TURTLE BODY SYSTEMS

INTEGUMENTARY

Thick, dry, scaly skin (prevents water loss); for protection
SCUTES – large scales covering shell bone; Surface cells fill with KERATIN;
lipids/proteins make skin watertight
Claws on feet
Bony plates: Carapace-top shell; plastron-lower shell
ENDOSKELETON: ribs and back bones inside fused to make shell;
Shoulders and pelvic bones of turtles lie inside ribs so they can pull limbs inside shell
(in all other terrestrial vertebrates these lie outside ribs)
Shell shape varies with habitat; high dome = terrestrial; low, streamlined = aquatic

SKELETAL

ENDOSKELETON: ribs and back bones inside fused to make shell;
Shoulders and pelvic bones of turtles lie inside ribs so they can pull limbs inside shell
(in all other terrestrial vertebrates these lie outside ribs)

DIGESTIVE

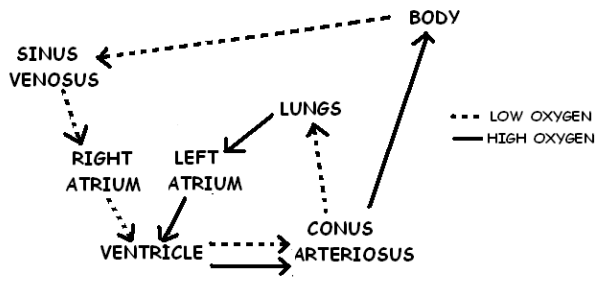
Sharp BEAK instead of teeth
ESOPHAGUS carries food to STOMACH- acids and muscle contractions break down food;
SMALL INTESTINE- finishes digestion/absorbs nutrients;
PYLORIC SPHINCTER controls food moving from stomach to small intestine
DUODENUM-(closest to stomach) receives bile and trypsin/completes digestion
ILEUM- coiled middle section-absorbs nutrients (fingerlike VILLI inside increase surface area)
LARGE INTESTINE (also called COLON) absorbs water/concentrates digestive waste;
CLOACA- receives feces, urine, eggs/sperm, VENT- exit opening in animals with a cloaca
LIVER-
makes bile; stores glycogen & vitamins; processes toxins including nitrogen waste for kidneys;
GALL BLADDER- stores bile;
MESENTERY-connects internal organs;
PANCREAS-makes digestive enzymes (trypsin) for small intestine;

CIRCULATORY- 3 CHAMBERS/2 LOOPS

CLOSED; 2 LOOPS; 2 atria/1 ventricle (like amphibians)
PULMONARY circulation- carries deoxygenated blood from heart to lungs and oxygenated blood back to heart
SYSTEMIC circulation-carries oxygenated blood from heart to body and deoxygenated blood back to heart
RENAL- blood going to kidneys CORONARY-blood going to heart HEPATIC-blood going to liver
ARTERIES carry blood away from heart; VEINS return blood to heart; CAPILLARIES gas/nutrient/waste exchange
SINUS VENOSUS and CONUS ARTERIOSUS are much smaller than in amphibians
Largest vein returning to heart from body = VENA CAVA; Largest artery leaving heart to body organs = AORTA
PULMONARY ARTERIES carry blood to the lungs; PULMONARY VEINS return blood from the lungs
Advantage over single loop system- going through capillaries for gas exchanges slows blood
Second trip through the heart = faster to body & more efficient distribution of oxygen
Heart has VALVES & a partial SEPTUM (dividing wall to partially divide ventricle) to prevent
mixing of high/low oxygen blood

Aquatic turtles can shut down pulmonary loop when needed:

- **when underwater holding breath underwater**
- **to warm organs body up fast**
- when inactive



SPLEEN- makes, stores, and processes red blood cells;
unlike mammals (humans) blood cells have nuclei

EXCRETORY

Excrete waste as URIC ACID/less toxic than urea
KIDNEYS- filter blood and remove nitrogen waste processed by liver;
OSMOREGULATION: Regulates ion/water level in blood and tissues
URINARY BLADDER –stores urine; urine exits through CLOACA/VENT

NERVOUS

Same size brain but larger CEREBRUM & OPTIC LOBES than in amphibians
TYMPANIC MEMBRANE (Eardrum)- but poor hearing; COLUMELLA bone connects eardrum and inner ear
EUSTACHIAN TUBES connect ears to back of throat; NICTITATING MEMBRANE covers/protects eyes

RESPIRATORY

LUNGS for respiration; GLOTTIS = opening to lungs;
Cartilage rings in TRACHEA (tube carrying air to lungs) keep it open;
TRACHEA splits into 2 BRONCHI before entering lungs
Lungs divided into chambers; lining folded into ALVEOLI (to increase surface area)
Breathe by expanding rib cage like humans
Some water sea turtles can breathe through cloaca

ENDOCRINE

THYROID GLAND makes THYROXINE to regulate heart rate, metabolism, growth & development
PANCREAS makes insulin (causes cells to take up glucose from blood & store it as glycogen) &
glucagon (causes cells to release stored glucose into bloodstream)

REPRODUCTIVE- Internal fertilization/Direct development
Separate sexes: males-TESTES(make sperm); EPIDIDYMIS- tubules where sperm complete their development (mature & grow tails); VAS DEFERENS (tubes to carry sperm from epididymis to cloaca); females-OVARIES (make eggs);
OVIDUCTS- add albumen & shell
Sperm & eggs empty into CLOACA; exit through VENT
INTERNAL fertilization ; males have a PENIS for transferring sperm
OVIPAROUS-lay amniotic eggs surrounded by tough protective shell;
buried and left unattended in nest;
AMNIOTIC EGG- aquatic environment inside egg/tough outer shell;
more protection than jellylike amphibian eggs
4 membranes: CHORION-surrounds all membranes/protection AMNION-encloses embryo & fluid;
YOLK SAC-encloses food supply; ALLANTOIS- stores nitrogen waste; ALBUMEN = protein & water
Sex of young turtles is DETERMINED BY TEMPERATURE OF NEST not sex chromosomes

MISCELLANEOUS

Deuterostomes (blastopore becomes anus)
ECTOTHERMIC (cold-blooded)
Scientists believe reptiles evolved from amphibians about 350 million years ago.
Mesozoic era (245-65 million years ago) was "Age of Dinosaurs"
Asteroid-impact hypothesis explains why dinosaurs became extinct 65 million years ago.
Kingdom: Animalia
Phylum: Chordata
Subphylum: Vertebrata
Class: Reptilia "creep or crawl"
Order: Chelonia- Latin-"tortoise" (formerly called- Testudines: Greek "tortoise")

CHARACTERISTICS OF ALL REPTILES:

Dry, scaly skin
3 chambered heart (except crocodiles)
2 loop circulatory system
Ectothermic (cold blooded)
Respiration with lungs
Lay amniotic eggs
Internal fertilization