PCZO 102 | Zoology 102 | Comparative Anatomy and Phylogeny of Vertebrates | 5 | 3 hrs. lect; 6 hrs lab
---|---|---|---|---
Subject Code | Subject Title | Descriptive Title | Credit Unit(s) | Hour(s)/Week

I. COURSE DESCRIPTION

The course is a comparative study of the morphology and physiology of the organ systems and their phylogeny through various vertebrate groups.

Pre – requisite: Zoology 11

II COURSE OUTCOMES

At the end of the course, the students should be able to:

1. trace the development of the human body as revealed by the study of the different vertebrates.
2. describe the structure and the functions of the different vertebrate groups with the use of specific representative types from each group.
3. relate the development and evolution of the organ systems in preparation for the study of the higher disciplines such as Embryology, Evolution and Human Anatomy.
4. appreciate and validate the history of the evolution of the various vertebrate organ-systems by comparing their conditions in different representative animals dissected.
5. apply the knowledge gained in Comparative Anatomy and Phylogeny of Vertebrates and enhance other productive endeavors such as animal husbandry, dissection and preserving specimens.
6. justify behaviors that are consistent with the core values of the university.
## III. COURSE PLAN

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<th>Teaching Strategies</th>
<th>Time Allotment</th>
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</table>
| At the end of the unit, the students should be able to: 1. enumerate, discuss, and recognize the important characteristics of the vertebrates based on symmetry, metamerism and cephalization | Unit I – Introduction  
A. Symmetry – Types and Examples  
B. Metamerism  
1. Homonomy and Heteronomy  
2. Evolutionary process making possible the shift from homonomous to heteronomous condition  
C. Cephalization  
D. Analogy and Homology  
1. Convergence and Divergence  
2. Types of Homologous Structures  
E. Ontogeny and Phylogeny | Socialized discussion,  
Oregami on the characteristics of vertebrates  
Research reading on evolutionary processes making possible the change from homonomous to heteronomous condition  
Laboratory Activities on the external anatomy of the milkfish and the cat to identify the different planes and axes of their bodies | One week | Quizzes  
Recitation  
Written Report (graded w/ rubrics)  
Laboratory work |
| 2. differentiate and associate homonomy from heteronomy, convergence from divergence, homology from analogy, ontogeny from phylogeny. | | | | |
| At the end of the unit, the students should be able to: 1. enumerate, compare and contrast the different characteristics of chordates 2. distinguish and organize larger group of chordates into smaller groups using several bases of classification such as their evolution, habitat, common distinctive traits, similar modes of development, etc. 3. classify and categorize the different representative species for each class through different taxonomic categories like their phyla, classes, orders, families, genera, species, scientific names. | Unit II-Classification of Phylum Chordata  
A. Important Characteristics and the Representative Types  
B. Classification of Phylum Chordata  
1. Subphylum Hemichordata  
2. Subphylum Urochordata  
3. Subphylum Cephalochordata | Exercises on the different classes of Chordates  
Slide presentation  
Exercises on the Classification of Chordates  
Assignment on the classification of chordates  
Recitation on the assignment  
Lecture-discussion on the backgrounds of the Taxonomy of the representative animals  
Field trips with album submission on said activity | Two weeks | Quizzes  
Practical exam  
Laboratory work  
Recitation  
Written Report (graded w/ rubrics) |

Legend: *To be discussed in the laboratory
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</thead>
<tbody>
<tr>
<td>4. enumerate and relate the important characteristics of each group taking note of the similarities and differences in structures and functions.</td>
<td>4. Subphylum Vertebrata a. Superclass Pisces Classes:  - Agnatha  - Placodermi  - Chondrichthyes  - Osteichthyes C. Orders/ genera &amp; species, under each class &amp; their characteristics b. Superclass Tetrapoda Classes:  - Amphibia  - Reptilia  - Aves  - Mammalia: D. Summary of Classification Laboratory Work Perform the exercises on the external anatomy of the representative specimens</td>
<td>Use of Taxidermied models of the representative vertebrates Game Simulation</td>
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<td>5. derive effective results from the experiments with honesty and diligence.</td>
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<td>6. express an appreciation on the unique features of the chordate groups.</td>
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</table>

At the end of the unit, the students should be able to:
1. discuss and assess the different stages of the vertebrate development
2. point out and relate the different chordate eggs to the type of cleavage they undergo
3. describe and trace the specific fate of each of the developing structures of the germ layers of the zygote

<table>
<thead>
<tr>
<th>Unit III – Vertebrate Development</th>
<th>Unit test</th>
<th>Laboratory work</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Different Types of Chordate Eggs</td>
<td>Slide presentation</td>
<td>Flow chart</td>
</tr>
<tr>
<td>B. Types of Cleavage</td>
<td>Laboratory investigation</td>
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<tr>
<td>C. Blastulation</td>
<td>Observe the life cycle either of the frog or chicken</td>
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<tr>
<td>D. Gastrulation</td>
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<td>E. Formation and Differentiation of the Mesoderm</td>
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<tr>
<td>F. Neurulation</td>
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<td>G. Notochord Formation</td>
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<td>H. Organogenesis</td>
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<tr>
<td>I. Comparison of the different chordate embryos*</td>
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Legend:  *To be discussed in the laboratory
<table>
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<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>4. compare and contrast human development with the lower chordates development</td>
<td>Laboratory Work: Use of models on the embryonic development of the frog</td>
<td>Slide presentation</td>
<td></td>
<td>Practical Exam Oral Exam Quizzes Participation in various activities (Graded with Rubrics)</td>
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<tr>
<td>5. show professionalism by conducting experiments at the expense of various forms of life for the sake of scientific advancement</td>
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<tr>
<td>At the end of unit, the students should be able to:</td>
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<tr>
<td>1. compare and cite the integuments of the chordate representative types</td>
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<td>2. discuss and establish the generalized functions of the chordate skin</td>
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<td>3. enumerate and assess the different skin outgrowths specific for each class</td>
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<td>4. account for the similarities and differences in the anatomy of the skin of the group</td>
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<td>5. discuss adaptive radiation and state and organize the importance in all vertebrate classes</td>
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<td>6. practice personal hygiene and sanitation</td>
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<td><strong>Unit IV – The Integumentary System and Adaptive Radiation</strong></td>
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<td>A. Functions of the Integumentary System</td>
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<td>B. General Structure of the Chordate Skin*</td>
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<td>C. Comparative Anatomy of the Skin</td>
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<td>D. The Different Skin Outgrowths (Exoskeleton) and Adaptive Radiation</td>
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<td></td>
<td>E. Comparative Anatomy of the Skin Outgrowths*</td>
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<td></td>
<td>Laboratory Work: Draw the different integumentary derivatives of the different chordates</td>
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<td>2. Examine the prepared slides and preserved integumentary derivatives</td>
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<td><strong>Unit V – Skeletal System of the Vertebrates</strong></td>
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<tr>
<td></td>
<td>A. General Considerations</td>
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<tr>
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<td>1. Functions of the endoskeleton</td>
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<td>2. Elements of the skeleton</td>
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<td>3. Divisions of the skeletal system</td>
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</table>
### Learning Outcomes

3. make a report on the differences and similarities among the skeletons of the representative types.
4. organize briefly the development of the different components of the skeleton.
5. breakdown and describe each part of the skeletons of the vertebrate representative types.

### Course Content

#### B. Comparative Anatomy of the Endoskeleton

1. The Skull
   a. Development
   b. Formation of the Components
   c. Comparative anatomy of the skull of the different representative types
   d. Types of accessory organs

2. The Vertebral Column
   a. Development
   b. Structure of the vertebra*
   c. Comparative anatomy of the chordate vertebral column

3. Ribs and Sternum
   a. Generalized structure*
   b. Comparative anatomy of the representative types
   c. Development and Evolution

6. Girdles (Pectoral/Pelvic)
   a. Elements of the Girdle*
   b. Comparative Anatomy
   c. Evolution

7. Limbs (Bones of the Forelimbs and Hindlimbs)
   a. Fins of the Fishes*
   b. Paired Appendages*
   c. Comparative Anatomy
   d. Evolution and Development

### Teaching Strategies

- Sponge activity
- Labeling a blank diagram of the skeleton
- Require the students to collect the skeletal leftovers of the chicken, pig and fish and bleach for use in identifying of parts.

### Time Allotment

<table>
<thead>
<tr>
<th>Laboratory Work:</th>
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<tbody>
<tr>
<td>Use of skeletal models of the representative specimens</td>
</tr>
</tbody>
</table>

### Evaluative Measures
### Learning Outcomes

At the end of the unit, the students should be able to:

1. Make a tabulation of the different types of muscles as to origin, insertion, action, structure and movement
2. Discuss the different muscle types in vertebrate organs
3. Illustrate the development of the muscular system
4. Explain the structures of the vertebrate muscles with special reference to the skeletal muscles
5. Validate the structures of the different representative types relating each to evolution
6. Value the physiology of muscles to the body

### Course Content

**Unit VI – Muscular System**
- A. Functions of the Muscular System
- B. Anatomy of the three types of vertebrate Muscles
- C. Types of Muscles
- D. Evolution and Development of Muscles
- E. Comparative Anatomy of the Representative Types*

**Laboratory Work:**
1. Expose the muscles of the cat and shark
2. Identify the axial, appendicular, branchiomeric and hypobranchial muscles of the representative animals

### Teaching Strategies

- Group discussion
- Dissection of the specimens of the different representative types (shark, milkfish, turtle, chicken, cat)
- Locate muscles on actual specimens
- Internet viewing of muscular dissection of the shark and cat

### Time Allotment

- Two weeks

### Evaluative Measures

- Graded recitation
- Practical exam
- Report on muscular system (Graded with Rubrics)
- Laboratory work

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### Learning Outcomes

At the end of the unit, the students should be able to:

1. Make a reflection journal on the functions of the respiratory system
2. Compare and contrast the different respiratory tracts of the different representative types

### Course Content

**Unit VII – Respiratory System**
- A. Functions of the Respiratory System
- B. Generalized structures of the vertebrate respiratory system
- C. Comparative anatomy of:
  - a. nasal passages
  - b. pharyngeal pouches and gills
  - c. swim bladders
  - d. lungs and airducts

### Teaching Strategies

- Socialized discussion of organs
- Concept mapping
- Film viewing
- Lecture Discussion
- Discussion of the different representative types
- Internet viewing of respiration

### Time Allotment

- One week

### Evaluative Measures

- Quizzes
- Laboratory Work
- Concept map (Graded with Rubrics)
- Reflection Journal (Graded with Rubrics)
- Written report (Graded with Rubrics)

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Legend: * To be discussed in the laboratory
### Learning Outcomes

3. discuss with the use of diagram the development of the respiratory organs
4. prepare a report on the parts of the respiratory tracts of the different representative types based on actual specimens
5. categorize similarities and differences in structures of the representative types.
6. trace the evolutionary processes involved which made possible the development of the different structures
7. demonstrate the mechanisms of respiration and its significance to life

### Course Content

D. Comparative anatomy of the tetrapod respiration

Laboratory Work:
1. Dissection and identification of the parts of respiratory tract

### Teaching Strategies

Group discussion
Film showing
Concept Mapping
Dissection of actual specimens
Game simulation
Internet surfing on the digestive process

### Time Allotment

One week

### Evaluative Measures

Practical exam
Oral and written test
Prepared concept map on Digestive System (Graded with rubrics)
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<tbody>
<tr>
<td>At the end of the unit, the students should be able to:</td>
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<tr>
<td>1. establish and infer the relationship existing between the excretory and</td>
<td>Unit IX- Excretory System</td>
<td>Lecture Demonstration using prepared slides on the cross-section of the kidney</td>
<td>One week</td>
<td>Reaction paper (Graded with Rubrics)</td>
</tr>
<tr>
<td>reproductive system.</td>
<td>A. Functions of the Excretory System</td>
<td>Prepared drawings showing the anatomy of the different representative types</td>
<td></td>
<td>Quiz</td>
</tr>
<tr>
<td>2. enumerate and explain the different functions of the system.</td>
<td>B. Structure of the Vertebrate Excretory System*</td>
<td>Film viewing</td>
<td></td>
<td>Diagram (graded w/ rubrics)</td>
</tr>
<tr>
<td>3. differentiate the three types of vertebrate kidneys.</td>
<td>C. Comparative anatomy of the Excretory Systems of anamniotes and amniotes</td>
<td>Panel Discussion</td>
<td></td>
<td>Written report (graded w/ rubrics)</td>
</tr>
<tr>
<td>4. make a diagram to determine the structures of the different representative</td>
<td>D. Effect of the environment on kidney functions and structure</td>
<td>Dissection and Identification of the parts of the excretory system</td>
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<td>types and account for their similarities and differences</td>
<td></td>
<td>Internet surfing</td>
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<td>5. prepare a report on the evolution of the system</td>
<td>Laboratory Work:</td>
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<tr>
<td>6. safeguard the normal conditions of the excretory system.</td>
<td>1. Dissection and identification of the parts of the excretory system</td>
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<tr>
<td>At the end of the unit, the student should be able to:</td>
<td>Unit X- Reproductive System</td>
<td>Group discussion using prepared drawings showing the anatomy of the different</td>
<td>One week</td>
<td>Paper &amp; pencil test</td>
</tr>
<tr>
<td>1. articulate the functions of the reproductive system.</td>
<td>A. Functions of the Reproductive System</td>
<td>representative types</td>
<td></td>
<td>Practical Exam</td>
</tr>
<tr>
<td>2. sketch the structures of the different representative types and account for</td>
<td>B. Female Reproductive System</td>
<td>Charts of the male and female vertebrate reproductive system models</td>
<td></td>
<td>Participation in various activities (Graded with Rubrics)</td>
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<tr>
<td>their similarities and differences</td>
<td>C. Comparative anatomy of:</td>
<td>Internet surfing</td>
<td></td>
<td>Reflection paper (Graded with Rubrics)</td>
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<tr>
<td></td>
<td>1. Ovaries</td>
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<td>2. Oviducts</td>
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</thead>
<tbody>
<tr>
<td>3. make a reflection journal on the evolution of the reproductive system</td>
<td>D. Male reproductive system</td>
<td>Film showing on chordate reproduction</td>
<td>One week</td>
<td>Quiz Practical exam Concept Map (Graded with Rubrics)</td>
</tr>
<tr>
<td>4. develop consciousness of the sanctity of the reproductive act and realize its spiritual and moral implications.</td>
<td>E. Comparative Anatomy of:</td>
<td>Group discussion</td>
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<td></td>
<td>1. Testes</td>
<td>Dissection and identification of the regions of the reproductive system</td>
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<td>2. Male ducts</td>
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<td>3. Copulatory organs</td>
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<td>Laboratory Work:</td>
<td>Identification of the organs of the Reproduction System</td>
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<tr>
<td>At the end of the unit, the students should be able to:</td>
<td>Unit XI – Circulatory System</td>
<td>Lecture discussion using prepared illustrations of the comparative anatomy of the representative types</td>
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<tr>
<td>1. relate the different functions of the circulatory system to its structure</td>
<td>A. Functions of the Circulatory System</td>
<td>Prepared slides of the cross-section of the heart, blood vessels, etc.</td>
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<td>Quiz Practical exam Concept Map (Graded with Rubrics)</td>
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<tr>
<td>2. compare the blood vascular systems of the different representative types</td>
<td>B. Blood Vascular System</td>
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<tr>
<td>3. prepare a concept map of the processes involved in the development and evolution of the system.</td>
<td>C. Comparative Anatomy of the Blood Vascular System</td>
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<td>4. tabulate the similarities and differences of the system</td>
<td>D. Lymphatic system</td>
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<td>5. value the importance of physical fitness</td>
<td>a. Lymph hearts</td>
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<td>6. practice the principle of moderation in all the aspects of life</td>
<td>b. Lymph sinususes</td>
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<td>c. Lymph vessels</td>
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<td>d. Lymph nodes</td>
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<td>E. Comparative anatomy of the Lymphatic System</td>
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<tr>
<td></td>
<td>a. Lymph hearts</td>
<td>Dissection and identification of the regions of the circulatory system</td>
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<td>Quiz Practical exam Concept Map (Graded with Rubrics)</td>
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<td></td>
<td>b. Lymph sinuses</td>
<td>Role playing on blood circulation</td>
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<td>Quiz Practical exam Concept Map (Graded with Rubrics)</td>
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<td></td>
<td>c. Lymph vessels</td>
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<td>Quiz Practical exam Concept Map (Graded with Rubrics)</td>
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<td></td>
<td>d. Lymph nodes</td>
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<td>Quiz Practical exam Concept Map (Graded with Rubrics)</td>
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<td>Laboratory Work:</td>
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<td>Quiz Practical exam Concept Map (Graded with Rubrics)</td>
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<td></td>
<td>1. Dissection and identification of the regions of the excretory system</td>
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<td>Quiz Practical exam Concept Map (Graded with Rubrics)</td>
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</tbody>
</table>

At the end of the unit, the students should be able to:

1. relate the functions of the nervous system to its structure
2. identify and describe the different parts of the nervous system.

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<tr>
<th>Unit XII- Nervous System and Sense Organs</th>
<th>Teaching Strategies</th>
<th>Time Allotment</th>
<th>Evaluative Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Functions of the Nervous System</td>
<td>Group discussion using prepared illustrations of the comparative anatomy of the central nervous system Concept map of the nervous System</td>
<td>Two weeks</td>
<td>Quiz Practical Exam Participation to various activities (graded with rubrics)</td>
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<tr>
<td>B. Central Nervous System</td>
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<tr>
<td>C. Comparative Anatomy of the Central Nervous System</td>
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Prepared slides of the cross-section of the heart, blood vessels, etc.
Preserved specimens of the different representative types
Tracing of patterns
Concept mapping
Dissection and identification of the regions of the circulatory system
Role playing on blood circulation
### Learning Outcomes

3. prepare a concept map of the origin, distribution and functions of the different cranial and spinal nerves.
4. employ a way to compare the nervous system of the different representative types.
5. diagram the development and evolution of the nervous system structures.
6. identify and describe the different sensory receptors.
7. refrain from emotional tension, shock, sudden outburst of feeling.

### Course Content

D. Peripheral Nervous System
E. Comparative Anatomy of the Peripheral Nervous System
F. Autonomic Nervous System
G. Comparative Anatomy of the Autonomic Nervous System
H. Sense Organs
I. Comparative Anatomy of the Sense Organs

#### Laboratory Work:
1. Dissection and identification of the regions of the nervous system

### Teaching Strategies

Socialized discussion using preserved specimens of the different nervous systems and sense organs
Cooperative Learning
Dissection and identification of the regions of the nervous system

### Time Allotment

One week

### Evaluative Measures

Quiz
Report evaluation (Graded with Rubrics)

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At the end of the unit, the students should be able to:

1. compare the different ductless glands in the body.
2. relate the general functions of the endocrine system to the specific functions of each endocrine gland.
3. tabulate structural differences and similarities in the different

### Course Content

Unit XIII- Endocrine System
A. Functions of the Endocrine System
B. Types of endocrine glands
C. Comparative anatomy of the following:
   1. Pituitary
   2. Thyroid
   3. Parathyroid
   4. Adrenal

### Teaching Strategies

Small group discussion using prepared illustrations
Charts
Tracing of pathways
Reporting using power point
Production, role playing number as culminating activity
Pop-up of the different body

### Time Allotment

One week

### Evaluative Measures

Quiz
Report evaluation (Graded with Rubrics)
<table>
<thead>
<tr>
<th>Learning Outcomes</th>
<th>Course Content</th>
<th>Teaching Strategies</th>
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<tbody>
<tr>
<td>6.  inculcate in the minds of the students on how to promote and maintain healthful living habits.</td>
<td>Laboratory Work: 1. Dissection and identification of the regions of the endocrine system</td>
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<td>7.  manifest a healthy attitude in accepting God’s providence in the life process.</td>
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<td>8.  learn to accept the physiological changes in individuals as they grow older.</td>
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</tbody>
</table>
III. TEXTBOOKS AND LABORATORY MANUAL:


Suggested Readings:


Electronic References:

www.zoology. ubc.ca/courses
www.science.widener.edu
www.sru.edu/depts/artci/bio