

What to know?

What are the functions of feathers?

Insulation, flight, ornamental/sexual signaling

Muscle fiber/metabolic differences (depending on biology of the bird, where would you expect to find muscles with a lot of myoglobin?)

-Flight muscles account for 25-35% of the total body mass of strong fliers

-Predatory birds, limb muscles 10% (flight muscles ~20%)

-Swimming birds, even distribution of limb and flight muscles

-Muscle fiber types and metabolic pathways

Dark Meat: legs; high capacity for aerobic metabolism; myoglobin

White Meat: wings; little capacity for aerobic metabolism

Strong fliers: breast muscles with high aerobic metabolic capacities

Which wing feathers (specifically) are responsible for flight?

The feathers responsible for flight in a bird are the inner remiges often referred to as secondaries (ulna- help lift). They are attached to the 'forearm' of the bird and are located between the body of the bird and the primaries (handbone- help propel).

- Major muscles involved with flight 1)
Pectoralis major -pulls wing down 2)
Supracoracoideus -lifts wing

In general, how do birds fly?

When a bird flaps its wings, air is pushed downward. This produces an opposite force that "lifts" the bird into the air. Since a bird's wing is in the shape of an airfoil, it produces some lift even when the bird is just gliding.

Alula - extra little wing on top of hand helps air flow smoothly over

Primaries - big long wing feathers Secondaries - feathers on arms

-primaries propel, secondaries lift

drag - force that is oppose to forward motion & wing movement

air pressures can differ on dorsal & ventral side of wing

angle of attack will help produce lift -angle

Wing loading - body mass/wing span area - if too heavy & wings 2 small don't fly

Aspect ratios - length:width

Lift: vertical force equal to or greater than weight of bird

Wing proportions/types of wings

Bird can kinda change surface area by changing feather position but mostly evolutionary.

Depending on if bird is a flier, or soaring gives birds lengthened arm sections. - hummingbird has fast wing beats which needs max force from primaries so their hand bones are longer than both forearm + upper arm. Barely have secondaries

Diving - needs high aspect ratio - fast strong fliers - slender top, no wing slots, arms bent back

Elliptical - rapid or slow flight w/ high maneuver. - low aspect ratio equalish - broad and square/elliptical

Dynamic - soaring - long flat narrow wings, needs persistent wind

High lift - static soarers make slotting in primaries seek out rising air masses. Intermediate aspect ratio - light wing loading & maneuver. Broad wings & high slotting gives maneuver. To changes in wind currents by changing positions of individual feathers vs moving whole wing

Understand respiratory and circulatory system of birds

-Separate systemic and pulmonary sides of the heart

- Division via a permanent septum; between ventricles; this is lacking in turtles, lizards and they therefore have lower blood pressure and rates of blood flow

- The permanent ventricle allows higher rates of flow associated with higher overall metabolism in birds

Heart - entire left systemic arch is lost & sinus venosus has been subsumed into the right atrium

Inspiration - Ventral rotation of the sternum while the longissimus dorsi muscle pulls on the ileum & lifts the pelvis; both of these movements increase thorax volume

Expiration - sternum returns to resting position & contraction of the suprapubic & infrapubic abdominal muscles pulls the pelvis downward reducing the volume of the thorax.

2 groups of air sacs anterior & posterior occupy much of body and are poorly vascularized, do not participate in gas exchange but are very large and used as reservoirs that store air during parts of the resp. cycle to create a through-flow lung where air flows only 1 direction

Have Cervical abdominal interclavicular, anterior & posterior thoracic air sacs connected to lungs by ventro/dorsobronchi

1st inhalation: trachea, posterior air sacs

1st exhalation: posterior air sacs, lungs

2nd inhalation: lungs, anterior air sacs

2nd exhalation: anterior air sacs, trachea, out

Understand how and why endothermy evolved in birds

Issues -

Need to resolve conflict b/w locomotion & lung ventilation that results from the primitive tetrapod method of locomotion. - > derived upright posture was developed w/ bipedality & primitive pattern of hindmuscles was retained

Need more oxygen to support the high metabolic rates associated w/ locomotion (flow through lung)

Need more food to fuel high metabolism - Gizzard

-Air exchange and sustained locomotion/activity produces heat and a substantial amount of energy lost as heat

-Body forms and posture changes to better deal with increased activity

Temperature regulation via ectothermy or endothermy For endothermy to evolve, need insulation and high metabolic rate

-Feathers -insulation, but can be moved to enhance air flow across the body to facilitate cooling

What are the different types of bird feet, beaks, and tongues covered in lecture?

Wood pecker tongues- elongated hyoid bone supporting the tongue inside a sheath of muscle that oases around the outside of the skull and rests in the nasal cavity. When contracted, the tongue is pushed out of the mouth. The tip of the tongue has barbs that impale insects to pull them out of tunnels.

No teeth, gastric apparatus helps process food that would normally occur in the mouth

Crop -enlarged portion of the esophagus

Stomach -Proventriculus and gizzard