

ANATOMY

OBJECTIVES

At the end of course, the learner shall be able to :

- 1 Describe the general anatomy of structures and organ systems of the human body
- 2 Describe the normal disposition, interrelationships, innervations, vascular supply and functional anatomy of *clinically relevant* structures and organs of the human body.
- 3 Correlate the normal microscopic structure of various organs with their functions (as a prerequisite for understanding the altered state in commonly encountered disease processes).
- 4 Explain basic principles and sequential development of the organ systems
- 5 Explain the embryologic basis of the major developmental abnormalities and variations.
- 6 Explain the basics of medical genetics with respect to common genetic syndromes.
- 7 Explain the anatomical basis of contraception.

Course Contents

General Anatomy	Must know	Desirable to know
Brief history of anatomy as related to medicine, subdivisions of anatomy; cadaver, anatomical position, other positions used in clinical practice, terms of position, terms of movement, colours used in anatomical drawings.	✓	
Structures met with during dissection: skin, superficial fascia - including contents, deep fascia - including its modifications; muscles - parts, origin, insertion, tendon, aponeurosis, bursa, synovial sheath; ligament, artery, vein, lymphatics, lymph node, peripheral nerves.	✓	
General principles of embryology, gestation period, subdivisions, spermatogenesis, structure of sperm, oogenesis, structure of ovum, growth & rupture of the ovarian follicles. Sperm in the male and female genital tracts, activation & capacitation of sperms in the female genital tract.	✓	
Embryology		
First week of development: Fertilization, formation of zygote, cleavage division, formation of morula & blastocyst, implantation, formation of decidua - its subdivisions. Types of implantation & abnormal sites of implantation. Anatomical basis of contraception.	✓	
Second week of development: Differentiation of embryoblast & trophoblast, changes in the embryoblast - bilaminar germ disc, changes in trophoblast, formation of cytotrophoblast, syncytiotrophoblast, amniotic membrane, yolk sac, extra-embryonic mesoderm & extra-embryonic celom & connecting stalk, formation of chorion, amniotic cavity, primary yolk sac cavity, appearance of prochordal plate.	✓	
Third week of development: Appearance of primitive streak & primitive node, formation of intra embryonic mesoderm resulting in trilaminar germ disc, formation of	✓	

	Must know	Desirable to know
notochord, buccopharyngeal & cloacal membranes, pericardial bar, paraxial, intermediate & lateral plate mesoderm, secondary yolk sac, intra embryonic celom & allantoic diverticulum, derivatives of ectoderm, mesoderm & endoderm.		
Third to tenth month of development: Maturation of tissues & organs & rapid growth of body. Estimation of age, horizons of development.	✓	
Placenta: Formation of placenta & chorionic villi, deciduas basalis, features & functions of placenta, placental circulation, abnormalities, placental barrier, types of placenta.	✓	
Umbilical cord: Formation of umbilical cord, features of umbilical cord.	✓	
Amniotic cavity: Amniotic cavity & membrane, amniotic fluid - functions, expansions of amniotic cavity & fusion with chorion, chorion leave with deciduas capsularis, deciduas capsularis with parietalis, obliteration of chorionic & uterine cavities, function of fused fetal membranes to dilate cervical canal.	✓	
Abnormalities, obliteration of chorionic & uterine cavities, abnormalities of chorion.	✓	
Formation and types of twins.	✓	
Arrangement of fetal membranes.	✓	
Development of face, pharyngeal arches, clefts, pouches, & associated common congenital anomalies	✓	
Teratology: Genetic & environmental factors as causative factors for congenital malformations. Mode of actions of teratogens & critical periods.	✓	
Postnatal growth & development: Meaning of terms like growth, development, principles of growth & development, types of postnatal growth, periods of growth & development & factors influencing them. Assessment of growth & development.	✓	
Milestones of development, growth & development during adolescence.	✓	
General Histology		
General Histology: Introduction including importance of studying histology in patient care, epithelium, surface specializations, connective tissue - definition, cells, fibres, ground substance, classification and features of different types of connective tissues, cartilage, bone, muscle, nerve tissue, general account of glands.	✓	
Basement membrane, junctional complexes.		✓
Integumentary System		
Skin and its appendages, superficial fascia, deep fascia, development and microscopic and applied anatomy.	✓	

	Must know	Desirable to know
Osteology		
Constituents of skeleton, types of bones, classification of bones with examples, names of bones, general features of different bones, colours used for marking origin and insertion of muscles, attachment of joint capsule, aponeurosis, ligaments, fascia, reflection of synovial membrane etc. of the body & their position, development & common congenital anomalies, microscopic anatomy of bone, common sites of fractures, general pattern of blood supply, ossification of bones of limbs for age determination and applied anatomy.	✓	
Process of the repair of bone.	✓	
Muscular system		
Classification & identification of muscles of body, main attachments, nerve supply & action, microscopic anatomy, development of muscles and applied anatomy.	✓	
Mechanism of movement caused by muscle/muscles & various forces exerted by them, nerve terminations.		✓
Arthrology		
Classification of joints, general features of different types of joints, detailed study of major joints of body & movements, a brief account of other joints, applied anatomy of major joints.	✓	
Range of movement in major joints, microscopic anatomy of articular cartilage, maintenance of articular cartilage, blood supply.		✓
Cardiovascular system		
Position and parts of heart, names of blood vessels & their distribution in the body, normal development of heart, common congenital anomalies, microscopic anatomy of heart & blood vessels, gross anatomy of major blood vessels of the body, pericardium, pericardial cavity, concept of precordium and applied anatomy.	✓ ✓	
Developmental anomalies, valvular defects & their effects.		✓
Respiratory system		
Position, parts, relations, blood supply, lymphatic drainage, microscopic anatomy, normal development & congenital anomalies, thoracic cage, superficial and deep cardiac dullness, and movements of thorax during respiration, pleura, pleural cavity and applied anatomy.	✓	
Blood air barrier, cell population in the respiratory tract.		✓
Gastrointestinal system		
Position, parts, relations, blood supply, nerve supply, lymphatic drainage, normal development & congenital anomalies, microscopic anatomy, sphincters of the gastrointestinal system. Peritoneum, peritoneal cavity, fossae & folds and applied anatomy.	✓	
Sphincteric action & mechanism. Peptic ulcer, Payer's patches, positions of appendix, marginal artery of Drummond.		✓

	Must know	Desirable to know
<p style="text-align: center;">Genitourinary system</p> <p>Parts, position, relations, blood supply, nerve supply, lymphatic drainage, normal development & congenital anomalies, microscopic anatomy of Genitourinary system. Normal sites of constrictions in the urinary passage. Prostate gland, Skenes tubules and applied anatomy.</p>	✓	
Anatomical basis of family planning measures.		✓
<p style="text-align: center;">Endocrine system</p> <p>Organs, location, relations, blood supply, nerve supply, lymphatic drainage, microscopic anatomy & normal development & congenital anomalies and applied anatomy.</p>	✓	
<p style="text-align: center;">Nervous system</p> <p>Parts of nervous system, meninges, neuroglia, cortex, functional cortical areas, basal ganglia, corpus striatum, white matter, ventricles, cerebellum, brain stem, motor & sensory pathways, cranial nerves, normal development, microscopic anatomy of neurons, motor & sensory cortex, blood supply and applied anatomy.</p>	✓	
Reticular formation, limbic system, extrapyramidal system, correlation of microscopic anatomy with function, developmental anomalies, anatomical basis of common neurological disorder / syndromes, nerve terminals.		✓
<p style="text-align: center;">Autonomic Nervous system</p> <p>Sympathetic, parasympathetic systems, cortical control, peripheral plexuses, common associated disorders and syndromes.</p>		✓
<p style="text-align: center;">Special sensory organs</p> <p>Introduction to the eyeball and internal ear, gross anatomy of middle ear, nose & tongue and applied anatomy.</p>	✓	
<p style="text-align: center;">Lymphatic system</p> <p>Gross anatomy of major groups of lymph nodes of body & their drainage areas. Gross anatomy of major lymphatics, specially thoracic duct, jugular, subclavian and mediastinal lymph trunks. Microscopic anatomy of lymph nodes and applied anatomy.</p>	✓	
Gross anatomy, development, blood supply and applied anatomy of thymus, spleen & palatine tonsil.	✓	
<p style="text-align: center;">Medical Genetics</p> <p>Morphology of human chromosomes, amniocentesis and other methods to procure tissue/cells for the genetic study, karyogram, anomalies of chromosomes - structural and numerical, introduction to the common genetic disorders like - Mongolism, Meta female (Super female), Turner syndrome, Klinefelter syndrome.</p>	✓	
<p style="text-align: center;">Imaging Anatomy</p> <p>Identification of normal anatomical features in some commonly used skiagrams (plain & contrast), CT scan, ultrasound, MRI and endoscopy.</p>	✓	
<p style="text-align: center;">Surface Anatomy</p> <p>Surface marking of those structures, organs and viscera of the body which are commonly affected in various disease processes.</p>	✓	

	Must know	Desirable to know
Sectional Anatomy		
Gross / sagittal / coronal sections of thorax, abdomen, pelvis, limbs, head & neck and brain to understand interrelations of organs and interpret CTs & MRIs.	✓	

SKILLS:

SKILLS:		Perform Independently	Under Guidance	Assist	Observe
1	Identify all the major structures, organs & viscera of the body	✓			
2	Demonstrate normal movements at various joints.	✓			
3	Demonstrate how to test the functioning of different muscles or muscle groups	✓			
4	Mark/draw the surface anatomy of all the major structures and organs of the body on a cadaver or a volunteer	✓			
5	Locate and palpate arterial pulsations, and identify structures against which arteries can be compressed to stop bleeding.	✓			
6	Locate ideal sites for venepuncture.	✓			
7	Locate the site for emergency tracheostomy.	✓			
8	Locate subcutaneous positions of large nerves.	✓			
9	Locate ideal sites for lumbar and sternal puncture, pericardial, intercostal and peritoneal tapping, and biopsies of liver, kidney and spleen.	✓			
10	Interpret the cross-sectional anatomy of the human body	✓			
11	Identify normal anatomical structures, organs and viscera in radiographs, ultrasound images, computerized tomograms, magnetic resonance images and the endoscopic views.	✓			
12	Identify the organs and tissues in sections under the microscope	✓			
13	Identify the critical stages in the embryonic development and interpret the effects of common teratogens, genetic mutations and environmental hazards on development	✓			
14	Identify and interpret normal karyograms, abnormal karyograms and clinical features of common genetic disorders.	✓			

TEACHING/LEARNING METHODS

1. Lectures - not more than 1/3rd of the total teaching hours.
2. e-mode learning of some of the topics.
3. Small group teaching - such as:
 - a) Demonstrations.
 - b) Tutorials.
 - c) Seminars.
 - d) Problem Based Learning.
4. Dissection / Prosected parts demonstrations / Instructions on mannequins.
5. Skills Lab with CDs of various stages of dissection.
6. Histology Lab.
7. Surface marking.
8. Imaging anatomy Lab.
9. Visit to the museum.
10. Preparation of scientific article.
11. Preparation of gross anatomy practical drawing book
12. Preparation of histology practical drawing book.

PRACTICALS

Gross Anatomy:

Dissection/Demonstration of Prosected parts

Dissection of the whole body, at least once or prosected part demonstration or skill lab with CD of dissection stages and adequate number of mannequins depending on the number of students.

Prosected part demonstration or skill lab with CD of dissection stages and adequate number of mannequins depending on the number of students.

Upper limb: demonstration: pectoral & scapular regions, shoulder region, axilla, arm, forearm, hand: palm & dorsum, joints of upper limb.

Thorax: demonstration: chest wall, diaphragm, mediastinum, lungs & heart.

Abdomen: demonstration: anterior abdominal wall, inguinal region, organs / viscera & posterior abdominal wall.

Pelvis: demonstration: pelvic viscera, wall, blood vessels and nerves.

Perineum: external genitalia, perineal pouches and anal triangle including ischioanal fossa.

Lower limb: demonstration: gluteal region, thigh: anterior, medial, posterior compartments, popliteal fossa, leg: anterior, lateral and posterior compartments, Foot: dorsum, sole. Joints of lower limb.

Head & Neck: demonstration: scalp, superficial & deep dissection of face & neck, parotid region, cranial cavity, contents of orbit, triangles of neck, introduction to the eyeball, submandibular region, temporal & infratemporal fossa, oral cavity, pharynx, larynx, ear, thyroid & parathyroid gland, oesophagus, trachea, blood vessels and cranial nerves, vertebral canal and contents.

Brain: Sections & prosected specimens of brain to demonstrate meninges, blood supply, functional cortical areas, ventricles, visual pathways, auditory pathways, basal ganglia, corpus

striatum, cerebellum and sections of the brain stem.

Demonstrations:

Bones, Sectional anatomy, Radiological anatomy & Ultrasonography, CT & MRI scan and Endoscopic anatomy.

Microscopic Anatomy:

Stained slides of all the clinically relevant tissues, organs and viscera.

Developmental anatomy:

Models / specimens to demonstrate various stages of fertilization, implantation, formation of embryo, development of fetus and development of various organs & systems. Commonly encountered congenital defects.

Medical Genetics:

Demonstration of normal karyogram. Clinical picture, features and karyogram of the common genetic conditions.

Visit to the museum:

At least once a week to study specimens, models, charts etc.

Areas for integrated teaching

Anatomical basis of birth control measures	O&G, Surgery
Postnatal growth & development	Pediatrics & Community Medicine
Antenatal growth & development	O&G
Genetic disorders	Various clinical departments
Neuroanatomy	Physiology & Medicine
Kinesiology - movements at joints	Orthopedics
Embryological basis of important & common congenital anomalies	Pediatrics, O&G

Ward posting

Evening, once / twice a week from third month onwards, besides visits to the community settings.

LEARNING RESOURCE MATERIALS

Recommended books:

I **Gross Anatomy**

1. **Cunningham's Manual of Practical Anatomy Vols. I,II & III** By G.J. Romanes
15th Edition 1996 Oxford University Press
2. **Clinical Anatomy for Medical Student** By R.S. Snell
7th Edition 2003 Lippincott Williams & Wilkins
3. **Grants Atlas of Anatomy** By A. Agur, M. Lec
11th Edition 2004

II. **Histology**

2. **Histology: A text & atlas** By M.H. Ross
4th Edition 2002 G.I. Kaye, W. Pawlina

2. DiFiore's- Atlas of Histology with Functional correlations
10th Edition 2004
Lippincott Williams & Wilkins
By V. Eroschenko
International Edition
3. Textbook of Histology
5th Edition 1995
Leeson C. Ronald
Papara A.
W.B. Saunders Co.,
Philadelphia
- III Developmental Anatomy**
1. Langman's- Medical Embryology with Simbryo Version 1CD-ROM
9th Edition 2003
T. Sadler
Lippincott, Williams and Wilkins
- IV Neuroanatomy**
1. Barr's The Human Nervous system An Anatomical View Point with CD
8th Edition 2004
J Kiernan
Harper & Row
2. Neuroanatomy An Illustrated Colour Text. 2nd Edition 2001
By AR Crossman and D Neary
Churchill Livingstone
- Reference books:**
- I Gross Anatomy:**
1. Gray's Anatomy
39th Edition
By Susan Standring
Churchill Livingstone (1600 + 2260 pages)
- II Histology**
1. Basic Histology (Text & Atlas)
10th Edition 2003(with CD ROM)
By Luis C. Junqueira
Carneiro
Appleton and Lange
3. Wheaters Functional Histology
4th Edition 2000
Edited by B, Young and J. Heath
Churchill Livingstone
- III Developmental Anatomy**
1. Human Embryology
3rd Edition 2001
William J. Larsen
Churchill Livingstone
www.med.uc.edu/embryology
- IV Genetics**
1. Thompson & Thompson
Genetics in Medicine
6th Edition 2001
Revised reprint March 2004
Nussbaum, McInnes & Willard
W.B. Saunders & Co.
Philadelphia, London
2. Essential Medical Genetics
5th Edition 1997
J.M. Connor
M.A. Ferguson Smith
Blackwell Scientific Publication
- V Neuroanatomy**
1. Human Neuroanatomy
9th Edition 1996
Andre Parent, Malcolm B Carpenter
Williams and Wilkins

- | | | |
|----|---|--|
| 2. | Clinical Neuroanatomy
for Medical Students
5 th Edition 2001 | By Richard S. Snell
Lippincott, William and Wilkins |
| 3. | Clinical Neuroanatomy
and related Neuroscience
4 th Edition 2002 | By MJT Fitzgerald
Saunders and Co. |

CDs & Internet:

1. A.D.A.M. (Animated Dissection of Anatomy for Medicine) Comprehensive for Windows. Publisher: A.D.A.M. Software Inc.
2. A.D.A.M. Interactive Anatomy, Publisher: A.D.A.M. Software Inc.
3. Cardioviewer 3D: CD-ROM, ISBN: 0-8151-3106-2, publication date: 1996
Imprint: MOSBY (Marketed by Elsevier)
4. Histology/pathology slides: <http://www.virtualslides.psu.edu/listSlides.jsp>
5. Collection of Links to Anatomical resources on the internet: <http://www.west.asu.edu/jbuenke/medicine/anatomy.html>

**Suggested topics for e-learning in Anatomy
(Recommended to assist and supplement teaching)**

1. Fertilization
2. Cleavage
3. Implantation
4. Post Natal Growth and Development
5. Development of Pharyngeal arches, clefts, pouches.
6. Descending tracts of Central Nervous System
7. Ascending tracts of Central Nervous system
8. Medical Genetics - common syndromes
10. Visual pathways and visual areas
11. Major Joints & movements