



The Muscular System

MUSCULAR SYSTEM

Overview

The muscular system is an organ system consisting of skeletal, smooth and cardiac muscles. It permits movement of the body, maintains posture, and circulates blood throughout the body. The muscular system is controlled through the nervous system, although some muscles (such as the cardiac muscle) can be completely autonomous.

Upon stimulation by an action potential, skeletal muscles perform a coordinated contraction by shortening each sarcomere, a structural unit of striated muscle. This is called a ratchet type drive system. Energy for this comes from adenosine triphosphate (ATP), the energy source of the cell. Muscles store little ATP and so must continuously recycle the discharged adenosine diphosphate molecule (ADP) into ATP rapidly. Muscle tissue additionally contains a stored supply of a fast acting recharge chemical, creatine phosphate which can assist initially in producing the rapid regeneration of ADP into ATP. Calcium ions are also required for each cycle of the sarcomere. Calcium is released from the sarcoplasmic reticulum into the sarcomere when a muscle is stimulated to contract. When the muscle no longer needs to contract, the calcium ions are pumped from the sarcomere and back into storage in the sarcoplasmic reticulum.

At rest, the body produces the majority of its ATP aerobically in the mitochondria without producing lactic acid or other fatiguing byproducts. During exercise, the method of ATP production varies depending on the fitness of the individual, as well as the duration and intensity of exercise. At lower activity levels, when exercise continues for a long duration (several minutes or longer), energy is produced aerobically by combining oxygen with carbohydrates and fats stored in the body. Activity that is higher in intensity, with possible duration decreasing as intensity increases, ATP production can switch to anaerobic pathways, such as the use of the creatine phosphate and the phosphagen system or anaerobic glycolysis. Aerobic ATP production is biochemically much slower and can only be used for long

duration, low intensity exercise, but produces no fatiguing waste products that can not be removed immediately from the sarcomere and results in a much greater number of ATP molecules per fat or carbohydrate molecule. Aerobic training allows the oxygen delivery system to be more efficient, allowing aerobic metabolism to begin quicker. Anaerobic ATP production produces ATP much faster and allows near-maximal intensity exercise, but also produces significant amounts of lactic acid which render high intensity exercise unsustainable for greater than several minutes. The phosphagen system is also anaerobic, allows for the highest levels of exercise intensity, but intramuscular stores of phosphocreatine are very limited and can only provide energy for exercises lasting up to ten seconds. Recovery is very quick, with full creatine stores regenerated within five minutes.

Cardiac muscles are distinct from skeletal muscles because the muscle fibers are laterally connected to each other. Furthermore, just as with smooth muscles, they are not controlling themselves. Heart muscles are controlled by the sinus node influenced by the autonomic nervous system.

Smooth muscles are controlled directly by the autonomic nervous system and are involuntary, meaning that they are incapable of being moved by conscious thought. Smooth muscle tissue is located in the walls of hollow internal structures such as blood vessels, the stomach, intestines, and urinary bladder. Functions such as heart beat and lungs (which are capable of being willingly controlled, be it to a limited extent) are involuntary muscles but are not smooth muscles.

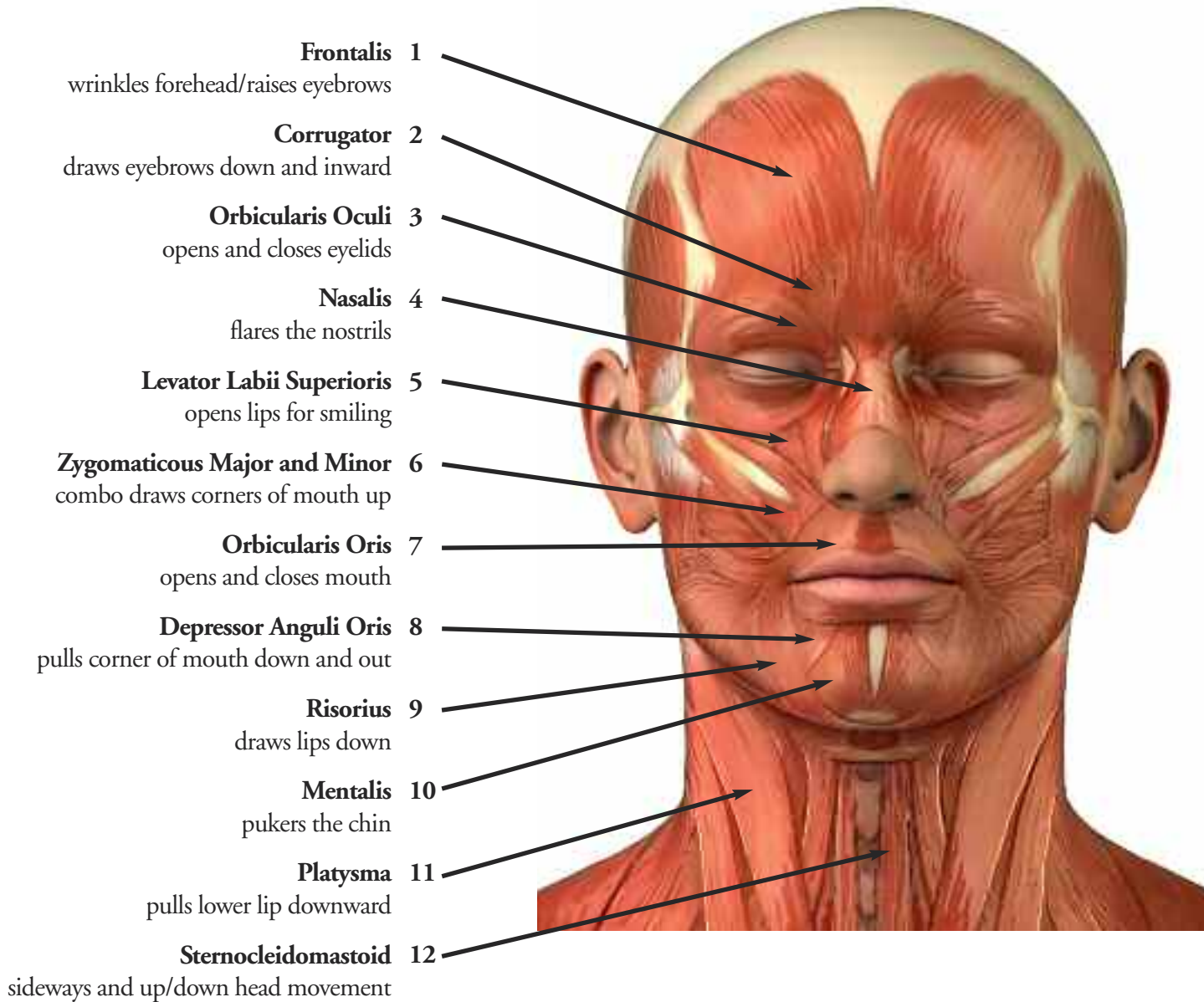
MUSCLES OF THE FACE AND NECK

Head	Position	Origin	Insertion	Action
Epicranius	Top of head	Frontalis	Occipitalis	
Occipitalis	Back of head	Occipital bone	Aponeurosis	Pulls back scalp
Frontalis	Forehead	Eyebrows	Aponeurosis	Wrinkles forehead/raises eyebrows
Aponeurosis	Connects frontalis/occipitalis	Connects front/back		
Facial Expression	Position	Origin	Insertion	Action
Platysma	Over chin, neck and chest	Fascia of the shoulder/chest	Mandible and Mouth skin and muscle	Skin movement
Buccinator	Between upper and lower jaws	Above at the maxilla and below at the mandible	Upper and lower lips, where it blends with obicularis oris	Blowing or squirting water
Orbicularis Oris	Surrounds the mouth	Maxilla and the nasal septum	Into the fibers of orbicularis oris near its origin	To close the lips and when strongly contracted, shapes them as for whistling
Zygomaticus		From the zygomatic bone	Orbicularis oris	Smiling
Levator Anguli Oris	Angle of the mouth	Lower border of orbit	Orbicularis oris	Pulls corner of mouth up and out
Risorius	Corner of the mouth	Parotid gland fascia	Orbicularis oris	Grinning muscle
Depressor Anguli Oris	Corners of mouth	Mandible	Orbicularis oris	Pulls corners of mouth down and out
Levator Labii Superioris	Lip	Lower border of the orbit	Upper lip	Elevate lip
Depressor Labii Inferioris	Lip	Mandible	Orbicularis oris	Depresses the lip
Corrugator	Beneath the eyebrows	Supra-orbital ridge	Into orbicularis oculi fibers	Draws eyebrows down and inward
Nasalis	Nose	Maxilla	Onto a membrane stretching onto the nose	Flaring of nostrils
Procerus	Bridge of nose	Membrane that covers the nose	Into the frontalis muscle	
Mentalis	Chin	Mandible	Skin of chin	Causes puckering of the chin
Occipito Frontalis	Over occipital bone and frontal bone	Occipital part: the occiput Frontal part: the aponeurosis	Occipital part: aponeurosis Frontal part: supra-orbital ridge	Raises the eyebrows
Orbicularis Oculi	Eyes	Medial and lower ridge of orbit	Into the fibers of orbicularis oculi muscle near its origin	Closes the eyelids

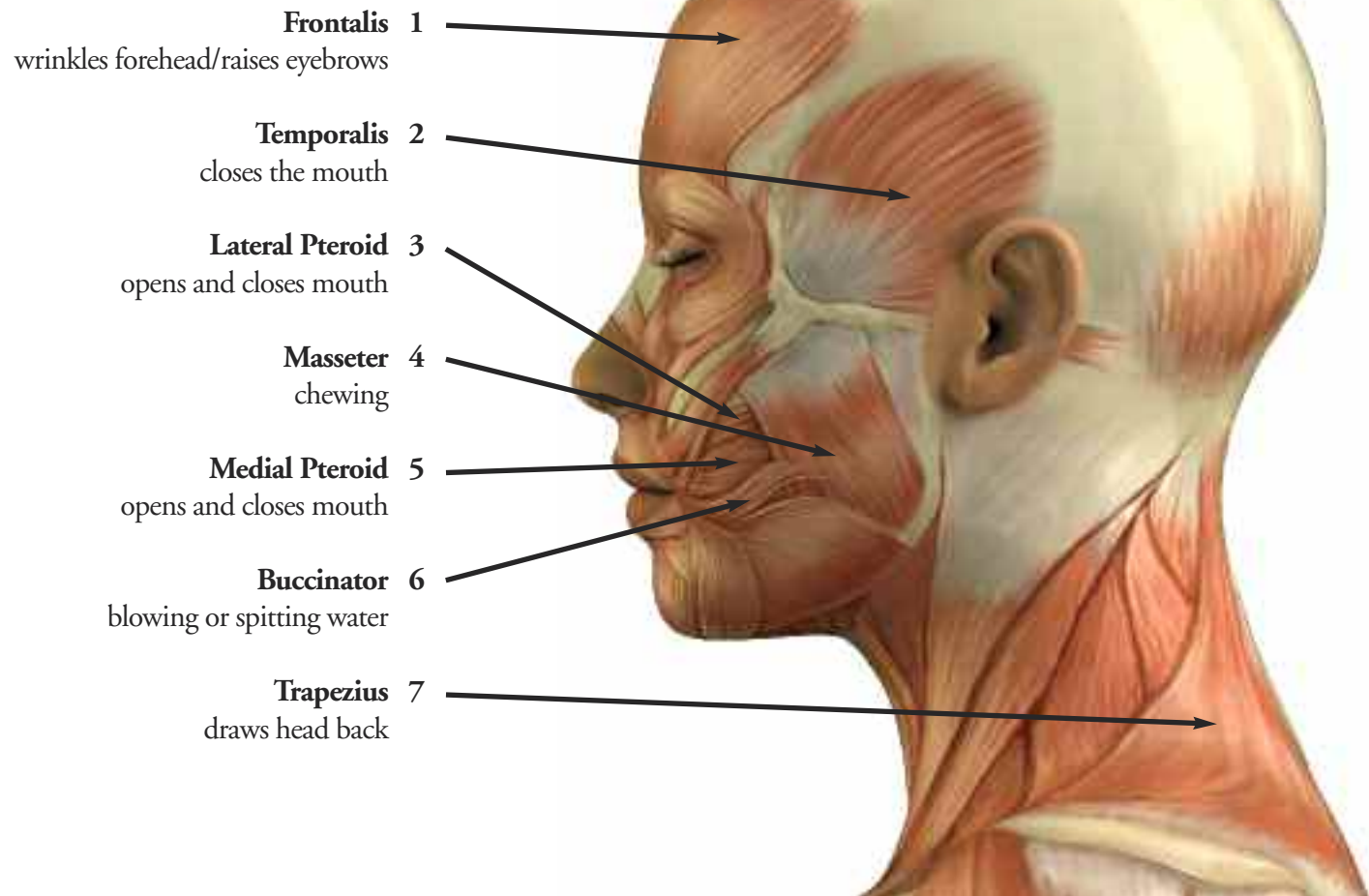
MUSCLES OF THE FACE AND NECK

Ear	Position	Origin	Insertion	Action
Auricularis superior	Top of ear	Epicranial	Cartilage of ear	Draws ear upwards
Auricularis posterior	Back of ear	Mastoid	Cartilage of ear	Draws ear backwards
Auricularis anterior	Front of ear	Temporal fascia	Cartilage of ear	Draws ear forwards
Mastication	Position	Origin	Insertion	Action
Temporalis	Squamous portion of the temporal bone		Ramus of the mandible	Closes the mouth
Masseter	Zygomatic arches	The zygomatic arch	Angle of the jaw	Draws mandible up to the maxillae when chewing
Medial Pterygoids	Underlying masseter	Sphenoid	Mandible	Closes the mouth and pulls the lower jaw forward
Lateral Pterygoids	Underlying masseter	Sphenoid	Mandible	Closes the mouth, pulls the lower jaw forward, and opens the mouth
Neck	Position	Origin	Insertion	Action
Platysma	Over chin, neck and chest and chest	Fascia of the shoulder and muscle of mouth	Mandible and skin	Skin movement
Sternocleidomastoid	Antero-lateral aspect of the neck, one on each side	Sternum and clavicle	On the mastoid process	Flex the neck (move chin to chest)
Trapezius	Covers shoulders and upper part of back	External occipital protuberance, Middle: spine of scapula	Upper: lateral clavicle, acromion upward rotation of scapula Lower: root of spine of scapula Lower: depression, upwward rotation of scapula	Upper: elevation, Middle: retraction of scapula

MUSCLES OF THE FACE AND NECK / FRONT



MUSCLES OF THE FACE AND NECK / SIDE VIEW



SUPERFICIAL MUSCLES OF THE BODY / FRONT

Muscle	Purpose	Examples	Action
Flexor Carpi Radialis	Bends wrist forwards bringing palm towards you. Assists in taking wrist sideways to thumb side.	Sports: water skiing, sailing Weight training: bicep curl, dumbbell weights, wrist rolling	Pulling rope towards you.
Opponens Pollicis	Rolls thumb across palm.	Sports: gripping in gymnastics, speedway, golf Weight training: dumbbell weights, spring grips	Picking up a small object, , pen/pencil or paper clip (precision grip).
Obliquus Externus	Bends trunk to same side and turns it forward. Both sides bend trunk forwards.	Sports: canoeing, gymnastics, rugby Weight training: sit ups (twisting)	Using a shovel to dig.
Obliquus Internus	Bends trunk to same side and turns it backwards. Both sides bend trunk forwards.	Sports – javelin, golf, pole vault Weight training: sit-ups (twisting)	Using a rake.
Rectus Abdominus	Bends the trunk forwards. All abdominal muscles assist in maintaining correct posture and protects internal organs.	Sports: active in all sports Weight training: sit-ups	Getting out of a chair.
Tensor Fasciae Latae	Straightens the knee. Assists in rotating lower leg outwards and thigh inwards.	Sports: hurdling, water skiing, horse riding Weight training: adductor/abductor machine, leg press squats	Walking movements.
Sartorius	Known as “Tailors Muscle.” Brings thigh forwards and turns it outwards.	Sports: ballet, soccer, skating Weight training: low pulley exercises, abductor machine	Sitting in a “cross-legged” position.
Gracilis	Assists in bringing thigh forwards and turning it inwards. Assists in bringing leg in and across the other leg.	Sports: horse riding, hurdling, soccer Weight training: adductor machine, low pulley exercises	Sitting with knees pressed together.

SUPERFICIAL MUSCLES OF THE BODY / FRONT

Muscle	Purpose	Examples	Action
Vastus Inter Medius Vastus Lateralis Rectus Femoris- Vastus Medialis	Known as the quadriceps, they straighten the knee. Vastus Medialis locks the knee.	Sports: soccer, running, skiing Weight training: quads, knee extension, leg press, hack squat, squats	Walking up stairs, cycling.
Pectineus	Brings legs in and across the other leg. Works with adductor muscles.	Sports: soccer, horse riding, rugby Weight training: adductor machine, low pulley exercises	Walking along a straight line.
Tibialis Anterior	Pulls foot upwards and assists turning it upwards.	Sports: hill walking, mountaineering, sailing (racing), running Weight training: quads, knee extension, low pulley exercises	All walking movements.
Extensor Digitorum Brevis	Assists in straightening and pulling up middle three toes	Sports: Running in all sports Weight training: low pulley exercises, treadmill	All walking movements.

DEEP MUSCLES OF THE BODY / FRONT

Muscle	Purpose	Examples	Action
Psoas Minor	Bends the trunk.	Sports: running actions, long jump Weight training: hip flexion, sit ups, and squats	Getting out of a low chair.
Psoas Major and Iliacus	Together, they bring thigh forward and up; bends trunk against gravity	Sports: hurdling, sprinting, diving Weight training: hip flexion, incline sit up	Going up a step.
Abductor Longus, Brevis and Magnus	Together, they pull leg in and across the other side.	Sports: hurdling, horse riding, swimming, judo, wrestling, soccer Weight training: Adductor machine	Bringing second leg in or out of car.
Extensor Digitorum Longus	Straightens and pulls up toes except big toes.		Walking up the stairs.
Peroneus Tertius	Assists in pulling foot up and turning it outwards; stabilizes ankle.	Sports: cross country skiing, cross country running, and water skiing Weight training: quads, knee extension, low pulley exercises, resistance band exercises	All walking movements.
Extensor Hallucis Longus	Straightens and pulls up big toe.		Walking up the stairs.
Coracobrachialis	Assists in bringing arm forwards and into side.	Sports: rowing, boxing, tug of war, archery Weight training: bicep curls, lat pulls, chinning	Mopping a floor.
Subscapularis	Turns arm inwards; part of the “rotator cuff.”	Sports: golf, racket sports, athletic throwing events Weight training: chest exercises	Tucking back of shirt into pants.
Pectoralis Minor	Pulls down point of shoulder.	Sports: climbing, gymnastics Weight training: dipping, lat pulls	Pushing on arms of chair to stand up.
Position: deep muscle of anterior wall and thorax Origin: 3rd, 4th, and 5th ribs Insertion: attachment to scapula			

DEEP MUSCLES OF THE BODY / FRONT

Muscle	Purpose	Examples	Action
<i>Together with Teres Minor and Infra spinatus, these muscles are known as “rotator cuff” and work during all movements of the arm, stabilizing shoulder joint:</i>			
Supraspinatus	Initiates arm movement away from the side of the body.	Sports: golf, racket sports, baseball Weight training: dumbbell weights, high pulley exercises	Holding shopping bag away from side of body.
Brachialis	Bends the elbow.	Sports: baseball, gymnastics, boxing, swimming Weight training: bicep curls, lat pulls, chinning	Bringing food or drink to the mouth.
Flexor Digitorum Superficialis	Bends the fingers (gripping).	Sports: high bar gymnastics, archery, golf, baseball, judo, rowing Weight training: lat pulls, chinning, bicep curls	Involved in “hook” grip and “power” grip; turning a faucet on or off.
Flexor Pollicis Longus	Bends the thumb.	Sports: speedway, cricket, racket games, baseball Weight training: lat pulls, dumb bell weights	Firm grip on a hammer.
Flexor Digitorum Profundus	Bends tips of fingers; assists in bending wrist forward.	Sports: rock face climbing Weight training: bicep curls, wrist rolling	Involved in “hook” grip, carrying a briefcase.

SUPERFICIAL MUSCLES OF THE BODY / POSTERIOR

Muscle	Purpose	Examples	Action
Extensor Carpi Radialis Longus/Brevus	Palm down assists in cocking wrist up. Bends wrist sideways towards thumb.	Sports: backhand badminton, golf Weight training: dumbbell weights, wrist roller	Kneading dough/typing.
Anconeus	Assists to straighten elbow	Sports: javelin throw Weight training: press ups, bench press, dipping, shoulder press	Pushing object at arm's length
Flexor Carpi Ulnaris	Assists in bending wrists to bring palm towards you. Bends wrist sideways towards little finger.	Sports: lob shot (racket sports), golf Weight training: dumbbell weights, press	Pulling an object towards you.
Extensor Carpi Ulnaris	Palm down assists in cocking wrist up. Also bends wrist sideways towards little finger.	Sports: racket sports, golf, speedway Weight training: dumbbell weights, wrist roller	Cleaning windows.
Gluteus Medius	Lifts leg out to the side and turns it in.	Sports: ice skating, cross country skiing Weight training: abductor machine, floor abduction exercises	Stepping sideways out of the bath.
Gluteus Maximus	Assists in taking leg backwards and turning it out. Raises trunk up from bent position.	Sports: running, wind surfing Weight training: squats, hack squat, seated leg press	Walking up stairs, cycling.
<i>As a group known as the hamstrings:</i>			
Semimembranosus Semitendinosus Biceps Femoris	Bends the knee and can in this position turn lower leg in or out. Also straightens the hip.	Sports: sprinting, hurdling, speed skating Weight training: hamstring curl	Stepping over an obstacle.
Gastrocnemius and Soleus	Pushes the foot down and braces back of ankle. Also raises heel for forward propulsion when weight bearing.	Sports: sprinting, long jump, triple jump, ballet dancing Weight training: calf raise, hack squats, squats	Standing on "tip toes" to reach high object.

SUPERFICIAL MAJOR MUSCLES OF THE BODY / POSTERIOR

Muscle	Purpose	Examples	Action
Trapezius Upper Fibres Mid Fibres Lower Fibres	Both sides together extends head backwards. Also bends it to the side and turns face away. Lifts shoulder, Lowers shoulder and brings the shoulder blade inward,	Sports: shot putting, boxing, rowing Weight training: shoulder press, rowing, clipping, and chinning	Changing an overhead light bulb, painting a ceiling,
Deltoid	Raise arm to the front, back and out to the side. Assists in lifting arm above horizontal.	Sports: shot putt, javelin, racket sports, wind surfing Weight training: vertical rowing, bench press, shoulder press	Reaching for a can on a high shelf / stacking shelves,
Infraspinatus and Teres Minor	Together with the Deltoid they turn the arm outwards.	Sports: back hand racket sports Weight training: dumbbell weights, high pulley extensions	Brushing back of hair.
Teres Major	Assists in drawing arm backwards and turning it inwards	Sports: rowing, cross-country skiing Weight training: seated rowing, lat pulls	Tucking back of shirt into pants.
Latissimus Dorsi	Pulls arm down against resistance. Brings shoulder blades together. Can also pull body up and forward.	Sports: gymnastics (ring), swimming, climbing Weight training: chinning, lat pulls	Pushing on arms of chair to stand up.
Triceps Brachii (all three heads)	Straightens elbow and takes arm back and into side.	Sports: volleyball, baseball (pitcher), shot putt, basketball (shooting) Weight training: press-ups, bench press, dipping, shoulder press	Pushing a door closed.
Levator Scapulae	With Trapezius, stabilizes shoulder blade when carrying a weight		Carrying a heavy shopping bag.

DEEP MAJOR MUSCLES OF THE BODY / POSTERIOR

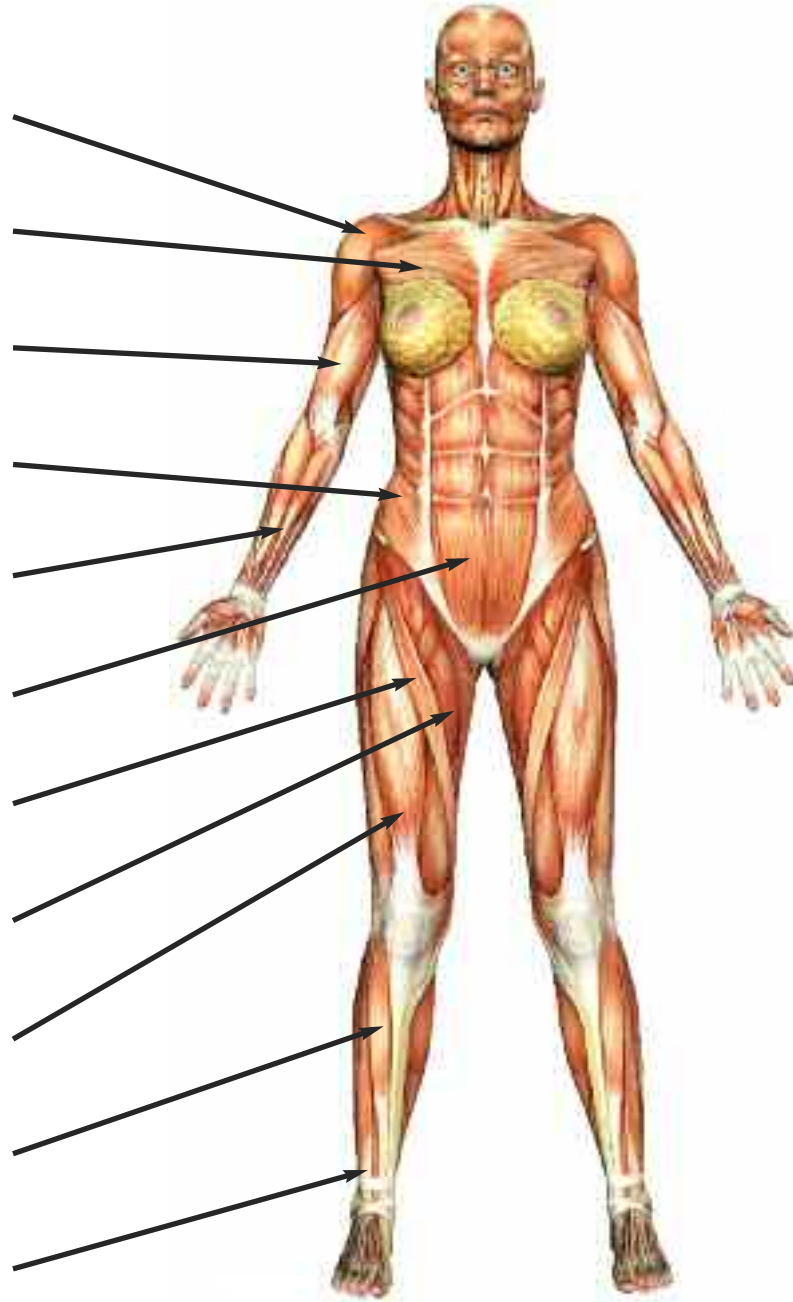
Muscle	Purpose	Examples	Action
Semispinalis Capitis Splenius Capiti Splenius Cervicis Semispinalis Thoracis	Together, they take upper back, neck and head backwards. Also turn head and neck.	Sports: rugby scrums, American football, wrestling, archery, swimming Weight training: neck machine, back extension	Turning and twisting head while driving a car.
Rhomboideus	With Trapezius, braces back shoulder blades. Assists in stabilizing the shoulder blade when working upper limb.	Sports: volleyball, racket sports, rifle shooting, rowing, archery, wind surfing Weight training: seated and vertical rowing, lat pulls	Pulling a drawer open.
Spinalis Dorsi Longissimus Dorsi Ilio Costalis Lumborum	Known as long extensors of the back. Backwards and sideways movement of the whole spine.	Sports – working in all sports, especially gymnastics, swimming and golf Weight training: back extension, lat pulls,	Straightening back to stand from a sitting position. hack squat, squats
External Intercoastal	Involved in breathing.		
Serratus Anterior	Raises whole shoulder up, rotates lower scapula and assists in raising arm forwards.	Sports – boxing, shot put, weight training, bench press, shoulder press	Reaching up to open a high window.
Quadratus Lumborum	Involved with bending body to same side, also breathing		Bending sideways from sitting to pick up an object from the floor.
Supinator	Turns forearm to bring palm facing up.	Sports: backhand in racket sports, water skiing grip. Weight training: bicep curl, dumbbells	Turning a door handle
Abductor Pollicis Longus Extensor Pollicis Brevis:	Raises thumb off palm at right angle.		Releasing grip on a flat object.
Gluteus Minimus	Lifts leg out to the side and turns it inwards.	Sports: cross country skiing, gymnastics, speed skating Weight training: abductor machine	Getting in and out of a car.

DEEP MAJOR MUSCLES OF THE BODY / POSTERIOR

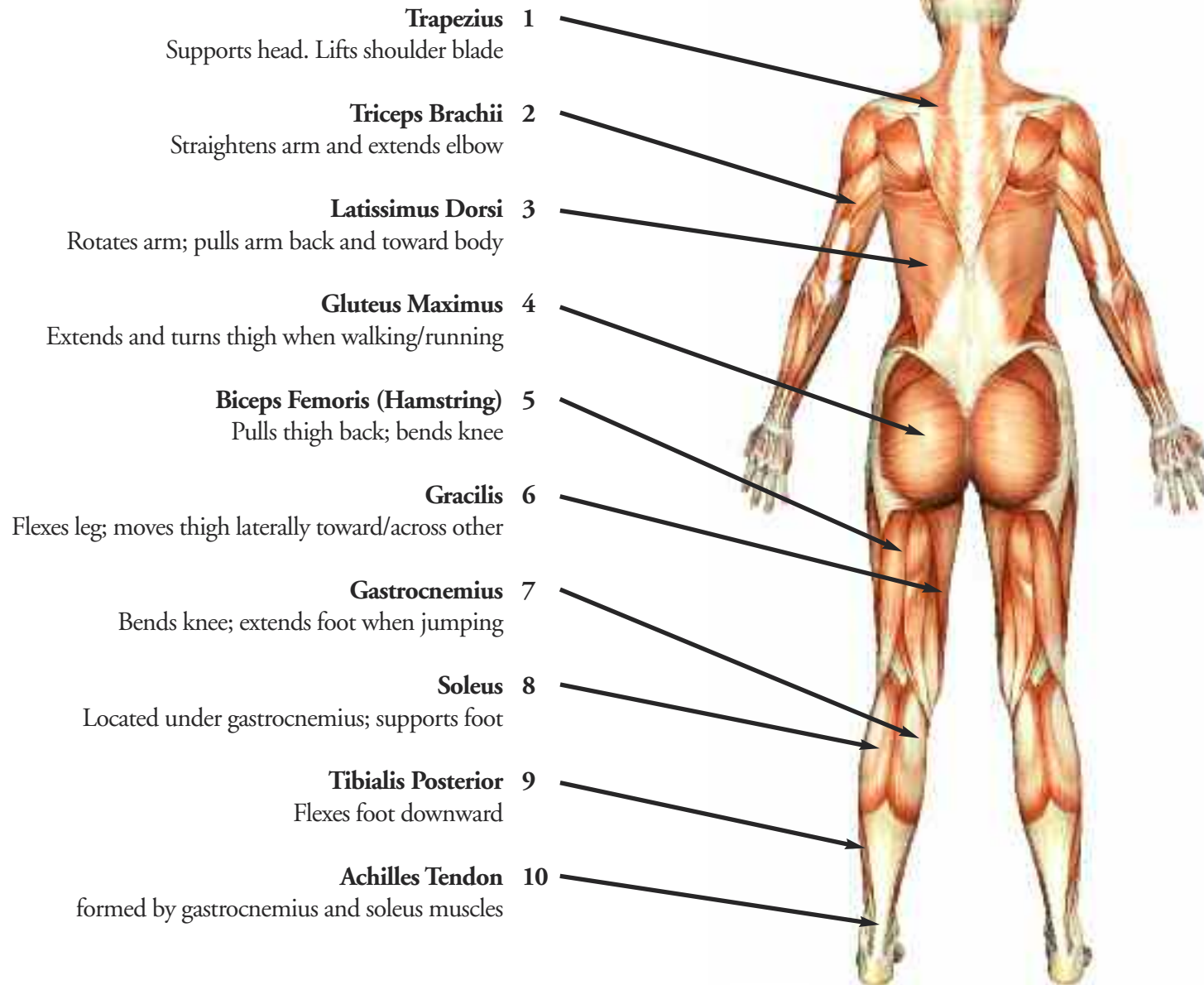
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MUSCLES OF THE BODY / FRONT

- Deltoid** 1
Moves shoulder and lifts arm
- Pectoralis Major** 2
Assists in lifting arm and pushing
- Biceps Brachii** 3
Bends arm at elbow
- External Oblique** 4
Pulls in abdomen. Turns trunk from side to side
- Flexor Digitorum Group** 5
Two muscles that flex the wrist and fingers
- Rectus Abdominis** 6
Pulls in abdomen. Bends trunk forward
- Sartorius** 7
Bends leg at hip and at knee. Turns thigh outward
- Adductor Longus** 8
Pulls thigh toward body and from side to side
- Quadriceps Femoris** 9
Bends leg at hip and extends it at knee
- Tibialis Anterior** 10
Bends foot toward shin
- Fibularis Group** 11
Flexes foot downward; stabilizes ankle joint



MUSCLES OF THE BODY / REAR



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