Zoology 325
Midterm Examination I
October 6, 2003

Name: _____

Student Number: _____

There are 22 questions and 6 pages to this test.

Part I: Multiple Choice Questions: One mark each, 10 marks total.

1. An example of a C_{21} steroid might be:

a) androgens
b) estrogens
c) vitamin D
d) progestins
e) cholesterol
f) none of the above

2. One of the characteristics of living organisms is a reversal of entropy. This may be thought as:

a) The separation of an internal environment from an external environment
b) The creation of order from chaos
c) The use of energy sources to create more complex chemicals
d) b and c only
e) all of the above
f) none of the above

'e' was deemed the correct answer, however, given that the word 'only' appears in choice 'd', this would exclude choice 'e', thus producing a logic error if 'e' was the correct choice. Consequently, we decided to give one mark if your choice was a, b, c, d or e. 'f' clearly was incorrect and so no mark was given if you chose 'f'.

3. Secretion of a signalling molecule from the dorsal cell layer of Trichoplax into the secondary layer is an example of:

a) paracrine secretion
b) intracrine secretion
c) exocrine secretion
d) endocrine secretion
e) autocrine secretion
f) none of the above

There is no vascular system in this species. The signal travels from one cell type to another inside of the organism, therefore by definition 'a' is the only correct answer.

4. Which hormones have been found in the dorsal strand of adult ascidians?

a) CRF, GnRH and GH
b) CRF, PRL and GnRH
c) CRF, ACTH and PRL
d) GnRH, PC, and ACTH
e) GnRH, ACTH and PRL
f) CRF, PC, and PRL

Taken directly out of the only assigned paper to read.

5. The primary mode of intercellular signalling thought to be utilized by the species of the Ediacaran assemblage was:

a) intracrine
b) endocrine
c) paracrine
d) neuroendocrine
e) a, b and c only
f) a and c only

Like trichoplax, the Ediacaran fauna are thought not to have a vascular system, nor a nervous system, thus 'c' is the only correct answer.

6. Steroids formed early during the prebiotic evolution of organic molecules because

a) they were present in meteorites and comets
b) they could be synthesized from formaldehyde using energy from lightning
c) they are derived from amino acids
d) they formed channels in membranes
e) all of the above
f) none of the above

Steroids did not form during prebiotic evolution (that we know of).

7. What mechanisms do the agnathan fishes utilize to allow communication between the hypothalamus and the pars distalis?

a) diffusion
b) portal system
c) direct neural communication
d) a and b only
e) b and c only
f) a, b and c

In this question, because the existence of a portal system in these fishes is controversial I accepted either 'a' or 'd' as correct answers.

8. The number of potential responses to a cellular stimulus can vary between tissues due to

a) processing of the prohormone
b) expression of receptors
c) number of chromosomes present
d) expression of amidation sites
e) a and b only
f) b, c, and d only

9. Examples of prebiotic nitrogenous compounds are:

a) urea
b) fatty acids
c) amino acids
d) formaldehyde
e) a and c only
f) a and d only

10. Examples of amphiphilic molecules might be:

a) carbohydrates
b) amino acids
c) eicosanoids
d) steroids
e) b and c only
f) c and d only

Part II: Short Answer Questions: 20 marks total

11. **(1 Mark)** The formation of ion gradients between the inner and outer environments of the protocells had a significant effect on the evolution of the protocells. What was it?

the formation of ion gradients provided protocells with their own energy source

12. **(1 Mark)** Energy-mediated transport of a molecule across the cell membrane is an example of what kind of transport?

active transport

13. **(2 Marks)** Why did the development of autocatalytic reactions endow some protocells with a selective advantage over other protocells?

allowed the amplification of chemicals that acted to enhance the survivability of individual protocells

14. **(4 Marks)** List four types of signalling mechanisms that may have occurred in protocells

1.protein-protein interactions 2. passive diffusion across membranes
3. passive and 4. active diffusion through ion channels

15. **(6 Marks)** List six types of molecules that may have been used as signalling molecules by protocells

amino acids ***modified amino acids***

peptides ***fatty acids***

gases ***ions***

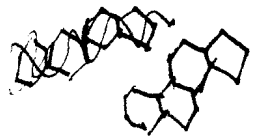
possibly nucleotide derivatives

16. **(1 Mark)** What cellular development was required before eicosanoids and steroids could be fully exploited as signalling molecules?

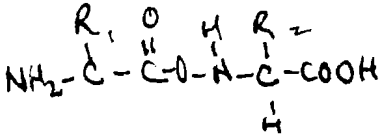
proliferation of intracellular membranes and associated biosynthetic pathways

17. **(5 Marks)** Draw a generalized structure of the following molecules:

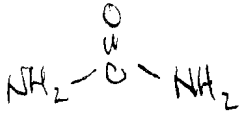
Steroid **(1 Mark)**



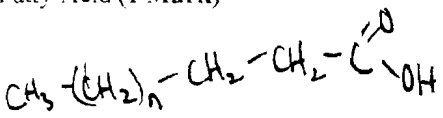
Dipeptide **(2 Marks)**



Urea **(1 Mark)**



Fatty Acid **(1 Mark)**



Part III Conceptual Multiple Choice Questions: 10 marks total

18. **(3 marks)** Gonadotropin-releasing hormone (GnRH) is a peptide with 10 amino acids. [Arg^8]-GnRH is a form of GnRH found in humans, frogs and sturgeons and has the amino acid arginine in the 8th position. [Ser^8]-GnRH is a form of GnRH with serine in the 8th position and is found in the teleosts. [Gln^8]-GnRH has glutamine in the 8th position and is found in birds and alligators. [His^5,Trp^{7}Tyr^8]-GnRH is another form of GnRH and is found in rats, snakes, goldfish and salmon. It has histidine in the 5th position, tryptophan in the 7th position, and tyrosine in the 8th position. Given the choices below, select the answer that is the most correct.

a) [Arg^8]-GnRH, [Ser^8]-GnRH, [Gln^8]-GnRH and [His^5,Trp^7,Tyr^8]-GnRH are orthologues.

b) [Arg^8]-GnRH, [Ser^8]-GnRH, [Gln^8]-GnRH and [His^5,Trp^7,Tyr^8]-GnRH are all paralogous to each other.

c) [Arg^8]-GnRH, [Ser^8]-GnRH, [Gln^8]-GnRH are orthologues, and paralogous to [His^5,Trp^7,Tyr^8]-GnRH.

d) [Arg^8]-GnRH and [Gln^8]-GnRH are orthologues whereas [Ser^8]-GnRH and [His^5,Trp^7,Tyr^8]-GnRH are orthologues

e) [Ser^8]-GnRH, [Gln^8]-GnRH and [His^5,Trp^7,Tyr^8]-GnRH are orthologues but [Arg^8]-GnRH is a paralogue to all others.

f) [Ser^8]-GnRH, [Arg^8]-GnRH and [His^5,Trp^7,Tyr^8]-GnRH are orthologues but [Gln^8]-GnRH is a paralogue to all others.

Commentary: a) cannot be considered as the [His^5,Trp^7,Tyr^8]-GnRH phylogenetic expression overlaps with the other GnRHs. Thus [His^5,Trp^7,Tyr^8]-GnRH cannot be orthologous. b) there is no strong evidence for this choice as none of the other GnRHs overlap with each other. Only [His^5,Trp^7,Tyr^8]-GnRH shows an overlap. c) this is the correct choice as [His^5,Trp^7,Tyr^8]-GnRH is the only GnRH that shows phylogenetic overlap. Moreover, the others change only by a single amino acid whereas [His^5,Trp^7,Tyr^8]-GnRH is different by 3amino acids. Paralogues tend to show greater sequence change than orthologues. d) is incorrect because [His^5,Trp^7,Tyr^8]-GnRH and [Ser^8]-GnRH overlaps in the teleosts then by definition cannot be orthologous. e) is incorrect as [Arg^8]-GnRH only overlaps with [His^5,Trp^7,Tyr^8]-GnRH but not the others. f) is incorrect because [Gln^8]-GnRH only overlaps with [His^5,Trp^7,Tyr^8]-GnRH but not the others.

19. **(2 Marks)** Urotensin-I in zebrafish and urocortin in rats are:

a) orthologous: the same peptide where the gene has separated due to species divergence

b) paralogous: the same peptide where the gene has separated due to species divergence.

c) orthologous: different peptides formed as a result of gene duplication

d) paralogous: different peptides formed as a result of gene duplication.

e) none of the above, because urotensin-I and urocortin are not related.

f) none of the above, because orthologues and paralogues cannot be compared.

This was an example covered in class

20. **(2 Marks)** If the protochordates had a single gene encoding beta-endorphin, and genomic duplications occurred once before the agnathans, a second before the cartilaginous fish and a third in the ray-finned fishes, how many beta-endorphin-like genes should be present in lungfish?

a) only one copy

b) two copies

c) three copies

d) four copies

e) six copies

f) eight copies

Lungfish are lobefinned fish.

21. (2 marks) How many different sequences could be formed in a peptide 4 amino acids long?

a) 40
b) 32,000
c) 16,000
d) 160,000
e) 320,000
f) 1,620

Four amino acid positions where each can be one of 20 different types. The answer is 20 to the 4th power or 160,000. (20x20x20x20 or 2x2x2x2=16, then add 4 zeros.)

22. (1 mark) If N-methyl transferase is not produced in the catecholamine biosynthetic pathway, then we might predict that the following hormones would be present:

a) dopamine and epinephrine
b) dopamine and norepinephrine
c) dopamine, epinephrine and norepinephrine
d) epinephrine and norepinephrine
e) L-DOPA only
f) none of the above.

Zoology 325 Endocrine Physiology
Midterm Test #1
October 13, 2004

Name [redacted] 31

Student Number [redacted]

Please answer all questions on this exam sheet.

Part I: True or false. One mark each. 5 marks total

1. The earliest plasma membranes found in the hypothetical protocells are believed to be composed of glutamic acid that was synthesized on the Earth prebiotically — True (False)

2. The pars neurointermedia is present in all tetrapods. — True (False)

3. If one attribute of life is the reversal of entropy, then for the reduction of entropy to occur in an organism there must be an increase in entropy in the environment surrounding the organism. — (True) False

4. Coelacanths, like all basal actinopterygians possess a ventral lobe in the pituitary. — True (False)

5. Amino acids are believed to have been seeded on Earth by meteorites originating in Mars — (True) False

5

Part II Multiple choice questions One mark each 10 marks total.

1. A distinguishing feature of the Dipnoi pituitary gland, relative to the Chrondrostei

a) the presence of a ventral lobe connected to the pars distalis by an epithelial stalk and a vastly reduced portal system

(b) an expanded neurohypophysis, and a lobular pituitary gland featuring a more developed portal system

c) the loss of the epithelial stalk but the retention of a ventral lobe of the pars distalis located above the buccal cavity

1

10

d) a vastly reduced portal system and a proliferation of neurosecretory nerve terminals in the neurohypophysis

e) the presence of a highly interdigitated pars nervosa and the reduction of a portal system

2. Endocytosis and exocytosis could not occur until:

a) a functional cytoskeleton occurred

b) there was a proliferation and elaboration of cellular membranes

c) molecular energy source was available

d) neurosecretion had evolved

e) a, b and c only

f) a and d only

3. Protocells possessing a rudimentary cytoskeleton were selected over those protocells that did not because

a) it increased the stability of the membrane and hence longevity of the protocell in the environment.

b) it allowed direct protein-protein coupling between protocells

c) it allowed the formation of ion channels such as gap junctions

d) it allowed cells to take on a spherical shape allowing more efficient movement across the substrate

e) a and d only

f) c and d only

4. Current evidence suggests that Rathke's pouch is

a) an inpocketing of the dorsal epithelium of the foregut that will eventually develop into the pars distalis.

b) A transient structure that leads to the formation of the buccal lobe in holocephalans.

c) An inpocketing of the dorsal buccal epithelium that interacts transiently with primodial neurosecretory tissue arising from the anterior neural ridge

d) An outpocketing of the ventral brain surface that will eventually result in the formation of the neurohypothesis, then later combine with the migrating anterior ridge tissue to create the pituitary gland.

e) a hypothetical structure which was once believed to exist, but the newest studies indicate that earlier researchers were mistaken.

5. A nerve net type nervous system is found in primitive deuterostomes, ecdysozoans and radiates. Given this observation, would you expect it to be found in the Lophotrochozoa?

a) No, because the nerve net evolved independently in each lineage

b) Yes, because nerve nets can evolve many times independently.

c) No, because the Lophotrochozoa evolved before the Radiata and therefore before the formation of the nerve net.

d) Yes, because the Lophotrochozoa and Ecdysozoa bifurcated after the bifurcation of the deteurostomes from the Lophotrochozoa and Ecdysozoa.

e) No, because the lophotrochozoans are a highly degenerate group of organisms

f) none of the above.

6. Hormones and other chemical signalling molecules differ from nutrients because

a) hormones reduce entropy and nutrients increase entropy

b) hormones and nutrients both convey information but nutrients also possess energy

c) hormones convey information only, and nutrients possess no informational value

d) hormones decrease the informational state of the cell that secreted them, whereas the secretion of nutrients from one cell to another acts to increase the informational state in that cell.

e) a and d only

f) b and d only

7. Gases that are believed to have existed in the early Earth atmosphere include

a) methane, ammonia and urea

b) ammonia, urea, and formaldehyde

c) nitrogen, water vapour and methane

d) urea, formaldehyde and oxygen

e) oxygen, methanol and ammonia

f) none of the above

8. Active transport of a molecule across the cell membrane differs from passive transport because

a) Active transport requires energy, and therefore can only transport nutrients across the membrane. Passive transport transports signalling molecules.

b) Active transport reverses entropy whereas passive transport increases entropy.

c) Active transport requires energy, whereas passive transport utilizes energy from concentration gradients. Both types of transport mechanisms convey information

d) Passive transport occurs in protocells only, active transport occurs in living cells

e) Active transport utilizes concentration gradients, whereas passive transport does not.

f) Active transport utilizes a protein, whereas passive transport does not.

9. The following are examples of nitrogenous compounds that were available during the prebiotic period in Earth's history.

a) ammonia, formaldehyde, glutamic acid and glycerol

b) methane, nitrogen, formaldehyde and glycine

c) aspartic acid, urea, ammonia and formaldehyde

d) glycine, ammonia, aspartic acid and urea

e) lipids, urea, methane and nitrogen

f) aspartic acid, glycine, serine and methane

10. Four classes of signalling molecules are:

a) thyroid hormones, steroids, eicosanoids and protinoids

b) steroids, eicosanoids, modified amino acids and proteins

c) fatty acids, carbohydrates, nucleic acids and proteins

d) steroids, eicosanoids, modified amino acids and gases

Part III Conceptual Multiple Choice Questions. 3 Marks each

1. Given what you know about the ontogeny and evolution of the pituitary gland, what might be a possible explanation for the formation of the buccal lobe in holocephalans?

a) The migration of the anterior neural ridge stopped at Rathke's pouch and remained in the buccal region in adults

b) The latest theory of pituitary evolution is incorrect, and the presence of the buccal lobe proves that the pituitary arises from Rathke's pouch

c) the anterior pituitary divided into the pars distalis and buccal lobe after the pituitary gland was formed.

d) The neurosecretory tissue from the anterior neural ridge began to separate into two lobes as it moved toward the developing neurohypophysis.

e) Our understanding of the phylogeny of the holocephali is incorrect, and they evolved before elasmobranches. Thus the pituitary gland is actually composed of two neurosecretory sources: that arising from the anterior neural ridge, and another component arising from Rathke's pouch.

f) none of the above theories are acceptable because the pars distalis is composed of hypothalamic tissue that migrates downward during brain development.

e) lipids, urea, methane and nitrogen

f) aspartic acid, glycine, serine and methane

10. Four classes of signalling molecules are:

a) thyroid hormones, steroids, eicosanoids and protinoids

b) steroids, eicosanoids, modified amino acids and proteins

c) fatty acids, carbohydrates, nucleic acids and proteins

d) steroids, eicosanoids, modified amino acids and gases

Part III Conceptual Multiple Choice Questions. 3 Marks each

1. Given what you know about the ontogeny and evolution of the pituitary gland, what might be a possible explanation for the formation of the buccal lobe in holocephalans?

a) The migration of the anterior neural ridge stopped at Rathke's pouch and remained in the buccal region in adults

b) The latest theory of pituitary evolution is incorrect, and the presence of the buccal lobe proves that the pituitary arises from Rathke's pouch

c) the anterior pituitary divided into the pars distalis and buccal lobe after the pituitary gland was formed.

d) The neurosecretory tissue from the anterior neural ridge began to separate into two lobes as it moved toward the developing neurohypophysis.

e) Our understanding of the phylogeny of the holocephali is incorrect, and they evolved before elasmobranches. Thus the pituitary gland is actually composed of two neurosecretory sources: that arising from the anterior neural ridge, and another component arising from Rathke's pouch.

f) none of the above theories are acceptable because the pars distalis is composed of hypothalamic tissue that migrates downward during brain development.

2. Consider the morphological differences in the pituitary gland arising during actinopterygian evolution in comparison to that evolving during the rise of the Sarcopterygii and subsequently evolving lineages. What might be a plausible physiological reason for this?

a) The greater complexity of the actinopterygian nervous system relative to the Sarcopterygii and later evolving lineages led to an mixing of pars nervosa and pars intermedia to allow neurohypophysial regulation of the hormone MSH.

b) Direct neurosecretory interaction from the hypothalamus to the pars distalis in sarcopterygians allowed this species to make neuroendocrine decisions more efficiently, allowing for greater niche adaption.

c) In actinopterygians, direct neurosecretory control of each of the pars distalis hormone-secreting cells by a particular releasing factor reduced the number of non-target receptor interactions to occur, thereby allowing the animals a greater metabolic rate.

d) Release of the hypothalamic neurohormones into a portal system, in lineages evolving from the basal sarcopterygians, allowed for more complex neuroendocrine decisions to be made, relative to the actinopterygians, thus allowing for greater physiological and behavioural responses when confronting an environmental hazard.

e) a and b, only

f) c and d, only

3. Consider the relationship among the endocrine system, vascularity, the nervous system, symmetry and the neuroendocrine system. What might be a plausible order of origin for these attributes

a) Symmetry is not important because the earliest metazoans had a vascular system. Thus a vascular system evolved first to allow more efficient delivery of oxygen and nutrients to the tissues. This was followed by the formation of an endocrine system, because secretory epithelial cells secreted their contents into the vascular system. Then after the sensory systems developed the nervous system and neuroendocrine developed. Afterward, symmetry evolved.

b) In the earliest metazoans, both sensory and non-sensory cells had the ability to secrete chemical signals in a paracrine manner. The first metazoans were asymmetrical without any defined shape among progeny. Once symmetry developed then a functional nervous system could develop as it allowed a nerve cell axon terminal to be located near the same cluster of cells within each individual. As the organisms began to evolve greater sizes to maximize prey capture and to avoid capture by predators, then diffusion was no longer practical to supply cells with the required oxygen and nutrients. Thus a vascular system developed. Because the earliest nerve cells and non-nerve cells were possessed secretory

ability, an endocrine system would have evolved almost simultaneously with the first vascular systems.

c) Once symmetry had evolved, then the vascular system, neuroendocrine system nervous system, and endocrine system all evolved simultaneously once locomotory structures evolved.

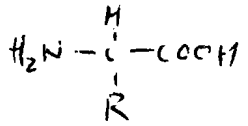
d) The nervous system evolved first. This allowed the formation of symmetry and paired legs and mouth parts. As a result of this, a vascular system evolved. Once this happened then the endocrine and neuroendocrine system evolved at the same time.

e) The presence of a vascular system in the Ediacaran-type (algal symbiotic) organism is evidence that a vascular system evolved first. As soon as a functional vascular system was present, then and endocrine system developed. A nervous system, such as the type found in primitive animals such as sponges indicates that symmetry only evolved after the formation of a nervous system.

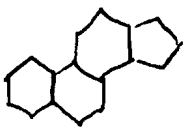
f) Animals such as Trichoplax possess a well defined nervous system but no vascular system, neurosecretion or symmetry. Thus this is evidence that the nervous system evolved first. Then as the organisms increased in size, a vascular system was necessary and the endocrine and neuroendocrine systems evolved shortly afterward. As animals were selected for a more fusiform shape, then symmetry evolved.

Part IV Draw the following structures:

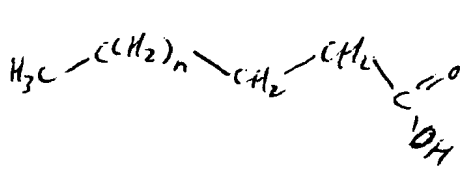
a) a generalized amino acid (1 mark)



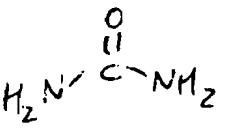
b) a generalized steroid (2 marks)



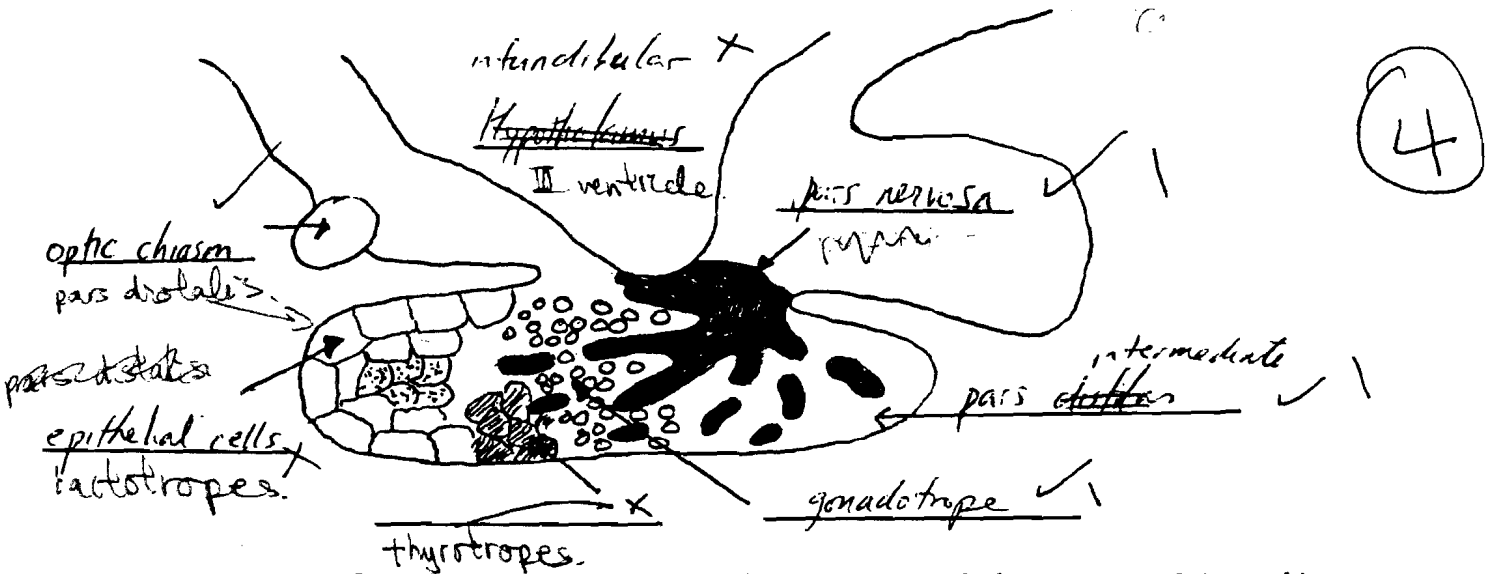
c) a generalized lipid (2 marks)



d) urea (1 mark)



Part V Label the following generalized pituitary gland: (7 marks, one mark for each correct label)



In what group of species would you expect this pituitary morphology to occur? (1 mark)

tetrapod

Zoology 325, Endocrine Physiology
Midterm Test I
October 12, 2005

Name_ _ _____ 31

Student Number__ ____ _____

Please answer all questions on the test paper. No electronic aids are allowed for this test. Do not use pencil for your final answers. Abbreviations will not be accepted. There are 6 pages in this test.

Part I: Multiple Choice Questions: Each question is worth 1 mark (Total 10 marks).

PLACE YOUR ANSWERS IN THE BOX PROVIDED

1. The route of passage of molecules through the protocell membrane might have included which mechanisms?

a) ion-coupled ATPases
b) pores in the membrane ✓
c) tandemly arranged integrin proteins
d) autocrine but not paracrine reactions
e) all of the above
f) b and c, only

ANSWER B ✓

2. What is a plausible evolutionary order of the following characteristics?

a) bilateral symmetry, nervous system, endocrine system, vascular system
b) nervous system, bilateral symmetry, vascular system, endocrine system
c) endocrine system, bilateral symmetry, nervous system, vascular system
d) endocrine system, bilateral symmetry, vascular system, nervous system
e) bilateral symmetry, nervous system, vascular system, endocrine system
f) nervous system, vascular system, endocrine system, bilateral symmetry

e ✓

2

3. Two genes are said to be orthologous when

a) they arise from different ancestral genes but are found in the same organism
b) they arise from the same ancestral gene and are found in the same organism
c) they arise from the same ancentral gene and are found in different species
d) they arise during genomic duplications that occur after species have evolved into different forms
e) they are present on the same chromosome, but come from a common ancestor gene
f) they are present on different chromosomes and come from a different ancestor gene.

c

4. Most of the signaling systems present in extant vertebrates can be traced to an origin

a) during a set of genomic duplication events, after the appearance of the Radiata, that led to the formation of bilateral triploblastic species.
b) during the formation of peptide signaling systems found in present day Hydra
c) in the unusual signaling qualities of the Ediacaran fauna with regards to their ability to be autotrophic
d) during the origins of the Placozoa, as exemplified by *Trichoplax adherens*
e) during the evolution of the signaling systems of the first protocells
f) during the expansion of membranes in the early eukaryotic cells

e

5. The formation of the first simple-lipid based membranes was important to life because

a) it acted to partition biotic events from non-biotic events
b) it protected the first simple lifeforms from large scale sterilization events such as erupting volcanoes
c) it provided an energy source in the form of ion gradients
d) it allowed cell to cell communication
e) a and c, only
f) a, b and c, only

f

6. Consider a peptide 5 amino acids long. How many possible combinations are there using only the amino acids that can be encoded by the nuclear genetic code of vertebrates?

a) 128,000
b) 32,000
c) 6, 400,000
d) 3, 200,000
e) 320,000
f) 160,000

20^5 2x2x2x2x2x2 4 8 16 3200,000

d

7. Autocrine refers to

a) a type of biosynthetic circuit associated with positive and negative feedback
b) a characteristic of peptide-type hormones
c) a reaction that occurs in amphiphilic environments
d) a type of signaling system that directly feeds back to the cell that produced it
e) an internal amphiphilic signaling system among organelles
f) a type of amplifier circuit that leads to self catalyzation of the initial product

d

8. In the earliest cells, it is thought that the following ions could passively cross the cell membrane without the help of protein channels or active transport:

a) Cd^{2+}, Ca^{2+} and Mg^{2+}
b) Ca^{2+}, K^+, and Na^+
c) Cl^-, Ca^{2+}, and Mg^{2+}
d) Ca^{2+}, Na^+, and Cd^{2+}
e) H^+, Cd^{2+}, and Na^+
f) Cl^-, H^+, and Cd^{2+}

b

3

9. The proliferation of membranes in the simple cell was an important step of paracrine and endocrine signaling because

a) it provided a two-dimensional matrix for paracrine reactions to occur
b) it led to the formation of the cytoskeleton and adhesion to mineral substrates
c) it was a prerequisite to exocytosis
d) it allowed for an efficient form of reproduction
e) it was a prerequisite for symbiotic events to occur
f) none of the above

c

10. If we cloned corticotropin-releasing factor (CRF) from a dinosaur, it could be classified as

a) an orthologue of reptile CRF
b) an orthologue of bird urocortin
c) a paralogue of teleost CRF
d) a paralogue of human CRF
e) a and b, only
f) a, c, and d, only

2

a

Part II: Short Answer: (Total 18 Marks)

11. What are the two basic functions of calcium? **(2 marks)**

- intracellular signalling
- activate G-protein

1

12. What was the impact of the evolution of segmentation on the development of the nervous and vascular systems? **(3 Marks)**

- segmentation gives the different parts/regions of the nervous syste
- brain development
- neuroendocrine system

1½

13. List four elemental ions that are believed to have passively crossed the membrane in the earliest cells. **(4 marks)**

Na^+ sodium — K^+ potassium — Cl^- chloride — Ca^{2+} calcium

4

14. What are the three basic regions of the chordate brain? **(3 Marks)**

forebrain — ~~midbrain~~ midbrain — hindbrain

3

15. List six types of hormone-secreting cells found in the vertebrate pars distalis **(6 Marks)**

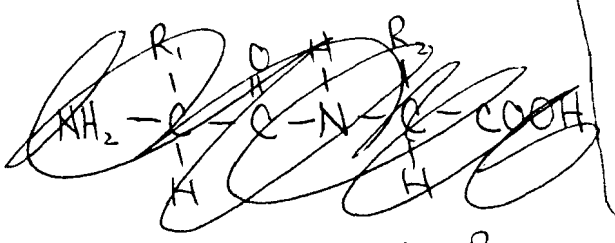
lactotropes ✓ — thyrotropes ✓ — gonadotropes ✓

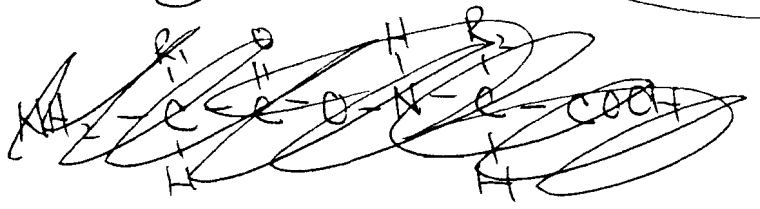
somatotropes ✓ — corticotropes ✓ — neurotropes ✗

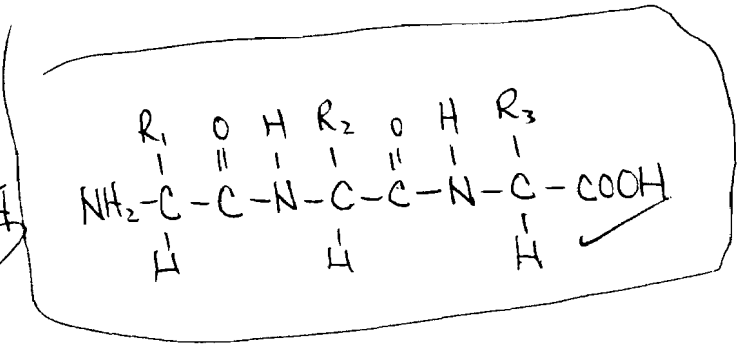
5

Part III: Drawings (Total 12 Marks)

16. Draw a generalized tripeptide **(2 marks)**

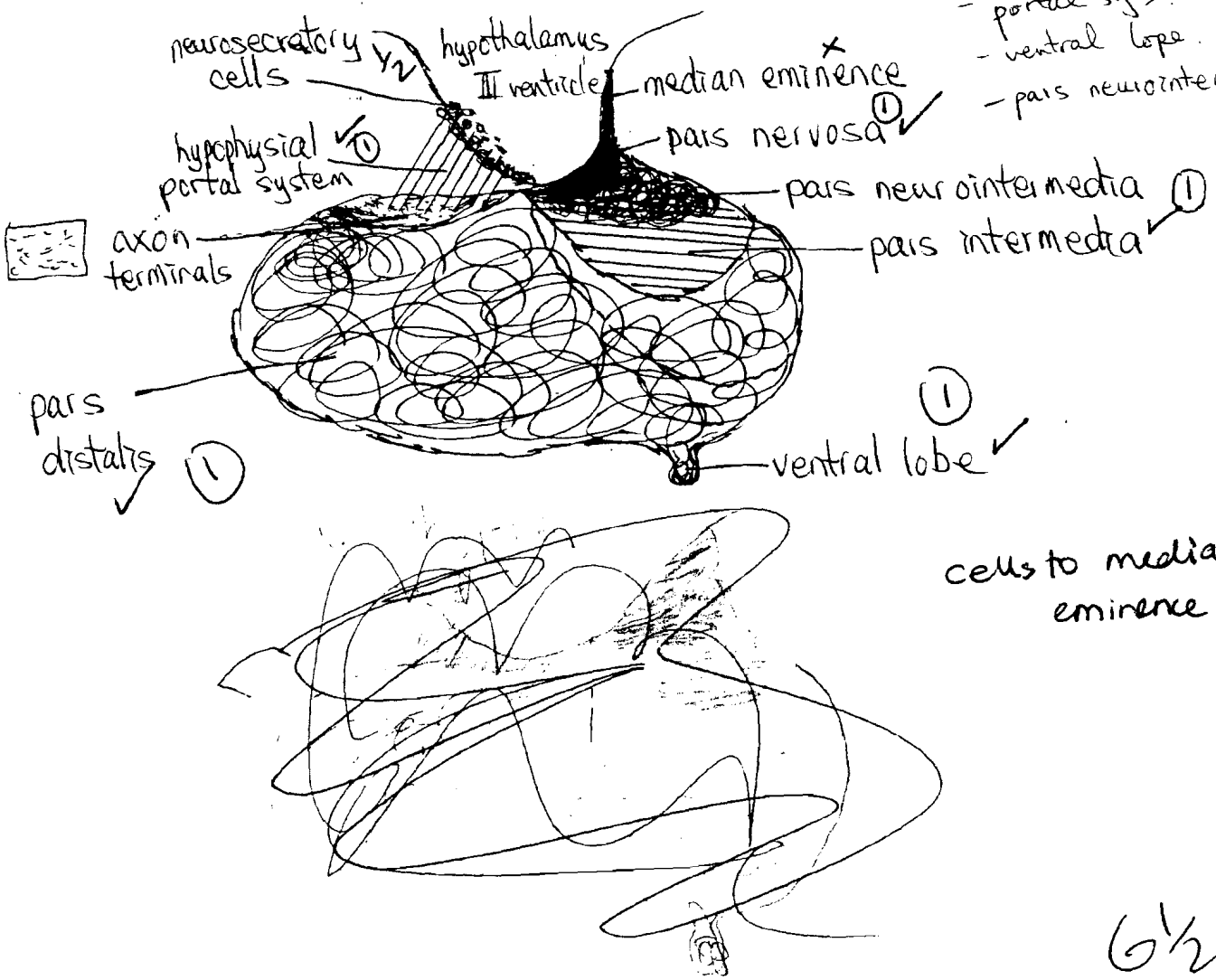






2

17. Draw a generalized elasmobranch pituitary gland. Label the following structures: ~~pars distalis, pars nervosa~~, pars intermedia, ~~ventral lobe~~, ~~hypophysial portal system~~, ~~median eminence~~. Show the general position of hypothalamic ~~neuroseeretory cells~~ and show the regions they send their axon ~~terminals~~ to. **(10 Marks)**



- portal sys.
- ventral lobe.
- pars neurointermedia.

cells to median eminence + pars nervosa.

6½

UNIVERSITY OF TORONTO
Faculty of Arts and Science

DECEMBER EXAMINATIONS 2004
ZOO 325HIF

Duration-2 hours

No Aids Allowed

PLEASE HAND IN

Name_____

Student Number_____

There are 9 pages in this exam. Ensure that all pages are present. Write all answers in pen. Do not use abbreviations.

Part I: Multiple Choice Questions. (1 mark each)

1. Seasonal molts in homeotherms are regulated primarily by

a) temperature
b) photoperiod
c) autonomonous physiological rhythms
d) social cues
e) c and d
f) a and c

2. Light-induced activation of the suprachiasmatic nucleus in Xenopus to induce colour change against a light background include the following signalling agents:

a) neuropeptide Y, dopamine, GABA
b) glutamate, melanostatin, dopamine
c) neuropeptide Y, galanin, GABA
d) 5-HT, GABA and glutamate
e) 5-HT, glutamate, dopamine
f) melanostatin, dopamine, neuropeptide Y

3. Which paralogue of rat CRF is the most potent at inhibiting food intake in rats?

a) rat urocortin
b) rat urocortin 2
c) rat urocortin 3
d) rat urotensin-II
e) fish urotensin-I
f) fish urotensin-II

4. Which statement is correct regarding ANP?

a) it is released from the OVLT to regulate water reabsorption from the collecting tubule.

b) it is another name for vasopressin, and is released from the pars nervosa to regulate water reabsorption from the collecting tubule

c) it is the precursor protein for angiotensin-I that is subsequently cleaved by renin

d) it is released by the atrium in the heart to regulate sodium concentrations in plasma

e) it is one of the precursors for aldosterone that acts antagonistically to the actions of aldosterone

f) is released by the pars distalis to stimulate the adrenal gland to release mineralcorticoids.

5. Somatostatin in humans and rats are:

a) orthologues
b) paralogues
c) eicosanoids
d) receptors
e) tridecapeptides
f) none of the above

cont'd...

6. After ingesting a large amount of salty popcorn, what would be expected to occur physiologically?

a) first vasopressin, then aldosterone concentrations will rise in plasma
b) first aldosterone, then vasopressin concentrations will rise in plasma
c) first vasopressin, then ANP concentrations will rise in plasma
d) first ANP, then vasopressin concentrations will rise in plasma
e) first ANP, then angiotensin-II concentrations will rise in plasma
f) first ANP, then angiotensin-II concentrations will rise in plasma

7. Gonadotropin releasing hormone can select between LH and FSH secretion by

a) first stimulating estradiol
b) utilizing different pulse frequencies
c) select between secretion from the OVLT and median eminence
d) stimulating the gonadotropins first, then stimulating LH and FSH
e) alternating the GnRH paralogue used
f) none of the above

8. Thyroid receptors can be classified as

a) G-protein coupled receptors
b) tyrosine kinases
c) transcription factors
d) heat shock proteins
e) serine/threonine kinases
f) ionotropic receptors

9. GnRH release is inhibited by the CRF-mediated release of

a) prolactin, interleukin-I
b) neuropeptide Y, galanin
c) oxytocin, vasopressin
d) ACTH, neuropeptide Y
e) AgRP, MSH
f) ACTH, ArRP, oxytocin

10. Basal metabolic rate may be described as

a) facultative thermogenesis
b) poikilothermic thermogenesis
c) obligatory thermogenesis
d) homeothermic thermogenesis
e) facultative pyrogenesis
f) obligatory pyrogenesis

cont'd...

11. CRF-induced MSH release from the pars intermedia in Xenopus is due to

a) CRF release by 5-HT in the locus coeruleus and norepinephrine in Raphe nucleus
b) CRF release by inhibition of melanostatin and norepinephrine in the locus coeruleus
c) CRF release by 5-HT in the Raphe nucleus and epinephrine in the locus coeruleus
d) CRF release by 5-HT in the locus coeruleus and epinephrine in the Raphe nucleus
e) CRF relase by 5-HT in the Raphe nucleus and norepinephrine in the locus coeruleus
f) CRF release by 5-HT and norepinephrine in the Raphe nucleus

12. The synthesis of the uncoupling protein in brown fat is stimulated by

a) glucocorticoid and thyroid receptors
b) cAMP responsive element binding protein
c) CRF binding protein
d) Type II glucocorticoid receptor only
e) Type I glucocorticoid receptor only
f) both R1 and R2 CRF receptors

13. During childhood, the GnRH pulse generator is inhibited by

a) glutamate and GABA
b) glutamate and NPY
c) NPY and TNFα
d) GABA and NPY
e) testosterone
f) estradiol

14. In Xenopus, what neurohormones stimulate the release of CRF to invoke colour change?

a) serotonin, epinephrine
b) dopamine, NPY
c) GABA, norepinephrine
d) serotonin, norepinephrine
e) acetylcholine, serotonin
f) norepinephrine, acetylcholine

cont'd...

15. Neuropeptide Y is synthesized in the

a) paraventricular nucleus
b) preoptic area
c) supraoptic nucleus
d) arcuate nucleus
e) suprachiasmatic nucleus
f) d and e only

16. Growth hormone releasing factor is synthesized in the

a) paraventricular nucleus
b) preoptic area
c) supraoptic nucleus
d) arcuate nucleus
e) suprachiasmatic nucleus
f) c and e only

17. Vasopressin release from the median eminence acts to stimulate

a) aldosterone from the kidney
b) aldosterone from the adrenal gland
c) corticosterone from the kidney
d) corticosterone from the adrenal gland
e) a and b only
f) c and d only

18. If a hungry mammal was suddenly threatened by a predator, NPY and cortisol levels would be expected to

a) both decrease
b) both increase
c) increase and decrease, respectively
d) decrease and increase, respectively
e) neither hormone would be expected to change
f) mammals cannot express NPY and cortisol at the same time

19. Juxtaglomerular cells secrete

a) angiotensinogen
b) angiotensin converting enzyme
c) angiotensin-I
d) aldosterone
e) none of the above
f) a and d only

cont'd...

20. The physiological role of thermogenin is to

a) allow Na ions across the membrane
b) allow hydrogen ions across the membrane
c) allow T3 to be converted to T4
d) allow T4 to be converted to T3
e) stimulate TSH release
f) stimulate TRH release

21 Atrial naturietic factor is antagonistic to

a) angiotensin-II
b) urotensin-II
c) angiotensin-I
d) urotensin-I
e) urocortin II
f) none of the above

22. The insulin receptor is a

a) G-protein coupled receptor
b) tyrosine kinase
c) transcription factor
d) ion channel
e) serine/threonine kinase
f) none of the above

23. The arcuate nucleus can synthesis and release

a) prolactin, GHRH and ACTH
b) β endorphin, ACTH and GHRH
c) oxytocin, vasopressin, and neuropeptide Y
d) growth hormone, ACTH and neuropeptide Y
e) somatostatin, neuropeptide Y and prolactin
f) CRF, galanin and somatostatin

24. Light input via the retina will stimulate the release of what hormones to inhibit MSH?

a) NPY, CRF, GABA
b) dopamine, norepinephrine, GABA
c) CRF, NPY, dopamine
d) NPY, GABA, dopamine
e) GABA, NPY, acetylcholine
f) acetylcholine, dopamine, norepinephrine

cont'd...

25. Melanostatin in frogs is structurally related to

a) CRF
b) MSH
c) NPY
d) ACTH
e) melatonin
f) none of the above

26. Which statement is true?

a) urocortin and corticotropin releasing factor are expressed in the same part of the brain.
b) urocortin and urocortin-I both bind the CRF-R1 receptor

c) urocortin and urocortin-III both bind the CRF-R1 receptor

d) corticotropin-releasing factor is expressed more rostrally in the brain compared to urocortin.

e) urocortin II and urocortin III have higher affinity for the CRF-R1 receptor

f) urocortin II and urotensin II are found in the same regions of the brain as urocortin but not corticotropin-releasing factor

Part II: Short answer questions (34 Marks)

1. Give two examples of pheromones found in goats (2 Marks)

_____ _____

2. What peptide is released from nerve fibers in UV-light damaged skin to trigger a mast cell response? (1 Mark)

_____

cont'd...

3. List three chemical signalling agents released by mast cells in response to stimulation by the hormone described above: (3 Marks)

_____ _____ _____

6. Name two neurotransmitters that inhibit the GnRH neuron during the juvenile and prepubertal stage of development (2 Marks)

_____ _____

7. What is the final active product of vitamin D that is synthesized in the kidney? (2 Marks)

_____

8. Name three hormones that regulate calcium absorption in gills (3 marks)

_____ _____ _____

9. Describe three mechanisms that parathyroid hormone utilizes to modulate plasma calcium (6 marks)

_____

_____

_____

10). Name five hormones that directly regulate the function of osteoclasts. (5 marks)

_____ _____

_____ _____

_____

cont'd...

11) Name ten hormones known to regulate GnRH neuron function in the hypothalamus (10 Marks):

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

UNIVERSITY OF TORONTO
Faculty of Arts and Science

DECEMBER EXAMINATIONS 2005

ZOO 325H1F

Duration – 2 hours

No Aids Allowed

PLEASE HAND IN.

Name_____

Student Number_____

There are 3 parts to this exam for a total of 75 marks. Please answer all questions on the exam sheet. There are 10 pages in this examination.

Part I: Multiple Choice Questions. Please choose the most correct answer (total: 15 marks)

1. Name two hypothalamic nuclei in vertebrates that Per gene expression has been found in.

a) suprachiasmatic nucleus, dorsal raphe nucleus
b) lateral hypothalamic nucleus, suprachiasmatic nucleus
c) dorsal raphe nucleus, area X
d) ventral hypothalamic nucleus, dorsal raphe nucleus
e) suprachiasmatic nucleus, area X
f) supraoptic nucleus, suprachiasmatic nucleus

2. Two hormones implicated in pair-bonding behaviours are:

a) CRF and NPY
b) CRF and vasopressin
c) vasopressin and NPY
d) vasopressin and oxytocin
e) oxytocin and ACTH
f) vasopressin and ACTH

3. If one of the characteristics of life is to create order from disorder, what would the prebiotic environment need to contribute to the reactions leading to the first biogenic molecules?

a) basic elements in the form of inorganic gases and ions
b) simple amino acid based enzymes
c) a source of energy
d) ionic gradients across the primitive membrane of the first cells
e) a and c, only
f) a, b and d, only.

4. Several theories have been suggested for how the first compound molecules came about. Out of the list below, what are the most plausible theories?

a) the random interaction of inorganic material in interstellar space that formed simple organic molecules that ended up in meteorites and comets.

b) a series of hydration and dehydration cycles in shallow pools of water on the Earth.

c) the 'seeding' of simple cells from another planet via meteorites

d) the adsorption of organic materials onto sulphide films produced by oceanic hot vent effluents.

e) all of the above

f) a, b and d, only

5. The pineal body receives photic input from the retina via which of the following pathways?

a) retina to intergeniculate leaflet to suprachiasmatic nucleus to pineal
b) retina to suprachiasmatic nucleus to dorsal raphe nucleus to pineal
c) retina to paraventricular nucleus to suprachiasmatic nucleus to pineal
d) retina to suprachiasmatic nucleus to paraventicular nucleus to pineal
e) retina to suprachiasmatic nucleus to dorsal raphe nucleus to pineal
f) retina to intergeniculate leaflet to dorsal raphe nucleus to pineal

cont'd...

6. Possible sources of chemical energy available to be used in the first prebiotic reactions leading to the formation of organic molecules have been suggested to be:

a) pyrites and glyceraldehyde reactions
b) simple glycine polymers, because glycine was thought to be plentiful in the early Earth
c) pyrophosphate bonds
d) UV radiation from the sun
e) a, b and c, only
f) a and c, only

7. Mammalian sertoli cells secrete:

a) activin and inhibin
b) FSH, LH and estradiol
c) testosterone and activin
d) FSH and inhibin
e) estradiol and inhibin
f) estradiol, testosterone and activin

8. What was thought to be the original physiological role of melatonin?

a) growth factor
b) antioxidant
c) neurotransmitter
d) hormone
e) enzyme co-factor
f) nutrient

9. The prebiotic synthesis of amino acids is thought to be a key step in the evolution of the first cells and the first signaling systems because

a) they play a role in acid/base reactions, and can act as an energy source
b) they form linear polymers, and are amphilic
c) they form branched structures and therefore contain more information than other molecules
d) none of the above
e) a and b, only
f) a and c, only

cont'd...

10. What kind of biological rhythm does a Tau mutant hamster have?

a) circadian
b) supradian
c) infradian
d) ultradian
e) microdian
f) nanodian

11. Types of signaling mechanisms in protocells may have included,

a) intracrine, autocrine and endocrine
b) endocrine, juxtacrine, and amphicrine
c) intracrine and exocrine
d) mostly intracrine, but some amphicrine
e) paracrine, endocrine and juxtacrine
f) justacrine and endocrine

12. The inhibition of the onset of puberty is achieved primarily by:

a) tumour necrosis factor alpha and glutamate
b) glutamate and neuropeptide Y
c) neuropeptide Y and GABA
d) GABA and leptin
e) tumour necrosis factor alpha and GABA
f) glutamate and leptin

13. Ultradian rhythms refer to biological rhythms that have a periodicity

a) of anything greater than a day
b) of slightly greater than a day but less than approximately a month
c) of about a day
d) of less than a day, but greater than a couple of hours
e) anything less than a day
f) of exceptionally long timespans, for example, migratory and hibernation periods

cont'd...

14. The release of epinephrine by the adrenal medulla during sympathetic nervous system activation by emotional stress regulates the amygdala by which pathway?

a) paraventricular nucleus to hippocampus to bed nucleus to amygdala
b) area postrema to paraventicular nucleus to hippocampus to amydala
c) area postrema to nucleus of solitary tract to locus coeruleus to amygdala
d) paraventicular nucleus to nucleus of solitary tract to area postrema to amygdala
e) bed nucleus to area postrema to nucleus of solitary tract to amygdala
f) paraventricular nucleus to area X to area postrema to locus coeruleus to amygdala

15. Kairomones

a) benefit both the receiver and producer
b) benefit producer but disadvantage the receiver
c) disadvantage both receiver and producer
d) benefit the receiver but disadvantage the producer
e) benefit the producer but have a neutral effect on the receiver
f) benefit the receiver but have a neutral effect on the producer

Part II: Short Answer. Each question is worth various marks. (total 38 marks)

16. What is the difference between reactive homeostasis and predictive homeostasis? **(2 marks)**

_____

_____

17. What hormone has been implicated in the aggressive behaviour of adult female hyenas? **(1 mark)**

_____

18. What are three stages in the evolution of reproductive pheromones? **(3 marks)**

_____ _____

_____

cont'd...

19. Provide a plausible theory for the origin of biological clocks **(2 marks)**

_____

_____

20. What are three actions of dihydroxytestosterone in humans? **(3 marks)**

_____ _____

_____

21. What tissue secretes leptin into the systemic circulation? **(1 mark)**

_____

22. If a cell experiences water loss, what happens to the osmolality within the cell? **(1 mark)**

_____

23 a)What is the name of the caudal neurosecretory organ located in the spinal cord of teleost fishes? **(1 mark)**

_____

b) What part of the pituitary gland is it most structurally similar to? **(1 mark)**

_____

24. Adrenal glucocorticoids activate the type I glucocorticoid receptor in the hippocampus but not the type I glucocorticoid receptor in the kidney. How is this possible? **(2 marks)**

_____

25. What is the name of the cells in the parathyroid gland that release parathyroid hormone? **(1 mark)**

_____

cont'd...

26. What type of biological rhythm would be used to explain the pulsatile secretory patterns of GnRH or GHRH: **(1 mark)**

_____

27. What are the two basic olfactory systems associated with the detection of pheromones in vertebrates: **(2 marks)**

_____ _____

28. Name three hormones secreted by the theca interna in antral follicles. **(3 marks)**

_____ _____

_____

29 a) How is a low plasma Na^+ concentration detected by the kidney of mammals? **(1 mark)**

_____

b) What part of the kidney that this occur in? **(1 mark)**

_____

30. Provide one example of a behaviour that occurs after angiotensin-II feeds back to the brain . **(1 mark)**

_____

31. What hypothalamic nucleus synthesizes most of the vasopressin that is released from the pars nervosa? **(1 mark)**

_____

cont'd...

32. What are three basic mechanisms by which neuro- and neuroendocrine –type toxins act to achieve their effects: **(3 marks)**

_____ _____

_____

33. What is the principal osmoregulatory hormone released by the neurophysis of fishes? **(1 mark)**

_____

34. Provide two functions of urotensin-II in teleost fishes? **(2 Marks)**

_____

_____

35. a)What is the primary action of vasopressin in the kidney? **(1 Mark)**

_____

b) Where in the kidney does this process occur? **(1 Mark)**

_____

36. What is the basic difference between alleochemicals and pheromones? **(2 marks)**

_____

cont'd...

Part III: Drawings (total 22 marks)

37. Draw the following: **(7 marks)**

a) generalized steroid (1 mark)

b) generalized amino acid (1 mark)

c) generalized catecholamine (1 mark)

d) generalized eicosanoid (1 mark)

e) Which of these hormones can pass through the plasma membrane without assistance? Why? (3 marks)

_____

_____

cont'd...

38. Draw the basic hypothalamic-pituitary-adrenal (HPA) and the hypothalamic-pituitary-gonadal endocrine and neuroendocrine circuits in male mammals. Show both inhibitory and stimulatory pathways for each. Indicate how the hormones of the HPA axis inhibit those of the HPG axis. **(15 marks)**

ZOO325 Endocrine Physiology
November 13, 2006
Midterm Examination II

Name
Student Number

The test is out of 40 marks. Do not use pencil. Tests written in pencil will NOT be marked.

Part I Multiple Choice Questions: Please circle the most correct answer. Only one answer is correct. Each question is worth 1 Mark. Total: 25 marks.

1. The majority of vasopressin synthesized in the supraoptic nucleus is released from the

a) SON
b) PVN
c) Neurohypophysis
d) Adenohypophysis
e) Median eminence
f) Amygdala

2. The regulation of calcium in higher teleosts involves:

a) a static equilibrium between bones and body tissues; and a static equilibrium between the external environment and body tissues.

b) an active equilibrium between bones and body tissues; and a static equilibrium between the external environment and body tissues

c) an active equilibrium between bones and body tissues and an active equilibrium between the external environment and body tissues

d) a static equilibrium between bones and body tissues and an active equilibrium between the external environment and body tissues

e) a biological equilibrium between bones and body tissues and a static equilibrium between the external environment and body tissues

f) a biological equilibrium between bones and body tissues and a biological equilibrium between the external environment and body tissues.

3. Two orthologous genes are

a) genes that have similar functions
b) genes that have a similar structure
c) genes that arise directly from a gene or genome duplication
d) genes that get copied as a function of speciation
e) genes present in an ancestor of two species but are no longer present today
f) none of the above

4. Somatostatin and growth hormone releasing hormone release secretion rhythms are an example of

a) infradian rhythms
b) seasonal rhythms
c) ultradian rhythms
d) daily rhythms
e) circadian rhythms
f) moradian rhythms

5. Which of the following hormones is released by the juxtaglomerular cells?

a) renin
b) angiotensin-I
c) angiotensin-II
d) angiotensinogen
e) all of the above
f) none of the above

6. One of the actions of orphinin is

a) analgesia
b) thermogenesis
c) hyperalgesia
d) feeding
e) osmoregulation
f) satiety in calcium appetite

7. What organ secretes calcitonin in mammals?

a) parathyroid gland
b) thyroid gland
c) Harderian gland
d) adrenal gland
e) interrenal gland
f) pituitary gland

8. Why is it possible to predict the structure of GnRH in dinosaurs?

a) dinosaur GnRH was found from DNA in dinosaur fossils
b) dinosaurs had the same genes as us therefore have the same GnRH
c) the structure of GnRH paralogues and orthologues are known in closely related living species
d) all vertebrates have the same structure of GnRH
e) dinosaurs do not have gene or peptide paralogues
f) dinosaur genes are orthologous to shark genes

9. What are three sites of leptin action in the brain?

a) nucleus accumbens, paraventricular nucleus, and nucleus of solitary tract
b) nucleus accumbens, lateral hypothalamus, and nucleus of solitary tract
c) lateral hypothalamus, paraventricular nucleus, and nucleus of solitary tract
d) nucleus accumbens, paraventricular nucleus, and dorsovagal complex
e) nucleus accumbens, dorsovagal complex, and nucleus of solitary tract
f) nucleus accumbens, paraventricular nucleus, and lateral hypothalamus

10. Actions of prolactin on birds include:

a) increase in body mass and astrocyte proliferatin
b) growth of intestinal mucosa and decrease in gonadal mass
c) increased gonadal mass and astrocyte proliferation
d) changes in feather growth and increase in gonadal mass
e) decrease in body mass and decrease in gonadal mass
f) decrease in body mass and changes in feather growth

11. The two main branches of the sympathetic nervous system are

a) parasympathetic and interrenal branches
b) vagal and hypoglossal branches
c) adrenal medullary and adrenal cortical branches
d) adrenal medullary and parasympathetic branches
e) sympathetic ganglia and adrenal medullary branches
f) sympathetic ganglia and interrenal branches

12. The thyroid hormones T3 and T4 have been implicated with the following actions:

a) sodium ion regulation
b) urotensin-II release
c) decreased thermogenesis
d) growth hormone release
e) all of the above
f) none of the above

13. Ground squirrels living in the boreal forest show a reduced stress response relative to populations in open alpine regions because

a) boreal forest squirrels have more predators because the predators can hide from the squirrels
b) boreal forest squirrels are naturally more stress resistant
c) open alpine squirrels are naturally more stress resistant
d) boreal forest squirrels have ACTH activated by vasopressin and not CRF
e) boreal forest squirrels are more protected from predators
f) open alpine squirrels have ACTH released by both vasopressin and CRF

14. Two genes are said to be paralogous when they

a) have similar functions
b) have a similar structure
c) they arise directly from a gene or genome duplication
d) get copied as a function of speciation
e) are present in an ancestor of two species but are no longer present today
f) are found in both the germ and somatic lines of cells

15. What is the predominant cation in blood plasma that is required for extracellular fluid balance?

a) K^+
b) Cl^-
c) Na^+
d) Ca^{2+}
e) Mg^{2+}
f) H^+

16. What are two targets of calcium calmodulin (CaM)?

a) cAMP and cGMP
b) phosphodiesterase (PDE) and MAP kinase (MAPK)
c) CRF and Urocortin
d) cAMP and PDE
e) cGMP and MAPK
f) cAMP and MAPK

17. In amphibians, alpha MSH release from the pars intermedia is stimulated by

a) NPY and dopamine
b) CRF and dopamine
c) NPY and CRF
d) CRF and TRH
e) NPY and GABA
f) Dopamine and GABA

18. The paraventicular nucleus synthesizes which of the following peptides?

a) vasopressin, NPY, galanin, somatostatin
b) CRF, NPY, galanin, somatostatin
c) vasopressin, ACTH, CRF, TRH
d) CRF, galanin, TRH, vasopressin
e) TSH, vasopressin, NPY, CRF
f) T8H, CRF, galanin, oxytocin

19. In fish, urotensin-II has been linked with a number of functions including:

a) aldosterone release and chloride ion regulation
b) cortisol release and angiotensin-II regulation
c) blood pressure changes and calcium ion regulation
d) aldosterone release and calcium ion regulation
e) blood pressure changes and angiotensin-II release
f) chloride ion regulation and blood pressure changes

20. Actions of atrial naturietic peptide (ANP) include:

a) decreased glomerular filtration rate and increased aldosterone secretion
b) stimulation of sodium resorption and decreased aldosterone secretion
c) increased renin secretion and decreased aldosterone secretion
d) increased glomerular filtration rate and inhibition of sodium resorption
e) increased thirst and decreased glomerular filtration rate
f) increased thirst and stimulation of sodium resorption

21. In mammals, actions of calcitonin include

a) inhibition of calcium adsorption in bone and decrease of calcium absorption in kidney
b) increased calcium appetite and increased ANP release from heart
c) inhibition of calcium adsorption in bone and increased calcium appetite
d) decreased calcium appetite and stimulation of calcium adsorption in bone
e) decreased ANP release from heart and stimulation of calcium adsorption in bone
f) inhibition of calcium adsorption in bone and increase of calcium adsorption in kidney

22. What are three hypothalamic hormones that can stimulate the somatotropes to release growth hormone?

a) dopamine, epinephrine, PACAP
b) somatostatin, PACAP, dopamine
c) GHRH, galanin, dopamine
d) GHRH, ghrelin, PACAP
e) PACAP, galanin, acetylcholine
f) GHRH, ghrelin, dopamine

23. If you ate salty popcorn, which of the following hormones would you expect to increase first?

a) ANP
b) Aldosterone
c) Oxytocin
d) Angiotensin-II
e) Renin
f) Cortisol

24. What are three peripheral hormones that act to provide satiety feedback during feeding?

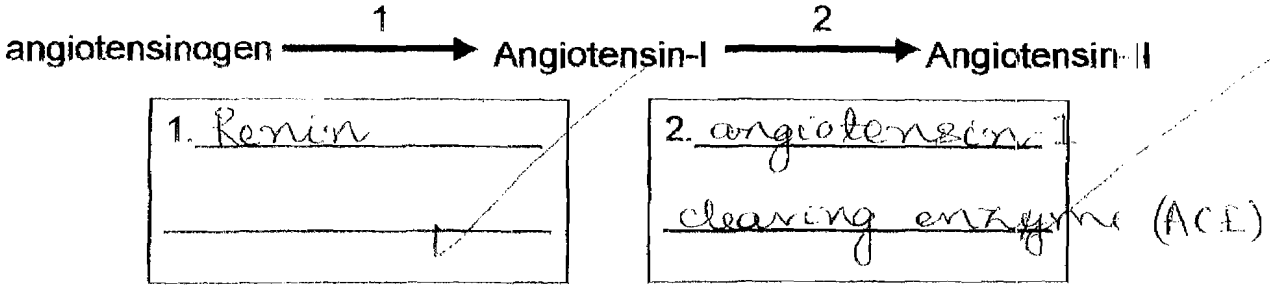
a) epinephrine, PACAP and leptin
b) leptin, GLP-1 and insulin
c) insulin, epinephrine and calcitonin
d) GLP-1, CRF and calcitonin
e) Neuropeptide Y, galanin and CRF
f) CRF, MSH and leptin

25. Photic information from the retina is transmitted to the suprachiasmatic nucleus via,

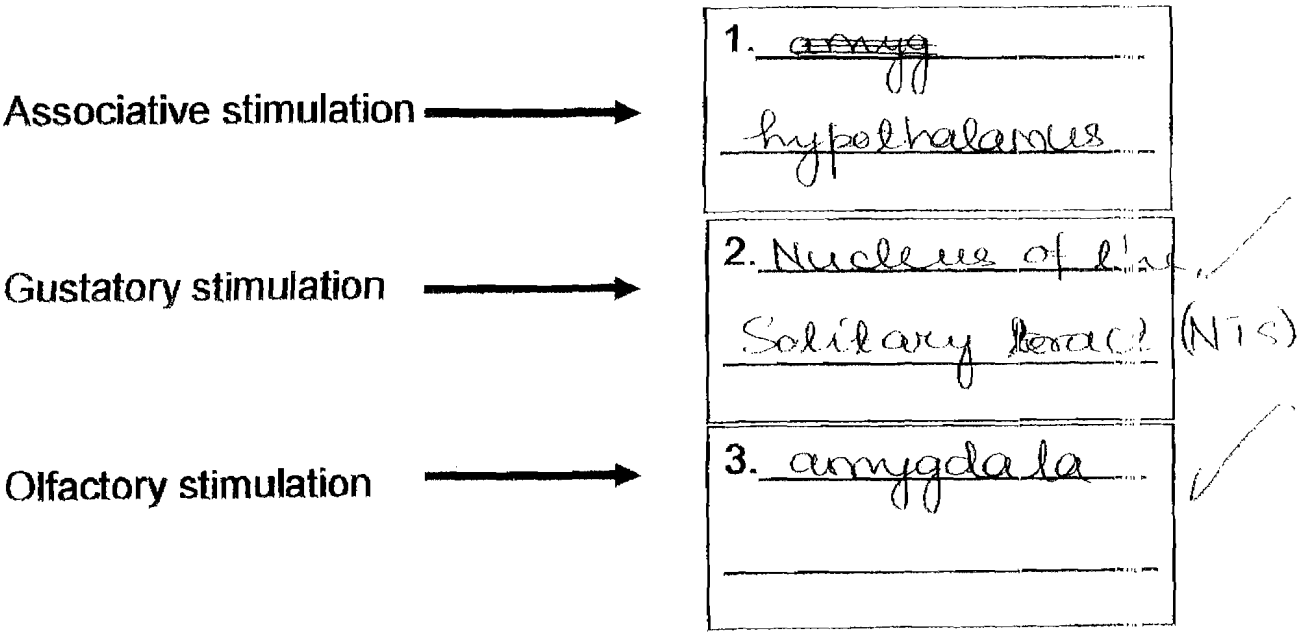
a) CRF and NPY
b) VIP and NPY
c) PACAP and GABA
d) NPY and glycine
e) VIP and glutamate
f) PACAP and glutamate

Part II. Write in the correct answer: Please circle the most correct answer. Each question is worth various marks. Total: 15 marks.

26. Please write the correct enzyme associate with angiotensinogen processing, in the box provided (2 Marks)



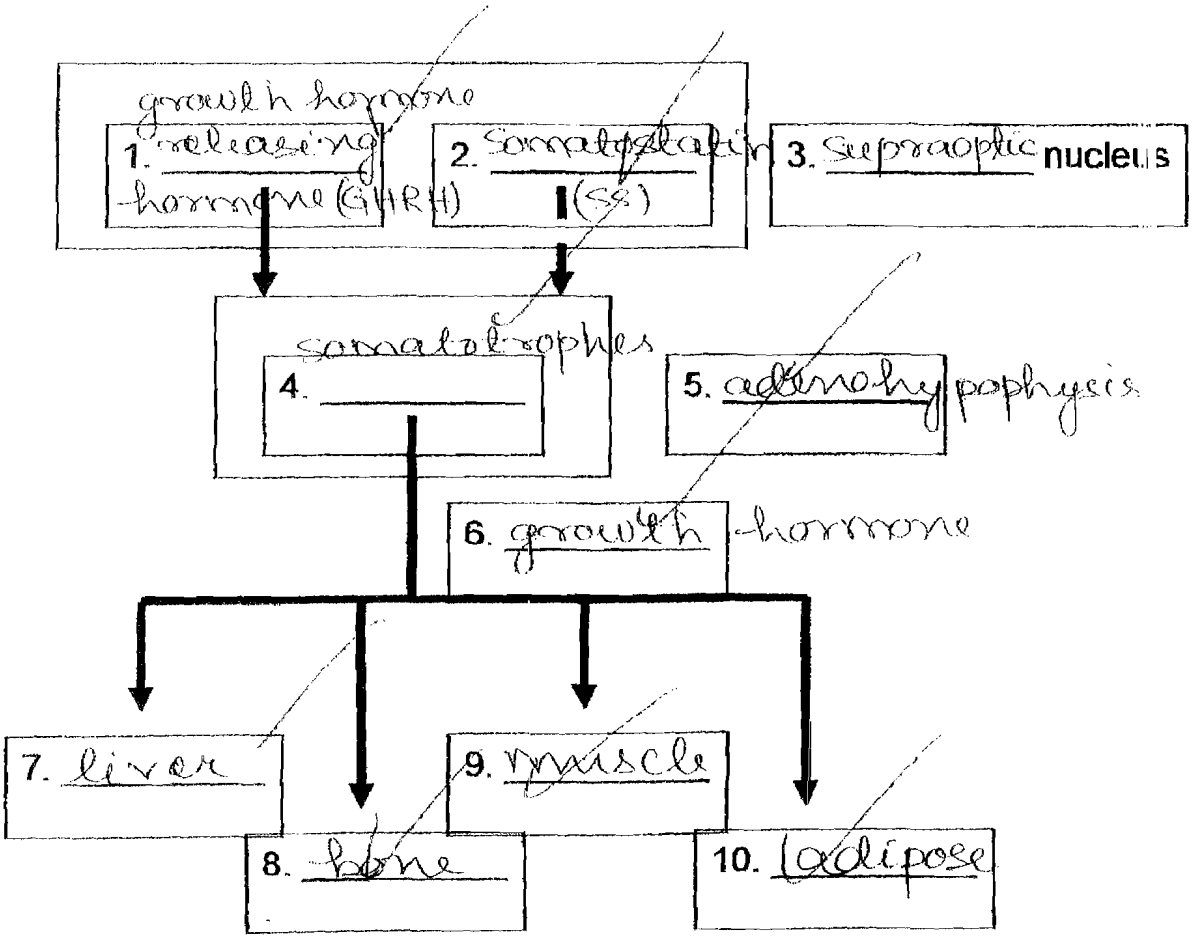
27. Provide the region of the brain that has been implicated with the following types of appetite stimulation (3 Marks).



28. Label the components of the growth hormone neuroendocrine axis: (10 Marks)

1, 2: hypothalamic regulatory hormones
3: the hypothalamic nucleus where these hormones are found
4: the pituitary cell type where the pituitary hormone is released
5: region of the pituitary where these cell types are located
6: principal hormone released from the pituitary
7-10: examples of four target ~~hormones~~ tissues that the pituitary hormone has an action on

Dotted line: inhibitory circuit; solid line: stimulatory circuit



PLEASE HAND IN

UNIVERSITY OF TORONTO
Faculty of Arts and Science

DECEMBER 2006 EXAMINATIONS

ZOO 325H1F

Duration – 2 hours

No Aids Allowed

Name: _____

Student Number:_____

Please answer all questions on the examination sheet. Please write in pen, examinations written in pencil will not be graded. There are four sections to this examination for a total of 70 marks. Read questions carefully before answering. There are 10 pages in this examination.

Part I. Multiple Choice Questions: Please circle the most correct answer. Each question is worth 1 Mark. Total: 25 Marks

1. The pineal body receives photic input from the retina via which of the following pathways?

a) retina, intergeniculate leaflet, suprachiasmatic nucleus, pineal
b) retina, suprachiasmatic nucleus, dorsal raphe nucleus, pineal
c) retina, paraventricular nucleus, suprachiasmatic nucleus, pineal
d) retina, suprachiasmatic nucleus, paraventicular nucleus, pineal
e) retina, suprachiasmatic nucleus, dorsal raphe nucleus, pineal
f) retina, intergeniculate leaflet, dorsal raphe nucleus, pineal

2. The inhibition of the onset of puberty is achieved primarily by:

a) tumour necrosis factor alpha and glutamate
b) glutamate and neuropeptide Y
c) neuropeptide Y and GABA
d) GABA and leptin
e) tumour necrosis factor alpha and GABA
f) glutamate and leptin

3. Ultradian rhythms refer to biological rhythms that have a periodicity

a) of anything greater than a day
b) of slightly greater than a day but less than approximately a month
c) of about a day
d) of less than a day, but greater than a couple of hours
e) anything less than a day
f) of exceptionally long timespans, for example, migratory and hibernation periods

4. During the follicular phase of the menstrual cycle,

a) estradiol has a facilitatory action on GnRH neurons
b) estradiol has an inhibitory action on GnRH neurons
c) prolactin is actively inhibiting GnRH neurons
d) prolactin is being actively released by the adenohypophysis
e) progesterone has a facilitatory action on GnRH neurons
f) progesterone has an inhibitory action on GnRH neurons

5. Mammalian Sertoli cells secrete:

a) activin and inhibin
b) FSH, LH and estradiol
c) testosterone and activin
d) FSH and inhibin
e) estradiol and inhibin
f) estradiol, testosterone and activin

6. What was thought to be the original physiological role of melatonin?

a) growth factor
b) antioxidant
c) neurotransmitter
d) hormone
e) enzyme co-factor
f) nutrient

7. Two hormones implicated in pair-bonding behaviours are:

a) CRF and NPY
b) CRF, and vasopressin
c) vasopressin and NPY
d) vasopressin and oxytocin
e) oxytocin and ACTH
f) vasopressin and ACTH

8. What kind of biological rhythm does a Tau mutant hamster have?

a) circadian
b) supradian
c) infradian
d) ultradian
e) microdian
f) nanodian

9. GnRH-II neurons originate in the

a) anterior neural ridge
b) lateral neural ridge
c) ventral tegmentum
d) olfactory placode
e) olfactory nerve
f) hypothalamus

10. Melatonin is initially synthesized from

a) dopamine
b) epinephrine
c) 5-hydroxytryptamine
d) norepinephrine
e) chatecholamines
f) acetylcholine

11. The teachings of Paracelsus and his followers represented a significant advance in physiology and medicine because

a) they were the first to understand the magic of alchemy
b) they purified the first hormone
c) they suggested that disease was not due to punishment from God
d) they introduced concepts of chemistry into medical practices
e) b and c, only
f) c and d, only

12. The pituitary structure of coelacanths is structurally simlar to that found in

a) birds
b) sturgeons
c) sharks
d) lungfish
e) salamanders
f) bowfin

13. GnRH I is to GnRH II as

a) growth hormone is to growth hormone releasing hormone
b) CRF is to urocortin 1
c) Neuropeptide Y is to CRF
d) FSH is to LH
e) Urocortin 1 is to urotensin-I
f) TRH is to TSH

14. The peripheral epinephrine activation of the amygdala during emotional stress and learning follows which route?

a) area postrema—nucleus of the solitary tract—raphe nucleus
b) subfornical organ—nucleus of the solitary tract—locus coeruleus
c) area postrema—dorsovagal complex—raphe nucleus
d) subfornical organ—dorsovagal complex—locus coeruleus
e) area postrema—nucleus of the solitary tract—locus coeruleus
f) subfornical organ—dorsovagal complex—raphe nucleus

15. Two basic regulatory components of vertebrate osmoregulation are

a) solute concentration and extracellular fluid volume
b) cytosolic and extracellular fluid volume
c) sodium and potassium regulation
d) sodium and chloride regulation
e) tissue osmoregulation and fluid osmoregulation
f) cardiac hormones and renal hormones

16. What are the three basic phases of a stress response?

a) catecholamine; adrenal cortisol activity; tissue/organ responses
b) parasympathetic; sympathetic; arousal
c) adrenal medullary; sympathetic ganglionic; adrenal cortisol
d) adrenal medullary; adrenal cortisol; parasympathetic
e) catecholamine; vagal; tissue/organ responses
f) adrenal medullary, catecholamine; tissue/organ responses

17. The principal adrenal hormone that inhibits CRF is

a) aldosterone
b) corticosterone
c) neuropeptide Y
d) ACTH
e) Norepinephrine
f) Dopamine

18. Cellular dehydration occurs when

a) the ion concentration in the cell is greater than outside the cell
b) the ion concentration is equal on both sides of the cell plasma membrane
c) cellular water loss is reduced by calcium influx
d) the ion concentration in the cell is less than the ion concentration outside of the cell
e) b and c, only
f) c and d, only

19. Actions of prolactin on the follicle and corpus luteum include:

a) inhibition of estradiol synthesis and inhibition of progesterone synthesis, respectively
b) inhibition of estradiol synthesis and maintenance of progesterone synthesis, respectively
c) maintenance of estradiol synthesis and maintenance of progesterone synthesis, respectively
d) maintenance of estradiol synthesis and inhibition of progesterone synthesis, respectively
e) inhibition of estradiol synthesis and inhibition of inhibit secretion, respectively
f) maintenance of estradiol synthesis and maintenance of inhibin secretion respectively

20. The aggressive behaviour of the female spotted hyena has been attributed to

a) excess production of androstenedione
b) a lack of estradiol
c) excess production of dihydroxytestosterone
d) a lack of progesterone
e) b and d, only
f) none of the above

21. Vasopressin originating from the paraventricular nucleus and released into the median eminence

a) stimulates oxytocin release from the neurohypophysis
b) stimulates aldosterone release from the adrenal gland
c) increases water reuptake by the kidney
d) releases cortisol via ACTH release
e) stimulates renin production from juxtaglomerular cells
f) stimulates renin production from the macula densa

22. The urophysis is structurally similar to the

a) hypothalamus
b) adenohypophysis
c) neurohypophysis
d) epiphysis
e) epididymus
f) pineal gland

23. Which statement is not true about the pituitary gland?

a) the pars distalis originates in Rathke's pouch
b) It is derived from tissue in the anterior neural ridge
c) It receives direct neurosecretory input from the hypothalamus in teleosts
d) The gonadotropins are present in the ventral lobe in elasmobranchs (sharks)
e) It is present in all chordate species
f) It is connect to the brain by a vascular portal sytem in frogs

24. Relative to ANP, BNP and CNP are

a) orthologues
b) paralogues
c) analogues
d) splice variants
e) juxtalogues
f) autologues

25. Two of the physiological consequences of calcitonin release might be

a) decrease plasma calcium and increase parathyroid hormone
b) increase plasma calcium and increase parathyroid hromone
c) increase parathyroid hormone and decrease parathyroid hormone
d) decrease parathyroid hormone and decrease parathryroid hormone
e) decrease parathyroid hormone and increase acellular bone
f) increase parathyroid hormone and decrease acellular bone

Part II. Fill in the blanks: Each question is worth various marks. Total 22 Marks

26. What are three types of neural and neuroendocrine-type toxins found in metazoan species that are active in vertebrates? **(4 Marks)**

_____ _____ _____

27. Provide the names of three basic types of alleochemicals and indicate their actions on the producer of these chemicals by circling the correct choice. **(6 marks)**

Type of Alleochemical	Action on producer
_____	disadvantage benefit
_____	disadvantage benefit
_____	disadvantage benefit

28. Provide the regions that are activated by the amygdala output pathways during arousal **(6 Marks)**

Forebrain: _____ _____

Midbrain: _____ _____

Hindbrain: _____ _____

29. What are three stages in the evolution of reproductive pheromones? **(3 marks)**

_____ _____

_____

30. What are the two basic olfactory systems associated with the detection of pheromones in vertebrates: **(2 marks)**

_____ _____

31. What is the basic difference between alleochemicals and pheromones **(1 mark)**

_____

Part III Neuroendocrine and Endocrine Circuits. Total 8 Marks

32. Draw the basic components of the endocrine and neuroendocrine regulatory circuit for lactation. Provide hypothalamic, pituitary and gonadal inputs. Label all components accurately. **(8 Marks)**

Part IV. Problem-Based Questions: Each question is worth various marks. Total: 15 Marks

33. You have discovered a number of peptides and are trying to determine whether they are orthologous or paralogous: Consider the following peptide sequences, where each letter represents a particular amino acid.

Peptide W: H-W-A-E-L
Peptide X: R-Y-T-S-G
Peptide Y: R-F-T-A-G
Peptide Z: K-Y-S-A-G

Imagine you have found these peptides in various species:

Species A: Peptides W, X and Z were found only
Species B: Peptide W, X was found only
Species C: Peptide X and Y were found only.

Which peptide (s) are orthologous? (Please circle the correct answer) **2 Marks**

a) peptides Z and W in species A
b) peptides W and X in species A and B
c) peptides Z and Y in species A and C
d) peptides X, Y and Z
e) a and b, only
f) b and c, only

34. Anthropogenic pollutants have been implicated with decreased reproductive fitness in a number of species including humans. Explain how these pollutants could act to disrupt elements of the hypothalamo-pituitary-adrenal (HPA) and hypothalamo-pituitary-gonadal axis (HPG) to inhibit sperm production in terrestrial animals. (Use back of sheet, if necessary) **(5 Marks)**

35. Consider the following scenario: After trying a novel food item, you become sick. Following that experience you discover that even the thought of that food item makes you sick. In addition, the thought of that food item makes you lose your appetite. Explain which endocrine, neuroendocrine and neurological pathways are associated with this phenomenon, and how they are integrated. **(8 Marks)**

CSB325 Endocrine Physiology
October 11, 2007
Midterm Examination I

Name _____

Student Number _____

Part I Multiple Choice Questions: Please circle the most correct answer. Only one answer is correct. Do not use pencil. Tests written in pencil will NOT be marked. Each question is worth 1 Mark. Total: 30 marks.

1. The majority of vasopressin release from the supraoptic nucleus is released from
   a) SON
   b) PVN
   c) Neurohypophysis
   d) Adenohypophysis
   e) Median eminence
   f) Amygdala

2. Which of the following hormones is released by the juxtaglomerular cells?
   a) renin
   b) angiotensin-I
   c) angiotensin-II
   d) angiotensinogen
   e) all of the above
   f) none of the above

3. Why is it possible to predict the structure of GnRH in dinosaurs?
   a) dinosaur GnRH was found from DNA in dinosaur fossils
   b) dinosaurs had the same genes as us therefore have the same GnRH
   c) the structure of GnRH paralogues and orthologues are known in closely related living species
   d) all vertebrates have the same structure of GnRH
   e) dinosaurs do not have gene or peptide paralogues
   f) dinosaur genes are orthologous to shark genes

4. Two genes are said to be paralogous when they
   a) have similar functions
   b) have a similar structure
   c) they arise directly from a gene or genome duplication
   d) get copied as a function of speciation
   e) are present in an ancestor of two species but are no longer present today
   f) are found in both the germ and somatic lines of cells

5. What is the predominant cation in blood plasma that is required for extracellular fluid balance?

a) K^+
b) Cl^-
c) Na^+
d) Ca^{2+}
e) Mg^{2+}
f) H^+

6. Serotonin in the brain:

a) synthesized from melatonin
b) taken up from blood
c) synthesized from blood tyrosine
d) used as a neurotransmitter
e) acts a releasing factor
f) none of the above

7. Inhibitory chloride channels use ligand:

a) epinephrine
b) dopamine
c) GABA
d) acetylcholine
e) glycine
f) a and b
g) c and e

8. G protein coupled receptors:

a) are made of seven subunits
b) bind GTP
c) phosphorylate Galpha
d) phosphorylate Gbeta
e) none of the above
f) b and c

9. Vasopressin stimulates

a) reabsorption of water in kidney tubules.
b) loss of sodium ions in urine.
c) increase in potassium ions in urine.
d) increased glomerular filtration.

10. Angiotensinogen is found in

a) macula densa.
b) juxtaglomerular cells.
c) lungs.
d) blood.

11. Urotensin-II may

a) increase blood pressure and increase chloride transport across the gills.
b) decrease blood pressure and increase chloride transport across the gills.
c) decrease blood pressure and decrease chloride transport across the gills.
d) increase blood pressure and decrease chloride transport across the gills.

12. An example of a C_{21} steroid might be:

a) androgens
b) estrogens
c) vitamin D
d) aldosterone
e) cholesterol
f) none of the above

13. Secretion of a signalling molecule from the dorsal cell layer of Trichoplax into the mesenchyme layer is an example of:

a) juxtacrine secretion
b) intracrine secretion
c) exocrine secretion
d) endocrine secretion
e) paracrine secretion
f) autocrine secretion

14. What mechanisms do the agnathan fishes utilize to allow communication between the hypothalamus and the pars distalis?

a) diffusion
b) portal system
c) direct neural communication
d) a and b only
e) b and c only
f) a, b and c

15. Examples of prebiotic nitrogenous compounds are:

a) urea
b) fatty acids
c) amino acids
d) formaldehyde
e) a and c only
f) a and d only

16. A distinguishing feature of the Dipnoi pituitary gland, relative to the Brachiopterigian

a) the presence of a ventral lobe connected to the pars distalis by an epithelial stalk and a vastly reduced portal system

b) the loss of the epithelial stalk but the retention of a ventral lobe of the pars distalis located above the buccal cavity

c) a vastly reduced portal system and a proliferation of neurosecretory nerve terminals in the neurohypophysis

d) an expanded neurohypophysis, and a lobular pituitary gland featuring a more developed portal system

e) the presence of a highly interdigitated pars nervosa and the reduction of a portal system

17. Atrial naturietic peptide acts to

a) decrease glomerular filtration rate; increase renin secretion.

b) increase both renin secretion and glomerular filtration rate.

c) decrease both renin secretion and glomerular filtration .

d) increase glomerular filtration rate; decrease renin secretion.

18. The hypothalamo-pituitary portal system

a) conveys hormones from the pituitary lobe into the brain

b) conveys releasing factors and other hormones from the brain to the pituitary gland

c) is an arterial vascular system

d) is part of the organum vasculosum of the lamina terminalis

19. Steroid hormones

a) cross the blood-brain barrier and plasma membrane

b) are secondary messengers

c) are structurally related to peptide hormones

d) all of the above

20. If N-methyl transferase is not produced in the catecholamine biosynthetic pathway, then we might predict that the following hormones would be present:

a) dopamine and epinephrine

b) dopamine and norepinephrine

c) dopamine, epinephrine and norepinephrine

d) epinephrine and norepinephrine

e) L-DOPA only

f) none of the above.

21. If the purpose of the blood brain barrier is to restrict the large molecules of the vascular system into the brain, how do the small hormones like calcitonin enter the brain?

a) Hormones of the endocrine system are small and pass easily through the blood brain barrier via passive diffusion.

b) Hormones do not need to communicate with the brain because the brain has its own autocrine feedback loop on nerves that communicate with the various endocrine organs.

c) Hormones from outside of the brain bind to receptors located in circumventricular organs and cross the blood brain barrier.

d) The endocrine organs signal the pars distalis, which then communicates to the brain via the hypothalamus

e) Hormones are transported across the blood brain barrier.

f) The blood brain barrier restricts the passage of toxins but not hormones. For this reason, humans are sensitive to synthetically prepared hormones such as contraceptive hormones.

22. Prohormone convertases

a) activate hormones by transporting them out of the cell
b) cleave preprohomones in the endoplasmic reticulum
c) cleave prohormones
d) cleave prohormone mRNA
e) b and c

23. Thyroxine stimulating hormone is

a) steroid hormone
b) quarternary structure peptide
c) tripeptide
d) releasing factor

24. Pars intermedia secretes:

a) MSH and endorphins
b) vasopressin and oxytocin
c) enkephalins
d) ACTH
e) c and d

25. If you ate salty popcorn, which of the following hormones would you expect to increase first?

a) ANP
b) Aldosterone
c) Oxytocin
d) Angiotensin-II
e) Renin
f) Cortisol

26. Evidence suggest at about 2 billion years passed from the time of the first true cells to the first heterotrophic metazoans. What are plausible theories for this long lag phase?

a) The early Earth was subject to intense meteorite bombardment and, thus complex organisms could not evolve during this period.
b) Metazoans required a coordinated neuroendocrine system for acquiring and extracting energy from nutrient sources
c) Metazoans required a sensory system.
d) Metazoans required vascular system for endocrine function.
e) a and c only
f) Metazoans required extracellular matrix proteins.

27. If osmoreceptors in the brain trigger vasopressin from the supraoptic nucleus, then
    a) ACTH is released from the pars distalis.
    b) drinking behaviour is stimulated.
    c) cortisol may be released from the adrenal cortex.
    d) aldosterone may be released from the adrenal cortex.

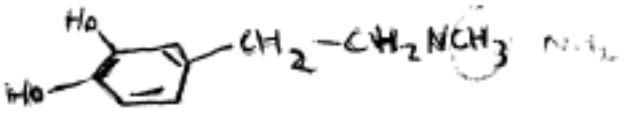
28. Phospholipase C
    a) is activated by inositol phospholipids
    b) activates protein kinase C
    c) binds G protein coupled receptors
    d) binds calcium
    e) releases cAMP
    f) b and d

29. In the absence of estrogen estrogen receptors are located
    a) nucleus and cytoplasm
    b) cytoplasm
    c) membrane
    d) bound to DNA
    e) none of the above

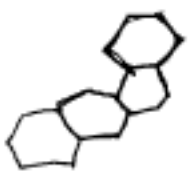
30. The teleost urophysis secretes
    a) urotensin-II
    b) urotensin-I
    c) ACTH
    d) prolactin
    e) a and c, only
    f) a and b, only

Part II

Draw structure of dopamine (2 marks)

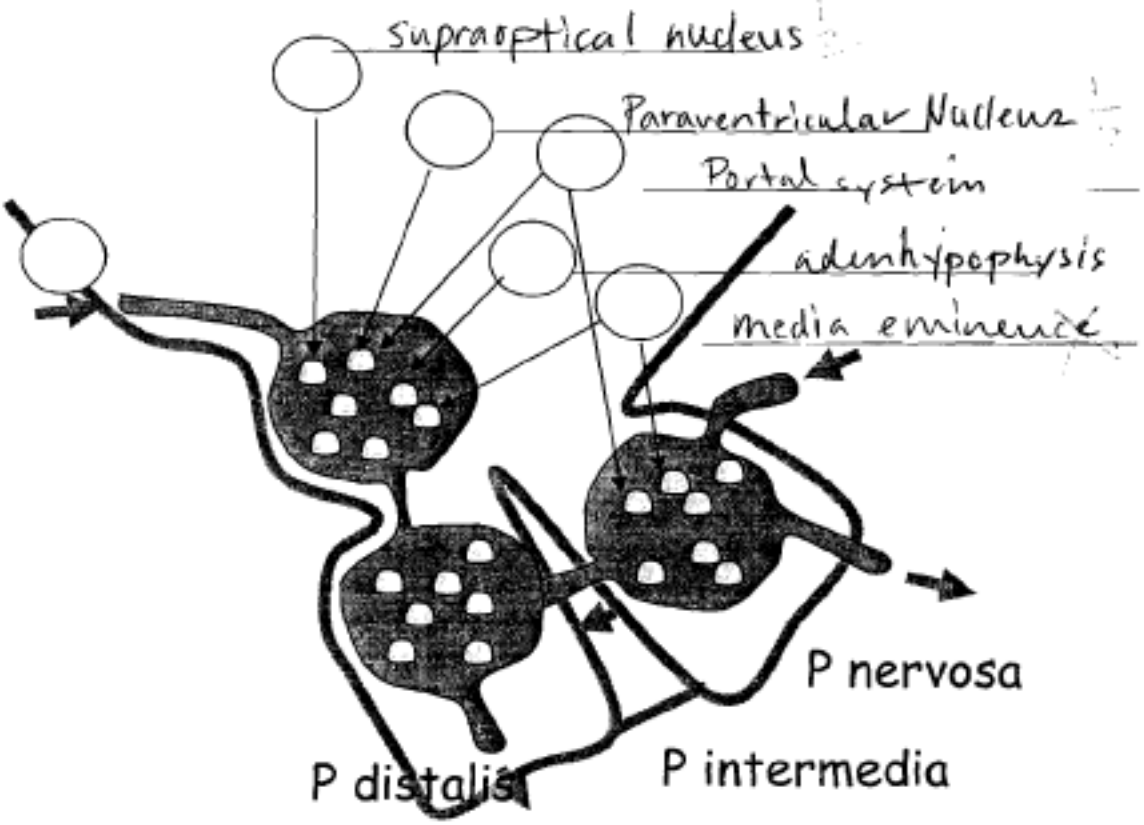


Draw structure of generalized steroid (3 marks)



Part III

26. In labels 1 to 5 indicate the nuclei in mammalian hypothalamo-pituitary axis. (Total: 5 marks for full names)



CSB325 Endocrine Physiology
November 12, 2007
Midterm Examination II

Answer Key: Correct answers are in bold.

1. Glucocorticoid receptor upon ligand binding:
    a) activates phosphorylase
    b) activates POMC gene
    c) inhibits glycogen synthetase
    d) inhibits proinflamatory transcription factors

2. Somatostatin inhibits:
    a) growth hormone
    b) ghrelin
    c) norepinephrine
    d) galanin

3. If gustatory stimulation activates locus coeruleus:
    a) leptin is released
    b) somatostatin is released
    c) somatostatin is inhibited
    d) CRF is released
    e) Galanin is inhibited

4. In birds, shortening daytime signals:
    a) increased HPA activity
    b) increased HPG activity
    c) increased melatonin output
    d) breeding
    e) high prolactin

5. Lipolysis is increased by:
    a) NPY
    b) Galanin
    c) Somatostatin
    d) MCH

6. Calcitonin is secreted in response to:
    a) high circulating calcium
    b) high calcium in bones
    c) calcium apetite
    d) vitamin D supplement

e) TSH

7. Osteoblast precursors are stimulated by:
   a) estrogen
   b) calcitonin
   c) glucocorticoids
   d) PTH
   e) Vitamin A

8. Gastrin does/is not
   a) released in response to nervus vagus stimulation
   b) released by G cells in the stomach
   c) stimulate acid secretion
   d) released in response to stomach acid
   e) binds to receptors in oxyntic cells

9. Acid in the intestine stimulates
   a) secretin secretion from S cells in the intestine
   b) gastrin secretion
   c) bile secretion
   d) gastric inhibitory peptide secretion from stomach
   e) more acid secretion

10. Insulin and glucagon are made by
   a) alpha and beta cells of the exocrine pancreas
   b) alpha and beta cells of the endocrine pancreas
   c) intestine
   d) stomach
   e) liver

11. Lipogenesis is stimulated by
   a) catecholamines
   b) glucagons
   c) glucocorticoids
   d) insulin
   e) norepineprine

12. Epinephrine stimulates
   a) lipolysis
   b) gluconeogenesis
   c) digestion
   d) glycolysis
   e) lipogenesis

13. Sitting and watching a TV show would not stimulate
    a) epinephrine mediated glycolysis
    b) epinephrine mediated glycogenolysis
    c) epinephrine mediated lipolysis
    d) stomach acid secretion
    e) gastrin secretion

14. Stimulating taste buds with good food does not activate:
    a) parabrachial nucleus
    b) suprachiasmatic nucleus
    c) amygdala
    d) nucleus accumbens
    e) locus coeruleus

15. Increased production of thyroid hormones would not result in:
    a) suppression of TRH
    b) thermogenesis
    c) metabolic rate increase
    d) inhibition of CRH
    e) catabolic rate increase

16. Calcium is used:
    a) hormone
    b) secondary messenger
    c) binding factor
    d) pituitary releasing factor
    e) osmoregulatory factor

17. In the cells, calcium is released from endoplasmic reticulum in response to
    a) protein kinase G activation
    b) glucocorticoid receptor
    c) phopholipase L activation
    d) phosphodiesterase
    e) cAMP

18. From the parathyroid cells, PTH release is mediated by:
    a) Mg2+ mediated vesicle trafficking and low extracellular Ca2+
    b) Ca2+ mediated vesicle trafficking and high extracellular Ca2+
    c) high extracellular Mg2+
    d) high extracellular Ca2+
    e) none of the above

19. Increased physical activity stimulates:
    a) norepinephrine mediated glycolysis
    b) norepinephrine mediated lipolysis
    c) NPY
    d) Gastrin
    e) insulin

20. Prometamorphosis is stimulated by:
    a) eating
    b) premetamorphosis
    c) hypothlamo pituitary adrenal and thyroid axis
    d) GH
    e) Thyroid hormone but not TSH

21. Sheep breed according to
    a) circadian pattern
    b) ultradian pattern
    c) infradian pattern
    d) none of the above
    e) sheepdian pattern

22. Decreased glycogenolysis is caused by
    a) glucocorticoids
    b) NPY
    c) MCH
    d) TSH

23. A distinguishing feature of glucocorticoids and mineralocorticoids is:
    a) Methyl group
    b) **Hydroxyl group at C11**
    c) aromatization of the A ring
    d) aldehyde group at C18

24. IGF2 does not cause:
    a) large offspring
    b) nitrogen retention
    c) cell proliferation
    d) GH release

25. IGF2 is an imprinted gene because:
    a) one copy is mutated
    b) the copy from one parent is silenced
    c) expressed only in fetus
    d) maternal copy is methylated
    e) paternal copy is insulated

26. Metamorphosis in amphibians is inhibited by:
    a) CRF and TRH activation of thyrotropes
    b) Thyroid hormone regulation of lactotropes and somatotropes
    c) Prolactin
    d) glucocorticoids
    e) ACTH

27. Somatostatin secretion from arcuate nucleus follows:
    a) circadian pattern
    b) ultradian pattern
    c) infradian pattern
    d) none of the above
    e) somatoradian pattern

28. Arcuate nucleus does not secrete:
    a) NPY
    b) Somatostatin
    c) Growth hormone
    d) Ghrelin

29. If parathyroid gland releases PTH:
    a) bones get stronger
    b) vitamin D acts as a secondary messenger
    c) 25 (OH) D-1-α- hydroxylase is activated in kidney
    d) osteocytes are activated
    e) 25 (OH) D-1-α- hydroxylase is activated in intestine

30. Bone building process is inhibited by:
    a) glucocorticoids
    b) androgens
    c) growth hormone
    d) IGF2
    e) calcitonin

31. Food in the stomach stimulates:
    a) gastrin release from G cells
    b) gastrin release from oxyntic cells
    c) glucagons
    d) gastrin-like peptide
    e) estrogen

32. Secretin and cholecystokinin
    a) promote acid secretion
    b) promote pancreatic enzyme secretion
    c) are release in response to glucose

d) are released in response to acid
e) promote gluconeogenesis

33. If you consume a sugary lollipop
a) protein synthesis is stimulated
b) gluconeogenesis is stimulated
c) glucagon is released
d) somatostatin is released
e) lipolysis stimulated

34. Corticotropes do not have receptors for
a) CRF
b) TSH
c) Vasopressin
d) Oxytocin
e) TRH

35. CRF receptors that activate HPA are found in:
a) paraventricular nucleus
b) corticotropes
c) adrenal cortex
d) interrenal
e) adrenal medulla

36. Suprachiasmatic-paraventricular nuclei connection is important in biological clocks because:
a) It regulates cyclic production of thyroid hormones
b) PVN receives light input form retina
c) The HPA axis activation is involved in arousal
d) Melatonin is secreted into PVN
(Either b or c were accepted)

37. BMAL and CLOCK do not regulate transcription of:
a) Cry and Per
b) Rev-erb-alpha
c) Vasopressin
d) Somatostatin

38. Periodic BMAL and CLOCK expression is found in:
a) pineal gland
b) eye
c) suprachiasmatic nucleus

d) lateral hyphothalamus
e) neurohypophysis

39. Nitrogen retention is not promoted by:
a) growth hormone
b) insulin
c) glucocorticoid
d) testosterone
e) corticosteroid

40. The long term consequence of the liposuction may be:
a) perpetual youth
b) CRF activation
c) Anorexia
d) MSH activation
e) weight gain

10/10 +

CSB325 Endocrine Physiology
May 28, 2008
Midterm Examination I

Name_____

Student Number_____

There are 3 parts to this exam. **Total worth 40 marks**.
ANSWER all questions from the First part. First part has 30 questions, **30 marks** worth.
YOU HAVE A CHOICE OF QUESTIONS for second and third parts. You may choose any combination of questions from Parts II and III that add up to a total of **10 marks.**
If you choose to answer questions totaling more than 10 marks, you will not receive any extra marks.

Part I Multiple Choice Questions: Please choose the most correct answer and fill the scantron sheet using a PENCIL. Only one answer is correct. Do not use pen on the scantron. Each question is worth 1 Mark. Total: 30 marks.

1. The teleost urophysis secretes
   a) urotensin-II
   b) urotensin-I
   c) ACTH
   d) a and c, only
   e) a and b, only

2. The nitrogenous molecules present in prebiotic earth were:
   a) fatty acids
   b) glutamic acid
   c) DNA
   d) formaldehyde
   e) none of the above

3. Hypothalamus is a part of:
   a) Rhombencephalon
   b) Prosencephalon
   c) Metencephlalon
   d) Cerebellum

4. Cerebrospinal fluid is found:
   a) surrounding the brain
   b) around spinal cord
   c) ventricles
   d) where the blood brain barrier is
   e) in circumventricular organs

5. Calcitonin is released by the thyroid gland and:
   a) enters the brain via blood-brain barrier receptors to increase calcium appetite
   b) enters the brain via circumventricular organ transporters to increase calcium appetite
   c) enters the brain via circumventricular organ receptors to decrease calcium appetite
   d) enters freely the brain to decrease calcium appetite

6. The majority of oxytocin is released from:
   a) PVN
   b) Neurohypophysis
   c) Adenohypophysis
   d) Median eminence
   e) Amygdala

7. Volvox developed capability of which signaling:
   a) endocrine
   b) intracrine
   c) ionic coupling
   d) juxtacrine
   e) none of the above

8. Nervous system is absent in:
   a) Porifera
   b) Radiata
   c) Cnidaria
   d) Hydra
   e) Lophotrochozoa

9. Ventral nerve chords are present in:
   a) Chordates
   b) Deuterostomes
   c) Acoela
   d) Protostomes
   e) Echinoderms

10. Which hormone is released by the juxtaglomerular cells?
   a) renin
   b) angiotensin-I
   c) angiotensin-II
   d) all of the above
   e) none of the above

11. Two genes are said to be paralogous when they
    a) have similar functions
    b) have a similar structure
    c) they arise directly from a gene or genome duplication
    d) get copied as a function of speciation
    e) are present in an ancestor of two species but are no longer present today

12. Atrial natriuretic peptide acts to
    a) decrease glomerular filtration rate; increase renin secretion.
    b) increase both renin secretion and glomerular filtration rate.
    c) decrease both renin secretion and glomerular filtration .
    d) increase glomerular filtration rate; decrease renin secretion.

13. Studying for an exam and eating salty chips would be expected to increase which hormone first?
    a) Calcitonin
    b) Aldosterone
    c) Oxytocin
    d) Angiotensin-II
    e) Renin

14. Dopamine in the brain:
    a) synthesized from melatonin
    b) taken up from blood
    c) synthesized from blood tryptophan
    d) used as a neurotransmitter
    e) acts a releasing factor

15. Inhibitory chloride channels use ligand:
    a) glutamate
    b) GABA
    c) glycine
    d) a and b
    e) b and c

16. G protein coupled receptors:
    a) are made of seven subunits
    b) bind GTP
    c) activate Galpha
    d) phosphorylate Galpha
    e) inactivate Galpha

17. vasopressin stimulates
    a) aldosterone secretion
    b) reabsorption of water in kidney tubules.

c) reabsorbtion of sodium ions in kidney tubules.
d) increase in potassium ions in urine.
e) increased glomerular filtration.

18. cAMP activation of protein kinase A can be inhibited by:
a) Regulators of G protein signaling
b) phosphodiesterase
c) calcium ions
d) Galpha q
e) none of the above

19. Steroid hormones
a) cross the blood-brain barrier and plasma membrane
b) are secondary messengers
c) are structurally related to peptide hormones
d) all of the above

20. An example of a C_{21} steroid might be:
a) androgens
b) estrogens
c) vitamin D
d) aldosterone
e) cholesterol

21. Secretion of a signalling molecule from the neural cell of Hydra to the epithelial cell is an example of:
a) juxtacrine secretion
b) intracrine secretion
c) exocrine secretion
d) endocrine secretion
e) paracrine secretion

22. What mechanisms do the Holostean fishes utilize to allow communication between the hypothalamus and the pars distalis?
a) diffusion
b) portal system
c) direct neural communication
d) a and b only
e) b and c only

23. Urotensin-II may
a) increase blood pressure and decrease chloride transport across the gills.
b) decrease blood pressure and increase chloride transport across the gills.
c) decrease blood pressure and decrease chloride transport across the gills.
d) increase blood pressure and increase chloride transport across the gills.

24. If osmoreceptors in the brain trigger vasopressin release from the supraoptic nucleus, then

a) ACTH is released from the pars distalis.
b) drinking behaviour is stimulated.
c) cortisol may be released from the adrenal cortex.
d) aldosterone may be released from the adrenal cortex.
e) sodium resorption is decreased in kidney tubules

25. A distinguishing feature of the Dipnoi pituitary gland, relative to the Brachiopterigian

a) the presence of a ventral lobe connected to the pars distalis by an epithelial stalk and a vastly reduced portal system
b) the loss of the epithelial stalk but the retention of a ventral lobe of the pars distalis located above the buccal cavity
c) a vastly reduced portal system and a proliferation of neurosecretory nerve terminals in the neurohypophysis
d) an expanded neurohypophysis, and a lobular pituitary gland featuring a more developed portal system
e) the presence of a highly interdigitated pars nervosa and the reduction of a portal system

26. If N-acetyl transferase (NAT) is not produced because of the gene mutation, then we might predict that the following hormones would not be present:

a) dopamine and epinephrine
b) dopamine and melatonin
c) dopamine, epinephrine and norepinephrine
d) epinephrine and norepinephrine
e) serotonin
f) none of the above.

27. If the purpose of the blood brain barrier is to restrict the large molecules of the vascular system into the brain, how do the small hormones like calcitonin enter the brain?

a) Hormones of the endocrine system are small and pass easily through the blood brain barrier via passive diffusion.
b) Hormones do not need to communicate with the brain because the brain has its own autocrine feedback loop on nerves that communicate with the various endocrine organs.
c) The endocrine organs signal the pars distalis, which then communicates to the brain via the hypothalamus
d) Hormones are transported across the blood brain barrier.
e) none of the above

28. Prohormone convertases

a) activate hormones by transporting them out of the cell
b) cleave preprohomones in the endoplasmic reticulum
c) cleave prohormones
d) cleave prohormone mRNA
e) b and c

29. Phospholipase C

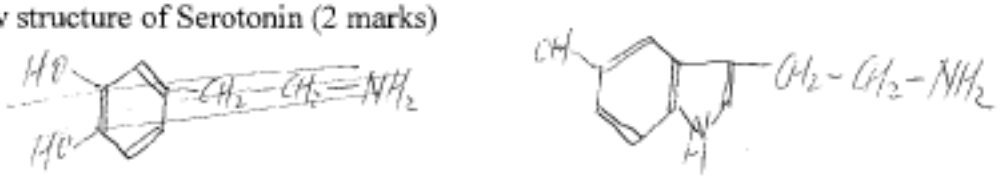
a) is activated by inositol phospholipids
b) activates protein kinase C
c) binds G protein coupled receptors
d) binds IP3
e) releases cGMP

30. Calcitonin is secreted in response to:

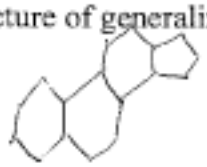
a) high circulating calcium
b) high calcium in bones
c) calcium apetite
d) vitamin D supplement
e) none of the above

Part II Draw structures in PEN.

Draw structure of Serotonin (2 marks)



Draw structure of generalized steroid (3 marks)



Part III. Short answers. Please answer in the space provided in PEN.

1. Explain why it took 0.5bn year for the cells to arise but 2.5bn years for the first multicellular organism, name essential events (2marks)

2. Explain importance of symmetry in endocrine signaling (2marks)

3. Explain the difference between old and new theories on the development of the pituitary gland (2marks)

4. Explain the difference between Elasmobranch and Amphibia pituitary glands (2 marks)

5. Explain importance of circumventricular organs naming them all (5 marks).

Pineal gland, area postrema, median eminence, neurohypophysis, organum vasculosum subfornical organ, subcommissural organ.
Circumventricular organs lack the blood-brain barrier. These 'breach points' allow the brain and blood to have contact, and the trafficking of factors that are unable to cross the blood-brain barrier otherwise. For example, the neurohypophysis allow the release of hormones from the brain into the blood.

6. Explain the stimuli that regulate vasopressin and the downstream consequences (5marks).