London School of Massage

"Massage to a Higher Level" ©

Muscular System

At the end of this section you will understand and appreciate:

- Structure and function of muscles
- Classification of muscles
- How muscles contract
- Factors affecting muscle contraction
- Names of muscles of the Head, Trunk and Extremities
- Conditions affecting the muscular system
- How massage affects the muscular system

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Muscular System

Muscle is a group of specialised **elastic** tissue. It is the most abundant type of tissue in the body.

23% of a woman's weight is muscle

40% of a mans weight is muscle

GENERAL FUNCTION OF MUSCLE

Through contraction, muscle performs 4 important functions:

1. **MOVEMENT** (both locomotion and internal movement,)

2. Maintenance of **POSTURE** and **stabilises** joints

3. **HEAT** production (through shivering)

4. **MUSCLE PUMP**: as well as the heart being a pump, skeletal muscle also helps to pump ***blood*** in blood vessels and ***lymph*** in lymphatic vessels)

COMPOSITION OF MUSCLE

- **20% Protein** - Actin & Myosin
- **75% Water**
- **5% Mineral Salts** - Glycogen, glucose and salts

CONNECTING STRUCTURES

Tendon - fibrous white collagen cords which are at the ends of the **muscle**.
They connect **muscle** to **bone**.

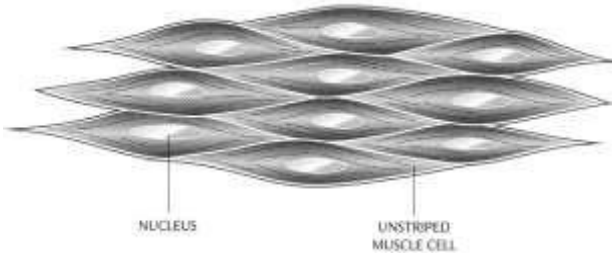
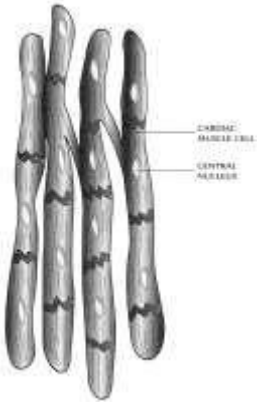
Ligament - **Inelastic** white fibrous cords, which join **bone** to **bone.**

Fascia - white fibrous **connective TISSUE** found in all parts of the body.

- **Superficial**: found beneath the skin and facilitates its movement.
- **Deep**: covers muscles + helps its action through providing pressure and tension

TYPES OF MUSCLE

There are 3 types of muscles:

Type	Structure	Function
1. Voluntary (Striated / Skeletal)	Cylindrical cells making up fibres. Each fibre has several nuclei and is surrounded by the sarcolemma. Under the microscope the muscle looks "striped" **"Myo" = Muscle**  On contraction, muscles fibres slide past each other thus making the muscle look "fatter". This sliding mechanism is known as the **"Sliding Filament Theory".** When a muscle fibre contracts it will follow the **"All or Nothing law"**, i.e. muscle fibres will either contract or remain at rest when stimulated.	▪ Provides voluntary movement. e.g.: **ELBOW FLEXION**
2. Involuntary (Smooth / Non striated)	Spindle shaped cells with no distinct membrane and only one nucleus.  	▪ Provides involuntary movement. e.g.: **PERISTALSIS** **VASOCONSTRICTION** **VASODILATION**
3. Cardiac	Only exists in the heart. It is involuntary, but its fibres are striated and each cell has a nucleus.  Note: Heart is **"Myogenic" – beats even without nerve supply**	▪ Powers the pump action of the heart.

MUSCLE CONTRACTION

Voluntary (Skeletal) Muscle

Message from brain via motor nerve → muscle → muscle contracts → moves joint

Motion occurs due to our **conscious** will (i.e. is voluntary).

Muscles never work independently, but usually in pairs. Each pair consists of:

- a contracting **agonist**
- an opposing relaxing muscle called the **antagonist**

There are **2** types of contraction:

1. **Isotonic** - the muscle contract and moves the joint with the tension remaining unaltered in the muscle.
2. **Isometric** - the muscle contract but produces no joint movement

A good **blood** supply is required for muscle contraction. This comes via the arteries and helps bring **oxygen** to the working muscle as well as **nutrients.**

Good circulation also helps remove the build up of waste products such as **lactic acid** in the muscles and is taken away by the venous blood stream.

Muscle Fatigue

Muscle needs **oxygen** and **glucose** (stored in muscle as **glycogen** and fats). When muscle tissue contracts, it burns glucose and fats combining them with oxygen from the blood **(AEROBIC RESPIRATION).**

Muscle that is repeatedly contracting and relaxing needs lots of oxygen to produce energy. That is why strenuous exercise causes rapid **breathing**.

If the muscle is exercised too much and runs out of oxygen, it continues to function for a short time without it **(ANAEROBIC RESPIRATION).** A by-product of **lactic acid** will build up. This build up causes a sensation of **burning** and quivering. As a result the exerciser will have to slow down.

FACTORS AFFECTING MUSCLE CONTRACTION

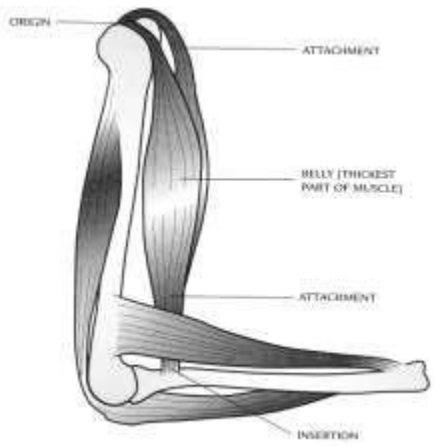
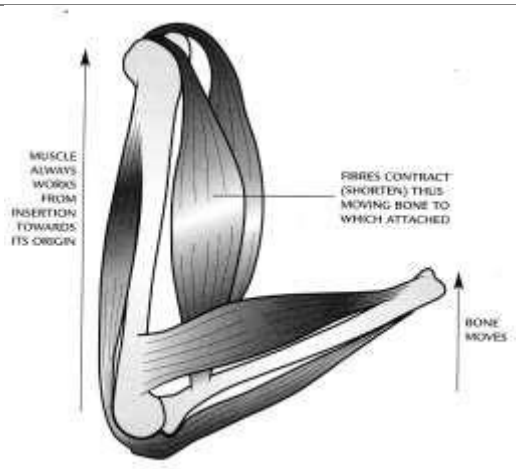
The following factors affect the ability for a muscle to contract:

- Energy available
- Strength of nerve stimulus
- Time muscle has been contracting
- Adequate supply of blood, oxygen and nutrients
- Strength of inhibitory nerve supply (to tell the muscle to stop contracting)
- Temperature of muscle (warmth increases response)
- Presence of waste material like lactic acid.

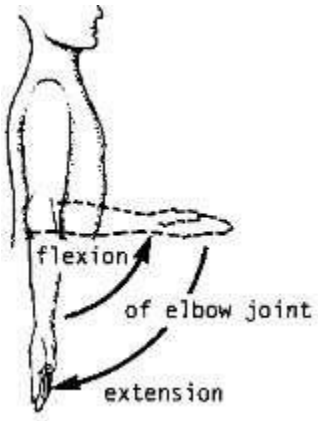
INVOLUNTARY & CARDIAC MUSCLE

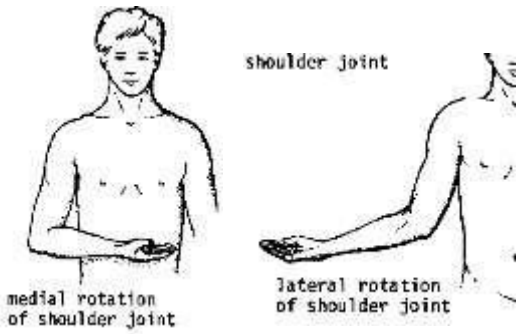
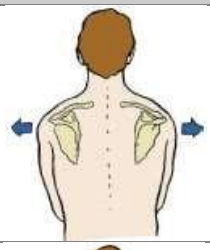
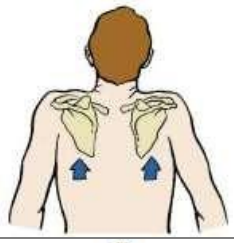
Both these contract independent of our conscious will (i.e. motion is involuntary)

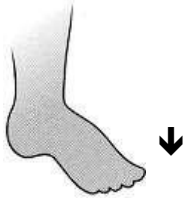
DEFINITIONS

Term	Description	
Origin	At the **<u>fixed</u>** end of attachment. This end barely moves during muscle action.	
Insertion	Located at the **<u>moving</u>** end of attachment. This end moves the joint it overlies.	
Action	Type of movement produced at a joint through muscle contraction e.g. elbow flexion.	
Tone		

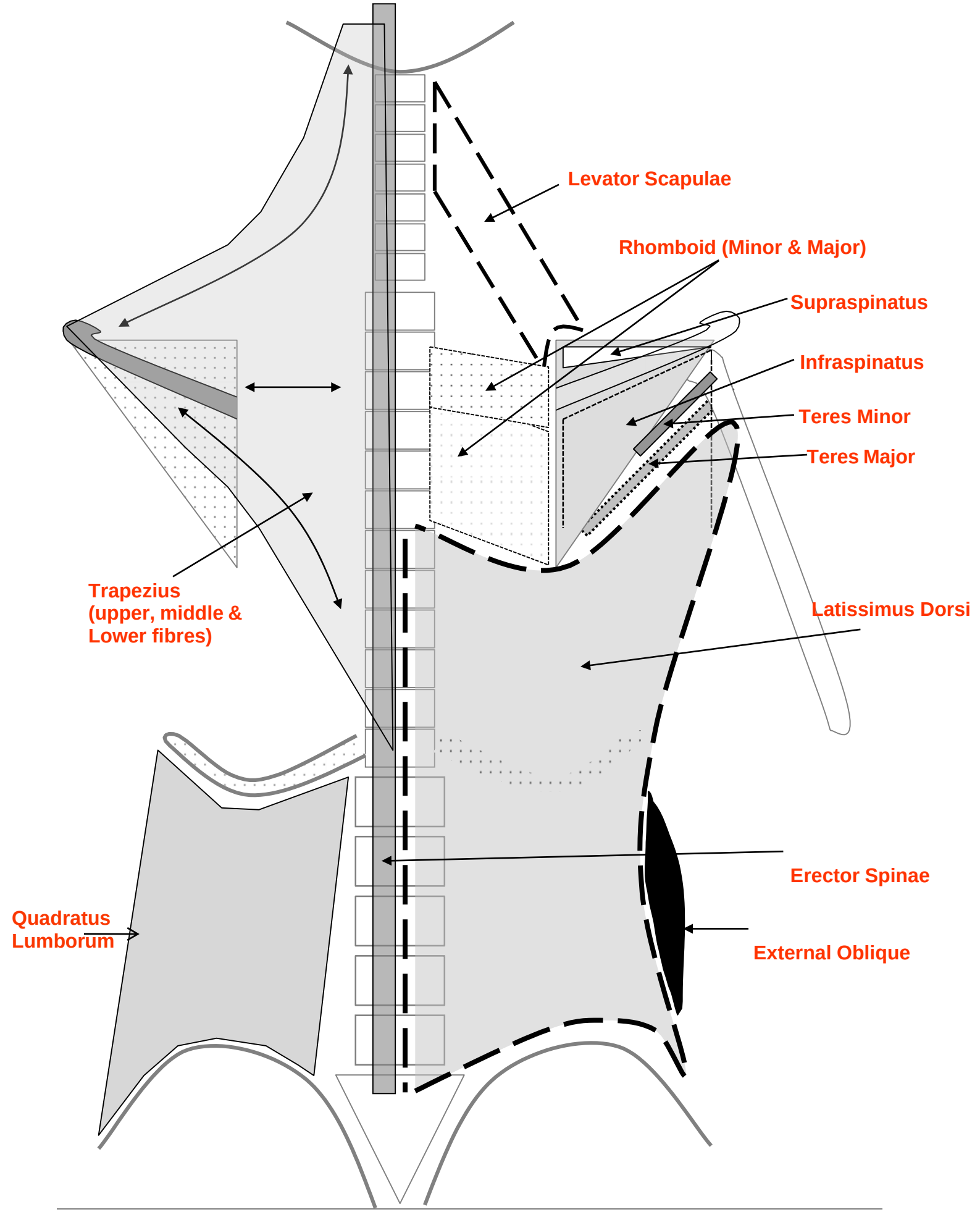
	<u>Slight contraction</u> within some **<u>parts</u>** of a muscle whilst other fibres are relaxing.
Tension	**<u>Over stimulation</u>** of muscle fibres. More muscle fibres contract then necessary to maintain tone.
Fatigue	Tiring of muscle due to : **1.** Lack of **<u>oxygen</u>** **2.** Build up of **<u>lactic acid</u>**
Lever	The bones act as a lever with the joint acting as a pivot where the movement will take place.

Term	**Description**	
Flexion	Bending of a joint **forwards** (anteriorly). Except **KNEE** flexion and **TOE** flexion	
Extension	Bending of a joint **backwards** (posteriorly). Except **KNEE** extension and **TOE** extension	
Abduction	Moving of limb away from the body midline	
Adduction	Adding to limb to the body midline	

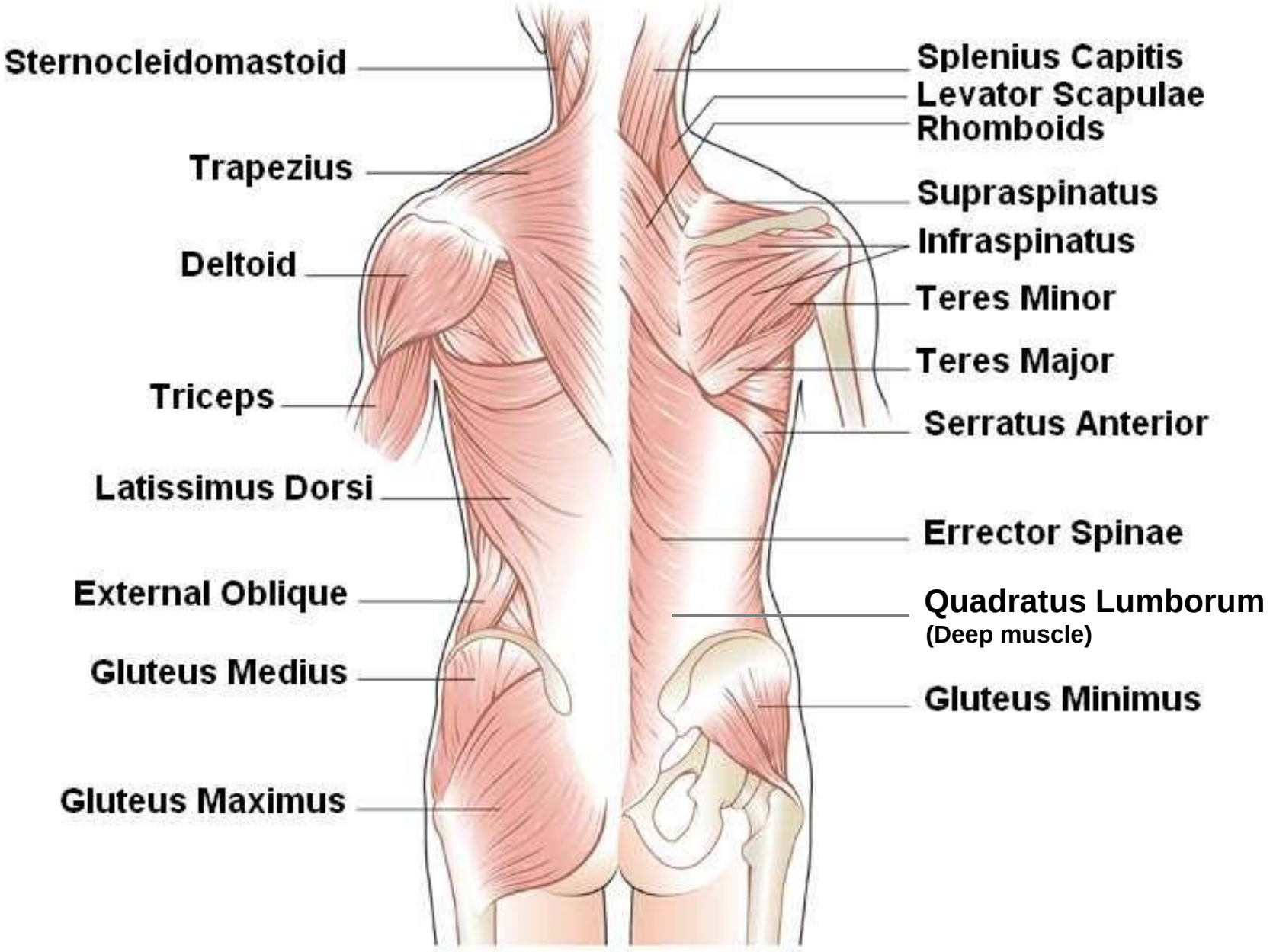
Rotation	Rotation of a part in one direction In the spine there is left or right rotation. In peripheral joints there is medial (internal) or lateral (external) rotation	
Supination	Turning the forearm so that the palm faces **UPWARDS**. "Offer a bowl of SOUP"	
Pronation	Turning the forearm so that the palm faces **DOWNWARDS**.	
Term	**Description**	
Protraction	Movement drawing the scapula forwards	
Retraction	Movement drawing the scapula backwards	
Elevation	Raising the scapula upwards	
Depression	Pulling the scapula downwards	
Dorsiflexion	Bending foot at ankle so that it moves **UPWARDS**.	

	i.e. the toes point upwards	
Plantarflexion	Bending foot at ankle so that it moves **DOWNWARDS**. i.e. the toes point downwards	
Inversion	Turning the feet so that the sole faces **INWARDS** **Raising the medial border of the foot**	
Eversion	Turning the feet so that the sole faces **OUTWARDS** **Raising the lateral border of the foot**	

MUSCLES OF THE TRUNK (POSTERIOR VIEW)



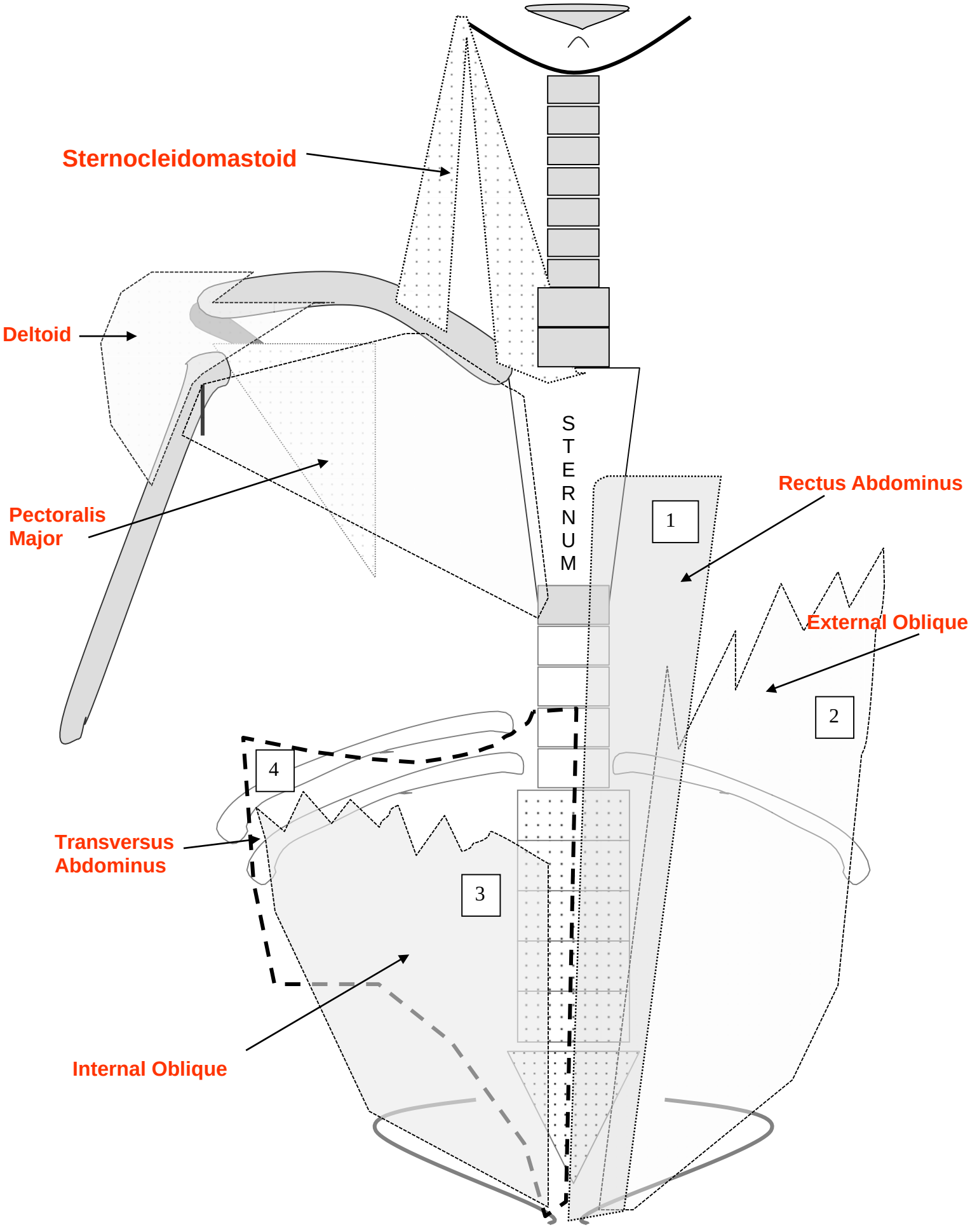
MUSCLES OF THE TRUNK (POSTERIOR VIEW)



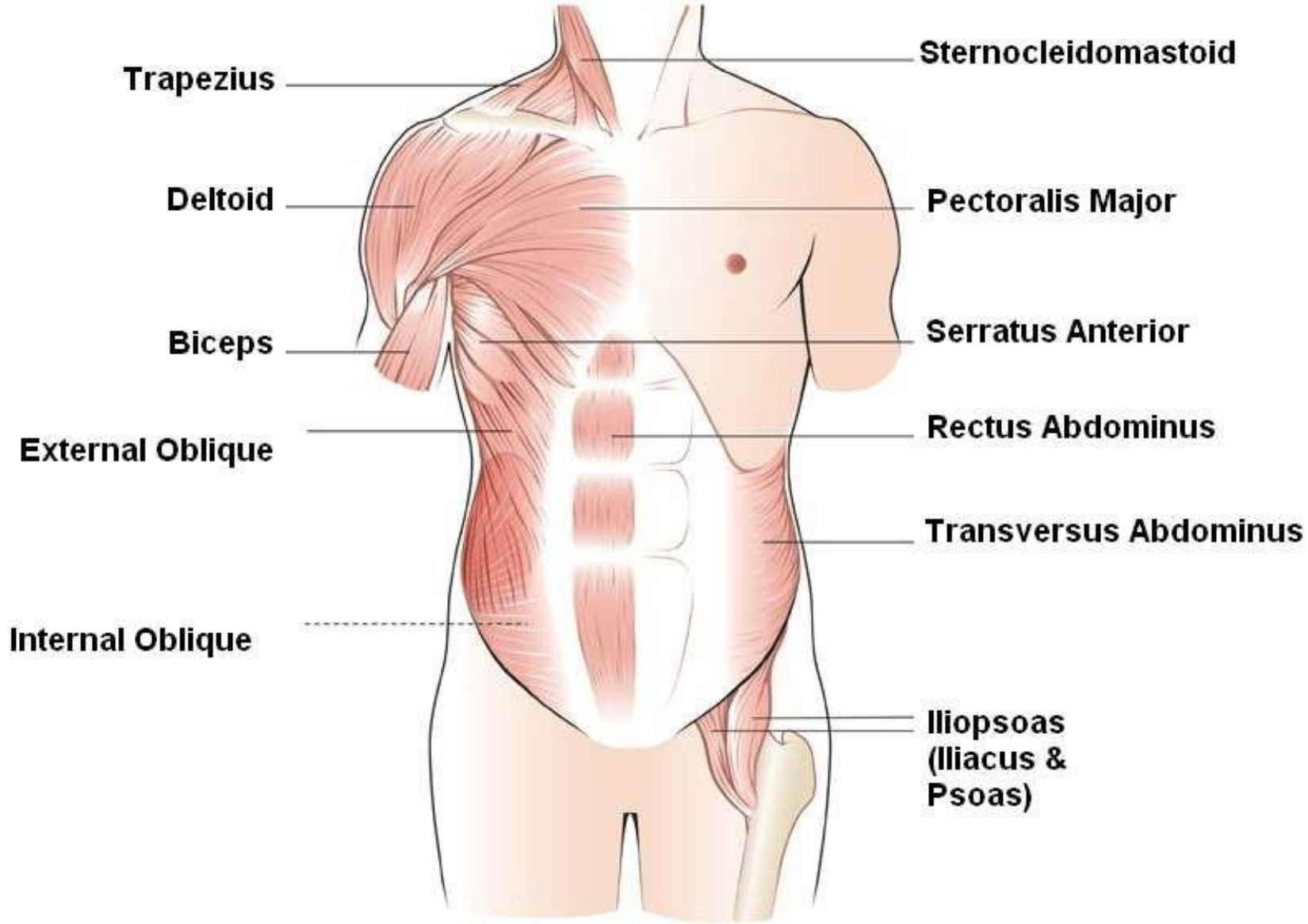
MUSCLES OF THE BACK

Name	Origin	Insertion	Action
Trapezius	Cervical spine Thoracic spine	Scapula Occipital bone	Elevates and braces shoulder Rotates scapula
Latissimus Dorsi	Thoracic spine Lumbar spine Iliac crest	Anterior humerus	Draws arm backwards, Adducts and rotates arm inwards
Levator Scapulae	Cervical spine	Scapula	Elevates shoulders, rotates scapula
Rhomboid Minor & Major	Thoracic spine	Scapula	Adducts and rotates scapula downwards
Teres Minor	Scapula	Posterior humerus	Rotates arm outward (laterally)
Teres Major	Scapula	Anterior humerus	Extends (draws arm backwards), adducts and medially rotates the arm
Supraspinatus	Scapula	Humerus	Abducts arm
Infraspinatus	Scapula	Posterior humerus	Rotates arm outwards (laterally)
Erector Spinae	Vertebra	Adjacent vertebrae	One side only – flexes trunk laterally Both sides – extends trunk
Quadratus Lumborum	Iliac Crest	12th Rib	One side only – flexes laterally and rotates trunk Both sides – extends trunk
External Oblique	Next page	Next page	Please note position

MUSCLES OF THE TRUNK (ANTERIOR VIEW)



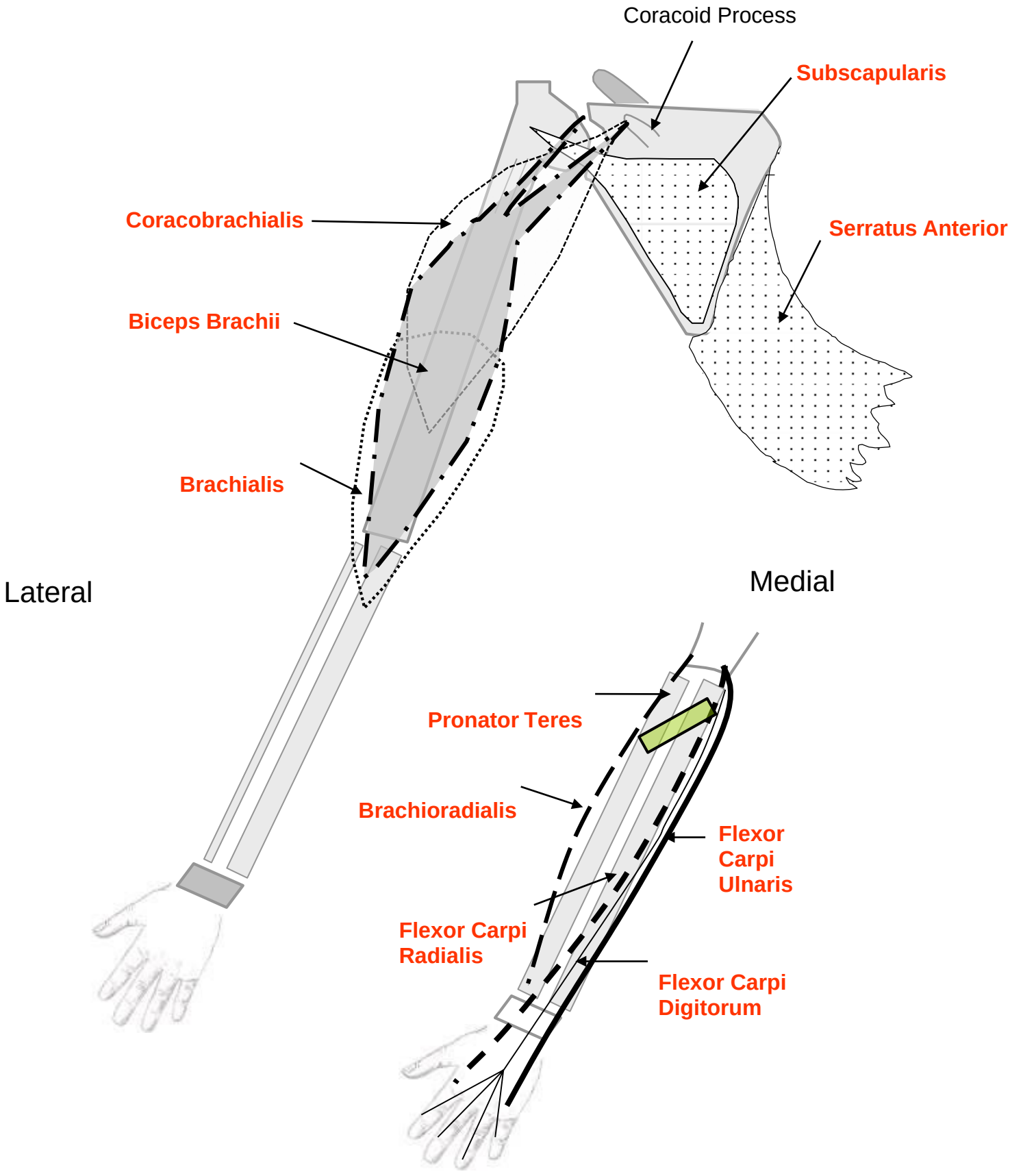
MUSCLES OF THE TRUNK (ANTERIOR VIEW)



MUSCLES OF THE TRUNK (ANTERIOR VIEW)

Name	Origin	Insertion	Action
Sternocleidomastoid	Sternum Clavicle	Mastoid process (on temporal bone)	▪ One side only- flexes neck laterally and rotates it ▪ Both sides – flexion
Pectoralis Major	Sternum Clavicle Upper ribs	Anterior humerus	▪ Flexes rotates arm at shoulder joint ▪ Adduct rotates arm at shoulder joint ▪ medially rotates arm at shoulder joint
Deltoid	Scapula Clavicle	Humerus	▪ Anterior Fibres – flexes humerus at shoulder joint ▪ Middle Fibres – abducts humerus at shoulder joint ▪ Posterior Fibres – extends humerus at shoulder joint
Rectus Abdominus	Pubis	Ribs Sternum	▪ Flexes the trunk
External Oblique	Lower ribs	Iliac crest Linea alba	▪ Lumbar flexion ▪ Side bending ▪ Rotation
Internal Oblique	Iliac crest Inguinal ligament Lumbar fascia	Lower ribs Linea alba	▪ Lumbar flexion ▪ Side bending ▪ Rotation
Transversus Abdominus	Iliac crest Inguinal ligament Lumbar fascia lower ribs	Linea alba	▪ Supports the viscera ▪ Compresses the abdomen

MUSCLES OF THE RIGHT UPPER EXTREMITY (ANTERIOR VIEW)



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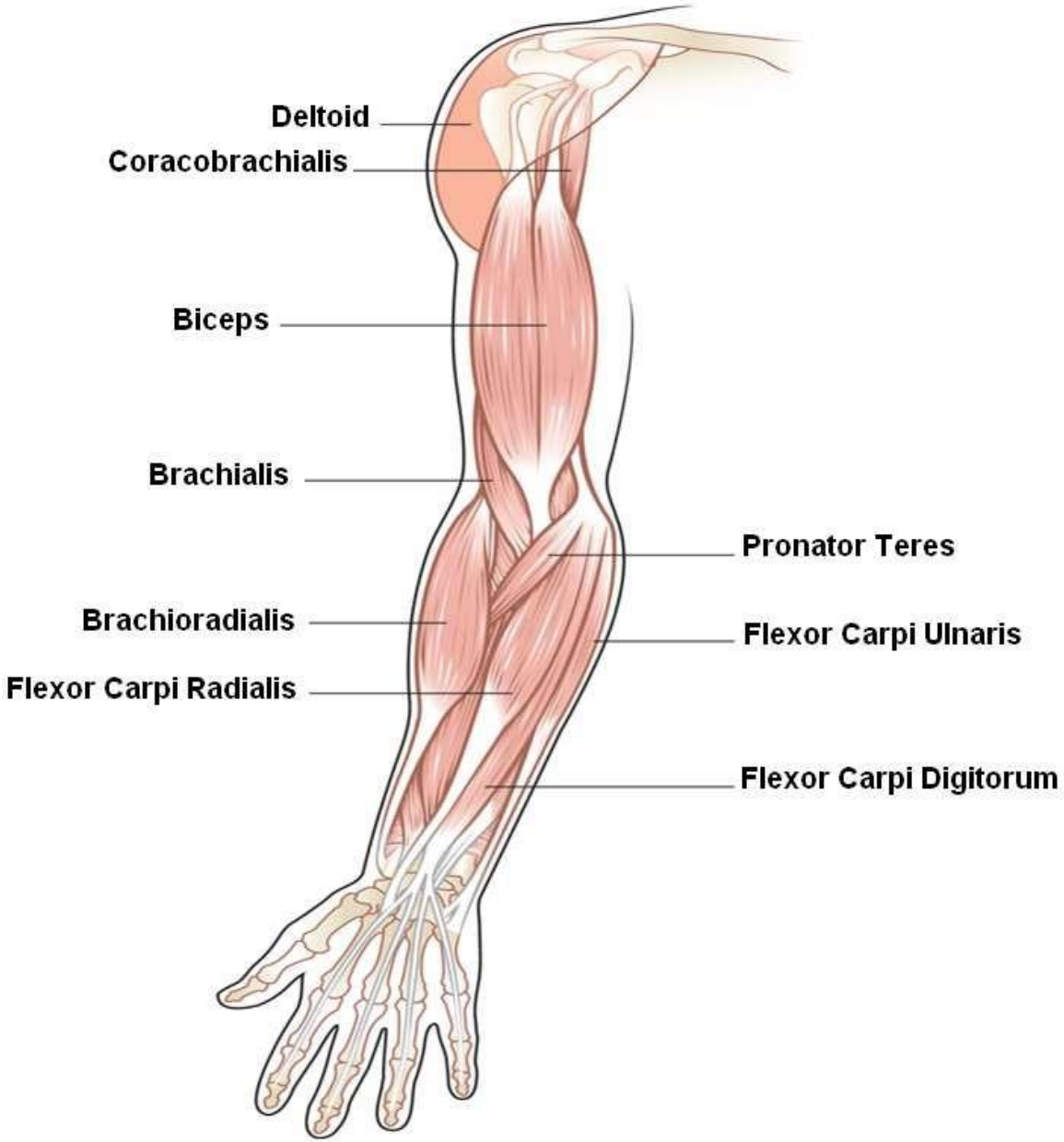
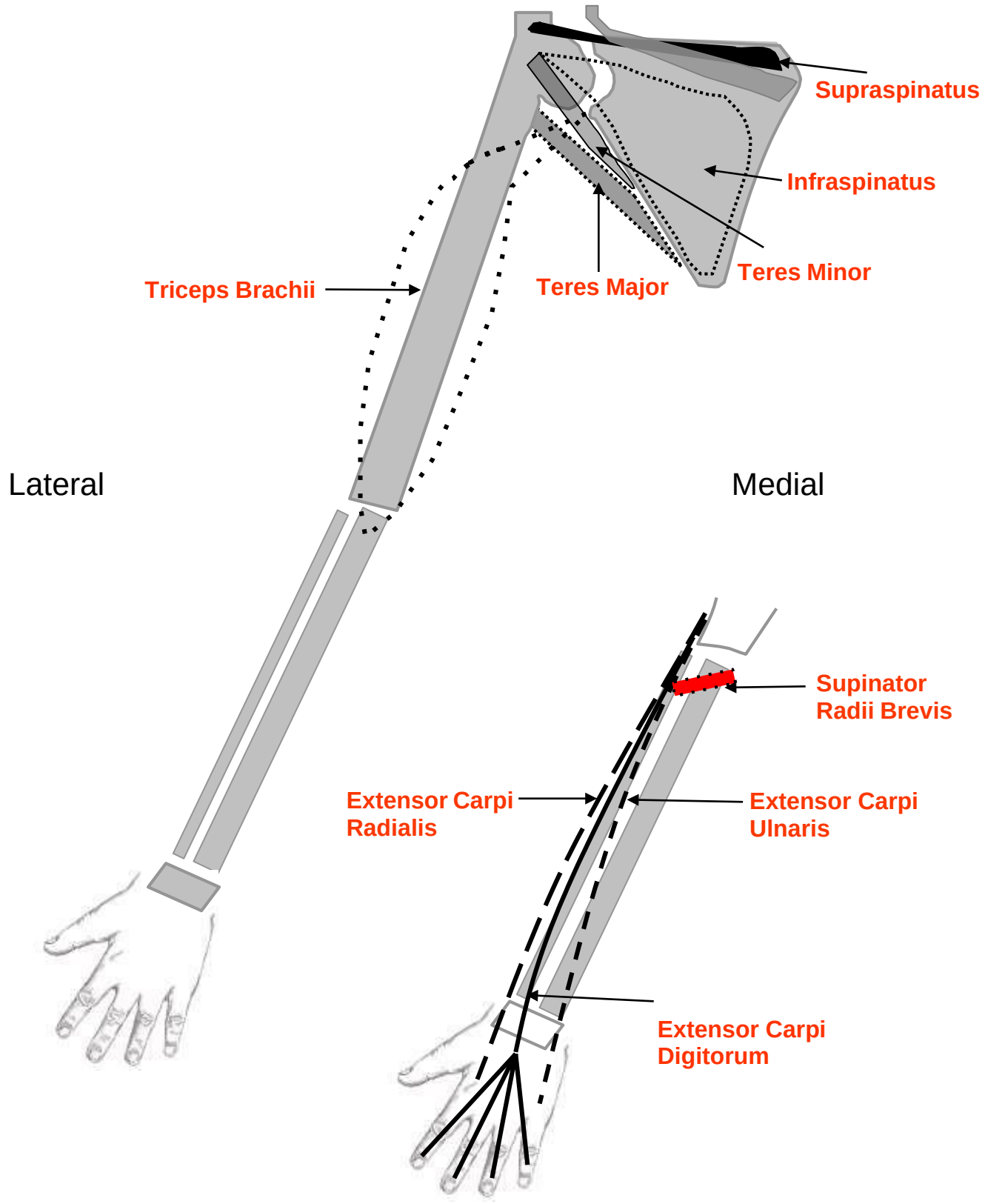


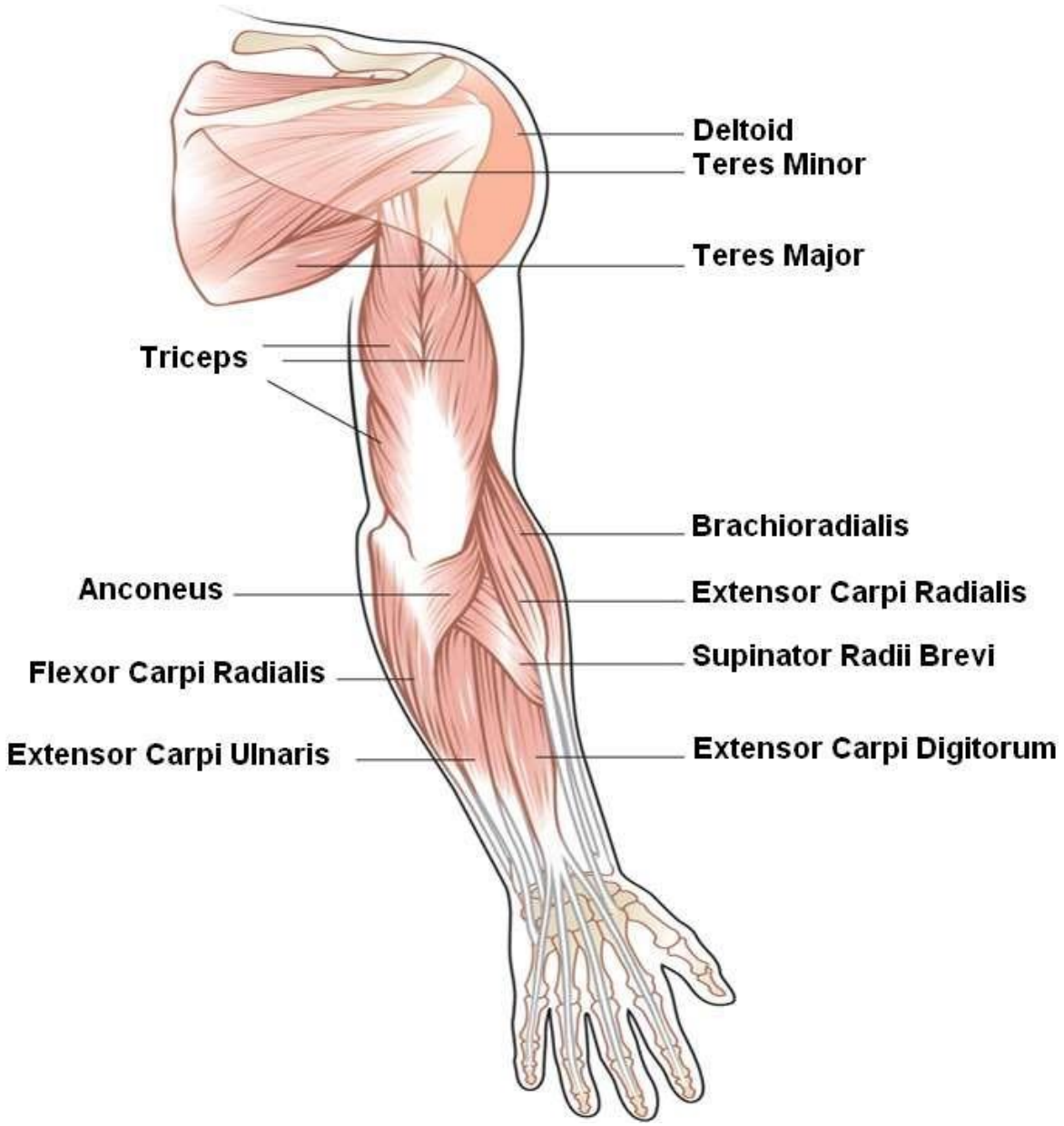
MUSCLES OF THE RIGHT UPPER EXTREMITY (ANTERIOR VIEW)

Name	Origin	Insertion	Action
Subscapularis	Anterior Scapula	Anterior humerus	Medial rotation of arm at shoulder joint
Serratus Anterior	Upper 9 ribs	Anterior scapula	Draws shoulder forwards and rotates scapula
Biceps Brachii	Scapula	Radius Ulna	Flexion of arm at shoulder joint. Supinates & flexes forearm at elbow joint
Coracobrachialis	Scapula	Humerus	Flexion of humerus at shoulder joint
Brachialis	Humerus	Ulna	Flexes forearm at elbow
Brachioradialis	Humerus	Radius	Flexes forearm at elbow
Flexor Carpi Radialis	Medial humerus	Metacarpals	Flexes & Abducts hand at wrist
Flexor Carpi Ulnaris	Medial humerus	Metacarpals	Flexes & Adducts hand at wrist
Flexor Carpi Digitorum	Medial humerus	Phalanges	Flexes hand wrist joint and fingers joints
Supinator Radii Brevis	Lateral humerus	Radius	Supinates forearm at elbow joint
Pronator Teres	Medial humerus	Radius	Pronates forearm at elbow joint

MUSCLES OF THE LEFT UPPER EXTREMITY (POSTERIOR VIEW)



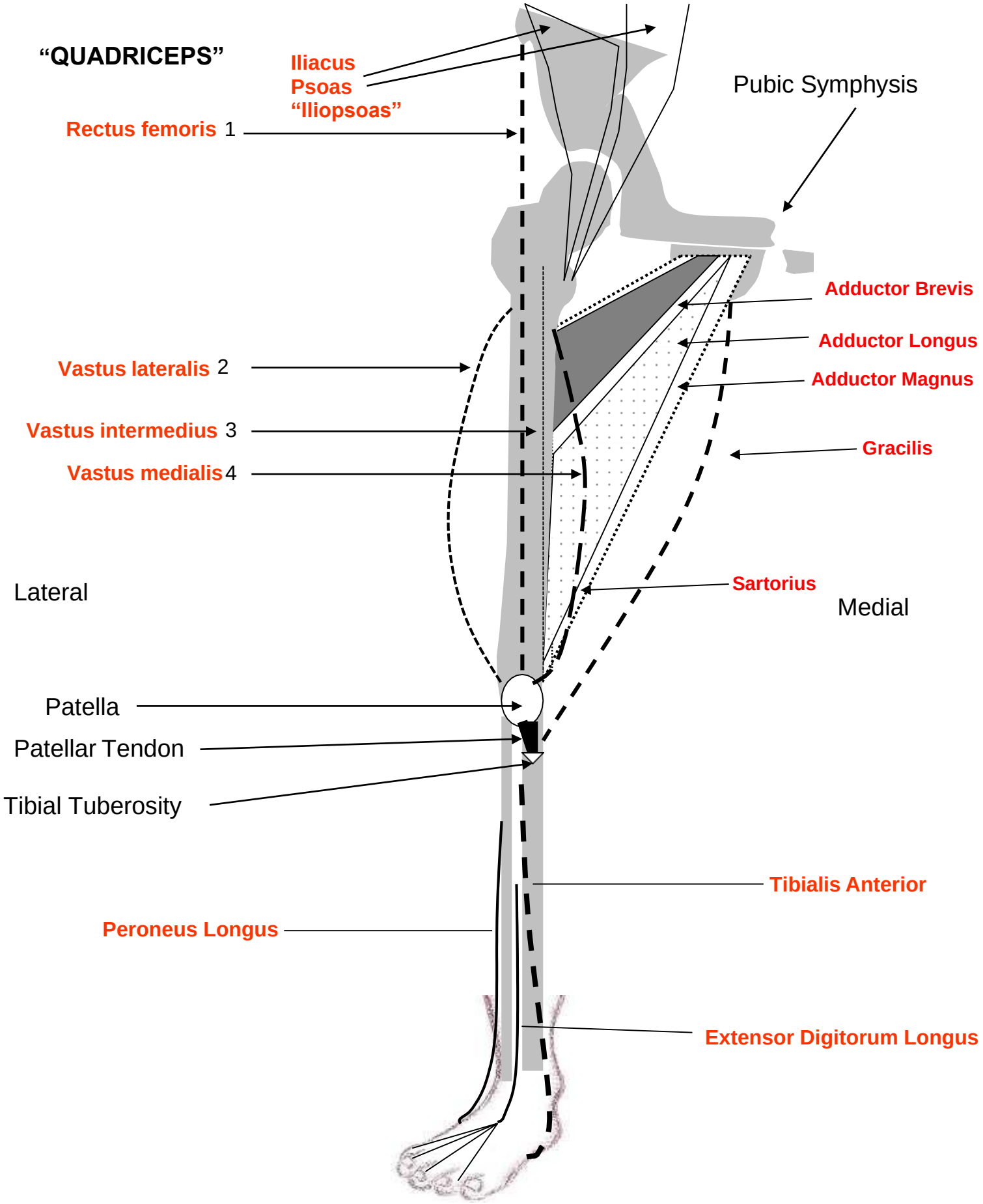
MUSCLES OF THE RIGHT UPPER EXTREMITY (POSTERIOR VIEW)



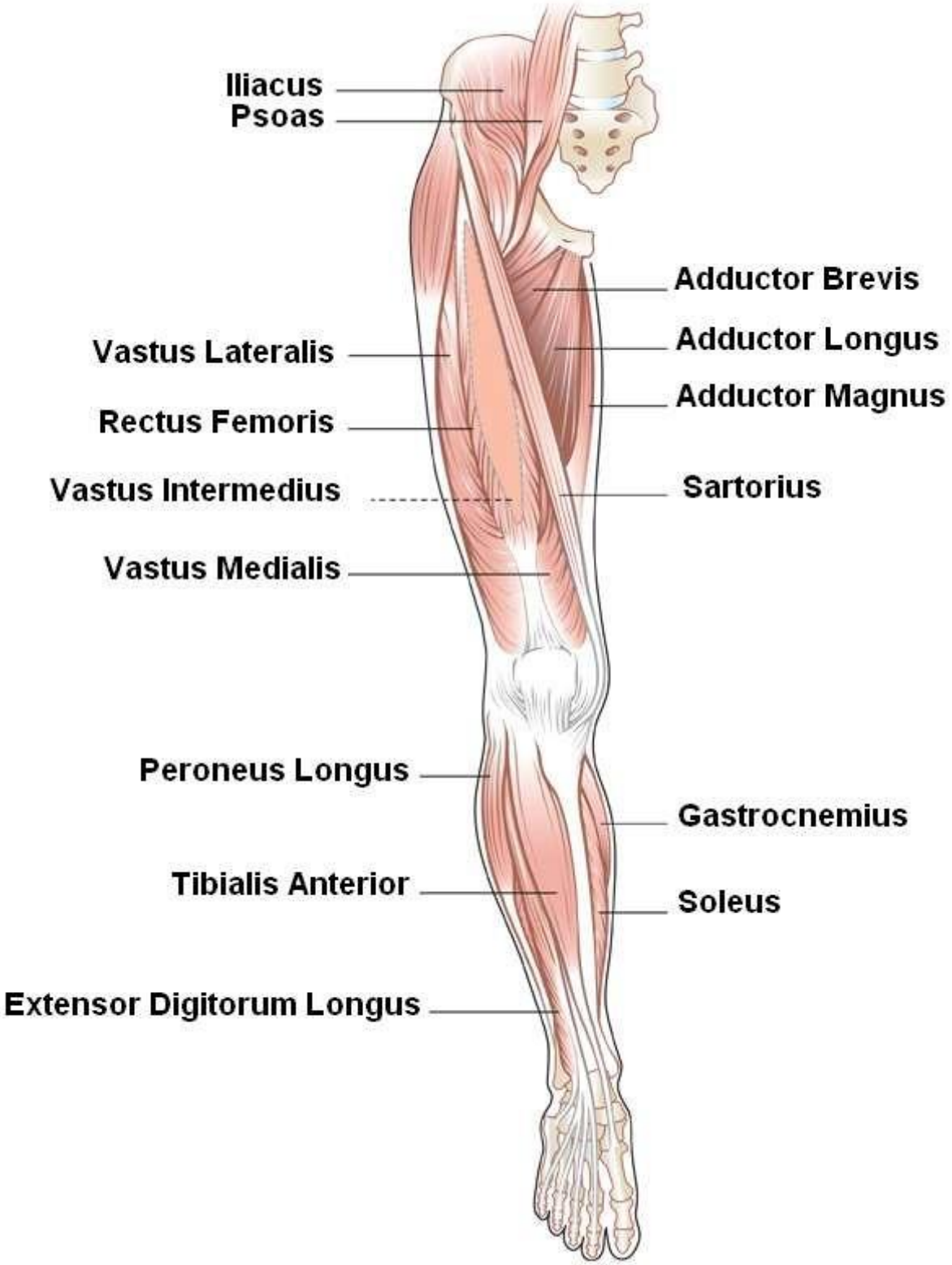
MUSCLES OF THE UPPER EXTREMITY (POSTERIOR VIEW)

Name	Origin	Insertion	Action
Supraspinatus	Scapula	Humerus	Abducts humerus at shoulder joint
Infraspinatus	Scapula	Humerus	Rotates arm outwards (laterally) at shoulder joint
Teres Minor	Scapula	Posterior humerus	Rotates arm outwards (laterally)
Teres Major	Scapula	Anterior humerus	Extends humerus at shoulder joint Adducts humerus at shoulder joint Medially rotates humerus at shoulder joint
Triceps Brachii	Scapula	Ulna	Extends humerus at shoulder joint Extends forearm at elbow joint
Extensor Carpi Radialis	Lateral humerus	Metacarpal	Extends hand at wrist joint Abducts hand at wrist joint
Extensor Carpi Ulnaris	Lateral humerus	Metacarpal	Extends hand at wrist joint Adducts hand at wrist joint
Extensor Carpi Digitorum	Lateral humerus	Phalanges	Extends hand at wrist joint Extends fingers
Thenar Eminence	Hand muscle (Palm)	Fat muscle on thumb side	Adduction, Abduction and flexion of thumb
Hypothenar Eminence	Hand Muscle (Palm)	Fat muscle on little finger side	Adduction and flexion of little finger

MUSCLES OF THE RIGHT LOWER EXTREMITY (ANTERIOR VIEW)



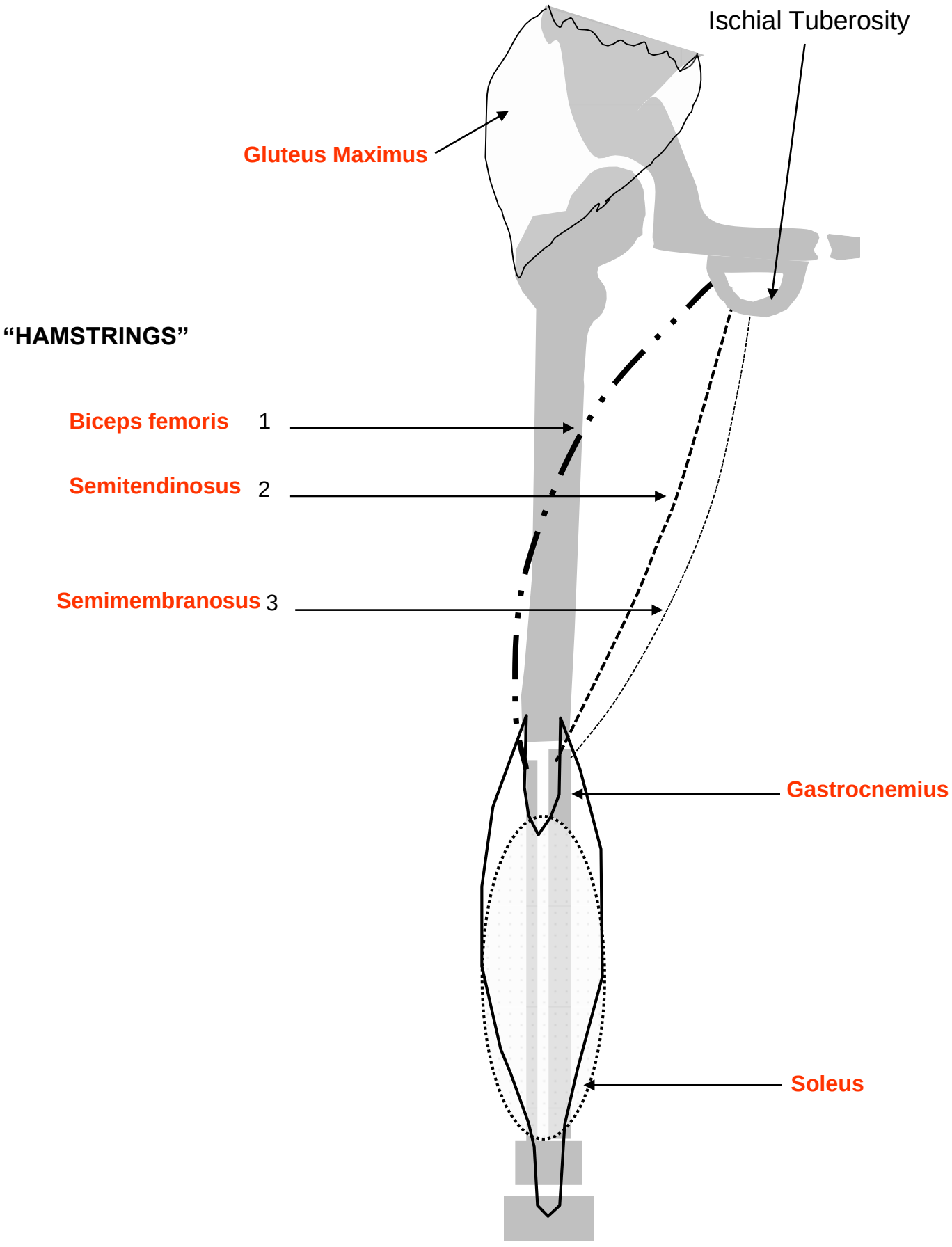
MUSCLES OF THE RIGHT LOWER EXTREMITY (ANTERIOR VIEW)



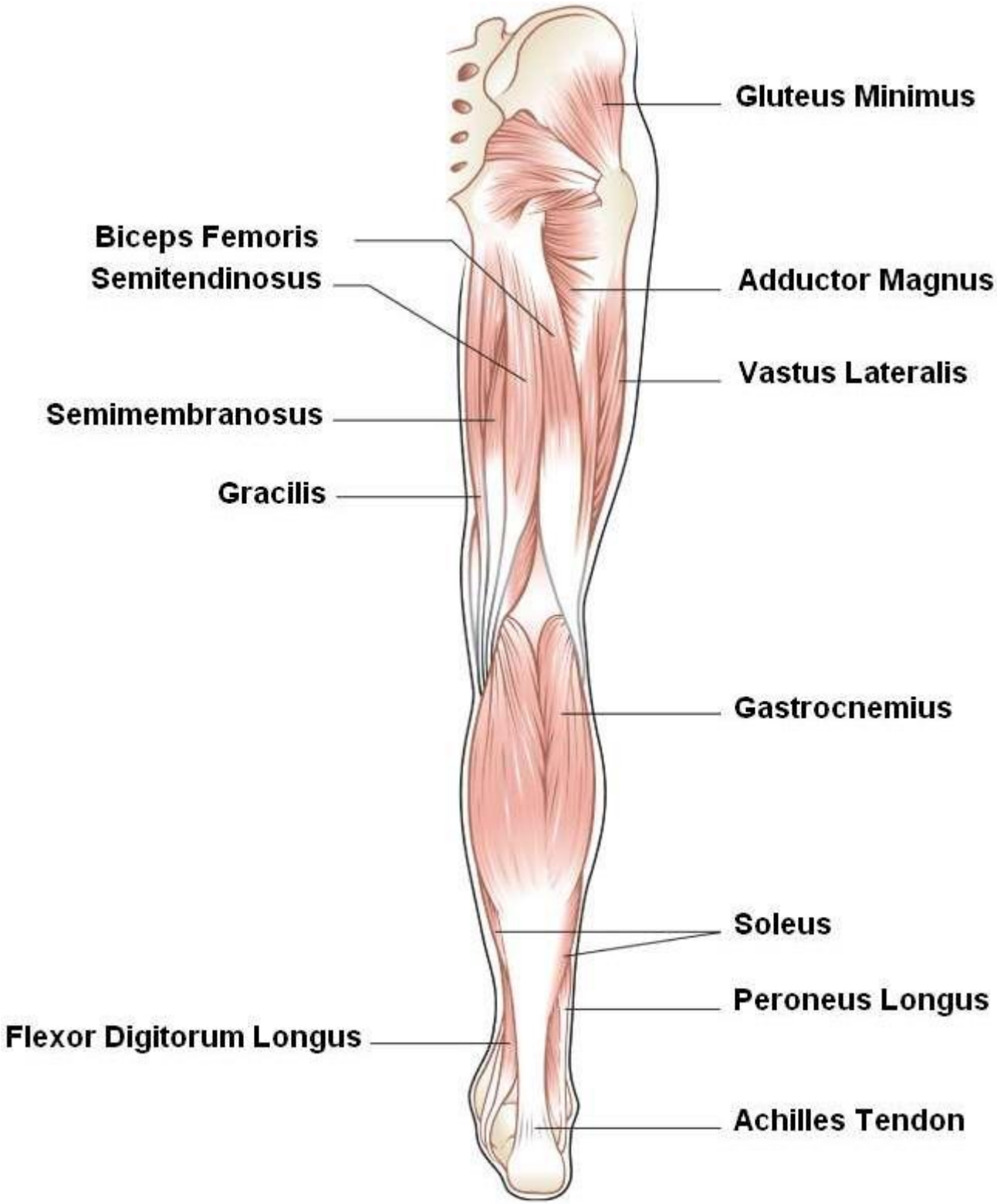
MUSCLES OF THE LOWER EXTREMITY (ANTERIOR VIEW)

Name		Origin	Insertion	Action
Iliacus	Collectively known as "Iliopsoas"	Iliac bones	Femur	Flexes femur at hip joint Laterally rotates femur at hip
Psoas		Lumbar spine	Femur	
Sartorius		Iliac bone	Tibia	Flexes femur at hip joint Abducts femur at hip joint Laterally rotates femur at hip joint Flexes leg at knee
Rectus Femoris *"Quadriceps Muscle"*		Iliac bone	Tibia via patella	Flexes femur at hip joint, Extends leg at knee joint
Vastus Lateralis Vastus Intermedius Vastus Medialis *"Quadriceps Muscles"*		Femur	Tibia via patella	Extends leg at knee joint
Gracilis		Pubic bone	Medial tibia	Adducts femur at hip joint Medially rotates femur at hip joint Flexes leg at knee joint
Adductor Brevis Adductor Longus Adductor Magnus		Pubic bone	Medial femur	Adducts femur at hip joint
Tibialis Anterior		Tibia	Tarsal bones (planter surface)	Dorsiflexes foot at ankle joint Inverts foot at ankle joint
Peroneus Longus		Fibula	Tarsal bones (planter surface)	Plantarflexes foot at ankle joint Everts foot at ankle joint
Extensor Digitorum Longus		Tibia & fibula	Phalanges	Dorsiflexes foot at ankle joint Extends the four lateral toes

MUSCLES OF THE LEFT LOWER EXTREMITY (POSTERIOR VIEW)



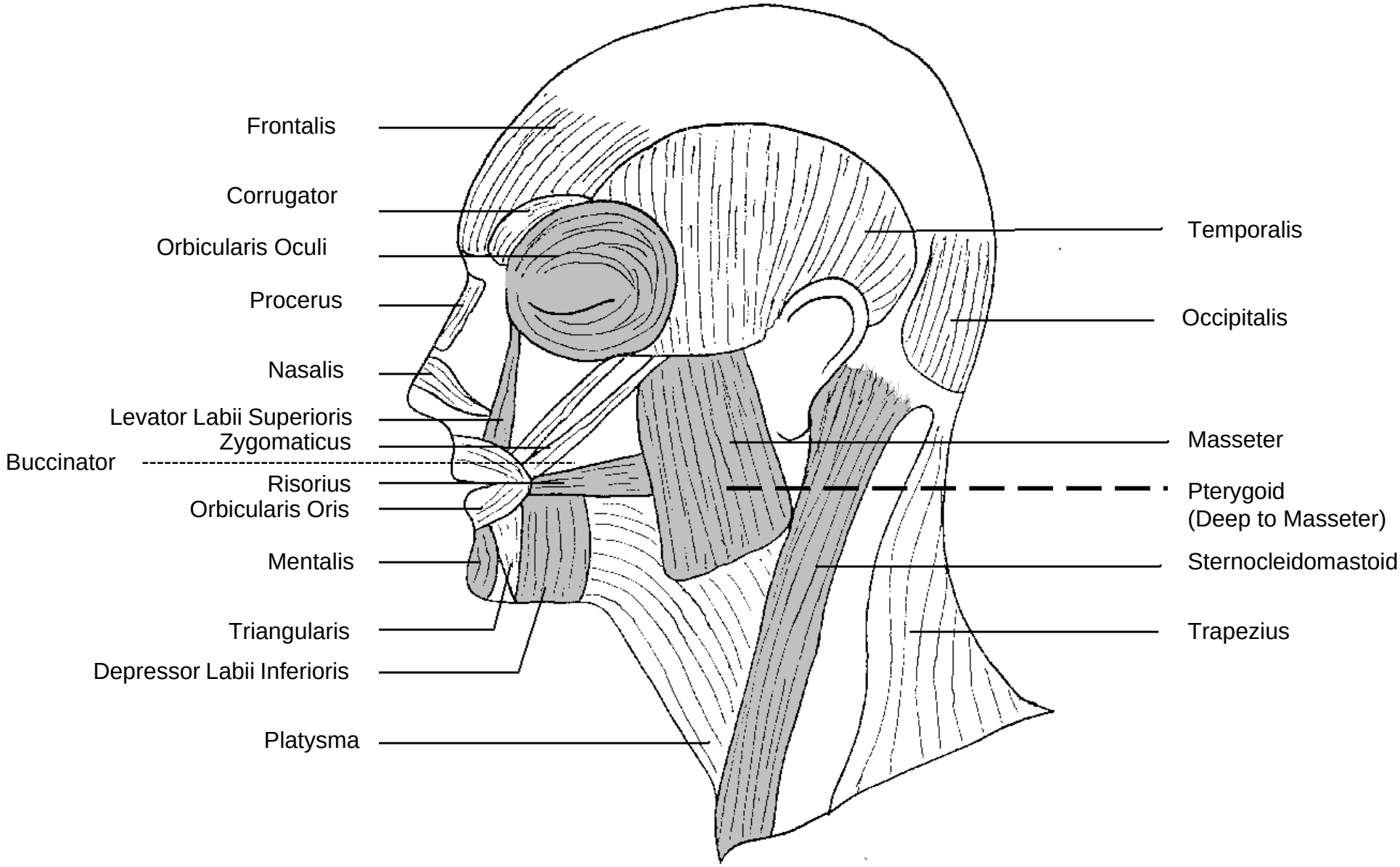
MUSCLES OF THE RIGHT LOWER EXTREMITY (POSTERIOR VIEW)



MUSCLES OF THE LOWER EXTREMITY (POSTERIOR VIEW)

Name	Origin	Insertion	Action
Gluteus Maximus	Innominate Sacrum Coccyx	Femur	Extends femur at hip joint Abducts femur at hip joint Laterally rotates femur at hip joint
Gluteus Medius Gluteus Minimus	Innominate bone	Femur	Abducts femur at hip joint. Medially rotates femur at hip joint
Biceps Femoris *"Hamstring Muscle"*	Ischium (innominate bone)	Fibula	Extends femur at hip joint Flexes leg at knee joint
Semitendinosus *"Hamstring Muscle"*	Ischium (innominate bone)	Tibia	
Semimembranosus *"Hamstring Muscle"*	Ischium (innominate bone)	Tibia	
Gastrocnemius	Posterior Femur	Calcaneus via Achilles tendon	Flexes leg at knee joint Plantarflexes foot at ankle joint
Soleus	Posterior Tibia	Calcaneus via Achilles tendon	Plantarflexes foot at ankle joint

MUSCLES OF THE FACE (LATERAL VIEW)



DISEASES & DISORDERS OF THE MUSCULAR SYSTEM

Term	Cause	Effect
Adhesions	"Sticking" of tissues	Poor functioning of area and discomfort
Adhesive Capsulitis	Commonly called "Frozen Shoulder". Results from inflammation of the joint capsule	Pain on moving the shoulder joint
Atony	Lack of normal tone or tension in a muscle	
Atrophy	Undernourishment; lack of use	Wasting away, or failure to reach normal size, of bulk of muscle.
Back Pain Lumbago Rheumatism	Can be caused by muscle strain or arthritis	Backache affecting the lumbar region or lower back;
Bursitis	Inflammation of a bursa. Bursa are fluid filled sacs which prevent friction with adjacent tissues e.g. Housemaids Knee Deltoid Bursitis	Pain, heat, swelling and redness in affected area.
Cramp	Vigorous exercise and over-exertion; also extreme heat; sodium and/or water depletion.	Painful localised and involuntary contraction of one or more muscles
Fibromyalgia (Fibrositis)	Unknown	Pain, stiffness and tenderness ofthe muscles, tendons and joints. Most common in the back, neck, shoulders and feet
Lateral Epicondylitis (Tennis Elbow)	Inflammation of the lateral tendon of the extensor muscles of the forearm	Lateral elbow pain, especially on moving the elbow and wrist.
Medial Epicondylitis (Golfers Elbow)	Inflammation of the medial tendon of the extensor muscles of the forearm	Medial elbow pain, especially on moving the elbow and wrist.
Muscular Dystrophy	An hereditary disease of the muscular system	Weakness and wasting of the skeletal muscle
Myositis	Inflammation of a muscle	
Repetitive Strain Injury (RSI)	Injury to an area resulting from repetitive movements. Usually affects the extensor muscles of the wrist and hand.	Pain on moving the affected joint
Rupture	Tear of a muscles, tendon or ligament	Pain and loss of function of the area

Shin Splints	Pain on the medial aspect of the tibia due to running on hard ground or poor footwear	Pain on movements of the foot as well as on touch.
Spasm	A more than usual Number of muscle fibres in sustained contracture, usually in response to pain.	Pain in the muscle.
Spasticity	Inhibitory nerves have been cut.	Spinal reflexes cause sustained contracture of muscles.
Sprain	Sudden twist or wrench of the joint's ligaments	An injury or damage to a joint; painful swelling of the joint; the most commonly sprained joint is the ankle (often called a 'twisted ankle'). A sprained ankle is usually caused by the joint 'going over', thus putting all the body weight on the ankle.
Strain	Overexertion, over-stretching, over-use; failure to warm up before strenuous activity, especially sport.	An injury to a muscle or its tendon; may occasionally involve rupture (tearing) of muscle fibres, muscle sheath or tendon.
Stress	Stress is any factor, which affects physical or mental well-being.	Excessive muscle tension and subsequent muscle pain, especially in the back and neck
Tendonitis	Inflammation of the tendon e.g. Achilles Tendonitis	Pain and swelling over the affected tendon.
Tetanus	An acute and serious infection of the central nervous system caused by bacterial infection of open wounds.	

INTERRELATIONSHIP OF MUSCULAR SYSTEM WITH OTHER BODY SYSTEMS

Nervous	Relies upon nerve impulses to produce contraction in the muscle. Without nerve stimulus movement would not be possible.
Skeletal	Muscles always cross a joint and thus relied on the skeletal system for leverage and movement.
GIT (Digestive)	Nutrition / energy in the form of glucose is received from the digestive system. If it is not immediately used it is converted to glycogen and stored in the muscle fibre for energy production later.
Circulatory & Respiratory	Muscles receive oxygen from the vascular and respiratory system.

EFFECTS OF MASSAGE ON THE MUSCLULAR SYSTEM

1. Improves muscle tone by stimulating stretch receptors
2. Relieves fatigue in muscle tissue by improving drainage and removing lactic acid
3. Helps prevent formation of adhesion of muscle fibres
4. Helps reduce the formation of scar tissue
5. Relaxing on tense tight muscles

SYMPTOMS OF THE MUSCULAR SYSTEM

- Muscle ache / pain
- Muscular stiffness
- Muscular soreness
- Muscular weakness and loss of power
- Muscle wasting and loss of muscle contour