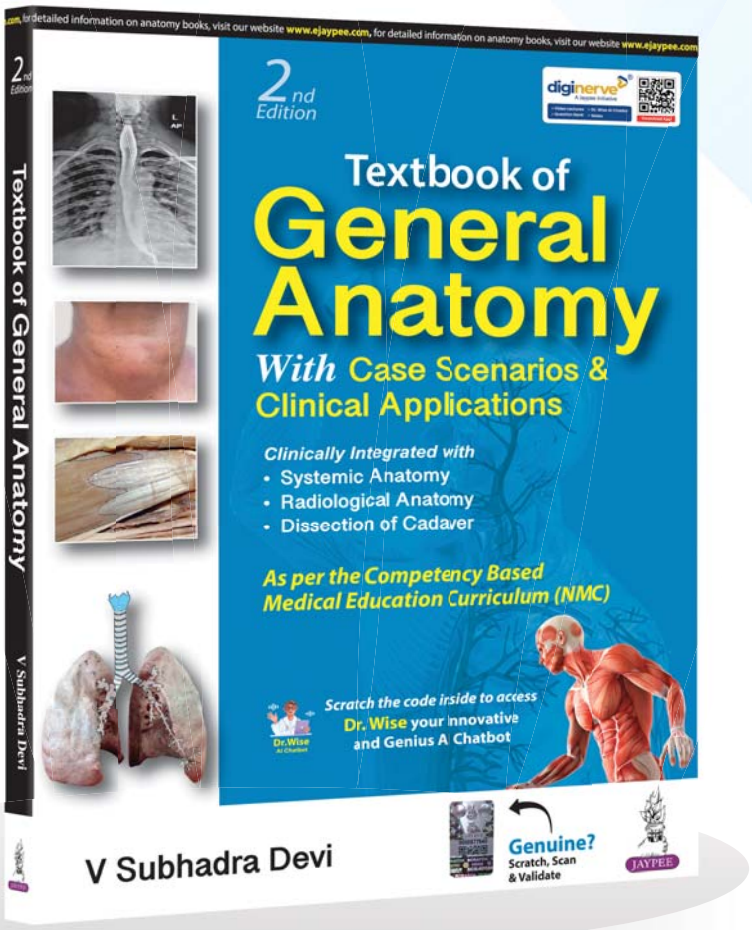

Textbook of

General Anatomy

With Case Scenarios & Clinical Applications

Clinically Integrated with
- Systemic Anatomy
- Radiological Anatomy
- Dissection of Cadaver

As per the Competency Based Medical Education Curriculum (NMC)

2nd Edition

V Subhadra Devi

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Why to Buy this Book ?

- This Book designed as per the basis of the **Competency Based Medical Education Curriculum (NMC).**
- **Anatomical terms** are given at the beginning of the book.
- Each chapter has learning objectives with **Clinical Relevance, Clinical Application** (Yellow Boxes), a **Case Scenario with questions and answers** (Blue Boxes), and a **Take-Home Message with a key concept** (Red Boxes).
- At the end of each chapter, questions are given which are from various different universities.
- Separate chapters are given on Introduction to **Radiological Anatomy, Introduction to Surface Anatomy,** and **Introduction to Dissection of Cadaver.**
- Instruments are given for dissection in the chapter **Introduction to Dissection of Cadaver** (Chapter No. 13).
- At the end of the book, **Multiple-Choice Questions** (MCQs) are given.

SAMPLE PAGES

Competency table are given in the beginning of the Book

COMPETENCY TABLE

Number	The student should be able to	Core (Y/N)	Chapter No.	Page No.
AN1.1	Demonstrate normal anatomical position, various planes, relation, comparison, laterality and movement in our body	Y	1	5
AN1.2	Describe composition of bone and bone marrow	Y	4	59, 61
AN2.1	Describe parts, blood and nerve supply of a long bone	Y	4	55, 60
AN2.2	Enumerate laws of ossification	N	4	69
AN2.3	Enumerate special features of a sesamoid bone	N	4	65
AN2.4	Describe various types of cartilage with its structure and distribution in body	Y	4	53
AN2.5	Describe various joints with subtypes and examples	Y	6	100
AN2.6	Explain the concept of nerve supply of joints and Hilton's law	Y	6	120
AN3.1	Classify muscle tissue according to structure and action	Y	5	77
AN3.2	Enumerate parts of skeletal muscle and differentiate between tendons and aponeuroses with examples	Y	5	78
AN3.3	Explain shunt and spurt muscles	N	5	93
AN4.1	Describe different types of skin and dermatomes in body	N	3	34, 36
			9	170
AN4.2	Describe structure and function of skin with its appendages	Y	3	34
AN4.3	Describe superficial fascia along with fat distribution in body	Y	3	43
AN4.4	Describe modifications of deep fascia with its functions	Y	3	43
AN4.5	Explain principles of skin incisions	N	3	34
			12	219
AN5.1	Differentiate between blood vascular and lymphatic system	Y	7	125
AN5.2	Differentiate between pulmonary and systemic circulation	Y	7	130
AN5.3	List general differences between arteries and veins	Y	7	128
AN5.4	Explain functional difference between elastic, muscular arteries and arterioles	Y	7	131
AN5.5	Describe portal system giving examples	Y	7	134
AN5.6	Describe the concept of anastomoses and collateral circulation with significance of end-arteries	Y	7	135, 137
AN5.7	Explain function of meta-arterioles, precapillary sphincters, arterio-venous anastomoses	N	7	136
AN5.8	Define thrombosis, infarction and aneurysm	N	7	139
AN6.1	List the components and functions of the lymphatic system	N	8	146
AN6.2	Describe structure of lymph capillaries and mechanism of lymph circulation	N	8	146
AN6.3	Explain the concept of lymphoedema and spread of tumors via lymphatics and venous system	N	8	153
AN7.1	Describe general plan of nervous system with components of central, peripheral and autonomic nervous systems	Y	9	157
AN7.2	List components of nervous tissue and their functions	Y	9	158
AN7.3	Describe parts of a neuron and classify them based on number of neurites, size and function	Y	9	158

Anatomical Terms are given for easy understanding

ANATOMICAL TERMS—HISTORICAL DERIVATION AND MEANING

There are approximately 170,000 medical terms that include names of medicines, medical investigations, medical conditions, medical examination, surgical procedures, body parts, body functions, etc. There are about 8000 frequently used terms.

Learning anatomy is not memorizing the facts. It has to be learnt by understanding the underlying development, evolution, function, and its clinical application. The complexities in learning can be reduced if one understands the meaning of the terms used in describing the various parts, their actions, shapes and relations.

Most of the anatomical terms we use have their roots from Latin or Greek. Memorization without understanding the meaning can lead to stress for the new learners. To facilitate the students certain of the terms are given in alphabetical order.

Anatomical term and its origin L-Latin G-Greek Fr-French	Meaning	Example
Abdomen (L)	*Abdere = to hide.* Belly	Part of trunk between thorax and perineum
Abducent nerve (L)	*Ab* = from; *ducere* = lead (movement)	6th cranial nerve that moves a muscle of eyeball (lateral rectus) that moves it away from midline
Abductor (L)	*Ab* = from; *ducere* = lead (movement)	A muscle that moves the part of body/limb away from midline
Aberrant (L)	*Ab* = from *Errare* = to wander *Deviation from normal*	Aberrant epiphysis
Accessory (L)	*Accedere* = to be added to	Accessory nerve: The 11th cranial nerve, functionally added to the vagus nerve (10th cranial nerve)
Acetabulum	*Acetum* = vinegar *-bulum*—suffix signifying instrument	Acetabulum of hip bone cup-shaped part of hip bone
Acromion (G)	*Akron* = tip or extremity *omos* = shoulder	Acromion process of scapula
Afferent (L)	Bringing towards	Afferent nerves bring information from the peripheral parts of the body to the central nervous system
Ala (L)	*Wing*	Ala of sacrum
Alba (L)	*Albicare* = white	Linea alba: The white linear fibrous structure that runs in the midline of the abdomen
Allantois (G)	*Allas* = a sausage *Eidos* = resemblance	Foetal membrane

Contd...

Clinical Application are highlighted in Yellow Boxes

Clinical Applications of Skeletal Muscle

- *Paralysis:* Muscle is unable to contract. It is due to damage to motor pathway that consists of upper motor neuron and lower motor neuron.
  - Upper motor neurons originate in the motor region of cerebral cortex or brainstem. Damage to upper motor neuron causes spastic paralysis with exaggerated tendon reflexes.
  - Lower motor neurons originate in the motor neurons located in the anterior gray column of spinal cord (spinal lower motor neurons) or in the cranial nerve nuclei of the brainstem (cranial nerve lower motor neurons). Damage to lower motor neuron causes flaccid paralysis with loss of tendon reflexes.
- *Muscular spasm:* It is due to spontaneous or involuntary contraction of a muscle. It may be localized (caused by muscle pull) or generalized (seen in tetanus and epilepsy).
- *Hypertrophy:* Excessive use of a particular muscle results in its hypertrophy. It is usually seen in athletes and body builders.
- *Atrophy:* If muscle is not used for a long time it becomes thin and weak. There will be reduction in size of muscle (muscle wasting). It is seen in paralysis and in generalized debility.
- *Regeneration:* Muscle is capable of limited regeneration. If large regions are damaged regeneration does not occur. The damaged muscle is replaced by connective tissue.
- *Muscular dystrophy:* It is progressive weakness and degeneration of muscles that control movement. These are a group of about 30 genetic disorders. There will be inherent defect in cell membrane of muscle and there is rupture of muscle fibers, e.g., Duchenne muscular dystrophy, Baker's muscular dystrophy. Duchenne muscular dystrophy is an X-linked recessive disorder. In this there is mutation in the gene for muscle protein dystrophin attached to cell membrane. This results in ineffective contraction of muscle leading to progressive damage and death of muscle cells.
- *Myasthenia gravis:* My = muscle, asthen = weakness, gravi = heavy. It is an autoimmune disease. There will be reduction in acetylcholine (ACh) receptors at neuromuscular junction as autoimmune antibodies attack the ACh receptors. It is characterized by progressive muscular weakness. Muscles of head and neck are affected first.
- *Intramuscular injections:* The muscles commonly used for intramuscular injection are deltoid (shoulder region), gluteus maximus (gluteal region), and vastus lateralis (thigh region) **(Fig. 5.15)**.
- *Muscle biopsy:* This is done for the diagnosis of certain muscle diseases by inserting a needle into a muscle under local anesthesia and collecting a small bit of muscle tissue. By this procedure diseases of connective tissue and blood vessel (*polyarteritis nodosa*) and inflammatory (*polymyositis*) and infectious (*toxoplasmosis*) diseases of muscle can be diagnosed.
- *Electromyography:* It is a diagnostic procedure performed to assess the health of the muscles and the motor neurons that control their movements.

Learning Objectives and Essential Concepts are underlined for clarity

LEARNING OBJECTIVES

- General features of muscular tissue
- Classification and types of muscles
- Structure of skeletal muscle
- Structural components of skeletal muscle
- Blood supply and innervation of skeletal muscle and its significance
- Classification of skeletal muscles
- Naming of muscles
- Clinical case with anatomical explanation

Case scenarios are highlighted in blue boxes

Anatomical Basis for Clinical Condition

Case Scenario

Problem: A middle aged person complained a snapping sound and sharp pain in the left heel after jumping from a height and landing on his sole and making him unable to walk properly. On examination a swelling above the heel was observed. The patient was unable to bend the left foot downward and unable to stand on the toes of the injured leg. It was diagnosed as rupture of Achilles tendon.

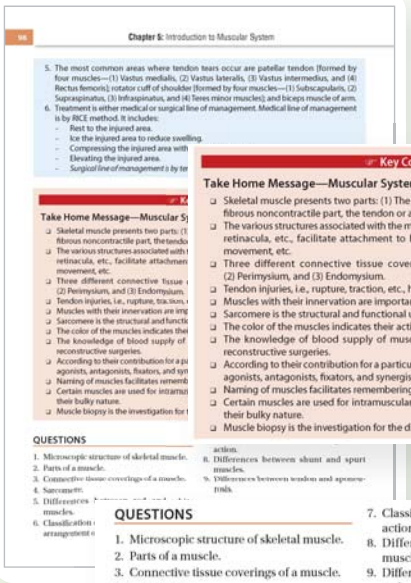
Questions:

1. What is Achilles tendon?
2. What is the site of rupture?
3. What is the cause for rupture of Achilles tendon?
4. What are the conditions in which it can occur?
5. What are the other tendons that rupture commonly?
6. What is the treatment?

Anatomical explanation:

1. Achilles tendon is a fibrous cord that connects the muscles of calf to the calcaneus.
2. Rupture of Achilles tendon occurs about 6 cm above the heel.
3. The tendon can bear forces of more than five times the body weight. Tear of this tendon is due to overstretching of the tendon and the poor blood supply to the tendon.
4. It occurs in recreational sports like jumping, running, etc., The common age at which it can occur is 30–40 years and is five times more common in men. In general rupture of tendon occurs in middle age and old age. In the middle age muscle tissue tears before the tendon will tear. Tendon tears are common in old people and in certain diseases such as gout, hyperthyroidism, and certain drugs like fluoroquinolones, statins, injection of steroids into a tendon, etc.

Take Home Message with Key Concepts are highlighted in Red Boxes



Chapter 5: Introduction to Muscular System

5. The most common areas where tendon tears occur are patellar tendon [formed by four muscles—(1) Vastus medialis, (2) Vastus lateralis, (3) Vastus intermedius, and (4) Rectus femoris], rotator cuff of shoulder [formed by four muscles—(1) Subscapularis, (2) Supraspinatus, (3) Infraspinatus, and (4) Teres minor muscles], and biceps muscle of arm.
6. Treatment is either medical or surgical line of management. Medical line of management is by RICE method. It includes:
   - Rest to the injured area.
   - Ice the injured area to reduce swelling.
   - Compressing the injured area with
   - Elevating the injured area.
   - *Surgical line of management is by te*

Take Home Message—Muscular Sy

- Skeletal muscle presents two parts: (1
- fibrous noncontractile part, the tendo
- The various structures associated with
- retinacula, etc., facilitate attachmen
- movement, etc.
- Three different connective tissue
- (2) Perimysium, and (3) Endomysium.
- Tendon injuries, i.e., rupture, traction,
- Muscles with their innervation are im
- Sarcomere is the structural and functi
- The color of the muscles indicates the
- The knowledge of blood supply of
- reconstructive surgeries.
- According to their contribution for a p
- agonists, antagonists, fixators, and syn
- Naming of muscles facilitates rememb
- Certain muscles are used for intramu
- their bulky nature.
- Muscle biopsy is the investigation for t

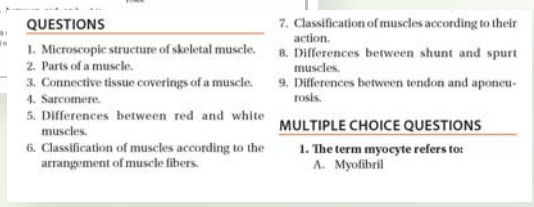
QUESTIONS

1. Microscopic structure of skeletal muscle.
2. Parts of a muscle.
3. Connective tissue coverings of a muscle.
4. Sarcomere.
5. Differences
- muscles.
6. Classificatio
- arrangement

Key Concept

Take Home Message—Muscular System

- Skeletal muscle presents two parts: (1) The fleshy contractile part, the belly and (2) The fibrous noncontractile part, the tendon or aponeurosis.
- The various structures associated with the muscles, i.e., tendons; ligaments, aponeuroses, retinacula, etc., facilitate attachment to bone, holding of structures, and facilitate movement, etc.
- Three different connective tissue coverings of the muscle are: (1) Epimysium, (2) Perimysium, and (3) Endomysium.
- Tendon injuries, i.e., rupture, traction, etc., heal slowly because of poor blood supply.
- Muscles with their innervation are important for functioning.
- Sarcomere is the structural and functional unit of muscle.
- The color of the muscles indicates their action.
- The knowledge of blood supply of muscle is important in choosing a muscle for reconstructive surgeries.
- According to their contribution for a particular movement the muscles are classified into agonists, antagonists, fixators, and synergists.
- Naming of muscles facilitates remembering them by their location, action, size, etc.
- Certain muscles are used for intramuscular injection because of their accessibility and their bulky nature.
- Muscle biopsy is the investigation for the diagnosis of certain muscle diseases.



QUESTIONS

1. Microscopic structure of skeletal muscle.
2. Parts of a muscle.
3. Connective tissue coverings of a muscle.
4. Sarcomere.
5. Differences between red and white muscles.
6. Classification of muscles according to the arrangement of muscle fibers.
7. Classification of muscles according to their action.
8. Differences between shunt and spurt muscles.
9. Differences between tendon and aponeurosis.

MULTIPLE CHOICE QUESTIONS

1. **The term myocyte refers to:**
   A. Myofibril

Question & Multiple Choice Questions are given in the chapter.

SAMPLE PAGES

Illustrative Diagram's for better Understandings.

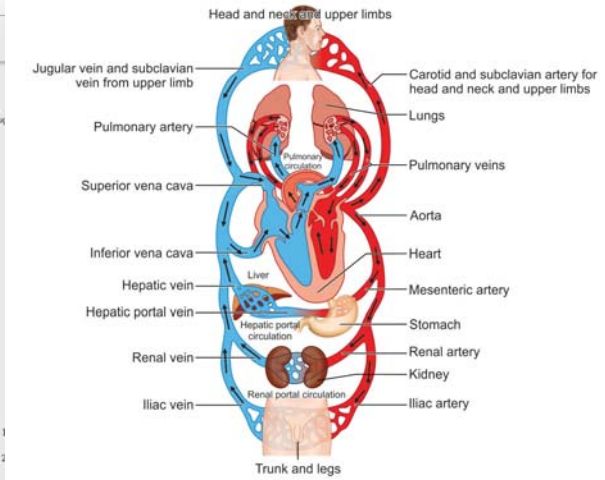


Fig. 7.6: Blood circulation—types.

1. A long loop consisting of heart, large arteries, and veins. – Distributing vessels
2. A short loop at the periphery consisting of capillaries. – Resistance vessels; Exchange vessels; Capacitance/reservoir vessels.

Radiological Image

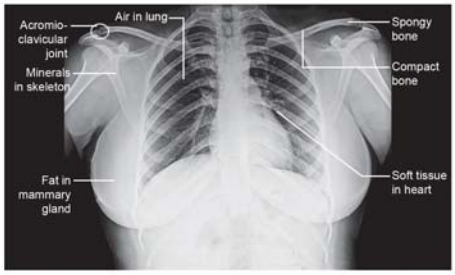


Fig. 11.1: X-ray chest [posteroanterior (PA) view].
Source: Saptagiri Scan Center, Tirupati.

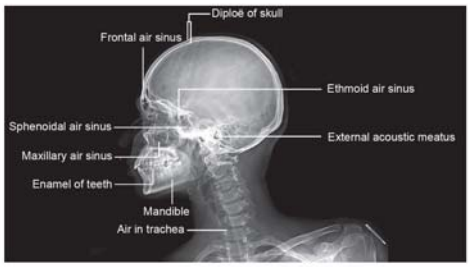


Fig. 11.4: X-ray—head and neck—lateral view.
Source: Saptagiri Scan Center, Tirupati.

Histological Slide given in green boxes

Table 2.4: Different types of stratified epithelia and their structure.

Stratified epithelia	*Structure (Figs. 2.6A to E)*
❑ *Stratified squamous*: The surface cells are flattened. There are two types: 1. *Stratified squamous epithelium (keratinized)*: • Present at dry surfaces where the superficial cells at surface lay down the protein keratin and lose their nuclei • Superficial cells are dead, dehydrated, non-nucleated, and scale like in appearance • Dead cells become hard or cornified • *Location*: Epidermis of skin • *Functions*: Protection of underlying tissues, prevents absorption of water, and keratin prevents dehydration of underlying tissues 2. *Stratified squamous epithelium (nonkeratinized)*: • Present on surfaces that are kept moist or wet • The deepest cells are columnar in shape. The intermediate cells are polyhedral and the surface cells are flattened • Shapes of nuclei of deepest cells are elongated, intermediate cells are rounded, and surface cells are flat • *Examples*: Lining epithelium of: – Oral cavity – Tongue – Esophagus – Vagina – Cornea • *Function*: Protection of deeper tissues	A Stratified squamous keratinized epithelium B Stratified squamous nonkeratinized epithelium
Stratified cuboidal: ❑ Cells of superficial layer are cuboidal. This is not a common epithelium ❑ *Example*: Ducts of sweat glands	C Stratified cuboidal
Stratified columnar: ❑ Cells of superficial layer are columnar ❑ *Examples*: Major ducts of the mammary gland and large salivary glands	D Stratified columnar epithelium
Transitional epithelium (urothelium): ❑ It is found lining hollow organs which are subject to great mechanical changes due to contraction and distension ❑ The shapes of cells in the surface layer of a transitional epithelium are convex, dome-shaped/umbrella shaped ❑ *Examples*: Ureter, urinary bladder ❑ *Functions*: Acts as a barrier and prevents absorption of toxic substances from urine and facilitates distension of urinary bladder	E Transitional epithelium

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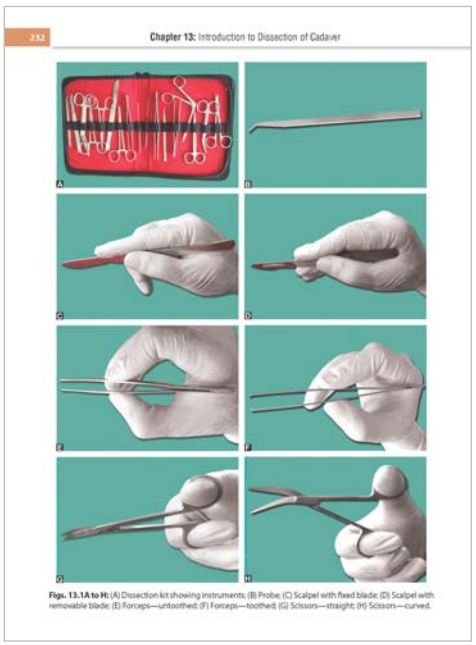
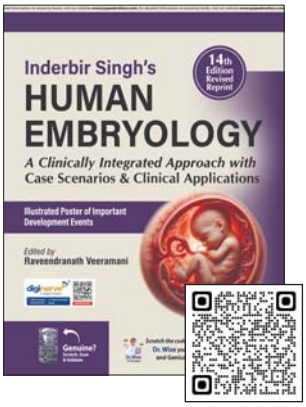
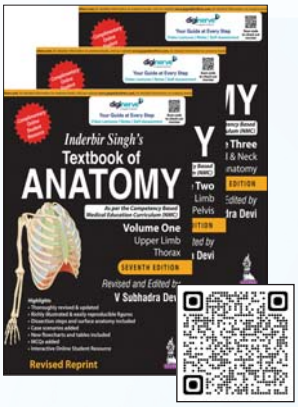
Instruments are given with the usage in the chapter of Introduction to dissection of cadaver.

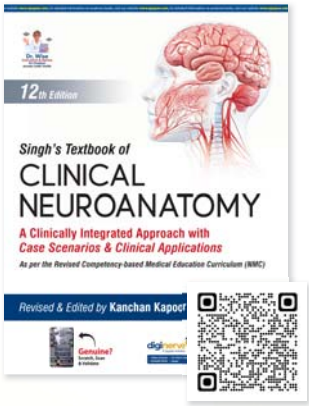


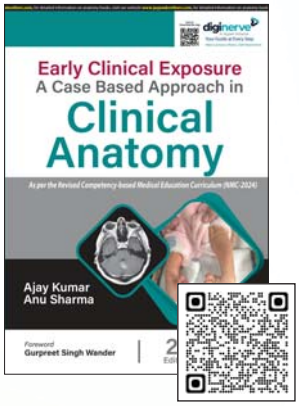
Figs. 13.1A to H: (A) Dissection kit showing instruments; (B) Probe; (C) Scalpel with fixed blade; (D) Scalpel with removable blade; (E) Forceps—untoothed; (F) Forceps—toothed; (G) Scissors—straight; (H) Scissors—curved.

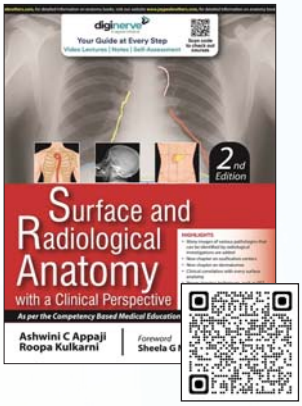
Other Useful Titles

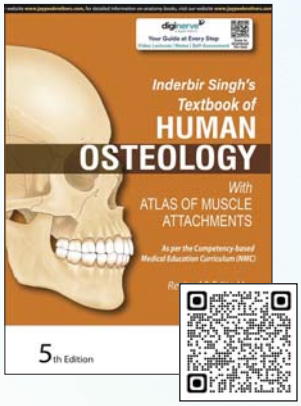


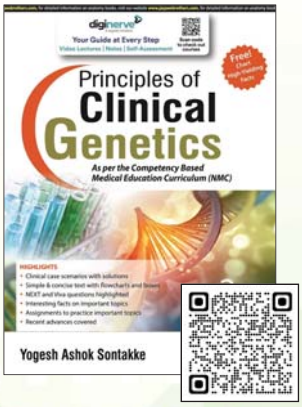


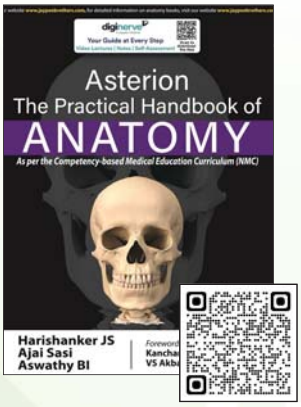


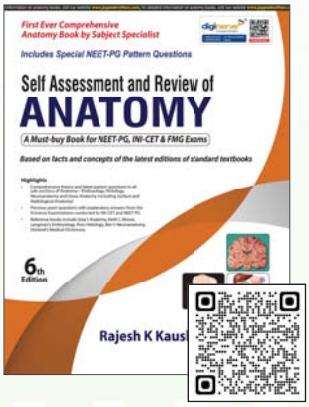












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