

Name: \_\_\_\_\_  
Student No: \_\_\_\_\_

**BIO 2135 - Animal Form and Function  
Final Examination  
Worth 35 % of the final grade**

**April 11, 2014**

- a) Place your name and student number in the space provided below. Be sure that your name, or student number, is on the top of each page.
- b) Check to be sure that your exam is complete with a total of 20 pages including this one.
- c) Answer all questions in the space provided on the exam. Do not transfer answers to the back of the page.
- d) Answer the essay question at the end of the exam in the examination booklet that has been provided. Be sure that your name and student number is on the cover of the examination booklet. Double spaced please!
- e) The exam is marked out of 180 points
- f) Please be sure that your seat number is on the exam and the examination booklet
- g) This is not an open book exam.

Name: \_\_\_\_\_

Student No: \_\_\_\_\_

Seat number: \_\_\_\_\_

BIO 2135 Animal Form and Function

Name: \_\_\_\_\_

Student No: \_\_\_\_\_

**30pts Part 1.** Briefly explain what each of the following biological terms means. Where possible include an example in your explanation from a group or an organism to which the term applies.

Kingdom Animalia

{multicellular, eukaryote heterotrophs} {ancestral cell the choanocyte} {division of labour between cells} {collagen} Must have first one with all three facts for 1 point, any other two can be added to get to the full three marks

Glomerulus

{Part of the excretory system/kidney} {blood pressure} {creates an ultrafiltrate as soluble materials forced across membrane}

Homodont

{teeth are all the same} {Usually conical or peg-shaped} {Reptiles (not birds so can't use diapsid here). Amphibians}

Gizzard

{In birds may also say diapsids} {modification of the stomach} {contains stones/hard objects that have been swallowed and these help to grind up the food}

Endotherm

{Is a term describing how the body is warmed} {heat generated internally} {heat from metabolic activity/typically muscles burning fuel/shivering may also be mentioned}

## BIO 2135 Animal Form and Function

Name: \_\_\_\_\_

Student No: \_\_\_\_\_

Sister group

{Taxonomic/classification term} {the closest relative in the cladogram} {to another taxon or group}

{may have a drawing to explain} max three points

Tunicin

{urochordata} {unique form of cellulose in protein matrix} {forms the tunic/outer casing of the animal}

Mutable connective tissue

{Echinodermata autapomorphy} {collagen/tissue between the ossicles} {shifts from being rigid to flexible} {Change is under nervous control}

Pedicellarea

{ex any of the Echinoderms} {pincer/scissor like structures on surface} {defensive/protective structures on the surface from other animals that may settle}

Eccrine glands

{In the skin/not associated with the follicle} {produces watery secretion} {Used for cooling} may also have {in primates secretions assist with grip } which is worth a third point

BIO 2135 Animal Form and Function

Name: \_\_\_\_\_

Student No: \_\_\_\_\_

**30 pts Part 2:** Answer each of the following multiple choice questions by placing an X in the space to the left of the correct choice. There is only one correct answer for each question and questions have either 4 or 5 answers to choose from. **Be sure your X doesn't cross over two answers – if it does the question will be scored as 0.**

2.1 One region of the sea star stomach, the \_\_\_\_\_, receives ingested food.

- a. gizzard
- b. crop
- c. cardiac stomach
- d. pylorus
- e. rectal cecum

2.2 Birds are thought to have descended from the ancient reptiles known as

- a. pterodactyls.
- b. saurentians.
- c. pterosaurs.
- d. archosaurs.
- e. plesiodactyls.

2.3 Interpretations of the life-style of the ancient bird Archaeopteryx have been important in the development of hypotheses on the

- a. origin of flight.
- b. appropriate reptilian ancestor for birds.
- c. appearance of light weight bones.
- d. development of amniotic eggs.
- e. origin of endothermy.

2.4 The functional excretory units in the kidneys of fishes are

- a. flame bulbs.
- b. nephridia.
- c. Malpighian tubules.
- d. green glands.
- e. nephrons.

2.5 Which of the following is not a chordate character:

- a. Ventral nerve cord
- b. Presence of a notochord
- c. Pharyngeal gill slits
- d. Hollow nerve cord
- e. A tail.

2.6 Ilium, ischium, and pubis comprise the \_\_\_\_\_ of tetrapods.

- a. hind limbs
- b. front limbs
- c. neck
- d. pectoral girdle
- e. pelvic girdle

BIO 2135 Animal Form and Function

Name: \_\_\_\_\_

Student No: \_\_\_\_\_

2.7 Bird eggs are hard because they are impregnated with

- a. Calcium
- b. Silica
- c. Phosphate
- d. Iron silicate

2.8 The posterior end of an adult tunicate is in the region of the

- a. siphuncle.
- b. oral siphon.
- c. atrial siphon.
- d. siphonoglyph.
- e. head.

2.9 Hagfishes

- a. are entirely freshwater animals.
- b. are parasitic.
- c. have a complex but well-researched reproductive cycle.
- d. generate enormous quantities of slime if disturbed.
- e. All of the above are correct.

2.10 The major excretory product of most mammals is

- a. ammonia.
- b. uric acid.
- c. guanine.
- d. creatine.
- e. urea.

2.11 Birds are capable of flight because they have

- a. Wings and a lightweight skeleton
- b. Highly efficient respiratory and digestive system
- c. A high-pressure circulatory system and well developed nervous and sensory systems
- d. All of these.

2.12 In frogs, long hind limbs and powerful muscles form an efficient \_\_\_\_\_ system for jumping.

- a. lever
- b. undulatory
- c. hydrostatic
- d. accordion
- e. pulley

2.13 In diapsids, the excretion of \_\_\_\_\_, conserves water.

- a. urea
- b. ammonia
- c. creatine
- d. creatinine
- e. uric acid

BIO 2135 Animal Form and Function

Name: \_\_\_\_\_

Student No: \_\_\_\_\_

2.14 Ancient members of the \_\_\_\_\_ are thought to be ancestral to all vertebrates.

- a. Agnatha
- b. Tetrapoda
- c. Pisces
- d. Gnathostomata

2.15 The major osmoregulatory problems of freshwater fishes are

- a. water loss and salt loss.
- b. water gain and salt loss.
- c. water gain and salt gain.
- d. water loss and salt gain.
- e. nonexistent because freshwater fishes are isosmotic to their environment.

2.16 Some sharks and some bony fishes such as the tuna, maintain water flow over the gills by holding the mouth open. This is called \_\_\_\_\_ ventilation.

- a. buccal
- b. pneumatic
- c. costal
- d. active
- e. ram

2.17 Mammals have all the following types of teeth except:

- a. Incisors
- b. Molars
- c. Dentaries
- d. Canines
- e. Premolars

2.18 The structure responsible for color and color changes in amphibian skin are

- a. mucous glands.
- b. warts.
- c. keratins.
- d. pigment glands.
- e. chromatophores.

2.19 Embryologically, the echinoderm water vascular system originates as a modification of the

- a. pyloric caecae.
- b. dermal branchiae.
- c. coelom.
- d. Tiedemann bodies.
- e. closed circulatory system

2.20 In the acornworms, the anterior region of the digestive tract, which contains the gills, is the

- a. pharynx.
- b. esophagus.
- c. buccal cavity.
- d. atrium.
- e. stomach.

BIO 2135 Animal Form and Function

Name: \_\_\_\_\_

Student No: \_\_\_\_\_

2.21 Which of the following is not one of the characteristics seen in all chordates at some time in their life history?

- a. tubular nerve cord
- b. mouth developed from blastopore
- c. notochord
- d. pharyngeal gill slits
- e. postanal tail

2.22 Members of the amphibian order Anura, frogs, have the vertebrae fused into a rod-like

- a. pygidium.
- b. telson.
- c. uropod.
- d. urostyle.
- e. anal cirrus.

2.23 Freshwater fishes move ions across the gills into the blood from the environment by

- a. simple diffusion.
- b. osmosis.
- c. active transport.
- d. facilitated diffusion.
- e. pinocytosis.

2.24 The tunic of tunicates is composed of proteins, various salts, and a glycoprotein.

- b. sclerotin.
- c. glycogen.
- d. cellulose.
- e. chitin.

2.25 The dorsal portion of a turtle shell is called the

- a. carapace.
- b. cephalothorax.
- c. plastron.
- d. sternum.
- e. dorsum.

2.26 Osmoregulation is a major function of kidneys and \_\_\_\_\_ in fishes.

- a. skin
- b. rectal glands
- c. hepatic caecae
- d. gills
- e. fins

2.27 Larval amphibians are usually \_\_\_\_\_ in their feeding habits.

- a. sanguivorous
- b. carnivorous
- c. herbivorous
- d. omnivorous
- e. insectivorous

BIO 2135 Animal Form and Function

Name: \_\_\_\_\_

Student No: \_\_\_\_\_

2.28 The perforated pharynx of chordates evolved as a device for

- a. Support
- b. Respiration
- c. Filter-feeding
- d. All of the above

2.29 The first (anterior-most) vertebra of an amphibian is

- a. thoracic.
- b. cervical.
- c. lumbar.
- d. cephalic.
- e. caudal.

2.30 The lancelet, *Amphioxus*, is supported during swimming and burrowing by its:

- a. Vertebral column.
- b. Myomeres.
- c. Hydroskeleton.
- d. Notochord.
- e. Axostyle.

**PART 3 Starts on the next page**

BIO 2135 Animal Form and Function

Name: \_\_\_\_\_

Student No: \_\_\_\_\_

**44 pts Part 3:** Fill in the missing word, or provide the one word answer in the space provided at the end of the sentence. If the line is missing, add it.

3.1 This stomach connects to the digestive glands found in each of a sea star's arms. **Pyloric** \_\_\_\_\_

3.2 These expand and contract when a bird breaths (Two words). **Air sacs** \_\_\_\_\_

3.3 These mammalian glands are used for communication; they're especially large in skunks so that you can be sure to get the message. **Scent/Aprocrine** \_\_\_\_\_

3.4 Reptiles, birds and mammals are distinguished from fishes and amphibians in that their embryos develop in this fluid filled sac. **Amnion** \_\_\_\_\_

3.5 Blood in this vessel moves toward the front of a lancelet. **Ventral** \_\_\_\_\_

3.6 The secondary acoustic pathway in amphibians detects these sound frequencies. **Low** \_\_\_\_\_

3.7 The sternum of a bird is modified and this part modification provides the attachment surface for flight muscles. **Keel** \_\_\_\_\_

3.8 This artery leaving the amphibian heart carries blood to the skin and lungs. **Pulmocutaneous** \_\_\_\_\_

3.9 To warm up reptiles often bask in the sun because they are **Ectothermic** \_\_\_\_\_ and can't generate their own body heat.

3.10 Contraction of these muscles in the collar help anchor an acorn worm in its burrow. **Longitudinal** \_\_\_\_\_

3.11 Number of paired gill arches in a bony fish. **Four** \_\_\_\_\_

3.12 Tunicates trap food in mucous secreted by a groove called the **Endostyle** \_\_\_\_\_.

3.13 The plate-like structures on the gill of a bony fish are where the gas exchange occurs. **Lamellae** \_\_\_\_\_

3.14 This internal organ contains nutrients stores in amphibians (Two words). **Fat body** \_\_\_\_\_

3.15 Echinoderms have this special type of radial symmetry. **Pentaradial** \_\_\_\_\_

3.16 These feathers insulate a bird. **Down** \_\_\_\_\_

3.17 The water vascular system is also called this type of system. **Ambulacral** \_\_\_\_\_

3.18 This is trapped on the inner surface of the mucus net the lines the pharyngeal cavity of early chordates. **Food** \_\_\_\_\_

BIO 2135 Animal Form and Function

Name: \_\_\_\_\_

Student No: \_\_\_\_\_

- 3.19 What we're more likely to call the vibrissae, the sensory tactile hairs in mammals. **Whiskers**
- 3.20 A shark's scales are formed from this layer of the integument. **Dermal/Dermis**
- 3.21 In echinoderms, the blastopore ultimately forms this structure. **Anus**
- 3.22 Blood flows through the gill arch of a bony fish in this direction. **Dorsoventral**
- 3.23 Number of chambers in an agnathan's heart. **Two**
- 3.24 This, along with the intercostal muscles, help aerate the lungs of a mammal. **Diaphragm**
- 3.25 Birds descended from the **Lizard** - hipped dinosaurs.
- 3.26 Type of symmetry seen in the larval stage of a cephalochordate. **None/asymmetry**
- 3.27 This and the tibia form the lower bones of the tetrapod hind limb. **Fibula**
- 3.28 Cilia on this organ create the water currents that bring food into the ammocoete's mouth. **Wheel**
- 3.29 The small diverticula, out-pockets of the gut wall, are found only in the digestive tract of the ray-finned fishes. They are an adaptation that increases the digestive surface area. **Ceaca**
- 3.30 Describes the structure of the chordate nerve cord. **Hollow**
- 3.31 When it was discovered this fish was thought to be the link between fish and the first tetrapods - it turns out it isn't. **Coelocanth**
- 3.32 Like all deuterostomes, echinoderms have this type of divided coelom. **Tripartite**
- 3.33 The only environment where you'll find a hemichordate. **Marine**
- 3.34 After leaving the heart of a fish, blood flows first to these structures. **Gills**
- 3.35 This term describes the body shape of a fish; it's the best one for moving through a dense medium such as water. **Fusiform**
- 3.36 The ancestral food for amphibians was this group of animals and their feeding strategy is this. **Insects/Insectivore**

Name: \_\_\_\_\_

Student No: \_\_\_\_\_

3.37 Water enters the water vascular system through openings in this structure. **Madreporite** \_\_\_\_\_

3.38 Relative to the surrounding sea water, the water in the water vascular system is this. **Isotonic** \_\_\_\_\_

3.39 Birds and mammals have to maintain their body temperature at a fixed point with little or no variation. **Homeothermic** \_\_\_\_\_

3.40 Although you can't compress or stretch the notochord it will do this. **Bend** \_\_\_\_\_

3.41 The extra loop in the amphibian circulatory system missing in fish. **Pulmonary** \_\_\_\_\_

3.42. The opening of the stomocord is connected to this structure in the acorn worm. **Gut** \_\_\_\_\_

3.43 Birds make sounds using this. **Syrinx** \_\_\_\_\_

3.44 Evolutionarily the presence of a cartilaginous skeleton in the Chondrichthyes is this type of trait. **Derived/advanced** \_\_\_\_\_

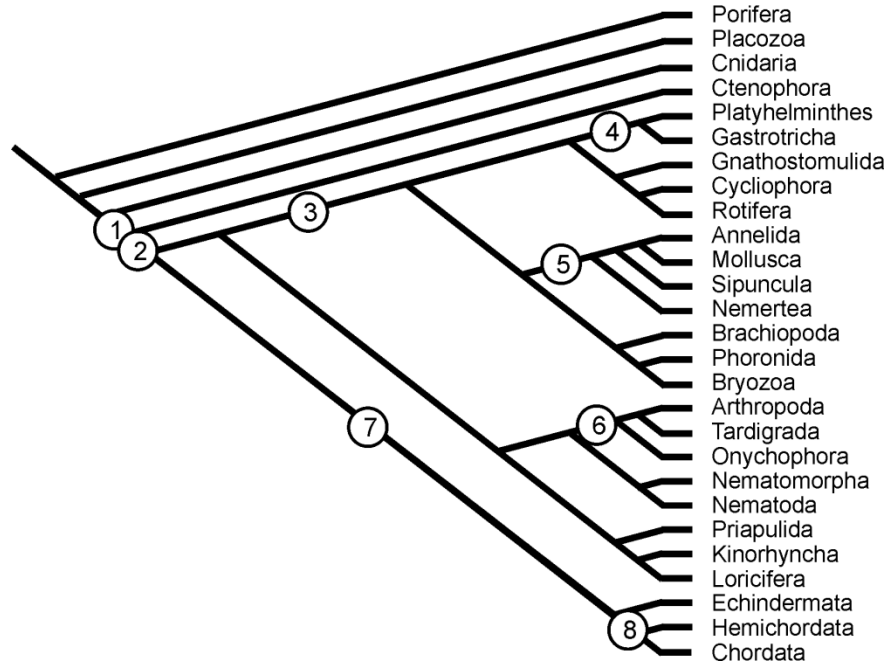
**PART 4 Starts on the next page**

BIO 2135 Animal Form and Function

Name: \_\_\_\_\_

Student No: \_\_\_\_\_

**10 pts Part 4** Using the numbers shown on the cladogram describe 5 of the 8 indicated events that defined the evolution of the major animal groups. Be sure to enter the character number in the table.

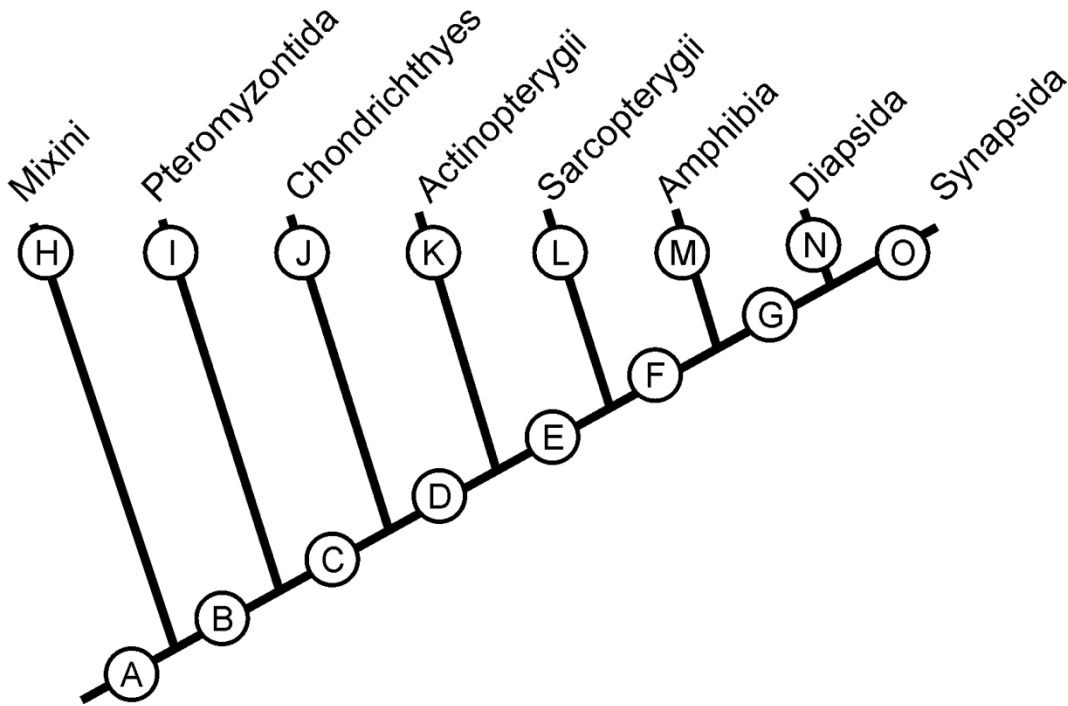


Character #	Description
1	2 pts {triploblastic} or {mesodermal musculature}
2	2pts {Bilateral symmetry}
3	2pts {spiral cleavage}
4	2pts {There are no morphological characters to define this}
5	2 pts {Presence of a trocophore} {larval satge – must know its larval}
6	{alpha chitin} {Food manipulated by limbs} {Saccate metanephridia} {Ecdysis} {Ostiate dorsal heart} Any two of these 1 pt each
7	{Blastopore becomes the anus} {Dipleurula larva} {tripartite coelom} Any two 1 pt each
8	{Pharyngeal gill slits} {Dorsal hollow nerve cord}

Name: \_\_\_\_\_

Student No: \_\_\_\_\_

**10 pts Part 5** Using the letters shown on the vertebrate cladogram identify where the synapomorphies and autapomorphies in the table would be located. Be sure to enter the character letter in the table and a letter may be used more than once.



Letter		Letter	
<b>C</b>	Paired fins	<b>N</b>	Faveolar lung
<b>J</b>	Heterocercal tail	<b>K</b>	Swim bladder
<b>I</b>	Horny keratinized teeth	<b>H</b>	Three pairs of barbels
<b>F</b>	Pectoral and pelvic girdles	<b>G</b>	Costal ventilation
<b>O</b>	Heterodont dentition	<b>A</b>	Neural crest cells

BIO 2135 Animal Form and Function

Name: \_\_\_\_\_

Student No: \_\_\_\_\_

**36 pts Part 6:** Answer 6 of the following 12 questions in the space provided. Each is worth 6 points. Do an extra question as a bonus and you could raise your marks by up to 6 points depending on how well you answer the extra question.

6.1 Describe the ancestral Echinoderm and how it fed.

Ancestral echinoderm {attached to the substrate/sessile} {oral opening faced up} {fed on food falling through the water} {trapped/caught the food with their tube feet} {tube feet also passed the food between them to get it to the mouth} {radial symmetric arrangement of the arms created a feeding basket/surface surrounding the mouth – some mention of the importance of radial symmetry to the way that they fed}

6.2 Describe how an acorn worm feeds

{Cilia on proboscis collect particulate food} {move it to preoral ciliary organ} {sorts the particles and suitable size enters the mouth} {Food particles in mucous} {propelled into digestive tract with cilia} {food concentrated by removal of water across the gill pores}

BIO 2135 Animal Form and Function

Name: \_\_\_\_\_

Student No: \_\_\_\_\_

6.3 What is a notochord, what group of animals has one and what does it do?

{stiff rod/cartilaginous rod} {Chordata - must be Chordata and not an animal from within the phylum since this is an autapomorphy} {Bends to create unique swimming/lateral undulations} {developmental control centre/induction} {Causes formation of the neural crest above it/will form the hollow nerve cord} {regulates formation of mesoderm/myomeres/somites}

6.4 What is knotting behaviour, what group of animals do it and why is it important

{in hagfish/Mixini}

Importance 1: {in feeding} {grasp the surface of the food with mouth/dental plate and tongue} {slide the knot to get a grip on food}

Importance 2: {produces slime as a defense} {behaviour removes the slime from the hagfish's body}

BIO 2135 Animal Form and Function

Name: \_\_\_\_\_

Student No: \_\_\_\_\_

6.5 How is the frog's appendicular and axial skeleton modified for its unique form of locomotion.

2 pts Axial skeleton modification: {Urostyle – to transmits the power of the jump of the hindlimb} {Urostyle modified vertebrae} {Sternum to contain the viscera} point for something about sternum and another for Urostyle – 2 pts max

Appendicular skeleton modifications:

2 pts Hindlimb {Ankle bones elongated} {tibia and fibula in hind leg fused} {Creates an extra lever for the jump} {long phalanges/finger bones for large surface area to push off with}

2 pts Forelimb – {radius and ulna fused to absorb landing} {Forelimb – long phalanges act as shock absorbers on landing}

6.6 The move on land created a problem that linked respiration and locomotion. What was the problem and how did the crocodiles resolve it?

3 pts problem - {Intercostal muscles were used to expand the ribcage} {forward movement of the limb alternated between the two sides of the body} {Forward movement compressed the ribs preventing their expansion} {Squeezed air between the lungs when moving} – any to a maximum of three points

3 points Crocodile solution- {Movements of the hind limbs} { moved the liver forwards and backwards/piston-like movement} {this expanded and contracted the thoracic cavity to move air in and out of the lungs}

BIO 2135 Animal Form and Function

Name: \_\_\_\_\_

Student No: \_\_\_\_\_

6.7 The feather was an important event in diapsid evolutionary history. Briefly describe the evolutionary sequence leading to the flight feather of birds.

{First feathers were bristles describe a bristle or provide a picture} {branching elements along a shaft became insulative} {Contour feathers/barbs and barbules lock the side branches together} {Contour feather protects insulative feathers underneath} {flight feather assymmetric contour feather} {with narrow leading edge and wider trailing edge}

6.8 Two different types of chordates have spiral valves. Who has them and what do they do in each?

{Frog – amphibian} { part of the circulatory system} {Controls blood flow between the pulmonary and systemic circuits }

{Chondrichthyes/cartilaginous fish/sharks} {part of the digestive system/intestine} {slows the movement of food through the digestive tract}

BIO 2135 Animal Form and Function

Name: \_\_\_\_\_

Student No: \_\_\_\_\_

6.9 Why is the lung fish heart, which has only three chambers, ideally suited to its survival in and out of water?

Point of information: Lung fish and amphibian both have the same circulatory organization.

{Spiral valve - directs blood to either systemic circuit or pulmonary}

On land {blood from the lungs enters ventricle and valve sends to systemic}{back from systemic valve sends to lungs}

In water {Spiral valve sends blood returning from systemic to system – no lungs}{eventhough blood doesn't go into cutaneous artery there is still blood going to skin through other vessels and is oxygenated}{in water the blood was oxygenated in the skin which is part of the systemic loop}

6.10 How does a tube-foot work?

{Hydrostatic skeleton}{fluid is the water vascular system}{valve in lateral canal isolates the foot from the system}{Muscle in ampulla contract and extend foot}{suction cup on tip of foot holds onto the substrate}{Muscles in wall of foot bend and lever the foot}

BIO 2135 Animal Form and Function

Name: \_\_\_\_\_

Student No: \_\_\_\_\_

6.11 A number of unique adaptations allowed the bony fish to be able to remain still (not always having to swim) in the aquatic environment. Describe them.

1 modification: {Swim bladder} {oxygen removed and added as required for different depths}

2: modification {Opercular gill} {operculum pulls water across the gills/ram ventilation is not necessary/don't have to swim to ventilate the gills}

3: Modification {articulated pelvic and pectoral fins} {skulling of the fins allows the fish to stay in one place}

6.12 What is genome duplication, what animal group has undergone duplication and what was the advantage of doing so?

{easy point – is a complete duplication of the genome of an organism}

{Gnathostome vertebrates have } {two rounds of genome duplication}

BIO 2135 Animal Form and Function

Name: \_\_\_\_\_

Student No: \_\_\_\_\_

**20 pts Part 7:** Answer the essay question in the examination booklet that has been provided. Please use both sides of the page and write double spaced, it's much easier to read (Thanks)!

**HINT: You may find it advantageous to organise your thoughts in point form using the first page of your examination booklet**

All animals have to obtain oxygen and transport it to actively metabolizing tissues that require it. Using an example organism from each of the following four categories and compare oxygen acquisition and its transport in each of the animals you have chosen

- A) A invertebrate marine deuterostome
- B) A terrestrial deuterostome
- C) A marine protostome
- D) An terrestrial protostome