PRINCIPLES & CLINICAL APPLICATIONS

1. Anatomical terms & structures. Principles of regions
2. Principles of bones, joints & muscles
3. Principles of skin & viscera
4. Principles of nervous system & nerves
5. Principles of vascular systems & vessels
6. Principles of imaging (projectional & sectional)

Learning resources:

ANATOMEDIA ONLINE (see anatomedia.com )

BOOK: General Anatomy: Principles & Applications
# GENERAL ANATOMY 1
## Anatomical terms & structures. Principles of regions

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<td>Chapter 17 pp 189-193</td>
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Prime objectives are to comprehend:

1. The anatomical position
2. Anatomical planes (sagittal, coronal & transverse)
3. Terms of relationship. Terms of comparison. Terms of movement
4. The 4 types of tissues (epithelial, connective, nervous, muscular)
5. Combinations of tissues into organs (anatomical structures)
6. Embryonic derivation from 3 germ layers (ectoderm, mesoderm, endoderm)
7. Potentials and limitations during development are determined by the germ layer (noting only mesoderm-derived structures are intrinsically vascular)
8. Classification of organs into organ systems (noting structure mirrors function)
9. Subdivision of the body into regions
10. Arrangement of anatomical structures into compartments and layers.
11. Unpaired regions and midline of body
12. Paired regions and bilateral symmetry
13. Flexor and extensor regions
14. Coronal morphological plane
15. Boundaries of regions (bony & soft tissue). Apertures between regions
16. Compartments (with boundaries and contents)
17. Layers (superficial, intermediate & deep)
18. Flexor and extensor compartments
19. Flexible and rigid compartments
20. Compartment syndrome (noting order of structures affected & effects)
21. Mobile fascial planes (noting significance regarding potential paths of direct spread)
22. Neurovascular bundles & fascial sheath (noting peripheral position of vein & lymphatics)
23. Fixed fascial planes (conduits for vessels & nerves to pass from deep to superficial)
24. Body walls and parietal structures
25. Serous sacs with body cavities
26. Visceral herniation and prolapse
27. Course of superficial veins (& cutaneous nerves) along axial borders of limbs
28. Course through a region (noting position of arteries relative to joints)
29. Relations within a region (to the boundaries and to the other contents)
30. Neurovascular endangerment (by severance, entrapment or external compression).
# GENERAL ANATOMY 2
## Principles of bones, joints & muscles

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<td><strong>Articular system</strong>&lt;br&gt;Fibrous &amp; cartilaginous joints. Synovial joint types&lt;br&gt;Articular surfaces &amp; cartilage. Fibrous capsule&lt;br&gt;Synovial membrane &amp; cavity. Ligaments&lt;br&gt;Special structures of joints. Joint mobility &amp; stability Neurovascular supply of a joint</td>
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<td>SYSTEMS 62&lt;br&gt;SYSTEMS 10-11&lt;br&gt;SYSTEMS 12-13&lt;br&gt;SYSTEMS 14-15&lt;br&gt;SYSTEMS 16-17&lt;br&gt;SYSTEMS 18</td>
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<td><strong>Muscular system</strong>&lt;br&gt;Muscle structure &amp; attachments. Tendons&lt;br&gt;Deep fascia &amp; retinacula. Fascial septa &amp; sheets&lt;br&gt;Fibrous &amp; synovial tendon sheaths&lt;br&gt;Skeletal muscle form. Muscular contraction &amp; actions Neurovascular supply &amp; myotomes</td>
<td>Chapter 6&lt;br&gt;pp 50-65</td>
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Prime objectives are to comprehend:

1. **Bone structure and bone marrow.** Roles (mechanical and haemopoietic)
2. **Bone types and bony features.** Cartilage types and their sites
3. **Centres of enchondral ossification** (primary and secondary)
4. **Parts of a developing long bone** (noting sites of growth in length). Types of epiphyses (noting sites)
5. **Neurovascular supply of bone** (noting the contrast with cartilage)
6. **Blood supply of a developing long bone** (noting sites & significance of ‘end arteries’)
7. **Fractures and epiphysial injuries** (noting their significance).
8. **Joint classification** (fibrous, cartilaginous & synovial). Characteristics and types of synovial joints
9. **Articular surfaces and articular cartilage**
10. **Synovial capsule** (noting attachments relative to articular margin)
11. **Synovial cavity and synovial membrane** (noting roles of synovial fluid)
12. **Types of ligaments and special structures** (noting their roles)
13. **Factors responsible for stability** (noting trade-off between stability & mobility)
14. **Neurovascular supply of joint components** (noting if rich, poor or absent)
15. **Cartilage degeneration and injury** (noting implications regarding pain & on healing)
17. **Muscle types** (skeletal, smooth & cardiac)
18. **Skeletal muscle structure and attachments** (origins & insertions)
19. **Associated fibrous tissue** (noting sites of a tendon, aponeurosis or raphe)
20. **Deep fascia** (noting roles and sites where thickened or absent)
21. **Fascial septa, sheets & sheaths** (noting roles and sites). Fibrous & synovial tendon sheaths
22. **Skeletal muscle form** (noting length & orientation of fibres and cross-sectional area)
23. **Types of muscle contraction and actions** (prime mover, antagonist, fixator & synergist)
24. **Neurovascular supply of muscles** (in contrast to tendons & fascia)
25. **Neurovascular hilum** (noting motor point) **and motor units.**
26. **Myotomes** (contrasting pattern in trunk with limbs)
27. **Muscle and tendon injuries** (noting implications regarding pain & on healing).
# GENERAL ANATOMY 3

## Principles of skin & viscera

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<td>Mucous membrane &amp; junction zones</td>
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*Prime objectives are to comprehend:*

1. Skin structure and relaxed skin tension lines (noting their significance)
2. Roles of skin
3. Skin appendages and specialisations
4. Surface area of body (noting significance in burns)
5. Subcutaneous tissue and fat (noting presence of superficial nerves & vessels)
6. Cutaneous nerve fibre types
7. Neurosomes (including dermatomes & peripheral cutaneous nerve supply)
8. Overlap in nerve supply and sites of internervous lines (noting significance)
9. Axial borders and axial lines
10. Dermatome maps (noting differing maps for different sensory modalities)
11. Dermatomal distribution of rash in 'shingles'
12. Referred pain (noting anatomical basis for sites of referral)
13. Angiosomes (noting significance for skin transplants)
14. Lymphotomes (& implications of watershed areas on spread of skin cancers).
15. Organisation into respiratory, digestive, urogenital & endocrine systems
16. Tracts of hollow tubes with associated solid glands
17. Wall layers of a hollow viscus. Visceral obstruction
18. Exocrine glands (with ducts) and exocrine secretion
19. Endocrine glands and endocrine secretion
20. Paired and unpaired viscera (noting implications for neurovascular supply)
21. Serous membrane and mesenteries
22. Mobility and fixation trade-off (noting vulnerability for torsion)
23. Muscle coats (and motility of a tubular viscus)
24. Sphincters (anatomical and functional)
25. Mucous membrane and junction zones
26. Hilum and vascular segments of a solid viscus
27. Neurovascular supply of viscera
28. Visceral strangulation
## GENERAL ANATOMY 4

### Principles of nervous system & nerves

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### Prime objectives are to comprehend:

1. **Nervous System: Central (CNS) & Peripheral (PNS) components**
2. **Peripheral nervous system** (12 pairs of cranial & 31 pairs of spinal nerves)
3. **Autonomic (visceral) nervous system** (sympathetic, parasympathetic & enteric divisions)
4. **Nerve fibre structure** (including connective tissue sheaths) and roles
5. **Sensory or motor and somatic or visceral functional fibre types in spinal nerves**
6. **Additional** (special motor & special sensory) functional fibre types in cranial nerves
7. **Reflexes and components of a reflex arc**
8. **Central nervous system** (brain and spinal cord)
9. **Structure & function of grey matter and of white matter**
10. **Arrangement of grey matter & white matter** (contrasting brain with spinal cord)
11. **Grey matter nuclei in the brain** (particularly basal nuclei)
12. **White matter tracts** (projection, association & commissural fibres)
13. **Sites of descending & ascending fibres in spinal cord** (contrasting their functions)
14. **Upper & lower motor neurones**
15. **Spinal nerve roots** (anterior & posterior) and rami (anterior & posterior)
16. **Spinal nerves and their segmental distribution**
17. **Nerve ganglia** (sensory & motor) and their locations
18. **Sympathetic trunks and fibre paths** (noting sites of connections to spinal nerves)
19. **Nerve plexuses** (noting significance of anterior & posterior divisions to limbs)
20. **Peripheral nerve distribution and types of branches** (noting branching sequence)
21. **Protective somatic reflexes** (particularly reflex muscle spasm)
22. **Vasa nervorum & vessels to the CNS** (noting the ‘blood brain barrier’ & its significance)
23. **Nerve injuries** (noting grades & effects)
24. **Neurogenic pain** (including ‘phantom pain’).
**GENERAL ANATOMY 5**

**Principles of vascular systems & vessels**

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<td><strong>Arterial system</strong>&lt;br&gt;Arteries &amp; branches&lt;br&gt;Anastomoses&lt;br&gt;End arteries&lt;br&gt;Neurovascular supply of a vessel</td>
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<td><strong>Venous system</strong>&lt;br&gt;Veins &amp; tributaries&lt;br&gt;Veinous valves &amp; venae comitantes&lt;br&gt;Veinous sinuses &amp; communications</td>
<td>Chapter 11&lt;br&gt;pp146-156</td>
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Prime objectives are to comprehend:

1. Arterial systems (pulmonary and systemic)
2. Artery structure (lumen & layers of arterial wall) & arterioles (noting their role)
3. Arterial tree and types of arterial branches
4. Sites of capillaries or sinusoids and of structures which are avascular
5. Arterial flow (noting where a pulse can be palpated) and arterial blood pressure
6. Types of haemorrhage (noting first aid management)
7. Arterial anastomoses (true & potential) and AV anastomoses
8. End arteries (anatomical & functional) noting sites
9. Arterial occlusion (intraluminal, intramural & external) and effects
10. Vasomotor nerve supply (controlling vascular tone) and vasa vasorum
11. Venous systems (pulmonary, systemic & portal)
12. Vein structure and venous valves (noting role and sites)
13. Venous tributaries and venae comitantes (noting role & sites)
14. Venous flow (noting mechanism of vascular, muscular & thoracic pumps)
15. Venous sinuses and communications (particularly via venous plexuses)
16. Thrombosis, venous embolism (noting the significance of a calf DVT) & arterial embolism
17. Varicose veins and venous valve incompetence
18. Significance of venous spread (of tumours & infection)
19. Components of lymphatic system and of haemopoietic system
20. Roles of lymphatic system (fluid return and defense)
21. Lymph vessel structure (noting blind origin of capillaries & presence of valves in lymphatics)
22. Sites of lymph capillary plexuses. Tissues without lymph capillaries
23. Lymph trunks and lymph ducts
24. Lymph return & mechanisms of lymph flow (vascular, muscular & thoracic pumps)
25. Major direct path of lymph to venous system (noting sites of entry of lymph ducts)
26. Potential sites of lympho-venous communications (particularly via lymph nodes)
27. Lymph node structure
28. Sites of major palpable lymph nodes (noting drainage from superficial to deep groups)
29. Lymph drainage (noting quadrants of body drained by thoracic duct)
30. Stages & significance of lymphatic spread (of tumours & infection)
31. Factors complicating direction of spread
32. Lymphoid organs and sites of lymphoid tissue aggregates
### GENERAL ANATOMY 6

**Principles of imaging (projectional & sectional)**

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<td>Ultrasound image production</td>
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<td>Tissue properties in US. Properties of US images</td>
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<td><strong>Endoscopic anatomy</strong></td>
<td>Chapter 27 pp263-267</td>
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<tr>
<td>Looking within hollow viscera, body &amp; joint cavities</td>
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*Prime objectives are to comprehend:*

1. **Tissue radiodensities** (& the radiodensity spectrum)
2. **Radiological interfaces. Lines on a radiograph**
3. **Types of radiographic views** (projections)
4. **Visualisation of bones on images** (long, short, irregular, flat, pneumatic & accessory bones)
5. **Identifying ossification centres** (to determine skeletal age). **Visualising epiphysial plates** (growth)
6. **The 'radiological joint space' and assessing bony articular surfaces**
7. **Identifying fat-soft tissue interfaces & air-soft tissue interfaces on images** (as well as distinguishing intraluminal air or gas)
8. **Tissue radiodensities relative to water of soft tissues** (slightly higher) & **bone** (much higher) and of fat (slightly lower) & **air** (much lower)
9. **Body slices in CT images** (creating pixels from voxels)
10. 'Windowing' in CT (to limit the grey scale displayed to the range of interest)
11. **Use of oral contrast media** (to help distinguish hollow organs) and **intravenous contrast media** (to help distinguish vessels & vascular solid organs)
12. **Magnetisation of body with MRI** (rather than ionising radiation)
13. **Contraindications to MR imaging** (particularly implanted electronic devises and potentially mobile ferromagnetic material)
14. **Proton densities** (T1 & T2) of **tissues in MRI** (reflecting their different chemical composition)
15. **Appearances on T1-weighted images** (high fat content is bright) and **on T2-weighted images** (high water content is bright) noting compact bone & **air appear black on both**
16. **The advantage of distinguishing types of soft tissues from each other on MR images**
17. **The advantage of Ultrasound for real time sectional imaging without ionising radiation**
18. **Acoustic interfaces** (at junctions of tissues with different acoustic impedance)
19. **Echogenicity of different tissues and Ultrasound tissue scale** (fluid appears black, soft tissues are varying degrees of grey and fat is white)
20. **Utilising the 'Doppler effect'** (from rapidly moving objects in Doppler Ultrasound) of flowing blood.