Quadrant II – Transcript and Related Materials

Quadrant II Template – Notes

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FORELIMBS AND HINDLIMBS IN VERTEBRATES

BONES OF THE UPPER LIMBS

The upper limbs include humerus, radius, ulna, carpals, metacarpals and Phalanges. The only bone of the arm is the humerus, which articulates with the forearm bones–the radius and ulna–at the elbow joint.

Humerus

The humerus is the single bone of the upper arm region. At its proximal end is the head of the humerus. This is the large, round, smooth region that faces medially. The head articulates with the glenoid cavity of the scapula to form the glenohumeral (shoulder) joint. The margin of the smooth area of the head is the anatomical neck of the humerus. The surgical neck is a common site of arm fractures. The deltoid tuberosity is a roughened, V-shaped region located on the lateral side in the middle of the humerus shaft. As its name indicates, it is the site of attachment for the deltoid muscle.

Ulna

The ulna is the medial bone of the forearm. It runs parallel to the radius, which is the lateral bone of the forearm. The proximal end of the ulna resembles a crescent wrench with its large, C-shaped trochlear notch. This region articulates with the trochlea of the humerus as part of the elbow joint. The inferior margin of the trochlear notch is formed by a prominent lip of bone called the coronoid process of the ulna. Just below this on the anterior ulna is a roughened area called the ulnar tuberosity. To the lateral side and slightly inferior to the trochlear notch is a small, smooth area called the radial notch of the ulna. This area is the site of articulation between the proximal radius and the ulna, forming the proximal radioulnar joint. The posterior and superior portions of the proximal ulna make up the olecranon process, which forms the bony tip of the elbow.

Ulna and Radius

The radius runs parallel to the ulna, on the lateral (thumb) side of the forearm. The head of the radius is a disc-shaped structure that forms the proximal end. The small depression on the surface of the head articulates with the capitulum of the humerus as part of the elbow joint, whereas the smooth, outer margin of the head articulates with the radial notch of the ulna at the proximal radioulnar joint. The lateral end of the radius has a pointed projection called the styloid process of the radius. This provides attachment for ligaments that support the lateral side of the wrist joint. Compared to the styloid process of the ulna, the styloid process of the radius projects more distally, thereby limiting the range of movement for lateral deviations of the hand at the wrist joint.

Carpal Bones

The wrist and base of the hand are formed by a series of eight small carpal bones . The carpal bones are arranged in two rows, forming a proximal row of four carpal bones and a distal row of four carpal bones. The bones in the proximal row, running from the lateral (thumb) side to the medial side, are the scaphoid (“boat-shaped”), lunate (“moon-shaped”), triquetrum (“three-cornered”), and pisiform (“pea-shaped”) bones. The small, rounded pisiform bone articulates with the anterior surface of the triquetrum bone. The pisiform thus projects anteriorly, where it forms the bony bump that can be felt at the medial base of your hand. The distal bones (lateral to medial) are the

trapezium (“table”), trapezoid (“resembles a table”), capitate (“head-shaped”), and hamate (“hooked bone”) bones. The hamate bone is characterized by a prominent bony extension on its anterior side called the hook of the hamate bone.

Metacarpal Bones

The palm of the hand contains five elongated metacarpal bones. These bones lie between the carpal bones of the wrist and the bones of the fingers and thumb. The proximal end of each metacarpal bone articulates with one of the distal carpal bones.

Phalanx Bones

The fingers and thumb contain 14 bones, each of which is called a phalanx bone (plural = phalanges), named after the ancient Greek phalanx (a rectangular block of soldiers). The thumb (pollex) is digit number 1 and has two phalanges, a proximal phalanx, and a distal phalanx bone . Digits 2 (index finger) through 5 (little finger) have three phalanges each, called the proximal, middle, and distal phalanx bones.

<u>Forelimbs in Vertebrates</u>

In Fishes

In Fishes the limbs function is done by fins. The fin skeleton can be divided into three domains: proximal radials, distal radials, and fin rays.The Proximal and distal radials forms the endoskeleton and fin rays forms the exoskeleton.The Pectoral fin is supported by nineteen fin rays and four radials which articulates with the pectoral girdle.

In Amphibia (Frog)

Forelimbs consists of Humerusbone.Radius and Ulna, both the bones are fused to form radioulna.Carpals, metacarpals and phalanges are present.

In Reptiles *(Varanus)*

Humerus bone is broad.Radius and Ulna are separated.Carpal, metacarpals and phalanges are present. Digits ends with claws.

In Aves *(Gallus)*

The forelimbs have evolved into wings. The forelimb has humerus bone with pneumatic foramen.Radius and Ulna are well formed.Ulna is large for the attachment of the flight feathers. Carpals fused with metacarpals to form carpometacarpus.Digits are present.

In Mammals (Rabbit)

The upper limbs include the bones of the arm (humerus), forearm (radius and ulna). The only bone of the arm is the humerus, which articulates with the forearm bones–the radius and ulna–at the elbow joint. The wrist bones are called carpals. The bones that form the palm of the hand are called metacarpals. The phalanges are the bones of the fingers.

BONES OF THE LOWER LIMBS

The lower limbs include Femur, tibia, fibula, tarsals, metatarsals and Phalanges. The only bone of the thigh is the Femur, which articulates with the leg bones–the tibia and fibula–at the knee joint.

Femur

The femur is the single bone of the thigh region. It articulates superiorly with the hip bone at the hip joint, and inferiorly with the tibia at the knee joint. The patella only articulates with the distal end of the femur. The narrowed region below the head is the neck of the femur. This is a common area for fractures of the femur. The greater trochanter is the large, upward, bony projection located above the base of the neck. Multiple muscles that act across the hip joint attach to the greater trochanter, which, because of its projection from the femur, gives additional leverage to these muscles. The greater trochanter can be felt just under the skin on the lateral side of your upper thigh. The lesser trochanter is a small, bony prominence that lies on the medial aspect of the femur, just below the neck. A single, powerful muscle attaches to the lesser trochanter. Running between the greater and lesser trochanters on the anterior side of the femur is the roughened intertrochanteric line. The trochanters are also connected on the posterior side of the femur by the larger intertrochanteric crest.

Patella

The patella (kneecap) is largest sesamoid bone of the body . A sesamoid bone is a bone that is incorporated into the tendon of a muscle where that tendon crosses a joint. The sesamoid bone articulates with the underlying bones to prevent damage to the muscle tendon due to rubbing against the bones during

movements of the joint. The patella is found in the tendon of the quadriceps femoris muscle, the large muscle of the anterior thigh that passes across the anterior knee to attach to the tibia. The patella articulates with the patellar surface of the femur and thus prevents rubbing of the muscle tendon against the distal femur. The patella also lifts the tendon away from the knee joint, which increases the leverage power of the quadriceps femoris muscle as it acts across the knee. The patella does not articulate with the tibia.

Tibia

The tibia (shin bone) is the medial bone of the leg and is larger than the fibula, with which it is paired .The tibia is the main weight-bearing bone of the lower leg and the second longest bone of the body, after the femur. The medial side of the tibia is located immediately under the skin, allowing it to be easily palpated down the entire length of the medial leg.

Fibula

The fibula is the slender bone located on the lateral side of the leg . The fibula does not bear weight. It serves primarily for muscle attachments and thus is largely surrounded by muscles. Only the proximal and distal ends of the fibula can be palpated.

Tarsal Bones

The posterior half of the foot is formed by seven tarsal bones . The most superior bone is the talus. This has a relatively square-shaped, upper surface that articulates with the tibia and fibula to form the ankle joint. Three areas of articulation form the ankle joint: The superomedial surface of the talus bone articulates with the medial malleolus of the tibia, the top of the talus articulates with the distal end of the tibia, and the lateral side of the talus articulates with the lateral malleolus of the fibula. Inferiorly, the talus articulates with the calcaneus (heel bone), the largest bone of the foot, which forms the heel. Body weight is transferred from the tibia to the talus to the calcaneus, which rests on the ground. The medial calcaneus has a prominent bony extension called the sustentaculumtali (“support for the talus”) that supports the medial side of the talus bone.

Metatarsal Bones

The anterior half of the foot is formed by the five metatarsal bones, which are located between the tarsal bones of the posterior foot and the phalanges of the toes. These elongated bones are numbered 1–5, starting with the medial side of the foot. The first metatarsal bone is shorter and thicker than the others. The second metatarsal is the longest. The base of the metatarsal boneis the proximal end of each metatarsal bone. These articulate with the cuboid or cuneiform bones. The base of the fifth metatarsal has a large, lateral expansion that provides for muscle attachments. This expanded base of the fifth metatarsal can be felt as a bony bump at the midpoint along the lateral border of the foot. The expanded distal end of each metatarsal is the head of the metatarsal bone. Each metatarsal bone articulates with the proximal phalanx of a toe to form a metatarsophalangeal joint. The heads of the metatarsal bones also rest on the ground and form the ball (anterior end) of the foot.

Phalanges

The toes contain a total of 14 phalanx bones (phalanges), arranged in a similar manner as the phalanges of the fingers. The toes are numbered 1–5, starting with the big toe (hallux). The big toe has two phalanx bones, the proximal and distal phalanges. The remaining toes all have proximal, middle, and distal phalanges.

<u>Hind limbs in Vertebrates</u>

In Fishes

The Pelvic fin is supported by nine fin rays and three radials which articulates with the pelvic girdle.

In Amphibia (Frog)

Femur bone is present. Tibia and fibula are fused to form tibiofibula.Tarsals, metatarsals, Phalanges are present.

In Reptiles *(Varanus)*

The bones of the hind limb are femur, Tibia, fibula, tarsals, metatarsals and phalanges. Tibia and fibula are separated.Patella bone is absent.Digits have claws.

In Aves *(Gallus)*

Bones of the upper foot joins with the tibia to form tibiotarsus.Bones of the lower foot are fused to form tarsometatarsus. Femur bone is present.Fibula and tibia bones are present.Patella bone is present at the knee joint. Digits are present.

In Mammals (Rabbit)

The lower limbs include the femur, tibia and fibula bones.Tarsal bones of the ankle.Phalanges that forms the toes.Metatarsals forms the bones of the sole feet. Patella bone is present.

Limbs of Vertebrates

The fins of fishes are used for swimming and balancing in water.The limbs of tetrapoda are pentadactyl.They are used for locomotion and to support the weight of the body.They are divided into three segments:Stylopodium- It has Humerus and Femur bone of both the limbs. Zeugopodium- It has radius, ulna, tibia and fibula bones of both the limbs.Between the Stylopodium and Zeugopodium there is a elbow joint of forelimb and knee joint of hindlimb.Autopodium- It has Phalanges(digits).