The Animal Kingdom

Invertebrates Animals - multicellular organisms without a backbone - make up 90% of animal kingdom

I. Poriferans - Sponges
II. Cnidarians - hollow body cavity
A. Corals
B. Jellyfish
C. Hydra
D. Sea Anemone
III. Worms
A. Platyhelminthes - flatworms
B. Nematodes - roundworms
C. Annelids - segmented worms
IV. Mollusks
A. Gastropods: no shell or Univalve – one-shelled
B. Bivalve – two-shelled
C. Cephalopods – head-footed
V. Arthropods
A. Crustaceans
B. Centipedes & Millipedes
C. Arachnids
D. Insects
1. anatomy
2. growth & development
3. behavior
4. defense mechanisms
VI. Echinoderm
A. Starfish
B. Other Echinoderms

I. Poriferans - Sponges
A. Simplest and oldest of the invertebrates
B. Grow attached to same spot on ocean floor whole life.(sessile)
C. Body has many "pores" or holes
1. pores are very small & can get clogged
2. water washes food & oxygen into pores, waste washed out through single larger opening (osculum)
D. If all sponge cells were separated, they would reorganize themselves into a new sponge
E. mistaken for plants (no photosynthesis)
F. Produce spicules – form skeleton of sponge
G. Reproduce sexually (egg & sperm) or asexually (budding – part of sponge breaks off)
H. Source of antibiotics

II. Cnidarian
A. Two basic body forms – both symmetrical (1) vase shaped polyp (2) bowl shaped medusa
B. Contain a central cavity with one opening
C. Around the mouth are tentacles with stinging cells called nematocysts - can sting or kill prey - good to be near mouth
D. Only one opening - waste leaves where food goes in
E. Have cells that perform special functions - more complex EX: jellyfish have muscle tissue to move
F. Reproduce sexually & asexually (budding)
G. Examples:
1. Coral - use minerals to form a hard shell
- after coral dies shell is left to form coral reef
- wide variety of shapes & colors
- algae lives on coral to help feed it
2. Sea Anemones - "underwater flower" on ocean bottom
- tentacles sting & kill fish
- coloring attracts fish
- some fish can swim through & attract others
3. Jellyfish - can move & have nematocysts
4. Hydra - live in freshwater
- polyp shaped
- move by somersaulting

III. Worms - have a head & mouth end & digestive tube in between
- have bilateral symmetry
A. Platyhelminthes - flatworms
1. Planaria - live in ponds & streams - feed on dead plants & animals (or themselves)
- "eyespots" detect light
- missing parts can be re-grown – regeneration
2. Tapeworm - long flat ribbon – parasite that lives in animals or humans
- head (scolex) has "hooks" that attach to host
- takes food & water from host (can be 6m long)
- each section (proglottids) have both male & female reproductive parts – can produce new worm
3. Liver Fluke - Eggs passed from human into water through feces - eggs hatch and enter a snail - after it matures, the fluke attaches to feet of human host walking in the water - lays eggs in the human liver - eggs passed into the water…
B. Nematodes - roundworms - means "thread-like"
1. Trichina - lives in muscle of pigs
- causes disease called trichinosis
2. Hookworm - burrows in feet of host & feeds on blood
- affects 600 million people in world each year
3. Ascaris – parasitic – ingested
4. Pinworm – ingested – lay eggs near anus (itching) – common in children
C. Annelids - segmented worms - means "ringed"
1. Earthworms

- improve soil quality by making pores & leaving waste
- move by gliding (mucus) on small bristles called setae
- Digestion: mouth — pharynx — esophagus — crop (storage) — gizzard (grinds food) — intestine.
- closed circulatory system (has blood vessels)
- air enters through moist skin
- each earthworm has male & female structures
- has cells to sense changes in the environment (moisture, danger)

IV. Mollusks - "soft" - fleshy body & often a shell
- most have a muscular foot to move or open & close shell
- head region has mouth & sense organs
- most have a mantle to make hard shell

A. Gastropods "stomach-foot" - no shell or Univalve - one-shelled mollusks
1. Radula - tongue to shave plants into pieces of food
- can be poisonous to humans
2. EX: Snail-releases mucous to slide over rough surfaces
3. EX: Slug-shell is small & inside or no shell

B. Bivalve - two-shells held together by powerful muscles
1. Examples: clam, oyster, mussel, scallop
2. move by clapping shells together
3. feed by filtering small organisms out of water

C. Cephalopods – head-footed - highly developed
1. Examples: Octopus, Squid & Nautilus
- most don't have outer shell (small shell inside)
- have tentacles to catch food (Octopus—8, Squid—1O)
- use jet propulsion to move
- can use a dark dye to confuse enemies

V. Arthropods - "Jointed leg" - most numerous & successful
- all have a segmented body, exoskeletons &jointed legs
- exoskeleton must be replaced as animal grows (molting)
- more species of arthropods that all animal species combined
- open circulatory system
- get oxygen from gills, book lungs or air tubes
- reproduce sexually

FIVE GROUPS OF ARTHROPODS

A. Crustaceans (crabs, lobster, crayfish, shrimp)
1. live in or near water
2. have 2 pair of antenna
3. mouth parts used for crushing food
4. get oxygen through gills
5. bodies are divided into segments & there are one set of limbs (such as claws) for each segment
6. can regenerate parts of body (good for crab fishermen)

B. Centipedes - 1 pair of legs per segment - meat eaters

C. Millipedes - 2 pairs of legs per segment - plant eaters

****Millipede & Centipede exoskeletons are not waterproof – live where moist

D. Arachnids (spiders, scorpions, ticks, mites)
1. all have 2 body sections: head & abdomen
2. all have 8 legs
3. make webs with silk (recycle), trap prey & inject venom through fangs
4. get oxygen through book lungs or air tubes
5. most live on land (some on animals)

E. Insects
1. about 300 million insects for every person alive on Earth
2. 3 body parts: Head, Thorax (chest) & Abdomen
3. have 3 pairs of legs (6 legs) attached to thorax
4. have compound eyes (many lenses) – good at detecting movement
5. most have wings & antenna
6. open circulatory system (no blood vessels)
7. reproduce sexually
8. release pheromones to attract mate (11 km away)
9. some are "social" – live in colonies or hives
10. some can camouflage to hide from predators
11. go through changes in appearance as they grow — metamorphosis
1. egg 2. larva 3. pupa 4. adult

VI. Echinoderms - rough spiny skin (starfish, sea lilies, sea cucumber, sea urchin, feather star, sand dollar)

A. Starfish - not a fish
- have an internal skeleton - have 5 or more arms from a central body
- water vascular system – fluid filled internal tubes that carry food, oxygen & waste
- have thousands of suction cups called tube feet (Helps starfish move & can pull clam open)
- if cut up parts can regenerate

Fishes & Amphibians

I. Vertebrate – animal with a backbone – belong to phylum Chordata = Chordates

At some time during life all have three characteristics:

1. nerve cord-hollow tube located near animals back
2. notochord-long flexible supporting rod-usually replaced by vertebral column
3. gill slits-paired structures in throat that connect throat to outside environment
   -water flows over gills allowing oxygen to pass into blood vessels in gills

A. Vertebrate bones

1. Vertebrae – bones that make up backbone (vertebral column)
2. Endoskeleton – internal skeleton (inside)

B. Advantages of endoskeleton

1. gives support & shape
2. increases in size as we grow
3. Protect the nerves in spinal cord that carry information through body

C. Coldblooded Vertebrates - Body temperature changes with surroundings
   – but must stay within certain range

II. Fish – were the first verts – about 540 million years ago

A. Characteristics

1. adapted to life underwater
2. streamlined bodies allow them to glide in water
3. (most) have scales & fins to move & steer (& keep upright)
4. take in oxygen through gills
5. reproduction: male & female are separate animals
   a. most external fertilization – sperm & egg unite outside fish
   b. some internal fertilization – sperm & egg join inside - lay fertilized egg
6. live in fresh & salt water
7. changes in environment change body temp (water temp more constant than land)
8. throats with gill slits
9. closed circulatory system
10. excretory system – tube-like kidneys filter nitrogen waste
11. fairly developed nervous system (smell & taste)

B. Three Classes of Fish

1. Jawless – most primitive
   a. no scales fins of jaws
   b. skeleton is made of cartilage – flexible
   c. skin covered with poisonous mucus
   d. example: Lamprey – uses suction like mouth to attach to other fish – drills hole & sucks blood & fluid
   e. example: Hagfish – worm-like with 4-6 tentacle surrounding mouth (touch)
      - feed on dead or dying fish with tongue – or twist into knot to get inside prey – also release slime
2. Cartilaginous Fish – Shark
   a. skeleton is made of cartilage
   b. have jaws & teeth
   c. other examples – skates & rays – have two large fins that stick out from sides
      – flap to move – lie on ocean floor – can bury in sand to hide
      – some can be poisonous or produce electricity to get prey
3. Bony Fish
   a. have many hard & sharp bones
   b. travel in groups called schools
   c. have a swim bladder – sac can take in or let out air depending on what level the fish wants to be
   d. have paired fins – some supported by rays
   e. adaptations:
      electric eel – uses electricity to stun prey
      flounder - can change color, both eyes on one side
      fish in deep dark water have big eyes – lanternfish-light emitting organs
      lungfish – can bury in mud when water evaporates
      anglerfish – dangle worm-like lure in front of prey
      remora – uses sucker to attach to other fish & feed on leftovers
      mudskippers – uses fins to "skip" on land

III. Amphibians – means double life (part in water, part on land)

**when immature are fish-like & breathe through gills
**as adults live on land & breathe through lungs & moist skin

A. Characteristics

1. born from eggs laid in water – must return to water to reproduce so that the eggs don't dry out
2. breathe through skin – skin must remain damp – stay near water
3. skin contains many glands & bodies lack scales & claws
4. Circulation – double loop: one loop transports O_2 rich blood between heart & lungs – other transports O_2 poor blood between heart & body
5. 2 oval shaped kidneys filter waste from blood
6. well developed nervous system
7. reproduction – external fertilization–sticky jelly around egg–tadpole–feeds on plants–metamorphosis–loses tail & grows legs–gills disappear
   ** some do use internal fertilization

B. Frogs & Toads

1. How do they survive in winter since coldblooded?
   Bury underground (warmer) and go into winter sleep called hibernation
   **body temp slows
   ** lives on food stored in body
   **breathes through skin
   **in spring – lots of chirps

2. Comparison
a. skin: frog – smooth & wet
toad – dry & wart-like
b. toad can have poison glands behind eyes
3. frogs & toads develop from tadpoles with no legs, have tail, gills & feed on plants
4. jump so well because of large back legs

C. Salamanders & Newts
1. amphibians with tails
2. small back legs – can't jump
3. live in moist areas – to breathe & lay eggs

Mammals

I. Characteristics of Mammals (about 4000 species)
**200 million years ago – evolved from reptiles
A. Phylum Chordata
B. Warmblooded – temp constant despite surroundings
C. Have hair or fur at some time in life (keeps warm)
D. Have mammary glands – structures in female that produce milk to feed young
E. Believed to be most intelligent animals on Earth
**Brain better developed
**give young more protection & attention
**better senses – taste & smell
F. Circulatory System – 4 chambered heart & blood vessels
O_2 poor blood -> heart -> lungs for O_2 ->heart -> body
G. Highly developed excretory system – paired kidneys filter nitrogen waste to form concentrated urea (+ water = urine)
H. Reproduction – internal fertilization
**three groups of mammals based on development

II. Monotremes – egg-laying mammals
A. only two: Duck-billed Platypus (Australia) & Spiny Anteater

III. Marsupials – pouched mammals
A. Born only partially developed – finish in pouch where they feed on mothers milk
B. Examples: 1. Kangaroo – born 2cm long, blind & deaf, crawls 30 cm to pouch joey lives in pouch 90 days
2. Koala – in Australia – eats only eucalyptus leaves, pouch upside-down
3. Opossum – only marsupial in North America – give birth to 24 –56 at a time, all can fit into a teaspoon

IV. Placental Mammals – develop totally in female
** Have a placenta – structure through which young receives food & oxygen from mother & gets rid of waste (.5-20 cm)
**gestation period – time inside mother (mice= few weeks, elephant=18-23 months)

11 Groups

1. Insect Eating (Insectivores):
star-nosed mole(ring of 22 tentacles at end of nose), hedgehogs, shrews,
pygmy shrew-smallest (1.5-2 g – eats lots; twice mass in insects every day)
2. Flying Mammals (Chiroptera): Bats
* skin stretches over fingers = wings
* high pitched squeaks that bounce off objects = radar
* 2 types; fruit eaters (tropical) & insect eaters (everywhere)
3. Flesh Eating (Carnivore): dog, cat, bear, otter, sea lion, walrus, seal
* predators – chase & kill others (strong muscles, legs & claws)
* sharp teeth – canines to tear meat
- tusks to defend or pull on ice
4. Toothless (Edentata) – no or poorly developed teeth
* Anteater – only member with no teeth
* Armidillo – eat plants, insects & small animals – protective coat
* Sloths – 2 or 3 toed, hang upside down in trees
5. Trunk Nosed (Proboscidea) – Elephants
* can swim & breath through trunk
* strong trunk can tear trees or pick up peanuts
* largest land animals
* 2 kinds: African (large ears) & Asian (small ears)
6. Hoofed Mammals (Ungulata) – feet end in hooves
**2 kinds: Even Toed: pigs, camels, goat, cows
Odd Toed: horses, rhinoceros, zebra, tapir
**important partners to humans – ride, meat, milk, skin
**herbivores – feed on plants
7. Gnawing (Rodentia): squirrels, chipmunks, beavers, rats, mice
**more of these than any other mammal
**have 4 scissor-like incisors used for gnawing; jaws move back & forth
**teeth grow whole life, constantly worn down
**can spread more than 20 diseases (bubonic plague)
8. Rodent-like (Lagomorpha): Rabbits – live below ground
Pikas – round ears & short legs Hares – larger legs & ears
**small pair of grinding teeth (behind gnawing teeth) instead of gnawing
**move jaws from side to side
9. & 10. Water Dwelling – breathe air, have hair, feed young with milk
9. Cetacea – can't live on land: whales, dolphins & porpoises
10. Sirenea – can live in shallow water but difficult to live on land because they are large with no back legs: Manatee, Sea Cow & Dugong
11. Primates: Gorilla, Orangutan, Chimpanzee
**eyes face forward to see depth
**five fingers & toes – capable of complicated movement; grasping
**large brains -communicate, use tools