BIOlogy II (BIO1201)

instructor’s handbook

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| **Course Information** | | | | |
| **Course title:** | Biology II (Lecture and Laboratory) | | | |
| **Course code:** | BIO1201 | | | |
| **Credit Hours:** | 4 credit hours | | 3 hours lecture and 3 hours lab per week for 15 weeks | |
| **Prerequisite:** | BIO1101 | | | |
| **Text:** | **Lecture** | Biology by OpenStax (Rice University); free online or as iBook; print copy available on order: <https://openstax.org/details/biology> | | |
| **Lab** | “Biology II - BIO1201 Laboratory Manual” OER available as PDF at <https://openlab.citytech.cuny.edu/oer-biology/labs/> | | |
| **Website** | <https://openlab.citytech.cuny.edu/oer-biology/>  (no sign-up needed) | | | |
| **Material** | Lab coat, disposable gloves and dissecting kit | | | |
| **Course Description:** | Biology II is the second half of First Year General Biology for non-science and science majors at New York City College of Technology. The course is a survey of organisms belonging to the Domains Archaea and Bacteria and, more extensively, the groups spanning the four kingdoms of the Domain Eukarya. A special focus will be dedicated to higher animal organization, ranging from animal tissues to organs and organ systems, and how these systems compare and contrast among other vertebrates and invertebrates. | | | |
| **Grading Procedure (see Grading Policies for details)** | | | | |
| Lecture: 50% | | | | Lab: 50% |
| The Lecture component will include at least 4 exams plus other assignments at the discretion of the Instructor. The Lab component will include at least 5 quizzes and a midterm and final practicums.  **Students must pass (*i.e.* score 60 or above) both components (lab and lecture) to pass the course.** | | | | |
| **Course Coordinator** | | | | |
| **Dr. Tatiana Voza** | | | | |
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**Grading Policies**

**Computing grades for the course**

Students’ performance on this course will be evaluated as follows:

* Lecture: 50% of final grade (based on at least 4 - and a maximum of 6 - exams and 20% attendance/participation)
* Lab: 50% of final grade, based on at least 5 quizzes (30% of the lab grade) and uniform midterm and final practical exams (50% of the lab grade) and attendance/participation (20% of the lab grade)

**Students must pass (*i.e.* score 60 or above) both components (lab and lecture) to pass the course.**

**Dropping & Curving grades**

Make sure you **do not** drop any grade or curve them; a better way to help students is to offer the entire class an additional test (they have to earn it).

**Make-up exams**

The department has a NO MAKE-UP policy. Inform your students of this and remind them regularly. If acceptable documentation is provided, a make-up can be arranged but this should be a **rare and exceptional** occurrence. In the situation where a make-up exam is granted, the **test should meet at least one of the following conditions**:

* a penalty of 10 points
* a short answer questions or essay format
* the test is administered with the final exam.

Any medical note has to be presented to the Center for Student Accessibility who will review it and determine whether or not an accommodation/adjustment (such as a make-up test) should be granted.

**Attendance and Lateness**

**Attendance/Participation Grades**

At City Tech, attendance is not mandatory and poor attendance cannot on its own result in a failing grade (missing exams can as they result in a grade of 0). However, physical absences, and lack of consistency with the online work, are directly linked to (poor) performance and can be disruptive. Hence, a **portion (20%) of the lab and lecture grades depends on attendance/participation**. Details are indicated in the syllabus. It is important to let students know that their attendance matters, and poor attendance will lead to a loss of points. Let students know (and remind them throughout the semester) what the policy is and how you will assess their attendance/participation.

* In Person Classes: It is strongly advised to give easy individual or group pop quizzes, chapter review or short questions for the attendance/participation grade. Such assignments engage students, encourage them and stimulate their critical thinking.
* Online Classes: provide **weekly assignments** (quizzes, Discussion Board participation, on Blackboard) and/or use graded incentives and class activities for **attending, and participating in, the online synchronous online classes.**

**Taking Attendance**

It is instructors’ duty to take attendance at the start of class; even if a little time consuming, this is better done by calling students on the class roster. Passing sign-up sheets has proven ineffective in addition to not being conducive to learning students’ names. Furthermore, remember that **attendance sheets are legal documents**; it is hence crucial to keep them as accurate as possible. **Presence, absence, lateness and early departure should be recorded for each student**.

**ACADEMIC INTEGRITY**

**Informing Students**

Make sure you remind your students of the academic integrity policy (what is academic dishonesty, what sanctions and procedures apply) of the college. Cheating and plagiarizing are NEVER allowed. As stated in the college catalog, cheating is the “*unauthorized use or attempted use of material, information, notes, study aids,* ***devices*** *or communication during an academic exercise*”. Hence make sure your students know that cell/smart phones or smart watches, tablets, headpieces, etc… are NOT allowed during exams, and in classes in general.

Below are some examples of cheating as listed in the City Tech catalog (*by no means is it an exhaustive list*):

*• Copying from another student during an examination or allowing another to copy your work.*

*• Unauthorized collaboration on a take-home assignment or examination.*

*• Using notes, or any digital device, during a closed-book examination.*

*• Taking an examination for another student, or asking or allowing another student to take an examination for you.*

*• Changing a graded exam and returning it for more credit.*

*• Submitting substantial portions of the same paper to more than one course without consulting each instructor.*

*• Preparing answers or writing notes in an exam booklet before an examination*.

**Reporting and Sanctioning**

ALL instances of academic dishonesty (cheating and plagiarism) should be documented and reported to course coordinators and the academic integrity officer. In addition, a grade of 0 should be administered to students caught cheating on an exam or turning in plagiarized work.

It is **not appropriate** for instructors to:

* Turn a blind eye when students cheat or plagiarize
* Let student get away with cheating with a ‘friendly’ warning or a few points retrieved from their grade.

**TEXTBOOK AND LAB MANUAL**

Please ask your students to get their textbook and lab manual. Students should not rely on slides and handouts only, they **need to read** and learn how to extract and organize the pertinent information. This is key to their future success in all possible fields they chose to pursue a career in and, of course, upper level courses.

Make sure you:

* Inform them about the free **digital versions** of the books (textbook and lab manual) - affordability is no obstacle.

**LABORATORY RULES & SAFETY**

**Students**

Students are required to wear their **lab coat at all time** when in a lab room. They are also expected to bring their gloves and dissection kits when needed. On the first lab meeting, students are required to read, sign and abide by the Lab Rules & Safety document provided by the CLT’s. Students should always wait outside of the lab until their instructor arrives.

**Instructors**

It is your responsibility to keep the signed page of the Lab Rules & Safety document and enforce safety rules. This means, for example, not allowing students without the proper attire (lab coat, gloves) in your lab and hence, counting them as absent. Similarly, any students refusing to follow your instructions or comply with safety rules, should be asked to leave the laboratory.

Any set-up issue or incident should be reported to the course coordinator(s).

**Material and Equipment**

All equipment and material used should be cleaned, turned off and placed back in their designated location. Any damaged material should be left on the instructor’s desk with the corresponding log sheet filled out. Broken glassware should be placed in the appropriate container and dissected specimens should be discarded as instructed by CLTs (not in regular trash).

At the end of classes, instructors and students should work together to leave the laboratory room and set-ups clean and organized; projectors and computers should be turned off and boards wiped off.

**LECture exams**

At least 4 lecture exams should be administered, and no grade should be dropped. It is advised to **keep exams**, (giving them back to students or letting them see their graded online test, may result in circulation of the tests between students and across sections and semesters) and offer students to consult their tests if they wish to do so (in person or online), during office hours, before or after class... In addition, for grade appeal purposes, graded final exams should be kept by instructors for 3 years before being discarded.

Each test should be a good **mix of factual, application and comprehension questions**, not just

the simplest factual (and easiest) questions; the number of questions on each topic should reflect the amount of time and material dedicated to them, as shown on the syllabus.

**In person Classes**

Lecture exams should be an hour long and consist of at least 50 questions (multiple choice, short answers, true/false, match correct term, fill-in the blanks).  **All tests should include a header with the course and section #, your name, the semester (or date), the number of questions and the time allotted for the test**. To prevent cheating, it is also advised to scramble tests and use and distribute different versions of the same exam when administering them.

**Online Classes**

In order to discourage cheating and effectively assess students, lecture exams should be at least an hour long and designed to allow **45-50 seconds per question**. For example, a 60-minute exam should include between 72 and 80 questions.

When posting exams on Blackboard, the following settings should be used:

* NO multiple attempts
* Do not choose “Forced completion” as this prevents students who lose connection to resume their tests.
* Time allowed: XX minutes and Auto-Submit ON (if students log out during their test, they can log back on but the timer will keep running thus the test still has to be completed in one sitting)
* Availability: during class time for synchronous classes. No more than 3 days for asynchronous classes (it is best to include weekends and at least one weekday and evening such as *Friday (00:01 am) to Sunday (11:59 pm)* or *Saturday (00:01 am) to Monday (11:59 pm)*.
* Do not allow students to take the test if due date has passed (no make-up tests departmental policy)
* Include in Grade Center calculations (the score will show immediately after completion of the test)
* Show test results: NO – select “Choose” (this will prevent the circulation of the test questions and exam screenshots on “cheating site”).
* ONE question at a time (to limit the possibility of pictures of the test being taken)
* NO backtracking (so they cannot take pictures of the test or check with someone)
* RANDOMIZED questions (so students cannot complete the test in tandem or groups)

For online asynchronous classes, when designing and posting exams on Blackboard, it is best to create larger **pools of questions** for each topic. This allows to have each student tested on the same number, but different randomized subsets, of questions for each topic. This results in slightly different tests from one student to another while ensuring they are all assessed equally on each topic and limiting the possibilities of cheating.

**Review Sheets For Exams**

Providing review sheets can be helpful when they help students study and have them go over all the material. A list of detailed learning outcomes and new vocabulary make a good review.

Review sheets **should not** be:

* Test bank questions (with or without answers)
* A list of specific questions with answers
* Paraphrased exam questions
* Previous exams or exams from other instructors or institutions
* Cheat-sheet that will prepare students only for that exam *i.e.,* indirectly giving out questions to students prior to exam

*Note: A copy of your exams and/or review sheets can be requested by the course coordinator(s) or chairperson at any time. This is to ensure curriculum coverage and assessment standardization across sections.*

**Lecture Exams Questions / Test banks**

For all lecture exams, questions are taken from a pool (test bank) provided by the course coordinator(s).

Under no circumstances should these test banks be shared with students or left on classroom or library computers or used for review purposes.

*Note: A copy of your exams and/or review sheets can be requested by the course coordinator(s) or chairperson at any time. This is to ensure curriculum coverage and assessment standardization across sections.*

**Laboratory Quizzes, Reports & Practicums**

**Lab Quizzes Format**

For all sections, quizzes should be about 10-30 min long and consist of multiple choice, short answers, true/false and/or labeling questions.

**Lab Reports Format**

If lab reports are required by an instructor, they should follow a scientific paper format as much as possible (*i.e*., Abstract, Introduction, Materials & Methods, Results, Conclusion/Discussion). If reports are the results of group work, instructors should make all efforts to ensure that all members of the group contribute equally to the work and that all students in the group get the same grade. As students tend to be very honest in grading each other, you can require that each student anonymously scores the other members of his/her group for their contribution (the grading form can be a grid with categories such as responsiveness, research contribution, discussion contribution, participation/meeting availability…).

**Laboratory Midterm Practicum**

On week 9, ALL lab sections will start the class with a 30 min uniform midterm practical exam. The test will be prepared by the course coordinator and delivered by CLT’s. The test will cover material from week 2-8 (bacteria, protists, fungi, plants, invertebrates). The test will focus on the classification/identification of all the different organisms and labeling and function of their key structures and features.

For each section, instructors will return the exams to the course coordinator as soon as graded and reviewed with students.

Instructors should remember that:

* Students’ success on the midterm practicum will be dependent on **proper coverage of the curriculum** and completion of all activities and observations listed in the syllabus.
* The lab midterm practicum questions will not be communicated to instructors beforehand.
* The lab midterm grade represents 25 % of the lab grade (10% of the final course grade).

**Laboratory Uniform Final Practicum Format**

A uniform final practical exam is scheduled to be given to all students in all sections, on week 15, on the last lab meeting date.

This exam will cover ALL material covered from week 9 through week 13 inclusive. The uniform portion of the final will be comprised of pictures of dissections (fetal pig and sheep brain, provided by the CLT’s) with structures to identify in about 25 minutes. Instructors can choose to have additional questions on the lab material and have their last quiz on that same date. The total duration of the final exam (uniform only or semi uniform, as decided by the instructor) will be anywhere between 30 min-2hrs and timed (limited time to sequentially identify structures and answer questions).

The list of structures to know for the uniform final practical exam will be communicated to instructors towards the end of the term.

**Review Sheets For Lab Exams**

Providing review sheets can be helpful when they help students study and have them go over all the material. A list of detailed learning outcomes and new vocabulary do make a good review.

Review sheets **should not** be:

* Test bank questions (with or without answers)
* A list of very specific questions with answers
* Paraphrased exam questions
* Previous exams or exams from other instructors or institutions
* Cheat-sheet that will prepare students only for that exam *i.e.,* indirectly giving out questions to students prior to exam.

*Note: A copy of your exams and/or review sheets can be requested by the course coordinator(s) or chairperson, at any time. This is to ensure curriculum coverage and assessment standardization across sections.*

**VIRTUAL ACTIVITIES / STUDENTS’ LAPTOPS**

**Virtual Activities**

Several **virtual dissections** are installed on laptop (stored in a small, wheeled cabinet in the lab room) provided to students during labs. Instructors need to make time to allow students to go over these activities aiming at increasing their understanding of the concepts and structures while enabling and engaging them (especially those reluctant to handling specimens). As instructors use the laboratory desktop, students can work in groups or individually on the laptops while observing the real dissected specimen provided.

**Laptops**

Laptops are not to be taken out of lab rooms and should be used for lab activities only. After use, they are to be placed back in the locked cabinets they are stored in. The cabinet should be plugged to an outlet to make sure all laptops batteries get charged for subsequent uses.

**EXTRA CREDIT / BONUS POINTS**

**In person Classes**

Extra credit points and questions can further motivate students. Whether in lecture or labs, bonus points should however be earned and deserved and **cannot make up for more than 5% of a grade**. Such points can be under the form for additional questions on a test, a reward for proper attire/behavior in the lab, great handling, and careful dissection of specimens.

Extra credit take-home assignments (short paper or half page on a topic, report on a site visit, event, …) should be avoided. However, if allowed by an instructor, they should be offered to the entire section, not a subset of students, and realistically accessible to all of them. Such work **cannot replace a test grade or count as such** and will still represent no more than 5% of a test (quiz or exam). **No extra credit points can count directly towards a final lecture or lab grade**.

**Online Classes**

Given the online format and the implicit open book testing, Extra credit points of any sort are **strongly discouraged** for online classes. Instead, emphasis should be put on attendance/participation activities that allow students to get points reflecting their online engagement with the material and class.

**CLASS FOLDERS**

The class folder is a **legal document** created for each section. For each session, student attendance must be recorded, noting presence, absence and lateness. It is thus imperative to take attendance at the start of class by calling each student listed on the class roster. Faculty members must also **initial the class folder for each class meeting** date. **All grades** for course examination, evaluations, remarks and the final grade must be recorded in the class folder. All *grades should be* ***reported as percentages*** (out of 100) only (no need to indicate the weighted) with **one decimal** (to match the standard percentage point evaluation determining the corresponding letter grades). A clear **break down of the grading policy** (nature and weight of each grade) must be indicated.

At the end of the semester, when folders are sent to the department as **PDF files**, each document should be complete, accurate, clear, signed and self-explanatory (one should not assume that readers are aware of all the course policies and grading calculations).

*Please note: since* ***students must pass (i.e. score 60 or above) both components (lab and lecture) to pass the course,*** *when a student scores below 60% in the lab, the lab instructor should NOT provide a numerical value to the lecture instructor (who computes the final course grade). Instead the letter F should be indicated as the lab grade and hence, an F will also be listed as the final course grade by the lecture instructor. Class folders however, should have all the numerical values and the letter grades attributed to each student*.

**Lecture Learning Outcomes and Objectives**

**Week 1: Classification of Living Organisms**

*Given 2 hours of discussion and assigned reading on the subject, upon an examination and within 70% accuracy, the student should be able to:*

1. Explain the binomial naming system, and name the eight main classification categories.
2. Explain why the Linnaean classification system forms a hierarchy.
3. Define taxonomy, phylogeny, classification, primitive and derived characters
4. Give an example that shows how Linnaean classification reflects phylogeny.
5. Explain a cladogram. Show how to construct a cladogram when given the necessary data.
6. Explain how systematists use the fossil record, homology, and a molecular clock to trace phylogeny.
7. Define homology and analogy
8. Explain the rationale for the three-domain classification system.
9. Use the three-domain system to classify organisms

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**Week 2: Viruses, Bacteria and Archaea**

*Given 2 hours of discussion and assigned reading on the subject, upon an examination and within 70% accuracy, the student should be able to:*

**Viruses**

1. List the major components of a virus.
2. List the three criteria used to categorize viruses.
3. Explain why viruses are considered to be obligate intracellular parasites.
4. Outline the steps of bacteriophage reproduction, distinguishing between lytic and lysogenic cycles.
5. Outline the steps of animal virus reproduction, explaining how the process differs from that in bacterial cells.
6. Explain why retroviruses are unique.
7. Provide examples of human diseases that are caused by viruses, particularly emerging viruses.
8. Compare and contrast viroids and prions with one another and with viruses.

**The Prokaryotes**

1. Describe the structure of a typical prokaryotic cell.
2. Explain how prokaryotic cells reproduce.
3. List the three means of genetic recombination in prokaryotes.

**The Bacteria**

1. List the defining characteristics of members of domain Bacteria.
2. Describe how bacteria may be categorized with respect to their oxygen needs and tolerances.
3. Describe the nutritional modes of photoautotrophic, chemoautotrophic, and chemoheterotrophic bacteria.
4. Provide examples of symbiotic relationships between bacteria and other organisms.
5. Provide examples of human diseases caused by bacteria.
6. Explain how bacterial endospores enable survival in harsh conditions.
7. Explain how antibiotic drugs harm bacteria.
8. Discuss the ecological significance of cyanobacteria.

**The Archaea**

1. State the unique characteristics of domain Archaea that led to them being classified separately from the members of domain Bacteria.
2. List the three categories of archaea based on the extreme habitats in which they are found.

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**Week 3: The Protists**

*Given 2 hours of discussion and assigned reading on the subject, upon an examination and within 70% accuracy, the student should be able to:*

**General Biology of Protists**

1. Describe the general characteristics of protists.
2. Summarize the endosymbiotic theory for the origin of the eukaryotic cell.
3. Distinguish between algae and protozoans.

**Diversity of Protists**

1. Provide the defining characteristics of each of the six eukaryotic supergroups, and list the protists assigned to them **or** 4 types of protists (based on mode of nutrition: phototrophs, heterotrophs by ingestion, heterotrophs by absorption, mixotrophs).
2. State the evolutionary relationship between the green algae and land plants.
3. Describe conjugation in *Spirogyra*.
4. Understand the life cycle of *Chlamydomonas*.
5. Give examples of the ecological and economic significance of the different types of algae.
6. Identify the types that include algae.
7. Describe the structure of a paramecium, euglenid, amoeboid, and a trypanosome.
8. Enumerate the major diseases caused by protists, and name the causative agent of each.
9. Distinguish between plasmodial and cellular slime molds.
10. State the evolutionary relationship between choanoflagellates and sponges (animals).
11. State the proposed evolutionary relationship between nucleariids and fungi.

***Remarks:***

* ***Include at least one lecture slide and/or 5 minutes on the endosymbiotic theory (chapter 4, page 64) to explain the origin of eukaryotic cell and illustrate transition from prokaryotic to eukaryotic organisms.***
* ***This can be an overwhelming chapter for students and it is advised to not spend too much time on life cycle details but rather explain evolutionary relationships of protists with other eukaryotes, their ecological importance and point out key features such as photosynthetic organelles, cilia, pseudopods, flagella, spores, contractile vacuoles, etc… that will also be observed in the laboratory.***

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**Week 4: The FUNGI**

*Given 2 hours of discussion and assigned reading on the subject, upon an examination and within 70% accuracy, the student should be able to:*

**Evolution and Characteristics of Fungi**

1. Compare and contrast fungal and animal heterotrophism.
2. List the five major groups within kingdom Fungi, and describe their divergence from a common ancestor.
3. Describe the general structure and characteristics of a fungus.
4. Explain how both sexual and asexual reproduction occurs in fungi.
5. Define dikaryotic/heterokaryotic and explain how the dikaryotic state fits into the fungal  life cycle.
6. Define the words hyphae, septate, nonseptate/coenocytic, mycelium, sporangium, spore

**Diversity of Fungi**

1. List the five major groups of fungi
2. Relate the defining characteristics of each of the five major groups of fungi.
3. Summarize the life cycle of a black bread mold.
4. Provide examples of the ecological and economic significance of fungi.
5. Provide examples of human health problems caused by fungi.
6. Define the terms zygospore, ascus, basidium, budding, yeast, conidiospore, fruiting body

**Symbiotic Relationships of Fungi**

1. 12. Name and explain the role of the two components of a lichen.
2. 13. Describe the mutualistic relationship between a mycorrhizae and plants.

***Note: Out of coherence with the textbook and manual, we are covering the fungi divisions mentioned above, however, the classification of fungi has changed recently. Zygomycetes are no longer recognized as a phylum and 2 additional phyla of flagellated spores producing fungi have been added.***

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**Week 5: Evolution and Diversity of Plants**

*Given 2 hours of discussion and assigned reading on the subject, upon an examination and within 70% accuracy, the student should be able to:*

**The Green Algal Ancestor of Plants**

1. Give four features of charophytes consistent with their sharing a common ancestor sometime in the past with plants.
2. Draw an evolutionary tree for plants showing significant innovations during their evolution.
3. Explain the mechanism of “Alternation of Generations” and distinguish between the sporophyte and the gametophyte in the plant life cycle.
4. Associate the increased dominance of the sporophyte with plant adaptations to the land environment.

**Evolution of Bryophytes: Colonization of Land**

1. Name and describe one example of bryophytes.
2. Explain in what ways are bryophytes adapted and not fully adapted to living on land
3. Explain a diagram of the moss life cycle, pointing out significant events.
4. Explain the terms cuticle, antheridia, archegonia, rhizoid, sporangium

**Evolution of Seedless Vascular Plants: Growing Tall**

1. Name and describe the vascular tissue of plants
2. Name and describe one example seedless vascular plants
3. Explain the observation that these plants but not bryophytes have roots, stems, and leaves.
4. In what way(s) are seedless vascular plants similar to bryophytes?
5. Explain a diagram of the fern life cycle, pointing out significant events.
6. Define the words xylem, phloem, heterosporous, homosporous, rhizome

***Remarks:***

***This is a dense portion of the curriculum. The main purpose is to have the students getting a sense of where plants come from, what makes them plants, how they are classified and the key features of the four groups of plants. They should also be going slowly and carefully through the alternation of generations and be reminded that all plants have all these stages.***

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**Week 6: SEED PLANTS**

*Given 2 hours of discussion and assigned reading on the subject, upon an examination and within 70% accuracy, the student should be able to:*

**Evolution of Seed Plants: Full Adaptation to Land**

1. Define a seed and explain how a seed plant life cycle differs from that of a seedless vascular plant.
2. Name and describe the significant difference between the two major types of seed plants.
3. Name, describe and compare gymnosperms and angiosperms
4. Name the two major types of flowering plants and state their differences.
5. Explain a diagram of the pine and flowering plant life cycles, pointing out significant events.
6. Describe the parts of a flower and their functions; explain how pollinators contributed to the diversification of flowers.
7. Understand the terms seed, gymnosperm, angiosperm, carpel, cone, flower, fruit, megaspore, microspore, ovary, ovule, petal, sepals, pollen tube, pollination, pollen grain, pollinator, stamen, stigma, stomata, style.

**Organs of Flowering Plants**

1. Contrast the general structure and function of roots, stems, and leaves.
2. List and describe five differences between monocots and eudicots.

**Organization and Diversity of Roots, Stems and Leaves**

1. Describe the various adaptations and associations that lead to root diversity.
2. Describe the various adaptations that lead to stem diversity.
3. Describe the various adaptations that lead to leaf diversity.

**Flowering Plants Reproductive Strategies**

1. Describe different types of flowers and fruits

**Seed Development**

1. Understand the seed function, its structure, dormancy and germination

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**Week 7: The Kingdom Animalia: Invertebrates and Vertebrate Chordates**

*Given 2 hours of discussion and assigned reading on the subject, upon an examination and within 70% accuracy, the student should be able to:*

**Evolution of Animals**

1. Describe the characteristics that separate the animal phyla from other phyla of living organisms.
2. Discuss the "colonial flagellate hypothesis" as it relates to the evolution of animals.
3. Explain the data used to develop the animal phylogenetic tree.
4. Distinguish between protostomes and deuterostomes.

**Introducing Invertebrates**

1. Describe the sponges.
2. Describe the comb jellies.
3. List examples of cnidarians.
4. Discuss the specializations unique to cnidarians.
5. List the characteristics of members of phylum Platyhelminthes.
6. Distinguish between the free-living flatworms and the parasitic flatworms.
7. Describe rotifers.
8. Discuss the characteristics of mollusks.
9. List and describe examples of the major groups within phylum Mollusca.
10. Describe the major characteristics of annelids.
11. Distinguish between the major groups of annelids.
12. List and describe examples of roundworms and their effects on humans.
13. Discuss the five characteristics credited for the success of arthropods.
14. Give examples of the major groups of arthropods and describe their specializations.
15. **Invertebrate Deuterostomes**
16. Describe the characteristics of echinoderms.
17. List examples of the major groups of echinoderms.
18. Discuss the adaptations of sea stars and how they relate to the characteristics of echinoderms in general.

**The Chordates**

1. Outline the four characteristics of chordates.
2. Describe and give examples of the two non-vertebrate chordates.
3. List the seven derived characteristics used to form the chordate phylogenetic tree.

**The Vertebrates**

1. Describe the four features in addition to the chordate that characterize the vertebrates.
2. Discuss the evolution of vertebrates.

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**Notes:**

* ***This lecture aims at giving a quick overview of how animals are classified and also where humans stand, so students can appreciate the anatomical/physiological similarities mentioned in the next lectures. Invertebrates being the most abundant and most elusive animals for our ‘city’ students, it is important to make sure they get a good grasp of their features and characteristics.***
* ***Even if more and more obsolete since the Linnean taxonomic ranks use is declining, please stick with the classification and terminology shown in the textbook and manual.***
* ***There is not enough time to cover in details the different phyla of vertebrates. Emphasis should be on the non-vertebrate chordates and the evolution of vertebrates (from water to land).***

**Week 8: ANIMAL ORGANIZATION AND HOMEOSTASIS**

*Given 2 hours of discussion and assigned reading on the subject, upon an examination and within 70% accuracy, the student should be able to:*

**Types of Tissues**

1. Give the broad functions of the four main types of tissues.
2. Outline the characteristics of epithelial tissue.
3. List and describe the different types of epithelial tissue.
4. Outline the characteristics of connective tissue.
5. List and describe the different types of connective tissue.
6. Outline the characteristics of muscle tissue.
7. Compare and contrast the three types of muscle tissue.
8. Outline the characteristics of nervous tissue.
9. Describe the types of cells found in nervous tissue.
10. Discuss recent advancements in treatment of spinal cord and nerve damage.

**Organs and Organ Systems**

1. Define the terms organ and organ system.
2. List the functions of skin.
3. Distinguish between the major layers of skin.
4. Describe the accessory organs of the skin.

**Homeostasis**

1. Discuss the concept of homeostasis in living organisms.
2. Use the concept of negative feedback to explain body temperature control in humans.
3. Explain the concept of positive feedback using labor and delivery in humans as an example.

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**Week 9: CIRCULATION AND CARDIOVASCULAR SYSTEMS**

*Given 2 hours of discussion and assigned reading on the subject, upon an examination and within 70% accuracy, the student should be able to:*

**Transport in Invertebrates**

1. Give examples of invertebrates that do not have a circulatory system and explain.
2. Give examples of invertebrates that have an open circulatory system and contrast and open system with a closed system.

**Transport in Vertebrates**

1. Show how structure of arteries, capillaries, and veins suits their function.
2. Compare the circulatory circuits in vertebrates.

**Transport in Humans**

1. Describe the anatomy of the heart including its attached blood vessels.
2. Describe the heartbeat, and relate it to the cardiac cycle.
3. Trace the path of blood in the pulmonary and systemic circuits.
4. Compare the velocity of blood and blood pressure in arteries, capillaries, and veins.
5. Explain the movement of blood in veins.
6. Relate the occurrence of hypertension to heart attack and stroke.

**Blood, a Transport Medium**

1. List and discuss six functions of blood.
2. Describe the composition of plasma and the structure and function of the formed elements.
3. Describe blood clotting as a series of three main steps.
4. Describe capillary exchange in the tissues.
5. Explain who can give blood to whom, utilizing the ABO system and the Rh system.

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**Week 10: LYMPH TRANSPORT AND IMMUNITY**

*Given 2 hours of discussion and assigned reading on the subject, upon an examination and within 70% accuracy, the student should be able to:*

**The Lymphatic System**

1. Be able to describe immune defenses in other organisms
2. Discuss four functions of the lymphatic system.
3. Describe the structure and function of the lymphatic vessels.
4. Give the chief functions of four lymphatic organs and three patches of lymphatic tissue.

**Nonspecific Defense Against Disease**

1. Group the first responders into four categories and describe each category.
2. Discuss how a fever could be part of the body's first and second lines of defense.
3. Describe the inflammatory response in terms of four events.

**Specific Defense Against Disease**

1. Distinguish between a foreign antigen and a self-antigen.
2. Describe the role of B cells and antibody-mediated immunity.
3. Distinguish between active and passive immunity.
4. Discuss the research and medical uses of monoclonal antibodies.
5. Describe the role to T cells and cell-mediated immunity.
6. Tell how cytokines can be helpful in cancer therapy.

**Immunity Side Effects**

1. Explain the role of MHC antigens in tissue rejection.
2. Name several autoimmune diseases, and tell the symptoms of each.
3. Distinguish between immediate and delayed allergic responses.

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**Week 11: DIGESTION AND NUTRITION**

*Given 2 hours of discussion and assigned reading on the subject, upon an examination and within 70% accuracy, the student should be able to:*

**Digestive Tracts**

1. Compare the digestive tracts of animals in terms of incomplete versus complete tracts, continuous versus discontinuous feeders, and adaptations to diet.

**Human Digestive Tract**

1. Describe the anatomy of the human mouth, and contrast mechanical and chemical digestion in the mouth.
2. Describe the anatomy of the pharynx and changes that occur during swallowing.
3. Describe the anatomy of the esophagus and the process of peristalsis.
4. Describe the anatomy of the stomach and the function of gastric glands.
5. Describe the anatomy of the small intestine and its role in chemical digestion and absorption of nutrients.
6. Describe the structure and function of the large intestine and common illnesses associated with the large intestine.
7. Describe several functions of the pancreas and liver and two serious liver disorders.

**Digestive Enzymes**

1. Outline the usual steps for the digestion of starch and lipids, and tell how the products of digestion are absorbed.

**Nutrition**

1. Compare the benefits and drawbacks of carbohydrates, lipids, and proteins in the diet.
2. Discuss how to control diabetes type 2 and cardiovascular disease through diet and exercise.
3. In general, discuss the need for minerals and vitamins in the diet.
4. Explain how to interpret a nutrition label.
5. Define three types of eating disorders, and list the harmful consequences of each.

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**Week 12: RESPIRATION**

*Given 2 hours of discussion and assigned reading on the subject, upon an examination and within 70% accuracy, the student should be able to:*

1. Name the three events that occur during respiration.
2. Contrast the respiratory exchange surface of a hydra, an earthworm, a fish, an insect, and a vertebrate and show that each is suitable to the environment.
3. Show that countercurrent flow increases the efficiency of gills in extracting oxygen from water.
4. Explain how the tracheal system in insects accomplishes ventilation and exchange.
5. Trace the path of air in the human respiratory system and discuss the cleansing role of the tracheal lining.
6. Describe the mechanics of ventilation in humans and compare to birds.
7. Explain how breathing rate in humans can be modified.
8. Discuss the transport of O2 and CO2; internal and external respiration; and the regulation of blood pH.
9. List and discuss lower respiratory tract infections and disorders including lung cancer.

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**Week 13: BODY FLUID REGULATION AND EXCRETION**

*Given 2 hours of discussion and assigned reading on the subject, upon an examination and within 70% accuracy, the student should be able to:*

**Excretion and the Environment**

1. Contrast the advantages of excreting ammonia, urea, and uric acid, and associate each with a particular environment.
2. Contrast the organs of excretion in planarians, earthworms, and arthropods.
3. Contrast the ways in which aquatic vertebrates maintain the water-salt balance.
4. Contrast the manner in which terrestrial vertebrates in extreme environments maintain the water-salt balance.

**Urinary System in Humans**

1. Trace the path of urine in humans and give a function for the organs mentioned.
2. Trace the path of filtrate in a nephron and the path of blood about a nephron.
3. List and describe the three primary steps in urine formation.
4. Describe how the human kidney maintains the salt-water balance, and maintains the acid-base balance.

***Remarks:***

***It is useful to quickly define again osmosis, hypertonic, hypotonic and isotonic solutions (seen in Biology I)***

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**Week 14: THE NERVOUS SYSTEM**

*Given 2 hours of discussion and assigned reading on the subject, upon an examination and within 70% accuracy, the student should be able to:*

**Evolution of the Nervous System**

1. Give examples of landmarks in evolution of invertebrate and vertebrate nervous systems.
2. List the three major regions of the vertebrate brain and summarize their respective functions.
3. List the three main functions of the human nervous system.

**Nervous Tissue**

1. Distinguish between neurons and neuroglia.
2. Describe the structure of a neuron.
3. List the three main types of neurons based on function.
4. Explain how an action potential is generated and propagated.
5. List the components of the synapse and explain how it works.

**Central Nervous System: Brain and Spinal Cord**

1. List the components of the human central nervous system (CNS) and their functions.
2. Distinguish between the RAS (reticular activating system) and the limbic system.

**Peripheral Nervous System**

1. List the components of the human peripheral nervous system (PNS) and their functions.
2. Differentiate between the somatic and autonomic divisions of the PNS.
3. Explain how a reflex arc works.
4. Differentiate between the sympathetic and parasympathetic divisions of the autonomic system.

**Science Focus: Drugs of Abuse**

1. Summarize how alcohol, nicotine, club and date rape drugs, cocaine, heroin, and marijuana affect the nervous system.

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**Week 15: THE REPRODUCTIVE SYSTEM**

*Given 2 hours of discussion and assigned reading on the subject, upon an examination and within 70% accuracy, the student should be able to:*

**How Animals Reproduce**

1. Contrast asexual and sexual reproduction.
2. Compare and contrast oviparous, ovoviviparous, and viviparous life history strategies.

**Male Reproductive System**

1. List the parts of the human male reproductive system and their functions.
2. Explain the events of male orgasm.
3. List the constituents of semen and the source of each.
4. Describe the structure of the testis and the process of spermatogenesis.
5. Explain how testes are regulated by hormones.

**Female Reproductive System**

1. List the parts of the human female reproductive system and their functions.
2. Explain events of female orgasm.
3. Summarize the events of the ovarian and uterine cycles, and explain how these two cycles are regulated.
4. Describe the roles of progesterone, estrogen, and human chorionic gonadotropin (HCG) hormone in pregnancy.
5. Describe the anatomy and function of the female breast.

**Control of Reproduction**

1. List the various means of birth control available for males and females, comparing the relative efficacy, advantages, and disadvantages of each.
2. List and describe the available means of assisted reproductive technology.

**Sexually Transmitted Diseases**

1. Describe the most common sexually transmitted diseases, along with their major symptoms and their causative agents.

**Laboratory Learning Outcomes and Objectives**

**Laboratory 1: SYSTEMATICS, TAXONOMY & PHYLOGENY: CLASSIFYING AND NAMING ORGANISMS**

*After completion of this laboratory session, and with 70% accuracy on the first laboratory quiz, the student should be able to:*

1. List the taxonomic levels from the broadest to the most specific.
2. Explain the degree of similarity and difference between organisms classified in a taxonomic table.
3. Identify animals/plants through the use of a dichotomous key.
4. Develop a dichotomous key to distinguish geometric figures and/or classmates and/or beans given specific characters
5. Understand phylogeny and the tools used to study the evolutionary history of organisms
6. Answer the review questions at the end of the exercises

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**Laboratory 2: INTRODUCTION TO MICROBIOLOGY: DOMAINS ARCHAEA, BACTERIA AND KINGDOM PROTISTA**

*After completion of this laboratory session, and with 70% accuracy on the first laboratory quiz, the student should be able to:*

1. Describe the distinguishing features of members of the Archaea and Bacteria domains
2. Explain how bacteria are characterized
3. Describe differences between bacteria and cyanobacteria
4. Explain and contrast binary fission and conjugation
5. Discuss the distinctive features of each group of algae and protozoans
6. Understand the economic importance of algae
7. List examples, habitats, reproductive methods, and unique features of the phyla of Kingdom Protista
8. Answer the review questions at the end of the exercises

***Remarks:***

***Students commonly confuse prokaryotes and protists… Thus, here it appears necessary to point out that two domains (prokaryotes) and one kingdom of the Eukarya domain are covered.***

***Activities:***

* ***Live cultures of* Paramecia, Amoeba *and* Euglena *will be provided for observations under the compound light microscopes. Cultures are to be used by several sections over several days and caution is required to keep them alive. Make sure you supervise and monitor students while they prepare the wet mounts.***
* ***In preparation for week 3 (Fungi ): Observe with the entire class the growth of mushrooms; make and write observations on the Mushroom Growth log sheet.***
* ***In preparation for week 3 (Fungi): ALL instructors should also assist students in preparing fungi cultures (Penicillium and Rhizopus) that will be used in week 3; make sure all culture are properly labeled (lab room, section, day/time, instructor) so CLTs can return them correctly.***

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**Laboratory 3: MYCOLOGY: KINGDOM FUNGI**

*After completion of this laboratory session, and with 70% accuracy on the first laboratory quiz, the student should be able to:*

1. Describe the characteristic features of Kingdom Fungi
2. Explain the division names: Chytridiomycota, Zygomycota, Ascomycota, Basidiomycota, AM Fungi
3. Discuss variations in structure, asexual reproduction and the sequence of events for sexual reproduction for three major divisions of Kingdom Fungi (Zygomycota, Ascomycota, Basidiomycota)
4. Answer the review questions at the end of the exercises

***Remarks:***

***Make sure you start the lab by preparing the warm glucose solution (distilled water is best) with yeasts, cover the beaker and keep it warm (about 37°C), in a water bath made with a bigger beaker or container. Later on, have students observe the yeast cells (unicellular fungi) by preparing wet mounts and under the compound microscope. They should also try to find budding cells…***

***New activities have been included to help and engage students:***

* ***Over a week or two, each section has to make observations on the growth of mushrooms (basidiomycota) displayed in the labs.***
* ***Each lab section gets to culture fungi (started on week 1) on agar dishes and then identify and observe the specimens (on week 3)***

***Note: Out of coherence with the textbook and manual, we are covering the fungi divisions mentioned above, however, the classification of fungi has changed recently. Zygomycetes are no longer recognized as a phylum and 2 additional phyla of flagellated spores producing fungi have been added.***

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**Laboratory 4: BOTANY PART 1: KINGDOM PLANTAE – SEEDLESS PLANTS: BRYOPHYTES, FERNS**

*After completion of this laboratory session, and with 70% accuracy on the first laboratory quiz, the student should be able to:*

1. Describe the characteristic features of Kingdom Plantae and their adaptations to land
2. Understand the alternation of generations and 4 groups of plants
3. Describe the life histories and related reproductive structures of mosses and liverworts
4. Discuss similarities and differences between ferns and bryophytes
5. Describe the life cycles of ferns and their allies
6. Answer the review questions at the end of the exercises

***Remarks: Lycopodium (club moss) spores will be provided. These spore, used to create “dragon fire” and other effects, are highly hydrophobic. This can be demonstrated by pouring them on a beaker filled with water to create a homogenous layer on the surface. Then, the instructor, or a student, can dip a finger in the beaker and observe its dryness. This demonstration should be used as a starting point to discuss the role of spores in the life cycle of plants and reinforce their differences with seeds/sperm.***

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**Laboratory 5: BOTANY PART 2: KINGDOM PLANTAE – GYMNOSPERMS AND ANGIOSPERMS. PLANT FORM AND FUNCTION.**

*After completion of this laboratory session, and with 70% accuracy on the first laboratory quiz, the student should be able to:*

1. Describe the distinguishing features of gymnosperms
2. Understand the life cycle of a pine
3. Explain the major evolutionary advances of the gymnosperms over the ferns
4. Understand some adaptations of evergreens to cold, dry environments
5. Identify the parts and understand the function of a cone
6. Identify the parts and understand the function of a seed
7. Describe the life cycle of angiosperms (flowering plants)
8. List and give the functions of the principal parts of a flower
9. Describe the events associated with the development of microspores, megaspores, seed, endosperm and fruits in angiosperms
10. Describe the structure and function of roots, stems, and leaves.
11. Know and list the differences between monocots and eudicots
12. Answer the review questions at the end of the exercises

***Remarks:***

***On this second week on plants it is useful to assess students on their grasps of the plant classification and the difference between spores, sperm, seeds, fruits and pollen; a good activity is to place all these structures, along with flowers, on the generalized life cycle of plants (alternation of generations).***

***Activities:***

* + ***Germinated monocot and eudicot seeds will be provided for observation and comparison***
  + ***A solution of iodine will be provided to stain dissected softened beans to see embryo plants.***
  + ***Observe the parts of fresh flowers, the stomata on fresh leaves***
  + ***Observe and identify the fruit and seeds of string beans***

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**Laboratory 6: ZOOLOGY PART I: KINGDOM ANIMALIA - LOWER INVERTEBRATES**

*After completion of this laboratory session, and with 70% accuracy on the first laboratory quiz, the student should be able to:*

1. Describe the characteristic features of Kingdom Animalia
2. Explain the features and criteria for animal classification: level of organization, body symmetry, body cavity, embryological development, segmentation
3. Describe the distinguishing features of members of the phyla Porifera and Cnidaria
4. Describe the body forms of cnidarians
5. Describe reproduction of those species alternating between polyps and medusa
6. Compare the feeding methods of sponges and jellyfish
7. Describe the general morphology of flatworms
8. List characteristics that phylum Platyhelminthes has in common with phyla Porifera and Cnidaria
9. List characteristics of flatworms that are more advanced than those of more primitive phyla
10. List examples of each major class of flatworm.
11. Answer the review questions at the end of the exercises

***Remarks:***

***Activities:***

* ***Live cultures of* Hydra *(and Daphnia) and* Planaria *(and fresh liver or cat food) will be provided to observe the feeding behavior of these organisms under the dissection microscopes; cultures are to be used by several sections over several days and caution is required to keep them alive. Make sure you supervise and monitor students while they prepare the wet mounts.***

***Note: even if more and more obsolete since the Linnean taxonomic ranks use is declining, please stick with the classification and terminology shown in the textbook and manual.***

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**Laboratory 7**: **ZOOLOGY PART II: KINGDOM ANIMALIA - LOWER INVERTEBRATES (CONTINUED)**

*After completion of this laboratory session, and with 70% accuracy on the first laboratory quiz, the student should be able to:*

1. Discuss anatomical characteristics that distinguish acoelomates, pseudocoelomates and coelomates
2. Discuss anatomical characteristics of cephalization and segmentation
3. Describe the general morphology of roundworms and rotifers
4. List characteristics present in roundworms that are more advanced than those of more primitive phyla
5. Describe the general morphology of organisms of the phylum Annelida and phylum Mollusca
6. List the characteristics that annelids and mollusks share with Platyhelminthes and Nematoda
7. Discuss the characteristics of annelids and mollusks compared to more primitive phyla
8. List examples of the major classes of annelids and mollusks
9. Answer the review questions at the end of the exercises

***Remarks:***

***Activities:***

* ***Live cultures of rotifers (with algae) will be provided to observe the behavior of these organisms under the compound microscopes; cultures are to be used by several sections over several days and caution is required to keep them alive. Make sure you supervise and monitor students while they prepare the wet mounts.***
* ***Preserved earthworms and clams will be provided for dissections (for relevant structures check the lab manual and YouTube videos)***

***Note: It is strongly advised to have students working in small groups where all students are engaged. For this purpose, while some members of a given group are preparing the specimens for dissection, others can start the corresponding virtual dissections installed on the laptops. These virtual dissections should be used to assist and guide students and allow all students to have a hands-on experience and participate actively in their group activities.***

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**Laboratory 8: ZOOLOGY PART III: KINGDOM ANIMALIA - HIGHER INVERTEBRATES AND CHORDATES**

*After completion of this laboratory session, and with 70% accuracy on the first laboratory quiz, the student should be able to:*

1. Describe the general morphology of organisms of phylum Arthropoda.
2. List characteristics that arthropods share with the phyla studied in previous exercises
3. Discuss characteristics of arthropods that are advanced over more primitive phyla
4. List representative genera of the major classes of arthropods
5. Describe modifications of the exoskeleton and paired appendages of arthropods
6. Discuss embryological characteristics that distinguish protostomes from deuterostomes
7. Describe the morphology of organisms of phyla Echinodermata,
8. Describe the water vascular system of echinoderms
9. Describe the morphology and features of the Chordata (Urochordates, Cephalochordates and Vertebrates)
10. List characteristics that echinoderms and chordates share with phyla previously studied
11. Discuss characteristics of echinoderms and chordates that are unique or advanced compared to more primitive phyla
12. Discuss the evolution of vertebrates
13. Answer the review questions at the end of the exercise

***Remarks:***

***Activities:***

* ***Preserved grasshoppers will be provided for observation ONLY (no dissection)***
* ***If available, preserved sea stars and frogs will be provided for dissections (for dissection steps YouTube videos)***

***Note:***

* ***It is strongly advised to have students working in small groups where all students are engaged. For this purpose, while some members of a given group are preparing the specimens for dissection, others can start the corresponding virtual dissections installed on the laptops. These virtual dissections should be used to assist and guide students and allow all students to have a hands-on experience and participate actively in their group activities.***
* ***There is not enough time to cover in details the different phyla of vertebrates. Emphasis just be on the non vertebrate chordates and the evolution of vertebrates (from water to land).***

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**Laboratory 9: MIDTERM PRACTICUM and ANIMAL ORGANIZATION – INTRODUCTION TO HISTOLOGY**

*After completion of this laboratory session, and with 70% accuracy on the first laboratory quiz, the student should be able to:*

1. Describe Epithelial Tissue: identify slides and models of various types of epithelium and tell where a particular type of epithelium is located in the body, and state a function
2. Describe Muscle Tissue: Identify slides and models of three types of muscular tissue, tell where a particular type of muscular tissue is located in the body, and state a function
3. Describe Nervous tissue: Identify slides of neuron and models of a neuron, tell where nervous tissue is located in the body, and state a function
4. Describe Connective Tissue: Identify slides and models of various types of connective tissues, tell where a particular type of connective tissue is located in the body, and state a function
5. Explain how different types of Tissues Form Organs
   1. Identify slides of the intestinal wall and any particular tissue in the wall. State a function for each tissue
   2. Identify a slide of skin and any particular tissue or structure in skin. State a function for each tissue or structure
6. Answer the review questions at the end of the exercise

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**Laboratory 10: Basic mammalian ANATOMY 1: Fetal Pig External Features, Respiratory, and Digestive Systems (DISSECTION)**

*After completion of this laboratory session, and with 70% accuracy on the first laboratory quiz, the student should be able to:*

1. External Anatomy:
   1. Compare the external anatomy of a fetal pig to the external anatomy of a human (e.g. limbs)
   2. Know the language of anatomy
2. Oral Cavity and Pharynx:
   1. Find and identify the teeth, tongue, and hard and soft palates, including the epiglottis, Identify and state a function for the glottis, nasopharynx, and esophagus
   2. Name the two pathways that cross in the pharynx
3. Neck Region: Find, identify and state a function for the thymus, the larynx, and the thyroid gland, trachea and esophagus.
4. Thoracic and Abdominal Incisions: List the major organs of the thoracic cavity and the major organs of the abdominal cavity
5. Thoracic Cavity:
   1. Identify the three compartments and the organs of the thoracic cavity,
   2. Find and identify the diaphragm
   3. Locate and identify major arteries and veins in the thoracic cavity
6. Abdominal Cavity:
   1. Find, identify and state a function for the liver, stomach, spleen, gallbladder, pancreas, large and small intestines
   2. Use anatomical terms to describe where these organs are positioned in relation to one another
   3. Locate and identify major arteries and veins in the abdominal cavity
7. Human Anatomy:
   1. Associate each organ with a particular system of human body,
   2. Compare the number of lobes in the lungs of the pig to those of the human being

***Remarks:***

***Activities:***

* ***Preserved fetal pigs will be provided for dissections (for dissection steps check YouTube videos). The same specimens will be used to following week; make sure all buckets, in which your piglets are placed, are labeled properly (lab room, section, day/time, instructor) using the labels (not writing on the buckets),***

***Note: It is strongly advised to have students working in small groups where all students are engaged. For this purpose, while some members of a given group are preparing the specimens for dissection, others can start the corresponding virtual piglet dissection installed on the laptops. These virtual dissections should be used to assist and guide students and allow all students to have a hands-on experience and participate actively in their group activities.***

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**Laboratory 11: BASIC MAMMALIAN ANATOMY 2: FETAL PIG EXCRETORY AND REPRODUCTIVE SYSTEMS (DISSECTION)**

*After completion of this laboratory session, and with 70% accuracy on the first laboratory quiz, the student should be able to:*

1. Abdominopelvic cavity:
   1. Find, identify and state a function for kidneys, ureters, urinary bladder, urethra
   2. Use anatomical terms to describe where these organs are positioned in relation to one another,
   3. Locate and identify ovaries, uterine horn and body, vagina and genital papilla on females; scrotum, testes, epididymis, vas deferens, spermatic cord and penis on males
2. Human Anatomy:
   1. Associate each organ with a particular system of human body,
   2. Compare the excretory and reproductive systems to those found in human beings

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**Laboratory 12: INTRODUCTION TO PHYSIOLOGY - HOMEOSTASIS**

*After completion of this laboratory session, and with 70% accuracy on the first laboratory quiz, the student should be able to:*

1. Lungs:
   1. Describe the anatomy of the lungs and their role in homeostasis
   2. Describe the microscopic anatomy of the lungs and the role of the alveoli in gas exchange
2. Liver:
   1. Describe the anatomy of the liver and its role in homeostasis.
   2. Trace the path of blood from the intestines, through the liver and to the heart
3. Kidney:
   1. Describe the anatomy of the kidneys and their role in homeostasis
   2. Trace the path of blood from the heart to the kidneys, about a nephron, and back to the heart
   3. State the three steps in urine formation and how they relate to the parts of a nephron
   4. Predict whether substances will be in the filtrate and/or urine, and explain
   5. Know how to use/read test strips for urinalysis and detect and discuss abnormalities.
4. Capillary Exchange in the Tissue:
   1. Describe the exchange of molecules across a capillary wall and the mechanisms involved

***Remarks: The urinalysis is an easy activity where students have to test the (fake( urine samples of 3 patients. For this they will have test strips testing for glucose, proteins, pH, blood, protein, etc… as well as tablets for ketones (demonstration only). Instructors should ask students to record their results and spot abnormalities. Causes and conditions explaining the results should be discussed (diabetes, fasting, infections, etc…).***

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**Laboratory 13: THE NERVOUS SYSTEM - SHEEP BRAIN (DISSECTION)**

*After completion of this laboratory session, and with 70% accuracy on the first laboratory quiz, the student should be able to:*

1. Define, identify, describe and draw all the parts of the sheep brain
2. Identify the components of the mammalian brain and list the physiological function involved
3. Observe and compare structures in the human brain, using models and preserved specimens.

***Remarks:***

***Activities:***

* ***Preserved halves of sheep brains will be provided for observation (no dissection)***

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**Laboratory 14: VERTEBRATE REPRODUCTIVE SYSTEMS, DEVELOPMENT AND EMBRYOLOGY & REVIEW FOR PRACTICAL:**

*After completion of the laboratory session and with 70% accuracy, the student should be able to:*

**Male Reproductive System**

1. List the parts of the human male reproductive system and their functions.
2. Explain the events of male orgasm.
3. List the constituents of semen and the source of each.
4. Describe the structure of the testis and the process of spermatogenesis.

**Female Reproductive System**

1. List the parts of the human female reproductive system and their functions.
2. Explain events of female orgasm.
3. Summarize the events of the ovarian and uterine cycles, and explain how these two cycles are regulated.

**Development and Embryology (if time permits as this is not covered in lecture)**

1. Early Embryonic Stages:
   1. Identify and compare the morula, blastula, gastrula and neurula in the models available
   2. Describe the development of the neural tube
2. Germ Layers
   1. Name the 3 germ layers and the major organs that develop from each
   2. Describe the significance of induction during development
3. Human Development
   1. Compare the development of humans to that of the other animals studied
4. Define embryonic and fetal development; identify human models as either embryo or fetuses.

**REVIEW:**

1. Identify and know ALL structures and their function(s) for the final practicum.

***Remarks: The final practical exam is a very new exam format for students. It is necessary to practice with them, putting students in examination conditions (timed sessions, spelling, etc…).***

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**Laboratory 15: FINAL PRACTICUM (UNIFORM)**

UNIFORM Final Practical Examination: ALL material covered from week 9 through week 13 inclusive