education, both nationally (Nicoll & Butler, 1996; Jordon
et al. 1999; Clancy et al. 2000; Davies, 2010; Smales, 2010;
Andrew et al. 2015; Taylor et al. 2015) and internationally
(Akinsanya & Hayward, 1980; Friedel & Treagust, 2005; Craft
et al. 2013).

When the studies were cross-matched and compared,
they revealed common and consistent findings in student
anxiety and low self-confidence in learning and applying
bioscientific knowledge, due to a suspected lack of concep-
tualisation. Anecdotal reports from students and teaching
staff have attributed these issues to a lack of sufficient
learning and teaching time for bioscience subjects, includ-
ing anatomy (Jordon et al. 1999; McVicar et al. 2015; Taylor
et al. 2015). This may be further complicated by a lack of
confidence displayed by many clinical mentors with regard
to integrating bioscientific principles into clinical practice
(Molesworth & Lewitt, 2015). Despite this, nursing students
have highlighted a fundamental knowledge in anatomy
as an important element of their practice (Meskell &
O’Connor, 2007).

Several previous studies have attempted to address defi-
cits in bioscience education by implementing and investi-
gating various pedagogical approaches (Davies et al. 2000;
Green et al. 2000, 2006; Al-Modhefer & Roe, 2010; Koch
et al. 2010; Efstrathious & Bailey, 2012; Craft et al. 2016;
Montayre & Sparks, 2017), whereas others have focused on
natural science entry requirements as key performance indi-
cators (McKee, 2002; Van Rooyen et al. 2006). However, the
existing body of evidence is largely based on data gathered
across only one or two sites per study, compromising gener-
alisability and maximising the likely impact of local influenc-
ing factors (Andrew et al. 2015). This has led to the
conclusion that student’s’ difficulty in learning and assimi-
lating biosciences is due, at least in part, to a lack of explicit
guidelines from the NMC, thereby creating widespread geo-
ographical variability in curricular content and delivery
(McVicar et al. 2015; Taylor et al. 2015).

In response to the need for enhanced integration and to
address the bioscience issue, the Bioscience in Nursing Edu-
cation group (BiNE) was established by the Higher Educa-
tion Academy (HEA) to create a quality assurance
framework for bioscience education in nursing. The BiNE
(2016) framework incorporates a list of broad learning
objectives spanning anatomy, physiology, biology, patho-
physiology, pharmacology and genetics. Although this
framework has provided additional clarity, the term ‘Bio-
science’ remains broad, leading to issues with identifying
and resolving problems specific to scientific domains.

To counter the lack of subject-specific guidelines, particu-
larly with respect to anatomy, we sought to develop the
first national advisory core anatomy syllabus for undergrad-
uate nurses. Subject-specific learning outcomes have been
shown to be effective for curriculum design, teaching and
learning, and developing assessment. Additionally, anat-
omy-specific outcomes can assist greatly in the systematic
design of integrated modules and programmes (Biggs &

The NMC and the General Medical Council (GMC, 2009)
endorse the development of transparent educational stan-
dards that can provide clarity on areas where educational
integration can be facilitated across health and social care
to reflect the integrated, multiprofessional dynamic in mod-
ern healthcare service delivery (NHS Scotland 2007, NMC,
2017, NHS Scotland 2014–15). This is also supported by disci-
plines allied to health education as exemplified by the
Anatomical Society and International Association of Anato-
mists creation of advisory core syllabi to provide a high-
quality ‘common-sense’ approach to anatomical teaching
and learning (McHanwell et al. 2007; Smith et al. 2016a,b;
Moxham et al. 2017).

The Anatomical Society has syllabi projects in medicine,
dentistry and pharmacy, and has engaged with stakehold-
ers in each respective field to produce explicit advisory guid-
ance on anatomy-learning outcomes. The rationale for
developing discipline-specific core anatomy syllabi is a
response to the reduction of anatomical teaching hours
across all healthcare disciplines and to provide transparent
and detailed guidance on the level of anatomical content
expected at the point of registration. The outcomes pre-
seented here for nursing have been developed by life science
nurse educators, with consensus analysis facilitated by the
Anatomical Society, thereby aiming to minimise variability
by providing a coherent content guide to assist anatomical
teaching and learning.

The recommended core anatomy presented below con-
ists of a list of defined learning outcomes, arranged by sys-
tems. Table 1 provides contextual information to guide
curriculum planners and teachers with the implementation
and integration of the syllabus outcomes into the curricu-
lum in a number of ways, outlined below. The list is illustra-
tive as opposed to exhaustive. Additionally, the contextual
information will assist nurse educators to signpost the clin-
cal relevance of the anatomy to students. It can also be used
by clinical mentors when integrating theoretical knowledge
into practice to provide clinical context. Finally, it serves to
aid mapping of learning outcomes and assessment throughout
the preregistration nursing curriculum.
Ethical approval

The study was granted ethical approval from the University of Edinburgh Health and Social Science ethical committee from the school of nursing (Reference No: NURS021).

Method

The established Delphi process used for the formation of the Anatomical Society's Core Regional Anatomy Syllabus for Undergraduate Medicine (McHanwell et al. 2007; Moxham et al. 2014; Smith et al. 2016a) was adopted for this study. The Delphi process is a consensus method that systematically facilitates and structures communication between experts to ascertain collective agreement on a single issue, through reiterated survey rounds (Keeney et al. 2011; Ab Latif et al. 2016; Smith et al. 2016b). The Delphi process outlined in Smith et al. (2016b) was modified to include a pilot panel of nurse educators, anatomists and clinical educational experts (n = 9). The role of the pilot panel was to screen the Anatomical Society's Core Regional Anatomy Syllabus for Undergraduate Medicine (Smith et al. 2016a,b) for applicability to nurses, based upon the recommendations within the BiNE (2016) framework. BiNE advised that nursing programmes undertake a system-based approach to designing and delivering anatomical content. To ensure that the format and phraseology of the syllabus was pertinent to a wider nurse educator audience, the pilot panel were asked to use the 'accept', 'reject', 'modify' and/or 'comment' structure on each intended learning outcome to reflect the design of the online survey, prior to national circulation of the learning outcomes.

A UCAS search identified 76 higher education institutions (HEI) that delivered accredited nursing programmes. A purposive sample of life science lecturers, senior lecturers, professors, associate professors and deans with a minimum of 3 years of anatomy teaching experience in undergraduate nursing programmes were then invited to participate by email, along with a participant information sheet and consent form. Participants were invited to take part over two rounds. In phase one, participants were asked to 'accept', 'reject' or 'modify' with open comments to refine the intended learning outcomes. In phase two, a final consensus was sought, with options to 'accept' or 'reject' with typographic changes only. In all, 69 of the 76 HEIs were contacted to take part. Pilot panellist institutions (n = 4) were excluded from undertaking the online survey. Five had no staff directory on their websites and did not respond to telephone calls. Of the 69 HEIs contacted, 48 individuals from 35 HEIs took part in the online survey. There was a total of 57 panellists, including pilot phase experts and national participants from 38 HEIs across the UK: one professor, one associate professor, one associate dean, 41 senior lecturers, six teaching fellows and seven registered nurses. Of survey participants, 68.09% reported more than 10 years of experience teaching anatomy to undergraduate nursing students. The panellists agreed on the presented final core syllabus in anatomy for undergraduate nursing students.

The syllabus

Anatomical terminology

1. Define the following terms relative to the anatomical position: Anterior/ventral, posterior/dorsal, superior, inferior, medial, median, lateral, proximal, distal, superficial, deep, prone, supine, palmar & plantar.

2. Describe the following anatomical planes: Axial/transverse/horizontal, sagittal/vertical plane and the coronal/fronetal plane.

3. Define and demonstrate the terms used to describe movement: Flexion, extension, abduction, adduction, medial rotation, lateral rotation, inversion, eversion, supination, pronation, plantar-flexion, dorsi-flexion, and circumdution.

4. Compare and contrast the systematic changes associated with growth and ageing in children, adults and the elderly.

Table 1 Contextual information to support the integration of outcomes into the curriculum.

<table>
<thead>
<tr>
<th>Learning outcome</th>
<th>Clinical context</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anatomical terminology</td>
<td>Position and relationship of anatomical structures. To describe patient positioning. Descriptors for the location of injury and pain. Keeping accurate records and interpreting documentation from other healthcare team disciplines</td>
</tr>
<tr>
<td>1</td>
<td>Joint movement and related injuries</td>
</tr>
<tr>
<td>3</td>
<td>Normal development vs developmental anomalies</td>
</tr>
<tr>
<td>4</td>
<td>Effects of adverse health behaviours on anatomical structures throughout the lifespan, e.g. smoking, excessive alcohol intake Systems based structural gerrontiological considerations correlated to pathology, physiological homeostatic adaptation and pathophysiology, i.e. vasculature changes, loss of bone density, detrusor muscle instability, etc. Drug dosage adjustments and modified calculations Choice of medication administration route in different patient populations</td>
</tr>
<tr>
<td>5</td>
<td>Care of pressure areas and prevention of pressure ulcers. Assessment of pressure ulcer grade 1–4. Landmarks for intramuscular injection (IM), i.e. humeral head for deltoid injection and the anterior superior iliac spine for gluteus medius injection</td>
</tr>
</tbody>
</table>

(continued)
<table>
<thead>
<tr>
<th>Learning outcome</th>
<th>Clinical context</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Histological overview</strong></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Homeostatic mechanisms, pathophysiology and pharmacological interventions</td>
</tr>
<tr>
<td>7</td>
<td>Physiological: endocrine secretions, bladder and uterus expansion, protection from abrasion, absorption and transport. Clinical: mucosal membrane assessment, oral lesions, carcinoma, granulation in wound care</td>
</tr>
<tr>
<td>9</td>
<td>Support, protection and mobility. Cartilage injuries and healing</td>
</tr>
<tr>
<td>10</td>
<td>Types of contraction, i.e. voluntary/involuntary</td>
</tr>
<tr>
<td>11</td>
<td>Supportive and protective role in relation to gross structures, extracellular fluid spaces, blood, immunity. Autoimmune disorders, i.e. lupus erythematosus</td>
</tr>
<tr>
<td><strong>Nervous system</strong></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Vital sign regulation, pain, reflexes, sensory and motor function throughout the body. Somatic sensory pathology, i.e. shingles, motor neuron disease, multiple sclerosis</td>
</tr>
<tr>
<td>13</td>
<td>Vital sign ‘control centres’, i.e. temperature regulation (hypothalamus), baroreceptors (pons) and chemoreceptors (medulla oblongata), pituitary tumours, schizophrenia (limbic system)</td>
</tr>
<tr>
<td>14</td>
<td>Parkinson’s disease, amnergic and cholineric systems and related pharmacology, gait, balance, coordination, muscle tone (i.e. hypotonia)</td>
</tr>
<tr>
<td>15</td>
<td>Relate to special senses Neurodegeneration, e.g. dementia Effects of stroke on various brain regions, e.g. dysarthria. Neuropsychiatric disorders and intellectual disability</td>
</tr>
<tr>
<td>16</td>
<td>Relate to corresponding regions of the brain, and assessment and interventions for activities of daily living</td>
</tr>
<tr>
<td>17</td>
<td>Blood-brain barrier, meningitis, subdural and extradural haemorrhage/haematoma</td>
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<tr>
<td>18</td>
<td>Anosmia (lack of smell affects appetite); blindness; diplopia (double vision); trigeminal neuralgia (facial pain and spasm); Bell’s palsy; hearing loss; tinnitus; dizziness; dysphagia. Cranial nerve abnormalities may be indicative of cervical spine and/or brainstem pathology/injury</td>
</tr>
<tr>
<td>19</td>
<td>Hydrocephalus, raised intracranial pressure related to consciousness</td>
</tr>
<tr>
<td>20</td>
<td>Infection, i.e. otitis media, labyrinthitis, dizziness and loss of balance. Administering ear drops</td>
</tr>
<tr>
<td>21</td>
<td>Conjunctivitis, cataracts, glaucoma, red eye, administering eye drops, basic eye care, Glasgow Coma Scale (GCS) pupil assessment</td>
</tr>
<tr>
<td>22</td>
<td>Reflex and pain, post-care and education of a lumbar puncture, cauda equina</td>
</tr>
<tr>
<td><strong>Musculoskeletal system</strong></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>Normal and abnormal integrity, fractures, osteoporosis</td>
</tr>
<tr>
<td>24</td>
<td>Bone marrow, immunity, pre- and post-care of bone marrow aspirate and stem cell transplants</td>
</tr>
<tr>
<td>25</td>
<td>Mobility, moving and handling, sprains, arthritis, tendinitis, bursitis, nerve impingement, rotator cuff injury, i.e. frozen shoulder, carpel tunnel syndrome</td>
</tr>
<tr>
<td>26</td>
<td>Neurovascular monitoring, myalgia, compartment syndrome, administration of intramuscular injection/safe sites, assessment of mobility, gait, muscle tone and general actions that impact on functional activities such as sitting, standing, lying, lifting and exercising. Rehabilitation, multidisciplinary communication, interpreting and supporting physiotherapy instructions, falls prevention</td>
</tr>
<tr>
<td>27</td>
<td>Quadriplegia, paraplegia, lordosis, kyphosis, scoliosis, moving and handling, pressure ulcer care</td>
</tr>
<tr>
<td><strong>Integumentary system</strong></td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>Cellulitis, burns, inflammation, decreased turgor in dehydration, skincare, assessment and medical referral of suspicious moles for skin cancer, topical medication</td>
</tr>
<tr>
<td>29</td>
<td>Anaesthetic action, referred pain, i.e. cholecystitis pain referred to the left shoulder via the phrenic nerve at level C3/4/5 due to diaphragmatic irritation. Monitoring diminished sensation postoperatively, i.e. patient-controlled analgesia (PCA) in situ, paraesthesia</td>
</tr>
<tr>
<td><strong>Cardiovascular system</strong></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>Palpation of apex heartbeat, electrocardiogram (ECG) electrode placement</td>
</tr>
<tr>
<td>31</td>
<td>Normal heart rhythm, blood pressure, cardiac output, arrhythmias, pericarditis, pericardial effusion, cardiac tamponade, care of pacemakers, heart failure, patent foramen ovale, septal defects, ECG, cardiac monitoring, cardioversion</td>
</tr>
<tr>
<td>32</td>
<td>Mechanism of circulation, rheumatic fever, endocarditis, cardiac valve insufficiencies, i.e. mitral valve regurgitation, aortic/pulmonary stenosis</td>
</tr>
<tr>
<td>33</td>
<td>Ischaemic heart disease, i.e. myocardial infarction, stable/unstable angina. Pre- and postoperative angiogram/percutaneous coronary intervention (PCI) pre-, intra- and post-care</td>
</tr>
</tbody>
</table>
5. Identify the major surface and bony landmarks in each body region (e.g. occipital protuberance, orbital ridge, nasal bones, mastoid process, cervical to sacrococcygeal vertebrae and associated joints, shoulder girdle and upper limb, sternal region, ribs and costal margin, pelvic girdle and lower limb).

6. Identify and describe the components of a basic cell.

7. Identify and describe the features of epithelial tissues (simple squamous, stratified squamous, transitional, cuboidal, columnar and ciliated).

Table 1 (continued)

<table>
<thead>
<tr>
<th>Learning outcome</th>
<th>Clinical context</th>
</tr>
</thead>
<tbody>
<tr>
<td>34</td>
<td>Circulatory function, i.e. oxygenation, deoxygenation and diffusion</td>
</tr>
<tr>
<td>35</td>
<td>Circulatory function in chronic obstructive pulmonary disease (COPD) and right-sided heart failure, pulmonary oedema and effusion, pulmonary embolism</td>
</tr>
<tr>
<td>36</td>
<td>Atherosclerosis, visceral ischaemia/infarct, aortic aneurysm, thrombus and embolism, peripheral venous disease (PVD) and peripheral arterial disease (PAD) – compression bandaging and care of PVD/PAD ulceration. Blood pressure, profusion (i.e. pallor, central and peripheral cyanosis/mottling), wound healing</td>
</tr>
<tr>
<td>37</td>
<td>Intravenous drug administration, cannulation, phlebotomy, phlebitis, varicose veins, deep vein thrombosis</td>
</tr>
<tr>
<td>38</td>
<td>Stroke, headache, haemorrhage, care of central lines</td>
</tr>
<tr>
<td>39</td>
<td>Portal hypertension</td>
</tr>
<tr>
<td>40</td>
<td>COPD, acute respiratory distress syndrome, asthma, pneumothorax, flail chest</td>
</tr>
<tr>
<td>41</td>
<td>Airway management, epistaxis, laryngitis, pharyngitis, tracheostomy care, airway suction</td>
</tr>
<tr>
<td>42</td>
<td>Normal and abnormal respiration, i.e. tachypnoea, hypoventilation, upper and lower respiratory chest infections, i.e. pneumonia</td>
</tr>
<tr>
<td></td>
<td>Pleurisy pre-, intra- and postoperative care of lobectomy</td>
</tr>
<tr>
<td></td>
<td>Administration of oxygen/nebulisers and/or inhalers</td>
</tr>
<tr>
<td></td>
<td>Peripheral oxygen monitoring (aka SpO2 monitoring)</td>
</tr>
<tr>
<td>43</td>
<td>Unstable cervical spine trauma at C3/4/5, quadriplegia, phrenic nerve palsy, assessment of bilateral chest movement</td>
</tr>
<tr>
<td>44</td>
<td>Oral lesions, candida, sublingual drug administration, oral hygiene</td>
</tr>
<tr>
<td>45</td>
<td>Bolus formation, xerostomia, mumps, autoimmune disorders that affect salivary secretions, i.e. HIV</td>
</tr>
<tr>
<td>46</td>
<td>Swallowing, aspiration, nasogastric (NG) insertion, feeding and aftercare</td>
</tr>
<tr>
<td>47</td>
<td>Peritonitis, postoperative adhesions and abdominal pain, abdominal and inguinal hernia</td>
</tr>
<tr>
<td>48</td>
<td>Digestion, absorption, NG placement, ulceration (haematemesis), gastric dumping</td>
</tr>
<tr>
<td>49</td>
<td>Peristalsis, gastro-oesophageal reflex disease (GORD), referred epigastric pain, the composition and flow of bile and pancreatic juices and faecal incontinence</td>
</tr>
<tr>
<td>50</td>
<td>Bowel obstruction, resection and stoma care, Crohn’s disease, ulcerative colitis, colorectal abscess</td>
</tr>
<tr>
<td>51</td>
<td>Nutritional and drug absorption, stool colour and formation, constipation/diarrhoea, excretion</td>
</tr>
<tr>
<td>52</td>
<td>Hepatitis, cirrhosis, jaundice, cholecystitis, cholelithiasis, pancreatitis, drug and alcohol metabolism, overdoses, liver failure</td>
</tr>
<tr>
<td>53</td>
<td>Abdominal and/or pain assessment, record keeping and multidisciplinary communication</td>
</tr>
<tr>
<td>54</td>
<td>Urinary catheterisation, urinary tract infections</td>
</tr>
<tr>
<td>55</td>
<td>Vascularisation of the kidney, nephrectomy, polycystic kidney disease, flank pain</td>
</tr>
<tr>
<td>56</td>
<td>Creation of urine and metabolic properties for urinalysis, blood pressure regulation, drug metabolism, i.e. diuretics. Acute and chronic kidney injury, dialysis</td>
</tr>
<tr>
<td>57</td>
<td>Urinary frequency/retention. Prostate hyperplasia/cancer</td>
</tr>
<tr>
<td>58</td>
<td>Sexual and reproductive health and disease. Can also be used to distinguish differences between sex and gender in the broader curriculum</td>
</tr>
<tr>
<td>59</td>
<td>Continence and incontinence, urinary retention, rectal and vaginal prolapse, sexual function and dysfunction. Kegel exercises postpartum</td>
</tr>
<tr>
<td>60</td>
<td>Lactation, breast cancer, pre- and postoperative care of breast biopsy, mastectomy, breast reconstruction</td>
</tr>
<tr>
<td>61</td>
<td>Normal and abnormal stressors and associated homeostatic changes</td>
</tr>
<tr>
<td>62</td>
<td>Lymphoedema, primary and secondary malignancy</td>
</tr>
<tr>
<td>63</td>
<td>Immunity and infection – related to microbiology and pharmacology</td>
</tr>
<tr>
<td>64</td>
<td>Neurotransmitter and hormonal pathophysiology</td>
</tr>
</tbody>
</table>

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8. Identify and describe the general structure of a neuron.
9. Describe and contrast different types of cartilage (hyaline, fibrocartilage and elastic cartilage).
10. Compare and contrast the structural features of skeletal, smooth and cardiac muscle.
11. Describe the role of connective tissues.

Nervous system and special senses
12. Define and describe the major divisions of the central nervous system (CNS), peripheral nervous system (PNS) and autonomic nervous system (ANS).
13. Identify the major divisions of the brain: The forebrain (cerebral hemispheres), the midbrain (amygdala, thalamus, hypothalamus, hippocampus, pituitary gland, pineal gland and crus cerebri), the brainstem/hindbrain (pons, medulla oblongata and cerebellum).
14. Describe the difference between grey matter (e.g. nuclei, cortex and basal nuclei/ganglia) and white matter (association, commissural and projection fibres, and the corpus callosum).
15. Identify the position of the frontal, parietal, temporal and occipital lobes and the major sulci/landmarks that separate them.
16. Identify and briefly describe the cerebral cortex in relation to its functions, namely: motor, sensory, visual, auditory, speech; memory and emotion, decision making, social behaviour.
17. Describe the structural differences between the three layers of meninges (dura, arachnoid and pia) and their relationship to the brain and spinal cord.
18. Name the 12 cranial nerves and summarise their major functions in relation to PNS innervation.
19. Describe the ventricular system and the formation, circulation, drainage and role of cerebrospinal fluid.
20. Describe the general organisation of the outer, middle and inner ear.
21. Describe the structure of the eye, eyelid, conjunctiva and lacrimal gland. Explain their importance for the maintenance of corneal integrity.
22. Describe the structure of the spinal cord, a typical spinal nerve and a reflex arc, and its relation to the vertebral column.

Musculoskeletal system
23. Identify the major bones that make up the axial and appendicular skeleton and summarise their main differences.
24. Outline the main differences between compact and cancellous bone.
25. Describe and contrast different types of joints (synovial, fibrous and cartilaginous) and their associated structures (cartilage, tendons, ligaments, bursa) in relation to movement and stability.
26. Name and describe the major muscles groups of the head, neck, thorax, abdomen, pelvis, upper limb and lower limb.
27. Identify the main curvatures and features of the vertebral column, individual vertebrae (cervical, thoracic, lumbar, sacral and coccygeal) and intervertebral joints.

Integumentary system
28. Describe the epidermis, dermis & subcutaneous layers of the skin and appendages (hair follicles, sweat glands, nails).
29. Summarise the contribution of the dermatomes in sensory perception and referred pain.

Cardiovascular system
30. Identify and describe the position of the heart in the mediastinum relative to the associated structures.
31. Describe the four chambers of the heart (external and internal features), its specialised conduction network, and the fibrous and serous layers of the pericardium.
32. Compare and contrast the structure and location of the valves of the heart.
33. Describe the origin, course and main branches of the left and right coronary arteries and describe their location relative to the heart and the general area of the heart that they supply.
34. Distinguish the structural differences between arteries, veins and capillaries.
35. Define and demonstrate the structures of the pulmonary and systematic circulation.
36. Identify and describe the course and important relationships of the major arteries and veins of the trunk, with emphasis on the aorta, superior vena cava and inferior vena cava, their major branches and associated pulse points.
37. Define the deep and superficial veins and outline the course of the main veins of the upper limb and lower limb.
38. Identify and describe the blood supply and venous drainage of the brain and its association to the great vessels of the heart and neck.
39. Identify and describe the hepatic portal-venous system.

Respiratory system
40. Identify the associated joints and muscles of respiration (accessory and intercostal muscles and thoracic joints, i.e. components of the sternum, ribs and costal cartilage articulations) and examine their contribution to the mechanism of breathing.
41. Identify and describe the major features of the external nose, the nasal cavity, the pharynx, the larynx and the trachea.

42. Describe the major features of the diaphragm, pleural layers and the lungs (lobes and fissures of the right and left lungs; bronchi, bronchioles, alveoli; surface landmarks).

43. Identify and describe the course and role of the phrenic nerve in maintaining normal breathing.

**Gastrointestinal system**

44. Describe the major features of the oral cavity including the teeth, tongue, soft and hard palate.

45. Describe the salivary glands (parotid, submandibular and sublingual) and their relationship to the oral cavity for digestion.

46. Identify and describe the structure of the oesophagus and explain the role of the epiglottis in demarcating the respiratory and digestive tracts.

47. Describe the relationship of the abdominal organs to the peritoneum (parietal and visceral layers) and the intestinal mesenteries.

48. Identify and describe the regions of the stomach.

49. Identify and describe the major sphincters of the gastrointestinal system in relation to their associated structures (oesophageal sphincter, cardiac sphincter, pyloric sphincter, ileocaecal sphincter, hepato-pancreatic sphincter, anal sphincters).

50. Identify and describe the constituent parts of the small intestine (duodenum, jejunum and ileum) and the large intestine (caecum, ascending colon, transverse colon, descending colon, sigmoid colon, rectum and anus).

51. Compare and contrast the composition of the walls of the small and large intestines.

52. Identify and describe the lobes and major ligaments of the liver, the anatomy of the gallbladder, the anatomy of the pancreas and its associated ducts, and their position relative to the intestines.

53. Identify the four quadrants and nine descriptive regions of the abdomen in relation to underlying organs.

**Reproductive system**

58. Identify and describe the differences between the male and female reproductive systems (organs, glands, external genitalia and pelvic characteristics).

59. Describe the anatomy of the pelvic diaphragm and perineum and their relationship to the neurovascular structures that supply these regions in males and females.

60. Describe the structure and composition of the breast.

61. Describe the anatomical changes that occur during pregnancy.

**Lymphatic system**

62. Describe the drainage of lymph throughout the body.

63. Identify the primary (bone marrow & thymus) and secondary lymphoid (lymph nodes, spleen, tonsils and appendix) organs and tissues of the lymphatic system.

**Endocrine**

64. Identify the major endocrine structures (hypothalamus, anterior and posterior lobes of the pituitary gland, pineal gland thyroid gland and parathyroid glands, thymus, adrenal gland, pancreas, gonads, skin, heart, kidneys, gastrointestinal tract and liver).

**Acknowledgements**

This project was funded by the Anatomical Society. The authors wish to express their gratitude to everyone involved, especially the nurse educator Delphi panelists from higher education institutions across Scotland, England, Wales, Northern Ireland and the Channel Islands who participated to develop the recommended syllabus. The authors also wish to extend their gratitude to the BNE group for their extensive work on curricular mapping and feedback that prompted the redesign of the syllabus from its original regional format to a system-based approach. Finally, we thank the School of Health & Social Science and the Centre for Medical Education, University of Edinburgh for their guidance.

**References**


