Name: _____
Student No:_____

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

April 14, 2012

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 you 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 175 points

f) This is not an open book exam.

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45pts 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

Syrinx

{in birds} {soundbox/produces sounds/vocalization} {walls of the trachea vibrate}{can produce more than one sound or note} Must have first two and either one of the other two for the third mark

Pterothorax

{In insects}{thoracic segments that have wings}{mesothorax and metathorax}

Swim bladder
{In ray-finned fishes/Actinopterygii}{Used to maintain neutral buoyancy/ won't sink it it stops swimming}{Volume of air changes as oxgen/gases added or removed from blood – must say blood there is no connection to the outside and some students will confuse this with lung

Hepatic portal system
{Connects digestive tract to the liver}{blood vessel with capillaries at both ends}{Insures that toxins, from the ingested meal that have passed into the blood are removed from blood}

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Assynchronous flight muscle

{There is not a wing beat}{for each nervous impulse to the flight muscle} {allows for very fast wing beat frequencies}some students will add insects – there is no point for this since not all insects have asynchronous muscles}

Opisthosoma

{posterior tagma/must say tagma and there no point for segment since it is a fusion of segment}{of chelicerates}{Spider is an example – scorpions, ticks and mites aren't because the opisthosoma has been modified

Drone

{Male}{honeybee}{from an unfertilized egg}

Endostyle

{Character that defines the chordate} {Ciliated groove in pharnx}{produces mucous that traps food}{origin of the thyroid gland} Must have first two and either one of the last for the third mark

Heterodont

{Teeth} {Mammalian jaw} {that have different shapes and functions}

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Sarcopterygii

{The lung fish although we can also accept lobe-finned fishes }{Pectoral and pelvic fins}{reinforced with a central bone}

Pneumatized bone

{In birds}{Explain the appearance: Bones are not solid but filled with air spaces and reinforcing boney struts}{strategy to make the bird lighter}

Mutable connective tissue

{Echinodermata}{Connective tissue between bonely plates (ossicles)}{can change from solid to fluid}

Placoid scale

{Cartilagenous fishes/Chondrichtheyes} {A description of appearance - Backwards directing and tooth-like}{composed of dentin and enamel}{produced and anchored in the dermis} First must be there and any two of the remaining three for the other two points. Some studnets will mention that the scales reduce drag while swimming – all scales do this so there is not point awarded for that.

Systemic arch
{Part of the vertebrate circulatory system}{Supplies blood to the anterior and posterior parts of the body}{Originally paired but reduced to one in birds and mammals}

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34pts Part 2: Answer each of the following multiple choice questions by placing and 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 A ventral plate of bone called the _____ is present in the anterior, ventral trunk region of amphibians. This plate provides support for the forelimbs and protection for internal organs.

_____ a. ilium
_____ b. coccyx
__X__ c. sternum
_____ d. ischium
_____ e. scapula

2.2 A group of synapsids called the therapsids gave rise to

_____ a. turtles.
_____ b. birds.
_____ c. snakes.
_____ d. lizards.
__X__ e. mammals.

2.3 Reptiles of the _____ lineage gave rise to mammals.

_____ a. triapsid
_____ b. diapsid
__X__ c. synapsid
_____ d. amphiapsid
_____ e. anapsid

2.4 Birds are

_____ a. synapsids
__X__ b. diapsids
_____ c. anapsids
_____ d. aviapsids

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2.5 In insects that display _____ metamorphosis, the primary difference between adults and larvae are wings and degree of sexual development.

_____ a. paurometabolous
__X__ b. hemimetabolous
_____ c. ametabolous
_____ d. holometabolous
_____ e. amphimetabolous

2.6 The ventral portion of a turtle shell is the

_____ a. dorsum.
__X__ b. plastron.
_____ c. sternum.
_____ d. carapace.
_____ e. scute.

2.7 The placental mammals belong to the infraclass

_____ a. mesotheria.
_____ b. metatheria.
_____ c. theria.
_____ d. prototheria.
__X__ e. eutheria.

2.8 The lancelet, *Brachiostoma*, is supported during swimming and burrowing by its:

_____ a. vertebral column.
_____ b. myomeres.
_____ c. hydroskeleton.
__X__ d. notochord.
_____ e. axostyle.

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2.9 The branchial sac of a tunicate plays a role in which of the following functions?

__X__ a. filter feeding

_____ b. respiration

_____ c. maintenance of the hydroskeleton

_____ d. discharge of gametes from the body

_____ e. all of these

2.10 The serves as an inlet into the water vascular system

_____ a. tiedemann body

_____ b. polian vesicle

_____ c. radial canal

__X__ d. madreporite

_____ e. ring canal

2.11 The major nitrogenous waste excreted by insects is

_____ a. urea.

_____ b. ammonia.

_____ c. urine.

__X__ d. uric acid.

_____ e. guanine.

2.12 Most female mammals undergo a/an _____ cycle, which includes the time during which the female is behaviorallyand physiologically receptive to the male.

_____ a. implantation

__X__ b. estrous

_____ c. fertilization

_____ d. menstrual

_____ e. vaginal

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2.13 Gas exchange in an insect occurs across the surface of which of the following

_____ a. tracheal tubes

_____ b. book lungs

_____ c. ctaenidia

__X__ d. trachioles

_____ e. spiracle

2.14 A statocyst

_____ a. detects light

_____ b. detects sound

__X__ c. detects the pull of gravity

_____ d. is used in the sense of smell

2.15 Mammalian teeth specialized for gnawing or nipping are the

_____ a. molars.

__X__ b. incisors.

_____ c. canines.

_____ d. premolars.

_____ e. fangs.

2.16 *Latimeria*, the coelocath, referred to as a living fossil, belongs to subclass

_____ a. Actinopterygii.

_____ b. Cephalaspidomorphi.

_____ c. Osteichthyes.

__X__ d. Sarcopterygiii.

_____ e. Chondrichthyes.

2.17 Members of subclass _____ are sometimes called the ray-finned fishes.

__X__ a. Actinopterygii

_____ b. Holostei

_____ c. Rhipidistii

_____ d. Sarcopterygii

_____ e. Myxini

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2.18 The anapsid lineage of reptiles is represented today by

_____ a. liurds.

_____ b. tuataras.

_____ c. snakes.

__X__ d. turtles.

_____ e. crocodiles.

2.19 The excretory system of insects works by

_____ a. excreting wastes across the digestive system membrane.

_____ b. active transport of just the waste molecules across the tubules.

__X__ c. transport of all ions and solutes across the tubule and retrieval of water and useful ions in the rectum.

_____ d. excretion of only ions and wastes in the rectum.

_____ e. packaging and sealing off toxic wastes until the organism dies.

2.20 All birds undergo a periodic renewal of their feathers by a shedding and replacing process called

_____ a. rejuvenation.

__X__ b. molting.

_____ c. regeneration.

_____ d. replumaging.

_____ e. preening.

2.21 Contraction of the _____ forces water into the tube feet of the water vascular system.

__X__ a. ampullae

_____ b. lateral canals

_____ c. polian vesicles

_____ d. hemal rings

_____ e. tiedemann bodies

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2.22 The _____ is a supportive rod that extends most of the length of the body of all chordates at some time in their life history.

_____ a. spinal column

_____ b. endostyle

_____ c. hemichord

_____ d. backbone

__X__ e. notochord

2.23 Which of the following is not a mammalian characteristic?

_____ a. heterodont dentition

_____ b. diaphragm

_____ c. three middle-ear ossicles

__X__ d. mucous glands in the skin

_____ e. four chambered heart

2.24 The first vertebrates to produce amniotic eggs were early members of the class

__X__ a. Reptilia.

_____ b. Aves.

_____ c. Amphibia.

_____ d. Mammalia.

_____ e. Agnatha.

2.25 In some sea stars, the aboral surface contains pincerlike structures called _____, which are used for protection and clearing the surface of debris.

__X__ a. pedicellariae

_____ b. chelicerae

_____ c. chelipeds

_____ d. chelae

_____ e. maxiIlipeds

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2.26 The names Chelicerata and Mandibulata have reference to

__X__ a. mouthparts.

_____ b. genitalia.

_____ c. locomotor appendages.

_____ d. sensory appendages

_____ e. internal anatomy

2.27 Which of the following is not a role of the water vascular system in echinoderms

_____ a. gas exchange

_____ b. excretion

__X__ c. digestion

_____ d. locomotion

_____ e. circulation

2.28 Birds do, but reptiles do not have

_____ a. scales

_____ b. bladders

__X__ c. endothermy

_____ d. internal fertilization

2.29 Tubular nerve cord and pharyngeal gill slits are considered to be evidence of evolutionary ties between _____ and chordates.

_____ a. echiurans

_____ b. echinoderms

_____ c. phoronids

_____ d. sipunculans

__X__ e. hemichordates

2.30 Pulmonary ventilation in lunged amphibians is accomplished by

_____ a. the diaphragm.

_____ b. the ribs.

_____ c. ram ventilation.

__X__ d. a buccal pump.

_____ e. countercurrent exchange.

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2.31 The mouth part immediately behind an insect mandible

_____ a. maxilliped

_____ b. chelicera

_____ c. pedipalp

__X__ d. maxilla

_____ e. labium

2.32 In reptiles, the teeth are uniformly conical and are referred to as

_____ a. apicodont.

_____ b. heterodont.

_____ c. conodont.

__X__ d. homodont.

_____ e. thecodont.

2.33 In the cuticle of terrestrial arthropods all but which of the following is true

a. the chitin and protein in the exocuticle are chemically cross linked to each other.

__X__ b. waxes in the procuticle waterproof the whole cuticle

_____ c. moulting starts with apolysis

_____ d. the only living layer is the epidermis

_____ e. the endocuticle is recycled and used in producing the new cuticle.

2.34 Which of the following structures are not included in the mouthparts of insects?

_____ a. pedipalps

_____ b. labrum

_____ c. mandibles

_____ d. maxillae

_____ e. hypopharynx

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40 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 The most anterior pair of fins on the side of a shark are these fins. **Pectoral**

3.2 Unlike other fish, you won't find these on the surface of an agnathan. **Scales**

3.3 Because their surface looks like pages of paper, the respiratory structures of spiders are referred to as these. **Book lungs**

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

3.5 The posterior set of paired fins are these fins. **Pelvic**

3.6 This, the larger of the two flight muscles in a bird, lowers the wing. **Pectorlis**

3.7 Unlike arthropods, but similar to echinoderms, chordates have this type of skeleton. **Endoskeleton**

3.8 Silk is produced by these structures found on a spider. **Spinerettes**

3.9 Even though they have pharyngeal slits and pores, acorn worms don't have these. **Gills**

3.10 These teeth, which you would find in predatory mammals, are missing in an herbivore. **Canines**

3.11 The fins on the left side of the body are connected to those on the right by these. **Girdles**

3.12 A terrestrial insect may swallow this to help escape from the old cuticle. **Air**

3.13 Air enters the tracheal system through these. **Spiracles**

3.14 Number of chambers in an agnathan's heart **Two**

3.15 Blood in the dorsal vessel of an insect is pumped toward this part of the animal. **Anterior/front**

3.16 A mammals first set of teeth are called deciduous, or this type of teeth. **Milk/baby**

3.17 These feathers insulate a bird. **Down**

3.18 The slime from a hagfish has two possible effects on fish that attack them. One is that it suffocates the attacker; this is the other mode of action. **Irritant**

3.19 The extra loop in the amphibian circulatory system missing in fish. **Pulmonary**

3.20 The basic sugar unit of the complex carbohydrate found in insect procuticle. **Glucoseamine**

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3.21 Like all deuterostomes, echinoderms and bryozoans have this type of divided coelom. **Tripartite**

3.22 Number of chambers in an amphibian heart. **Three**

3.23 U-shaped structure in a urochordate. **Gut/Digestive tract**

3.24 The appearance of radial symmetry in the echinoderms is referred to as this type of evolutionary event. **Secondary**

3.25 Although they don't have vertebrae, agnathans do have a skeletal structure called this, and are included in the taxon because of it. **Cranium**

3.26 Sharks have four types of fins that help stabilize the animal as it swims. This is one of the unpaired fins. **Doral/caudal**

3.27 In part a turtles shell is built from the fusion of ribs and these bones. **Vertebrae**

3.28 When present these vesicles act as reservoirs that store water for the water vascular system. **Polian**

3.29 In insects the contraction of indirect flight muscles changes the shape of this, causing the wings to move. **Thorax**

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

3.31 A ligular flap refers to this structure in a frog. **Tongue**

3.32 This insect stage is found in only one of the two types of metamorphosis. **Pupal**

3.33 Blood in this vessel moves toward the front of a lancelet. **Ventral**

3.34 Name given to the blocks of muscle along the length of the lamprey or hagfish. **Myomeres**

3.35 The unique shape of a shark's tail, which has a dorsal lobe that is much larger than the ventral lobe. **Heterocercal**

3.36 The tongue of an insect. **Hypopharynx**

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

3.38 In a frog this is formed from fused vertebrae and is an adaptation related to jumping. **Urostyle**

3.39 Extremely fast wing beat frequencies are possible in insects because of this type of muscle associated with flight. **Indirect/assynchronous**

3.40 In an insect's life cycle this is the period between molts. **Instar**

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36 pts Part 4: Answer 6 of the following 10 questions in the space provided: . 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 bonus.

4.1 How does a starfish keep its aboral surface free of debris and other organisms.

Point for naming the structure and another for describing how it works
{cilia}{movement of cilia on the surface sweep away small particulate debris}
{spines}{Spines on the surface prevent large organisms from settling}
{Pedicellaria}{Pinches anything that tries to settle on the surface}

4.2 Describe how a bird ventilates its lungs

{Expansion and contraction of the ribs}{anterior and posterior air sacs}There should be a description that explains why it takes two cycles to complete the ventillation{first expansion pulls air into posterior air sac through nostrils}{first contraction contraction forces air into lung}{second expansion pulls air from lung into anterior air sac}{second contraction pushes air out of anterior air sacs and the nostrils} Point each

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4.3 What are the similarities and differences in the structure and function of protonephridia saccate metanephridia and metanephridia? Give an example of animals for each.

Similarities: {All three remove metabolic wastes}
Differences in what they filter: {protonephridia filter interstitial fluids between cells}{Metanephridia filter coelomic fluid} {Saccate metanephridia filter fluid in the hemocoel/hemolymph}
Differences in structure {protonephridia flame cells with cilia that drive the fluid in the protonephridia}{ciliated funnel open to the coelom – cilia on the surface pull in coelomic fluid} {Saccate metenaphridia – membrane covers ciliated funnel and cilia create suction that pulls filtrate of hemolymph in to the structure} There are seven points here but the maximum that can be awarded are six

4.4 What are the similarities and differences in how the muscles work during insect indirect and direct flight.

Similarities: {Dorsoventral muscles}{Pull on the notum/cause the wings to rise}
Differences with muscle and how they lower the wing: {With direct flight, muscles attached to the wing make pull it down}{In indirect flight Longitudinal muscles NOT attached to the wing}
Differences in innervation {Direct flight – one nerve impulse for each wing beat}{With indirect flight there is no relationship between nerve impulse and wing beat frequency}

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4.5 Identify the appendages found on the first, second and third segment of the first tagma of the chelicerates and atelocerates. What is the function of each? (A table will help to organize your answer)

	Chelicerata	
1	None (Acron)	Compound eye was lost
2	Chelicera	Food manipulation
3	Pedipalp	Sensory and food manipulation
1	None (Acron)	Compound eye
2	Antennae	Sensory
3	None	Lost the second pair of antennae

4.6 What are the autapomorphies that define the Hemichordates? Describe the biological role and function of one of the three.

3 autapomorphies: {Stomochord}{Proboscis/proboscis complex}{Glomerulus}

Stomochord: {divericulum formed from gut/buccal diverticulum}{support structure for proboscis}{once thought to be a notochord}
Proboscis/proboscis complex: {Cilia on proboscis collect particulate food}{move it to preoral ciliary organ}{sorts the particles and suitable size enters the mouth}
Glomerulus: {Heart vesicle squeezes blood vessel against stomochord} {Filtrate enters glomerulus} {Glomerulus drains into proboscis coelom/protocoel}

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4.7 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}{Determines if blood flows to the lungs/pulmonary circuit – used to prevent blood flow into the pulmonary circuit} {Chondrichtheyes/cartilaginous fish/sharks} {digestive system} {slows the movement of food through the digestive tract}

4.8 How does a spider spin its web?

{Sends out first line and wind carries it an attaches to another object}{spider moves to middle of first line and drops down with a new line (Y shaped)}{more spokes added}{From center works its way out to the outside spinning loose/scaffold/first spiral}{Moves from outside in producing final tight spiral}{eating the first spiral as it goes back towards the centre} Direction and tight or loose must both be together to get the point

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4.9 What major changes in the bony fish, compared to a cartilaginous fish allowing the bony fish to hover in one place?

{Movement of the Pectoral and Pelvic Fins/ must state both} – {change from being more orless immovable and embedded in the musculature of the body wall to highly striculated and moveable with their own musculature.}
{Neutral Buoancy}- {Change from oils in shark to swim bladder}
{Ventillation of the gills} {Change from ram ventilation and constant swimming in the shark to the opercular gill that pulls water over the gills without swimming}

4.10 Describe the embryological origins of the chordate autapomorphies of a hollow dorsal nerve cord and notochord.

{Induction}{explain induction as when two different tissues contact each other and signal changes in the genetic program/fate of the cells} {Ectoderm and endoderm come in contact with each other}{In the region of contact between the two tissues the Ectoderm becomes the hollow dorsal nerve cord}{Causes the neural crest/ectoderm folds up and on itself}{In the area where the Endoderm contacts the ectoderm the notochord forms endoderm becomes the notochord}

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20 pts Part 5: Answer the essay question in the examination booklet that has been provided. Please Write double spaced please, 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) An invertebrate marine deuterostome
B) A terrestrial deuterostome
C) A marine protostome
D) A terrestrial protostome