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Lab PowerPoint slides can be viewed at: [http://spot.pcc.edu/anatomy/lab.htm](http://spot.pcc.edu/anatomy/lab.htm)
1. Upon entering the laboratory, please locate the exits, fire extinguisher, eyewash station, and clean up materials for chemical spills. Your instructor will demonstrate the location of fire blanket, safety kit, and showers.

2. Read the general laboratory directions and any objectives before coming to lab.

3. Food and drink, including water, are prohibited in laboratory. This is per Federal laboratory guidelines and per College Safety Policy. Do not chew gum, use tobacco products of any kind, store food or apply cosmetics in the laboratory. No drink containers of any kind may be on the benches.

4. Please keep all personal materials off the working area. Store backpacks and purses at the rear of the laboratory, not beside or under benches. Some laboratory spaces have shelving in rear for this purpose.

5. For your safety, please restrain long hair, loose fitting clothing and dangling jewelry. Hair ties are available, ask your instructor. Hats and bare midriffs are not acceptable in the laboratory. Shoes, not sandals, must be worn at all times in laboratory. You may wear a laboratory apron or lab coat if you desire, but it is not required.

6. We do not wish to invade your privacy, but for your safety if you are pregnant, taking immunosuppressive drugs or who have any other medical conditions (e.g. diabetes, immunological defect) that might necessitate special precautions in the laboratory must inform the instructor immediately. If you know you have an allergy to latex or chemicals, please inform instructor.

7. Decontaminate work surfaces at the beginning of every lab period using Amphyl solution. Decontaminate bench following any practical quiz, when given, and after labs involving the dissection of preserved material.

8. Use safety goggles in all experiments in which solutions or chemicals are heated or when instructed to do so. Never leave heat sources unattended: hot plates or Bunsen burners.

9. Wear disposable gloves when handling blood and other body fluids or when touching items or surfaces soiled with blood or other body fluids such as saliva and urine. (NOTE: cover open cuts or scrapes with a sterile bandage before donning gloves.) Wash your hands immediately after removing gloves.

10. Keep all liquids away from the edge of the lab bench to avoid spills. Immediately notify your instructor of any spills. Keep test tubes in racks provided, except when necessary to transfer to water baths or hot plate. You will be advised of the proper clean-up procedures for any spill.

11. Report all chemical or liquid spills and all accidents, such as cuts or burns, no matter how minor, to the instructor immediately.

12. Use mechanical pipetting devices only. Mouth pipetting is prohibited.

Students who do not comply with these safety guidelines will be excluded from the Laboratory
Safe Disposal of Contaminated Materials

• Place disposable materials such as gloves, mouth pieces, swabs, toothpicks and paper towels that have come into contact with blood or other body fluids into a disposable Autoclave bag for decontamination by autoclaving. This bucket is not for general trash.

• Place glassware contaminated with blood and other body fluids directly into a labeled bucket of 10% bleach solution. ONLY glass or plastic-ware is to be placed in this bucket, not trash.

• Sharp’s container is for used lancets only. It is bright red. When using disposable lancets do not replace their covers.

1. Properly label glassware and slides, using china markers provided.

2. Wear disposable gloves when handling blood and other body fluids or when touching items or surfaces soiled with blood or other body fluids such as saliva and urine. (NOTE: cover open cuts or scrapes with a sterile bandage before donning gloves.) Wash your hands immediately after removing gloves.

3. Wear disposable gloves when handling or dissecting specimens fixed with formaldehyde or stored in Carosafe/Wardsafe.

4. Wear disposable gloves when handling chemicals denoted as hazardous or carcinogenic by your instructor. Read labels on dropper bottles provided for an experiment, they will indicate the need for gloves or goggles, etc. Upon request, detailed written information is available on every chemical used (MSDS). Ask your instructor.

5. No pen or pencil is to be used at any time on any model or bone. The bones are fragile, hard to replace and used by hundreds of students every year. To protect them and keep them in the best condition, please use pipe cleaners and probes provided instead of a writing instrument.
   a. Probes may be used on models as well. The bones are very difficult and costly to replace, as are the models and may take a long time to replace.

6. At the end of an experiment:
   a. Clean glassware and place where designated. Remove china marker labels at this time.
   b. Return solutions & chemicals to designated area. Do not put solutions or chemicals in cupboards!

7. You cannot work alone or unsupervised in the laboratory.

8. Microscopes should be cleaned before returning to numbered cabinet. Be sure objectives are clean, use lens paper. Place objectives into storage position, and return to the storage cabinet. Be sure cord has been coiled and restrained. Your instructor may require microscope be checked before you put it away. Be sure it is in assigned cupboard.

9. Please replace your prepared slides into the box from which they came (slides and boxes are numbered), so students using them after you will be able to find the same slide. Before placing slides in box, clean it with Kimwipes if it is dirty or covered with oil. If you break a slide, please, inform your instructor so the slide can be replaced. Please be aware that there is hundreds of dollars worth of slides in each box and handle the boxes with care when carrying to and from your workbench.

10. Be sure all paper towels used in cleaning lab benches and washing hands are disposed of in trash container provided.

Students who do not comply with these safety guidelines and directions will be excluded from the Laboratory
Lab Presentation Instructions

- **Objective:** To work as a group to create an educational presentation.
- Your project is an **8-10 minute PowerPoint presentation** on a **special topic** of your choosing related to 233 topics. Often, presentations focus on diseases, but that is not necessary.
- **You will work in a group of 3 students.** The project will be graded on six criteria
- All group members receive the same grade.

1. **Overall cohesiveness of the presentation** 3 points

2. **Evidence of good planning and teamwork:**
   - **4 points:** groups who coordinate and share their roles equally among members
   - **2 points:** those groups whose members contribute unequally
   - **0 points:** those who clearly have members that do not contribute or students who work alone
   If a group member does not contribute to the project, the other group members have the right to “expel” the person from the group.

3. **Demonstrated insight and understanding of the material:**
   - **6 points:** mastery of the material beyond expectation
   - **4 points:** a solid understanding - but with a limited lapse
   - **2 points:** a fair understanding but who fail to demonstrate a thoughtful understanding, or who lapses in a significant area of the topic presentation
   - **0 points:** those who clearly do not understand significant aspects of the topic

4. **Clarity and organization of the presentation:**
   - **4 points:** if the entire presentation is presented in a clear, organized verbal and visual fashion,
   - **3 points:** if there are some areas that appear somewhat unclear or without thoughtful organization
   - **1 point:** if it is difficult to understand because the presentation was not thoughtfully considered
   - **0 points:** if it is extremely difficult to understand

5. **Quality of the graphics, text and pictures**
   - **4 points:** high quality graphics (with good resolution) and pictures that help explain the topic.
   - **3 points:** graphics are average
   - **2 points:** graphics are kept at a minimum or are very poor quality or are not appropriate
   - **0 points:** if there are no graphics

6. **Creativity and Audience Engagement:**
   - **4 points:** The presentation demonstrates exceptional creativity that helps to captivate and educate the audience
   - **2 points:** The presentation shows some creativity, but it is merely entertaining, and not helpful in teaching the audience
   - **1 point:** The presentation is in an “encyclopedia report” format
   - **0 points:** The presentation is clearly not geared to the audience. Remember, your audience is the other students, not the instructor.
Lab Activity 27: Respiratory System
Martini Chapter 23

Define these terms:
1. Pulmonary ventilation

2. External respiration

3. Internal respiration

4. Cellular respiration

Gross Anatomy
1. Nose:
   a. External nares
   b. Superior, middle, and inferior turbinates (nasal conchae)

2. Auditory tube (Eustachian tube)

3. Sinuses
   a. Frontal
   b. Maxillary
   c. Sphenoid
   d. Ethmoid

4. Tonsils
   a. Palatine
   b. Pharyngeal (Adenoids)
   c. Lingual

5. Pharynx
   a. Nasopharynx
   b. Oropharynx (common passage for food and air)
   c. Laryngopharynx
6. **Larynx:**
   a. Thyroid cartilage (“Adam's apple”)
   b. Cricoid cartilage
   c. Cricothyroid ligament (site of emergent cricothyrotomy)
   d. Thyrohyoid membrane
   e. Tracheal cartilage (hyaline cartilage)
   f. Hyoid bone
   g. Epiglottis (elastic cartilage)
   h. Glottis
      i. Rima glottis
   i. Vestibular folds (False vocal cords) (upper)
   j. True vocal cords (lower)
7. Airways:
   a. Trachea
   b. Carina
   c. Right and left primary (=mainstem) bronchi
   d. Secondary bronchi (one per lobe)
   e. Tertiary bronchi
   f. Bronchioles

8. Lungs:
   a. Apex
   b. Base
   c. Hilus
   d. Right lung:
      i. Upper (superior), middle, and lower lobes
      ii. Horizontal fissure
      iii. Oblique fissure
   e. Left lung:
      i. Left upper and lower lobes,
      ii. Cardiac notch
      iii. Oblique fissure

f. Parietal pleura and visceral pleura

9. Mediastinum
10. Inspiratory Muscles
   a. Diaphragm
   b. External intercostals
   c. Accessory muscles of inspiration
      i. Scalene muscles
      ii. Pectoralis minor
      iii. Serratus anterior
      iv. Sternocleidomastoid

11. Expiratory Muscles (forced exhalation)
   a. Internal intercostals
   b. Transversus thoracic
   c. Abdominal muscles
<table>
<thead>
<tr>
<th>Histology</th>
<th>Draw a picture</th>
</tr>
</thead>
</table>
| **1. Trachea**  
  a. Ciliated pseudostratified columnar epithelial lining  
  b. Goblet cells  
  c. Sero-mucous glands  
  d. Hyaline cartilage rings  
  e. Smooth muscle | |
| **2. Bronchi**  
  a. Pseudostratified columnar, ciliated epithelium (shorter)  
  b. Goblet cells (fewer)  
  c. Sero-mucous glands  
  d. Hyaline Cartilage  
  e. Smooth muscle – in spirals, not rings  
  f. Between the smooth muscle layer and the (discontinuous) cartilage in the submucosa, which may contain seromucous glands | |
| **3. Bronchioles**  
  a. Low columnar/cuboidal epithelial lining with cilia  
  b. No (diminishing, at least) goblet cells  
  c. No glands  
  d. Smooth muscle (relatively abundant) | |
<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>4. Respiratory Bronchiole</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>a. Low columnar to low cuboidal.</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>5. Alveolar Duct</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>a. Simple squamous (Pneumocyte type I) and cuboidal epithelium (Pneumocyte type II).</td>
</tr>
<tr>
<td></td>
<td>b. Smooth muscle</td>
</tr>
<tr>
<td><strong>6. Alveolar Sacs and Alveoli</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>a. Type I Pneumocyte</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>b. Type II Pneumocyte (septal cells)</td>
</tr>
<tr>
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<td></td>
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<td></td>
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</tr>
<tr>
<td></td>
<td>c. Macrophages (dust cells)</td>
</tr>
</tbody>
</table>
Lab Activity 28: Spirometry & Buffers

1. Define these terms.
2. Label the spirogram.
3. Calculate the volume or capacity from the spirogram.
   a. Tidal Volume
   
   b. Inspiratory Reserve Volume
   
   c. Expiratory Reserve Volume
   
   d. Residual Volume
   
   e. Vital Capacity
   
   f. Inspiratory Capacity
   
   g. Functional Residual Capacity
   
   h. Total Lung Capacity
4. Define these terms. Label the graph and calculate volumes
   a. Forced vital capacity
   
   b. FEV1
   
   c. FEV1/FVC (FEV1%)  
     1. Ratio is over 76% in normal individuals, ratio is decreased in obstructive airway disease

5. Using the spirometry equipment in the lab, complete this chart:

<table>
<thead>
<tr>
<th></th>
<th>TV</th>
<th>ERV</th>
<th>IRV</th>
<th>FVC</th>
<th>FEV1</th>
<th>FEV1/FVC (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trial 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trial 2</td>
<td></td>
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<tr>
<td>Average</td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

Do you have obstructive lung disease?
Buffers:
1. What is a buffer?

2. What is the importance of the carbonic acid buffer?

3. Write the reaction that is facilitated by carbonic anhydrase. List several factors that shift the equilibrium of the reaction.

Buffer Exercise Instructions:
- Phenol red is a pH indicator
  - It turns yellow in acidic solutions (pH < 6.8)
  - It turns darker red/pink in basic solutions (pH of > 7.4)
- Rinse beaker to remove all contaminants.
- Fill a beaker with 100ml of distilled water.
- Add 5 drops of 0.1N NaOH
- Add 10 drops of phenol red.
- Using a straw, blow bubbles into the water.

4. What color change did you observe?

5. What happens to pH of water when one exhales into it?

6. What chemical reaction is taking place?

- Fill 4 beakers and label accordingly
  - Beaker #1: 100 ml of water
  - Beaker #2: 100 ml of water
  - Beaker #3: 100 ml of buffer solution
  - Beaker #4: 100 ml of buffer solution
- Add 10 drops of phenol red to each beaker.
- Using the pH meter, record the initial pH of each beaker.

After adding the number of drops indicated, observe the color change and measure the pH
- Beaker #1: add 1 drop of concentrated HCL.
  - Add 3 more drops of concentrated HCL.
- Beaker #2: add 1 drop of concentrated NaOH. Observe the color change and measure the pH
  - Add 3 more drops of concentrated NaOH.
- Beaker #3: add 1 drop of concentrated HCL.
  - Add 3 more drops of concentrated HCL.
- Beaker #4: add 1 drop of concentrated NaOH.
  - Add 3 more drops of concentrated NaOH.

Complete this chart:

<table>
<thead>
<tr>
<th>Beaker</th>
<th>Initial pH</th>
<th>Color change after adding 1 drop</th>
<th>pH with after adding 1 drop</th>
<th>Color change after adding 3 more drops</th>
<th>pH with after adding 3 more drops</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1 H₂O + HCL</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>#2 H₂O + NaOH</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>#3 Buffer + HCL</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>#4 Buffer + NaOH</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

7. How successful was water in resisting pH changes when a strong acid (HCL) or a strong base (NaOH) was added?

8. How successful was the buffer solution in resisting pH changes when a strong acid (HCL) or a strong base (NaOH) was added?

9. How does carbonic acid buffer deal with excess acid?

10. How does carbonic acid buffer deal with excess base?
**Activity: Pulse Oximeter**
Check your oxygen saturation levels and record on chart:

Have several students do each activity:

<table>
<thead>
<tr>
<th>Activity</th>
<th>Pulse Oximeter Reading</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sitting quietly</td>
<td></td>
</tr>
<tr>
<td>Breathing into paper bag several times (while sitting, stop if you feel faint)</td>
<td></td>
</tr>
<tr>
<td>If there is a smoker in the class: after a cigarette</td>
<td></td>
</tr>
<tr>
<td>Run up and down the stairs a few times.</td>
<td></td>
</tr>
</tbody>
</table>

1. How do you account for the differences in each situation?

Lab Activity 29: Digestive System
Martini Chapter 24

Gross Anatomy: Identify the structures
* Identify the function, (items without * you only need to identify the structure)

1. Tongue

2. Teeth
   a. Incisors*
   b. Canines *
   c. Premolars*
   d. Molars*

3. Salivary glands*
   a. Parotid
   b. Submandibular
   c. Sublingual

4. Esophagus
   a. Body (Gullet)
   b. Lower esophageal sphincter (LES) (cardiac sphincter)*

5. Membranes
   a. Parietal peritoneum
   b. Visceral peritoneum
   c. Mesentery
   d. Greater Omentum
   e. Lesser Omentum
   f. Mesocolon
6. Stomach
   a. Cardia
   b. Fundus
   c. Body
   d. Antrum (pyloric region)
   e. Greater curvature
   f. Lesser curvature
   g. Rugae*
   h. Pyloric Sphincter*
   i. Muscularis externa*
      iii. Longitudinal layer
      iv. Circular layer
      v. Oblique layer
   j. Serosa

6. Small Intestine*
   a. Duodenum
      i. Bulb (not in picture)
      ii. C-loop
      iii. Major papilla*
      iv. Minor papilla*
      v. Plica circularis
   b. Jejunum

7. Pancreas*
   a. Head, body, tail;
   b. Pancreatic duct (leads to major papilla)
   c. Accessory duct (leads to minor papilla)
   d. Also in this picture
   e. Common bile duct
8. Ileum:
   a. Terminal ileum (region just before ileocecal valve)
   b. Ileocecal valve*

9. Large Intestine*
   a. Cecum
   b. Appendix
   c. Colon
      i. Ascending
      ii. Transverse
      iii. Descending
      iv. Sigmoid
   d. Rectum
   e. Anal canal
   f. Hepatic flexure
   g. Splenic flexure
   h. Haustra
   i. Teniae coli
   j. Epiploic Appendages
   k. Also in picture
      i. Abdominal aorta
      ii. Superior and inferior mesenteric arteries
      iii. Hepatic portal vein

10. Biliary tree
    a. Right and left hepatic ducts
    b. Common hepatic duct
    c. Gall bladder*
    d. Cystic duct
    e. Common bile duct
    f. Sphincter of Oddi*
    g. Hepatopancreatic ampulla (Vater)
11. Liver*
   a. Right lobe, left lobe
   b. Hepatic artery
   c. Hepatic portal vein
   d. Hepatic vein
   e. Falciform ligament
   f. Ligamentum teres
# Histology

<table>
<thead>
<tr>
<th>Histology Structures</th>
<th>Draw a picture:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Salivary glands</strong></td>
<td></td>
</tr>
<tr>
<td>1. Mucus acini*</td>
<td></td>
</tr>
<tr>
<td>2. Serous acini*</td>
<td></td>
</tr>
<tr>
<td>a. Demilunes</td>
<td></td>
</tr>
<tr>
<td>3. Ducts (simple cuboidal epithelium)</td>
<td></td>
</tr>
<tr>
<td><strong>General Histology Layers</strong></td>
<td></td>
</tr>
<tr>
<td>1. Mucosa</td>
<td></td>
</tr>
<tr>
<td>a. Lamina propria</td>
<td>(loose areolar CT)</td>
</tr>
<tr>
<td>b. Muscularis mucosa</td>
<td></td>
</tr>
<tr>
<td>2. Submucosa</td>
<td></td>
</tr>
<tr>
<td>a. Dense irregular connective tissue</td>
<td></td>
</tr>
<tr>
<td>b. Blood vessels</td>
<td></td>
</tr>
<tr>
<td>c. Submucosal plexus</td>
<td>(parasympathetic ganglion)</td>
</tr>
<tr>
<td>3. Muscularis Externa</td>
<td></td>
</tr>
<tr>
<td>a. Myenteric plexus</td>
<td>(parasympathetic ganglion)</td>
</tr>
<tr>
<td>➝Between longitudinal and circular muscle layers</td>
<td></td>
</tr>
<tr>
<td>4. Serosa</td>
<td></td>
</tr>
<tr>
<td><strong>Esophagus</strong></td>
<td></td>
</tr>
<tr>
<td>1. Mucosa</td>
<td></td>
</tr>
<tr>
<td>a. Non-keratinized, stratified squamous epithelium</td>
<td></td>
</tr>
<tr>
<td>a. Lamina propria</td>
<td></td>
</tr>
<tr>
<td>b. Muscularis mucosa*</td>
<td></td>
</tr>
<tr>
<td>2. Submucosa</td>
<td></td>
</tr>
<tr>
<td>a. Esophageal glands</td>
<td></td>
</tr>
<tr>
<td>b. Submucosal plexus</td>
<td></td>
</tr>
<tr>
<td>3. Muscularis Externa</td>
<td></td>
</tr>
<tr>
<td>a. Upper 1/3 skeletal muscle</td>
<td></td>
</tr>
<tr>
<td>b. Middle 1/3 Mixed smooth and skeletal muscle</td>
<td></td>
</tr>
<tr>
<td>c. Lower 1/3: smooth muscle</td>
<td></td>
</tr>
<tr>
<td>d. Myenteric plexus</td>
<td></td>
</tr>
<tr>
<td>e. Adventitia (no serosa)</td>
<td></td>
</tr>
<tr>
<td>Histology Structures</td>
<td>Draw a picture:</td>
</tr>
<tr>
<td>----------------------</td>
<td>----------------</td>
</tr>
<tr>
<td><strong>Stomach</strong>*</td>
<td></td>
</tr>
<tr>
<td>1. Mucosa</td>
<td></td>
</tr>
<tr>
<td>a. Simple columnar epithelium</td>
<td></td>
</tr>
<tr>
<td>b. Gastric pits leading into gastric glands</td>
<td></td>
</tr>
<tr>
<td>i. Mucous neck cells secrete: ____________________</td>
<td></td>
</tr>
<tr>
<td>ii. Parietal cells secrete: ____________________ &amp; ____________________</td>
<td></td>
</tr>
<tr>
<td>iii. Chief cells secrete: ____________________ &amp; ____________________</td>
<td></td>
</tr>
<tr>
<td>iv. G cells in antrum secrete: (You do not need to identify ____________________</td>
<td></td>
</tr>
<tr>
<td>c. Lamina propria</td>
<td></td>
</tr>
<tr>
<td>d. Muscularis mucosa</td>
<td></td>
</tr>
<tr>
<td>2. Submucosa</td>
<td></td>
</tr>
<tr>
<td>a. Submucosal plexus</td>
<td></td>
</tr>
<tr>
<td>3. Muscularis Externa*</td>
<td></td>
</tr>
<tr>
<td>a. Inner oblique layer</td>
<td></td>
</tr>
<tr>
<td>b. Middle circular layer</td>
<td></td>
</tr>
<tr>
<td>c. Myenteric plexus</td>
<td></td>
</tr>
<tr>
<td>d. Outer longitudinal layer</td>
<td></td>
</tr>
<tr>
<td>4. Serosa</td>
<td></td>
</tr>
</tbody>
</table>

<p>| Small Intestine       |                |
| 1. Mucosa             |                |
| a. Simple columnar epithelium |        |
|   i. Folded into villi* |     |
|   ii. Microvilli (brush border)* |    |
|   iii. Crypts of Lieberkühn* |    |
|   iv. Paneth cells* |                |
| b. Lamina propria    |                |
| c. Muscularis mucosa*|                |
| 2. Submucosa         |                |
| a. Submucosal plexus*|                |
| b. Plicae circulares*|                |
| c. Duodenal glands (Brunner’s glands)<em>|          |
| d. Ilium: Peyer’s patches</em>|        |
| e. Lacteal           |                |
| 3. Muscularis Externa*|                |
| a. Inner circular layer |            |
| b. Myenteric plexus* |                |
| c. Outer longitudinal layer |        |
| 4. Serosa            |                |</p>
<table>
<thead>
<tr>
<th>Histology Structures</th>
<th>Draw a picture:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Large Intestine</strong>*</td>
<td></td>
</tr>
<tr>
<td>1. Mucosa</td>
<td></td>
</tr>
<tr>
<td>a. Simple columnar epithelium</td>
<td></td>
</tr>
<tr>
<td>i. (No villi or microvilli)</td>
<td></td>
</tr>
<tr>
<td>ii. Crypts of Lieberkühn*</td>
<td></td>
</tr>
<tr>
<td>iii. Goblet cells</td>
<td></td>
</tr>
<tr>
<td>b. Lamina propria</td>
<td></td>
</tr>
<tr>
<td>c. Muscularis mucosa</td>
<td></td>
</tr>
<tr>
<td>2. Submucosa</td>
<td></td>
</tr>
<tr>
<td>a. Blood Vessels</td>
<td></td>
</tr>
<tr>
<td>b. Submucosal plexus</td>
<td></td>
</tr>
<tr>
<td>3. Muscularis Externa</td>
<td></td>
</tr>
<tr>
<td>a. Inner circular layer</td>
<td></td>
</tr>
<tr>
<td>b. Myenteric plexus</td>
<td></td>
</tr>
<tr>
<td>c. Outer longitudinal layer, note this exists as the 3 strips called Teniae coli</td>
<td></td>
</tr>
<tr>
<td>4. Serosa</td>
<td></td>
</tr>
<tr>
<td><strong>Liver</strong>*</td>
<td></td>
</tr>
<tr>
<td>1. Lobules</td>
<td></td>
</tr>
<tr>
<td>2. Sinusoids</td>
<td></td>
</tr>
<tr>
<td>3. Hepatocytes*</td>
<td></td>
</tr>
<tr>
<td>4. Central vein*</td>
<td></td>
</tr>
<tr>
<td>5. Portal triad*</td>
<td></td>
</tr>
<tr>
<td>a. Bile duct</td>
<td></td>
</tr>
<tr>
<td>b. Branch of hepatic artery</td>
<td></td>
</tr>
<tr>
<td>c. Branch of portal vein</td>
<td></td>
</tr>
<tr>
<td><strong>Pancreas</strong>*</td>
<td></td>
</tr>
<tr>
<td>1. Acinar cells; secrete</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(enzyme precursors)</td>
</tr>
<tr>
<td>2. Pancreatic duct; secretes:</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Islets of Langerhans; secretes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(enzymes) and (enzymes)</td>
</tr>
</tbody>
</table>
Lab Activity 30: Digestive Enzymes

**Wash all Test Tubes before the experiments**

**Starch Digestion with Amylase**

- Amylase is the enzyme used to hydrolyze _______________ into _______________
- Amylase comes from _______________ and _______________
- Lactase, maltase, and sucrase are ____________ border enzymes of the small intestine.
- Lactose is digested by lactase to _______________ and _______________
- Maltose is digested by maltase to _______________ and _______________
- Sucrose is digested by sucrase to _______________ and _______________

➤ Starch is a polysaccharide and maltose is a disaccharide.

**Directions:**
1. Take 6 test tubes and label them 1A, 2A, 3A, 4A, 5A and 6A (use grease pencil)
2. **Tube 1A:** Place 3 drops of water and 3 drops of starch.
3. **Tube 2A:** Place 3 drops of water and 3 drops of amylase
4. **Tube 3A:** Place 3 drops of water and 3 drops of maltose
5. **Tube 4A:** Place 3 drops of amylase.
   Boil tube 4A for 4 minutes
   **After boiling, add 3 drops of starch**
6. **Tube 5A:** Place 3 drops of amylase and 3 drops of starch
7. **Tube 6A:** Place 3 drops of amylase and 3 drops of starch

*Incubate tubes 1A, 2A, 3A, 4A and 5A for 1 hour in a 37°C water bath (body temperature)*
*Incubate tube 6A for 1 hour in a 0°C ice water bath

_______ Time In _________ Time out

**Lugol’s IKI Test**
*This solution turns blue/black in the presence of starch*
1. On a spot plate, mark 6 of the wells with the tube numbers.
2. Add 1 drop from the tube into the appropriate well.
3. Then add 1 drop of IKI to each sample.
4. Record the results on the table.
   ∅ (No change)
   +  (Slight color change)
   ++  (Medium color change)
   +++  (Dark color change)
**Benedict’s solution test**

*This test checks for the presence of glucose and maltose. After heating, it will have an orange precipitate if these sugars are present.*

1. In each of the tubes (after the sample for Lugol’s IKI test has been taken out), add 3 drops of Benedict’s solution.

2. Boil for 5 minutes.

3. Record the results on the table

\[ \emptyset \text{ (No orange precipitate)} \]
\[ + \text{ (Slight orange precipitate)} \]
\[ ++ \text{ (Medium amount of orange precipitate)} \]
\[ +++ \text{ (Large amount of orange precipitate)} \]

<table>
<thead>
<tr>
<th>Test</th>
<th>1A</th>
<th>2A</th>
<th>3A</th>
<th>4A</th>
<th>5A</th>
<th>6A</th>
</tr>
</thead>
<tbody>
<tr>
<td>IKI test</td>
<td>Water + Starch 37°C</td>
<td>Water + Amylase 37°C</td>
<td>Water + Maltose 37°C</td>
<td>Amylase (boiled) + Starch 37°C</td>
<td>Amylase + Starch 37°C</td>
<td>Amylase + Starch 0°C</td>
</tr>
<tr>
<td>Predicted result</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Actual result</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Benedict’s test</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Predicted result</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Actual result</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Tubes 1A, 2A, and 3A were controls

- What was the purpose of tube 1A?

- What was the purpose of tube 2A?

- What was the purpose of tube 3A?

- What happened to the enzyme in 4A? Explain the actual results vs. predicted results.

- What process happened in tube 5A?

- Explain reason for the difference in tube 5A and 6A.
Protein Digestion with Trypsin

- Trypsin is the enzyme used to hydrolyze ________________ into ________________
- Pepsin comes from the ____________ (in the presence of HCl.)
- Proteins are digested by pepsin into ________________
- Pancreatic enzymes such as trypsin, chymotrypsin, and carboxypeptidase break large polypeptides down into ________________
- Dipeptidases on the brush border and inside intestinal epithelial cells digest dipeptides into ________________

**BAPNA**: (N-alpha-benzoyl-L-arginine-P-nitroanilide) This is a synthetic “protein”. It is an amino acid covalently bonded to a dye molecule. When trypsin hydrolyzes BAPNA, it turns yellow.

**Directions**:  
1. Take 5 test tubes and label them 1T, 2T, 3T, 4T, and 5T (use grease pencil)
2. **Tube 1T**: Place 3 drops of water and 3 drops of trypsin.
3. **Tube 2T**: Place 3 drops of water and 3 drops of BAPNA
4. **Tube 3T**: Place 3 drops of trypsin.  
   Boil tube 3T for 4 minutes  
   **After boiling**, add 3 drops of BAPNA
5. **Tubes 4T and 5T**: Place 3 drops of trypsin and 3 drops of BAPNA

*Incubate tubes 1T, 2T, 3T and 4T for 1 hour in a 37°C water bath (body temperature)*  
*Incubate tube 5T for 1 hour in a 0°C ice water bath*

<table>
<thead>
<tr>
<th>Test</th>
<th>1T</th>
<th>2T</th>
<th>3T</th>
<th>4T</th>
<th>5T</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Water + Trypsin</td>
<td>Water + BAPNA</td>
<td>Trypsin (boiled) + BAPNA</td>
<td>Trypsin + BAPNA</td>
<td>Trypsin + BAPNA</td>
</tr>
<tr>
<td></td>
<td>37°C</td>
<td>37°C</td>
<td>37°C</td>
<td>37°C</td>
<td>0°C</td>
</tr>
<tr>
<td>Predicted result</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Actual result</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

∅ (No change) ++ (Medium color change)  
+ (Slight color change) +++ (Dark color change)
- What was the purpose of tubes 1T & 2T?

- What happened to the enzyme in 3T? Explain the actual results vs. predicted results.

- What process happened in tube 4T & 5T? Explain the difference between incubating at body temperature vs. ice water.

- In the stomach, what does HCL do to enhance protein digestion by pepsin?

---

**Emulsification of Fats with Bile Salts**

**Directions:**
1. Add 1 cm of water to 2 test tubes
2. Add an equal amount of vegetable oil to each tube.
3. Add a pinch of Bile Salts to one of the tubes.
4. Cover the tubes with parafilm.
5. Shake vigorously.
6. Compare the changes in the tubes over the next 10 minutes.

- Describe what is happening in each tube.
Fat Digestion with Lipase

- Lipase is the enzyme used to hydrolyze __________________ into _______________ and ________________
- What does bile do to speed triglyceride digestion?

Litmus Cream is a fat mixed with a litmus powder that indicates a change in pH. It will turn blue if there is an alkaline pH and pink if there is an acid pH. The darker the color change, the greater the change in pH.

***Pancreatin is a pancreatic extract containing lipase

Directions:
1. Take 7 test tubes and label them 1L, 2L, 3L, 4L, 5L, 4B & 5B (use grease pencil)
2. Tube 1L: Place 5 drops of water and 5 drops of pancreatin
3. Tube 2L: Place 5 drops of water and 5 drops of litmus cream
4. Tube 3L: Place 5 drops of pancreatin
   Boil tube 3L for 4 minutes
   After boiling, add 5 drops of litmus cream
5. Tubes 4L & 5L: Place 5 drops of pancreatin and 5 drops of litmus cream
6. Tubes 4B & 5B: Place 5 drops of pancreatin, 5 drops of litmus cream and a pinch of Bile Salts (mix well by gently swirling tube)

*Incubate tubes 1L, 2L, 3L, 4L and 4B for 1 hour in a 37°C water bath*
*Incubate tubes 5L and 5B for 1 hour in a 0°C ice water bath

<table>
<thead>
<tr>
<th>Test</th>
<th>1L</th>
<th>2L</th>
<th>3L</th>
<th>4L</th>
<th>5L</th>
<th>4B</th>
<th>5B</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Water + Pancreatin</td>
<td>Water + Litmus Cream</td>
<td>Pancreatin (boiled) + Litmus Cream</td>
<td>Pancreatin + Litmus Cream</td>
<td>Pancreatin + Litmus Cream + Bile Salts</td>
<td>Pancreatin + Litmus Cream</td>
<td></td>
</tr>
<tr>
<td></td>
<td>37°C</td>
<td>37°C</td>
<td>37°C</td>
<td>37°C</td>
<td>0°C</td>
<td>37°C</td>
<td></td>
</tr>
<tr>
<td>Predicated result</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Actual result</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>∅ (No change)</td>
<td>++ (Medium color change)</td>
<td></td>
<td></td>
<td></td>
<td>+++ (Large color change)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
- What color did the litmus cream turn in some of the tubes and why?

- What process happened in tube 4L & 5L? Explain the difference between incubating at body temperature vs. ice water. (What happens to fat when you put it in cold?)

- Explain the difference between what happened in tubes 4L and 4B

---

**Peristalsis**

Although gravity plays a role in delivering food and drink to the stomach, it is not the only mechanism. Peristalsis is waves of smooth muscle contractions that propel the food along the alimentary canal. When the food gets to the end of the esophagus a peristaltic wave opens the lower esophageal sphincter to let the food into the stomach.

**Directions:**
1. Get a cup of water and a stethoscope.
2. Person #1 will listen to person #2 about 1 inch and to the left of the xiphoid process while #2 takes a large drink of water.
3. You should listen for 2 sounds.
   a. The splash of the water arriving at the lower esophageal sphincter (LES)
   b. The splash of the water entering the stomach.

- What is the difference between peristalsis and segmentation?

- Why is it important to keep the LES closed if there is no food waiting to get into the stomach?
Lab Activity 31: Urinary System
Martini Chapter 26

Gross Anatomy:
1. Note the position of the kidneys compared to the peritoneum. What term describes its relationship?
2. What endocrine glands are on the superior pole of the kidneys?
3. What is the medial border of the kidneys called?
4. Name three structures that enter or leave the kidneys at this area.

Internal Anatomy of Kidney:
1. Cortex
2. Columns
3. Pyramids (equivalent with the renal medulla)
   a. What is the tip of the pyramid called?
   b. What part of the calyceal system is next to this tip?
4. Minor calyces (singular=calyx)
5. Major calyces
6. Renal pelvis
7. Ureter.
8. Renal artery and vein
Nephron
1. Bowman’s capsule
   a. Parietal layer
   b. Podocytes
2. Proximal convoluted tubule
3. Descending limb of the loop of Henle
4. Ascending limb of loop of Henle
5. Distal convoluted tubule
6. Collecting duct
7. Renal papilla
8. Papillary duct
9. Minor calyx
10. Afferent and efferent arteriole.
   a. Which supplies the glomerulus, and which drains the glomerulus?
11. Peritubular capillaries
12. Vasa Recta

13. What is the difference between cortical nephrons and juxtamedullary nephrons?

14. The ______________________capillaries are near the convoluted tubules; the ______________________are looping vessels near the long loops of Henle in the renal medulla.
1. A renal corpuscle includes a glomerulus plus ____________________________

2. What is the glomerulus?

3. What are fenestrations?

4. The visceral layer of Bowman's capsule has podocytes. The outer layer of Bowman's capsule is the parietal layer. What fluid is in between these two layers?
   
   a. How is this different from plasma (what things are not filtered)?

5. Define these terms:
   
   b. Filtration

   c. Reabsorption

   d. Secretion
6. What are macula densa cells?

7. What are juxtaglomerular cells?

8. What is the function of renin?

9. Where does angiotensinogen come from?

10. Where does angiotensin I get converted into angiotensin II?

11. What are the functions of angiotensin II?

12. What are the functions of aldosterone?

13. What is the function of ADH?
14. Urinary bladder
   a. Trigone
   b. Ureteral orifices
   c. Internal urethral sphincter
   d. External urethral sphincter
   e. Detrusor muscle

15. What is the difference in length between the male and female urethra?

   a. What is one consequence of this difference?

16. What are the 3 sections of the male urethra?
### Histology:

<table>
<thead>
<tr>
<th>Histology Structures</th>
<th>Draw a picture:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Cortex</strong></td>
<td></td>
</tr>
<tr>
<td>Glomerulus</td>
<td></td>
</tr>
<tr>
<td>Bowman’s capsule</td>
<td></td>
</tr>
<tr>
<td>Parietal layer</td>
<td></td>
</tr>
<tr>
<td>Visceral layer</td>
<td></td>
</tr>
<tr>
<td>Distal convoluted tubule (simple cuboidal)</td>
<td></td>
</tr>
<tr>
<td>Macula densa</td>
<td></td>
</tr>
<tr>
<td>Collecting duct (simple cuboidal)</td>
<td></td>
</tr>
<tr>
<td>Proximal convoluted tubule (simple cuboidal with microvilli)</td>
<td></td>
</tr>
<tr>
<td><strong>2. Medulla</strong></td>
<td></td>
</tr>
<tr>
<td>Thin segments (simple squamous)</td>
<td></td>
</tr>
<tr>
<td>Thick segments (simple cuboidal)</td>
<td></td>
</tr>
<tr>
<td>Collecting duct (simple cuboidal)</td>
<td></td>
</tr>
<tr>
<td>Vasa recta</td>
<td></td>
</tr>
<tr>
<td><strong>3. Bladder</strong></td>
<td></td>
</tr>
<tr>
<td>Transitional epithelium</td>
<td></td>
</tr>
</tbody>
</table>
Lab Activity 32: Urinalysis

Instructions:
1. Obtain a specimen cup. Put a small piece of masking tape on the cup with your initials. (Do not write directly on the cup, since these are not disposable.)
2. Go to the bathroom and get a urine sample.
3. Place a paper towel at your workstation.
4. Put on gloves (wear gloves during the entire lab).

Visual/Olfactory Inspection
5. Observe the color and smell of the urine. Record your observations on the table.
6. With the lid on tight, shake the sample vigorously. Observe the presence or absence of thick foam (not just bubbles).

Dipstick Analysis
7. Dip a Chemstrip urinalysis strip into the urine, and remove it immediately. Place it on a paper towel. Wait the appropriate amount of time indicated on the canister next to each test. (Varies from 60 seconds to 120 seconds)
8. Hold your strip next to the color indicator on the canister. Record your findings.

Specific gravity
9. Obtain a urinometer cylinder and float.
10. Fill the urinometer cylinder about 2/3 full with urine.
11. Carefully lower the urinometer float into the urine. Make sure it is floating freely before attempting to take the reading.
12. Read the scale on the float, and record your findings.
13. Pour the urine sample back into your specimen cup.
14. Carefully place the glass cylinder and urinometer float into the appropriate bucket for cleaning.

Sulfates
15. Add 5 ml of urine to a test tube.
16. Add a few drops of dilute hydrochloric acid and 2 drops of 10% barium chloride solution.
17. The appearance of a white precipitate (barium sulfate) indicates the presence of sulfates.
18. When finished, rinse out the test tube and place in the appropriate bucket for cleaning.

Phosphates
19. Put a large beaker filled half way with water on a hotplate.
20. Add 5 ml of urine to a test tube.
21. Add 3 or 4 drops of dilute nitric acid and 3 ml of ammonium molybdate.
22. Mix well.
24. Formation of a yellow precipitate indicates the presence of phosphate in the sample.
25. When finished, rinse out the test tube and place in the appropriate bucket for cleaning.
**Chlorides**
26. Add 5 ml of urine to a test tube.
27. Add several drops of silver nitrate (AgNO$_3$).
28. A white precipitate (silver chloride) is a positive test for chlorides.
29. When finished, rinse out the test tube and place in the appropriate bucket for cleaning.

**Microscopic analysis**
30. Put 10 ml of urine in a centrifuge tube. (Put your initials on it with a grease pencil. 
31. Give your sample to the instructor to put in the centrifuge.
32. Spin the sample for 10-15 minutes.
33. Pour the supernatant back into your specimen cup. (A small drop of fluid will remain at the bottom).
34. Add 1 or 2 drops of sedistain to the tube.
35. Flick the bottom of the tube with your fingers to mix.
36. Pipette 1 drop onto a glass slide and cover with a coverslip.
37. Put the tube in the appropriate bucket.
38. Examine under the microscope. Draw a picture of what you see and identify the structures.

**Cleanup**
39. Place all microscope slides in the bleach bucket for glass.
40. Empty your specimen cup in the bathroom.
41. Remove the masking tape with your initials and put the specimen cup in the appropriate bucket.
42. Place all gloves, paper towels and dipsticks in the red bucket.
43. Clean your workbench with disinfectant.

**Draw a picture of your microscopic examination.**
1. What makes urine yellow?

2. What can cause urine to be red?

3. What causes cloudiness?

4. Specific gravity is the relative density of a specific volume of liquid compared to an equal volume of:

5. What is the normal range for the urine specific gravity?

6. What conditions would lead to a specific gravity near 1.001?

7. What conditions would lead to a specific gravity of 1.030?

8. What conditions can cause a specific gravity >1.035? Explain.

9. What can cause an ammonia-like odor to urine?

10. What does the urine smell like if a diabetic is suffering from ketoacidosis?

11. Urine pH: What are the average, as well as the normal range?

12. How does diet influence urinary pH?
13. The most important nitrogenous wastes to enter the urine are urea, uric acid, and creatinine.
   a. Urea comes from:
   b. Uric acid comes from:
   c. Creatinine comes from:

14. What is the significance to seeing epithelial cells in the urine?

15. What is the significance to seeing white blood cells in the urine?
   a. What is considered normal for a male?
   b. What is considered normal for a female?

16. What is the significance to seeing red blood cells in the urine? Discuss the different morphologies of RBC in urine.

17. Describe these common crystals:
   a. Struvite
   b. Uric Acid
   c. Calcium Oxalate
18. What is a cast?

19. Name 2 places in the kidney where casts can be formed.

20. Describe these casts and indicate their significance.
   a. Hyaline cast
   b. Red blood cell cast
   c. White blood cell cast
21. Define the following and list the cause(s) of each.

   a. Glycosuria

   b. Albuminuria/proteinuria

   c. Ketonuria

   d. Hematuria

   e. Bilirubinuria

   f. Pyuria

   g. Cystitis

   h. Pyelonephritis
# Urinalysis Worksheet

<table>
<thead>
<tr>
<th>Test</th>
<th>Test result</th>
<th>Normal Value</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Color</td>
<td>Yellow: Pale—medium—dark Other: ____</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transparency</td>
<td>Clear Cloudy: + ++ +++</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Odor</td>
<td>Normal or other:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Foam after shaking</td>
<td>No Foam Foam</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leukocytes</td>
<td></td>
<td></td>
<td></td>
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Lab Activity 33: Reproductive System Anatomy
Martini Chapter 28

Male Reproductive System

External Anatomy
1. Scrotum
2. Shaft of penis
3. Glans penis
4. Foreskin (prepuce) (not in picture)
5. External urethral orifice
6. Inguinal canal (not in picture)

Internal Anatomy
1. Corpus cavernosum
2. Corpus spongiosum. (Contiguous with the glans penis)
3. Testes
4. Seminiferous tubules
5. Rete testes
6. Epididymis
7. Vas deferens
   a. Ampulla
8. Seminal vesicles
9. Ejaculatory duct
10. Prostate gland
11. Bulbourethral glands
12. Urinary bladder
13. Prostatic urethra
14. Membranous urethra
15. Penile urethra.
1. List the major components of seminal fluid and their functions.

2. List the major components of prostatic fluid and their functions.

3. What is secreted by the bulbourethral gland and what is its function?

4. What erectile tissue does the penile urethra travel through?

5. List the structures located in the spermatic cord.

6. Where are sperm made?

7. Where are sperm stored?

8. What moves the sperm through the epididymis and vas deferens?

9. What is the function of the cilia in the epididymis?
Histology of the Male:
1. Seminiferous tubules:
   a. Sertoli cells
      i. Functions:
         ii. What hormone stimulates them? ______________________
         iii. They produce ____________________ (concentrates testosterone in the seminiferous tubules)
         iv. When sperm production is too high, Sertoli cells secrete _______________, which inhibits the secretion of FSH and GnRH.

   b. Interstitial cells (Leydig cells)
      i. Produce the hormone ____________________ when stimulated by the hormone ____________________ (from the pituitary gland)

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<thead>
<tr>
<th>Histology Structures</th>
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<td>Seminiferous tubules:</td>
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<td>1. Sertoli cells</td>
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<td>2. Interstitial cells (Leydig cells)</td>
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<tr>
<td>3. Spermatogonia</td>
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<tr>
<td>4. Spermatozoa</td>
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</tbody>
</table>
Female Reproductive System

External Anatomy
1. Perineum
2. Mons pubis
3. Labia majora
4. Labia minora
5. Prepuce
6. Clitoris
7. External urethral orifice
8. Vaginal orifice
9. Hymen (not in this picture)

Internal anatomy:
1. Vagina (stratified squamous epithelium)
   a. Fornix
   b. Bartholin (vestibular) Glands
2. Uterus
   a. Cervix
   b. Cervical canal (aka: endocervical canal)
   c. External os
   d. Internal os
   e. Body of uterus
   f. Fundus
   g. Endometrium
   h. Myometrium
   i. Perimetrium
3. Fallopian tubes (oviducts)
   a. Fimbriae
   b. Infundibulum
   c. Ampulla
   d. Isthmus
4. Ovaries
5. Ligaments
   a. Ovarian ligament
   b. Broad ligament
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<th>Histology Structures</th>
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<td><strong>Uterus</strong></td>
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<td>1. Endometrium</td>
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<td>a. Stratum functionalis</td>
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<tr>
<td>i. Simple columnar epithelium</td>
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<td>ii. Endometrial glands</td>
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<td>b. Stratum basalis</td>
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<tr>
<td>2. Myometrium</td>
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</table>
## Fallopian tubes (simple columnar ciliated epithelium)

1. What is the function of the cilia?

## Ovary:

1. Primordial follicle
   a. Follicle cells
      (Simple squamous/cuboidal)
   b. Primary oocyte

2. Primary follicle
   a. Granulosa cells
      (Stratified cuboidal)
   b. Primary oocyte
      i. Zona pellucida
   c. Thecal cells
3. **Secondary follicle**  
   a. **Granulosa cells**  
      (Stratified cuboidal)  
   b. **Primary oocyte**  
      i. Zona pellucida  
      ii. Antrum (fluid filled cavity)  
   c. **Thecal cells**

4. **Graafian follicle (tertiary follicle)**  
   a. **Granulosa cells**  
      (Stratified cuboidal)  
   b. **Primary or secondary oocyte**  
      i. Zona pellucida  
      ii. Antrum (fluid filled cavity)  
      iii. Corona radiata  
   c. **Thecal cells**

1. **Which cells does FSH stimulate?**

2. **What hormone do the granulosa and thecal cells secrete?**

3. **Which hormone causes the Graafian follicle to rupture (ovulation)?**

4. **What is the corpus luteum?**

5. **What 2 hormones are secreted by the corpus luteum to mature and maintain the endometrium?**
Breasts
1. Areola
2. Nipple
3. Lobules
4. Alveoli
5. Lactiferous ducts
7. Adipose tissue

8. What muscle is deep to the breast tissue?

9. Where are the lymphatics that drain the breasts located?

10. Which hormone from the pituitary gland promotes synthesis of milk?

11. Which hormone from the posterior pituitary gland stimulates milk ejection?
1. Define gametogenesis

2. Define these terms:
   a. Haploid
   b. Diploid
   c. Homologous chromosomes
      i. How many pairs of homologous chromosomes are in humans?
   d. Sister chromatids
   e. Tetrad

3. What process occurs in the gonads to form a haploid number of chromosomes?

4. Define synapsis.

5. What phase of meiosis does synapsis occur in?

6. Describe crossing over.
Draw mitosis

Draw Meiosis

- Spermatogonia
  OR
  Oogonia

1st Spermatocyte
  OR
  1st Oocyte

2nd Spermatocyte
  OR
  2nd Oocyte/polar body

Spermatids
  OR
  Oocyte/2nd polar body

Spermatids
  OR
  Polar bodies
Male spermatogenesis and spermiogenesis:

1. Where does spermatogenesis take place?

2. To help you understand spermatogenesis, sort the following in the correct order, from least mature to most mature:

   ______ Spermatids
   ______ Primary spermatocyte
   ______ Functional sperm
   ______ Secondary spermatocyte
   ______ Spermatogonia.

3. Which of these undergoes mitosis?

4. Which are 2n (46 chromosomes) and which are 1n?

5. What is the difference between the terms spermatogenesis and spermiogenesis?

6. Describe the contents of the head, midpiece, and tail of spermatozoa.
Female oogenesis

1. What phase of meiosis are these in, and which one undergoes mitosis?

_____________________ Oogonia
_____________________ Primary oocyte
_____________________ Secondary oocyte
_____________________ Ovum

2. Which one is ovulated?

3. Which one occurs after sperm penetration, and before fusion of the male and female pronuclei?

4. What is a polar body?

5. What is a zygote?
Lab Activity 35: Embryology Lab
Martini Chapter 29

Define these terms:

1. Zygote

2. Blastomeres

3. Morula

4. Blastocyst

5. Inner cell mass

6. Trophoblast

7. Blastocoele
*Identify these structures and describe their function

8. Syncytiotrophoblast*

a. What enzyme is secreted to erode the endometrium?

9. Cytotrophoblast*
10. Chorionic villi*

11. Embryonic disc*
   a. Endoderm
   b. Ectoderm

12. Amnion (amniotic cavity)*
13. Yolk sac*

14. Primitive streak

15. Mesoderm*

Also in this picture:
- a. Endometrium
- b. Chorionic villi
- c. Amniotic cavity
- d. Syncytiotrophoblast
- e. Cytotrophoblast
- f. Blastocoele
- g. Lacunae
16. Allantois

17. Chorion

18. How long is the human gestational period (from fertilization to parturition)?
   
   a. How long is it if you calculate from the last menstrual period?

19. What is the term for rapid mitotic cell division without cell growth?

20. What hormone is secreted by the trophoblast? (Hint: Used to detect pregnancy)

21. Which part of the blastocyst will become the embryo?

22. Where are embryonic blood cells made?
23. Explain why the corpus luteum does not degenerate if an embryo implants into the uterus.

24. Define gastrulation.

25. List the structures that are formed by ectoderm.

26. List the structures that are formed by mesoderm.

27. List the structures that are formed by endoderm.
Placenta

Identify these structures:

1. Umbilical arteries
2. Umbilical vein
3. Chorionic villi
4. Maternal blood vessels
5. Syncytiotrophoblast
6. Amnion
7. Area filled with maternal blood
8. Decidua basalis of the endometrium

28. When is the placenta fully formed and functional?

29. Is the blood oxygenated or deoxygenated in these umbilical vessels?
   a. Two arteries
   b. One vein

30. What 6 hormones are secreted by the placenta and what are their functions?
Lab Activity 36: Principles of Heredity
Martini Chapter 29

Definitions

1. Gene

2. Allele

3. Locus

4. Homozygous

5. Heterozygous

6. Dominant gene (allele)

7. Recessive gene (allele)

8. Genotype

9. Phenotype

10. Karyotype
11. Complete Dominance

12. Codominant

13. Incomplete dominance

14. Sex-Linked Inheritance

15. Polygenic Inheritance

16. Genomic Imprinting

17. Cytoplasmic Inheritance

18. Trisomy

19. Monosomy

20. Pleiotropy
Complete Dominance

Pea plant

Tall (dominant) = T
Dwarf (recessive) = t

#1 Parents: Tt (dad) & tt (mom)

% of genotype TT
% of genotype Tt
% of genotype tt
% of phenotype tall
% of phenotype dwarf

#2 Parents: Tt (dad) & Tt (mom)

% of genotype TT
% of genotype Tt
% of genotype tt
% of phenotype tall
% of phenotype dwarf

Guinea pig

Rough coat (dominant) = R
Smooth coat (recessive) = r

#1 Parents: RR (dad) & rR (mom)

% of genotype RR
% of genotype Rr
% of genotype rr
% of phenotype rough
% of phenotype smooth

#2 Parents: RR (dad) & rr (mom)

% of genotype RR
% of genotype Rr
% of genotype rr
% of phenotype rough
% of phenotype smooth
**Incomplete Dominance**

Snapdragon flowers

Red = RR
White = rr
Pink = Rr

#1 Parents: Dad is red & mom is white

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% of genotype RR __________
% of genotype rR __________
% of genotype rr __________
% of phenotype red __________
% of phenotype white __________
% of phenotype pink __________

#2 Parents: Dad is white & mom is pink

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% of genotype RR __________
% of genotype rR __________
% of genotype rr __________
% of phenotype red __________
% of phenotype white __________
% of phenotype pink __________

#3 Parents: Dad is pink & mom is pink

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% of genotype RR __________
% of genotype rR __________
% of genotype rr __________
% of phenotype red __________
% of phenotype white __________
% of phenotype pink __________
# Codominance

**ABO blood types**

### #1 Parents: dad is AB & mom is AO

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<td>BO</td>
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### #2 Parents: dad is BO & mom is AO

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<td>OO</td>
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<td>BO</td>
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<tr>
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### Questions??

1. Is O codominant or recessive?

2. Which blood groups are codominant?

3. Considering Rh factor, is it codominant, incomplete dominance or complete dominance?
**Pedigrees**

1. What is a pedigree?

2. **Autosomal Dominant**
   
   2. Draw a pedigree with 3 generations showing autosomal dominant inheritance.

3. If a child has an autosomal dominant trait, what can you say about the parents?

4. If two parents have an autosomal dominant trait, what can you say about their children? (Do not give numbers, percentages, or ratios.)
**Autosomal Recessive**

5. Draw a pedigree with 3 generations showing autosomal recessive inheritance.

6. If two parents have an autosomal recessive trait, what can you say about their children?

7. If two parents do not have an autosomal recessive trait, what can you say about their children?
   (Do not give numbers, percentages, or ratios.)

X-Linked Recessive

9. Draw a pedigree with 3 generations showing X-linked recessive inheritance.

10. If a female has a X-linked disease, what can you say about her genotype?

11. If a female has a X-linked disease, what can you say about her mother’s genotype?

12. If a female has a X-linked disease, what can you say about her father’s genotype?

13. If a female does not a X-linked disease but her son does, what can you say about her genotype?
Pedigree analysis

Legend:

- Normal male
- Affected male
- Normal female
- Affected female

Family affected by albinism (autosomal recessive disease)

Use this punnett square to help you answer the questions.

?? Questions

A= normal allele
a= albino allele

1. What is the genotype of mom? _________
2. What is the genotype of dad? _________
3. What is the genotype of child #1 and #3? _________ or _________
4. If they have another child, what is the probability of having an albino child? _________
Family affected by color blindness (X-linked recessive disease)

**Questions**

$X =$ normal allele

$X^c =$ color blind allele

2. What is the genotype of mom? _________

5. What is the genotype of dad? _________

6. What is the genotype of child #2? _________

7. What is the genotype of child #1? _________ or _________

8. If they have another male child, what is the probability he will be colorblind? _________

Use this punnett square to help you answer the questions.
**Probability**

- Probability of event A occurring **OR** event B occurring =
  (Probability of event A) + (probability of event B)
  
  Example: When flipping a coin, what is the probability of Heads or Tails?
  
  Heads = $\frac{1}{2}$  Tails = $\frac{1}{2}$
  
  $\frac{1}{2} + \frac{1}{2} = 1$ (or 100% chance)

- Probability of event A occurring **AND** event B occurring =
  (Probability of event A) x (probability of event B)
  
  Only if you ask the question before either A or B has occurred. **BE Careful!** If event A has already happened when you ask about the probability of event B, and A & B are two independent events, then you may need to ignore A's probability when asking about B

  Example: Flip a coin twice
  What is the probability of getting Heads both times?
  
  $\frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$ (25%)

1. What is the probability of a mother having a girl?

2. What is the probability of a mother having a boy or a girl?

3. If a mother has given birth to a girl for her first child, what is the probability of her having a girl as her second child?

4. Say a mother has a genetic disease and there is a 25% chance of her offspring having the disease. Say she intends to have three kids. What is the probability of all three kids having the disease?

5. Say a mother has a 50% chance of having a blue-eyed child and 50% chance of having a brown-eyed child. If she has had six kids, all blue-eyed, what is the probability that her seventh kid will be blue eyed?

6. In the above question, what is the probability that her seventh kid will be a brown-eyed boy?

7. If a woman is planning on having six children, what is the probability that they will all be boys?
Activity: Flipping Coins

- Obtain 2 coins
- Flip 1 coin ten times and record the number of head (H) and the number of tails (T).

_________ # of heads
_________ # of tails

- Now simultaneously flip 2 coins 24 times.

# of HH: __________
# of HT: __________
# of TT: __________

Does the outcome of the one toss have any influence on the next toss?

Draw a Punnett square using HT for the alleles of each coin

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<td>T</td>
<td>H</td>
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Probability of HH: _________
Probability of HT: _________
Probability of TT: _________

How closely do the probabilities of the Punnett square correlate with the percentages obtained from the coin tossing?
**Using phenotype to determine genotype**

For each characteristic, determine your phenotype and genotype.

If you have the recessive trait, you are homozygous (aa)

If you have the dominant trait, it is impossible to determine if you are heterozygous or homozygous for the trait without more information, so record it as A—(use the letter used to indicate the alleles)

- **Interlocking fingers:** Clasp your hands together by interlocking your fingers.
  - Dominant (I): The left thumb is uppermost
  - Recessive (i): The right thumb uppermost

- **PTC taste:** Phenylthiocarbamide is a harmless chemical that some people can taste and others find tasteless. Chew a PTC taste strip.
  - Dominant (P): tastes bitter
  - Recessive (p): cannot taste

- **Sodium benzoate taste:**
  - Dominant (S): can taste it
  - Recessive (s): cannot taste it

- **Sex:** XX is female, XY is male

- **Dimpled cheeks:**
  - Dominant (D): dimples in one or both cheeks.
  - Recessive (d): no dimples

- **Tongue rolling.** Extend your tongue and attempt to roll it into a U shape longitudinally.
  - Dominant (T): can roll the tongue
  - Recessive (t): cannot roll the tongue

- **Attached earlobes:** If no portion of the ear lobe hangs free inferior to its point of attachment to the head, it is considered attached.
  - Dominant (E): free earlobe
  - Recessive (e): attached earlobe

- **Widow’s peak:** a distinct downward V-shape hairline at the middle of the forehead is referred to as a widow’s peak.
  - Dominant (W): widow’s peak
  - Recessive (w): straight or continuous forehead hair line

- **Bent little finger:** If the distal phalanx on the little finger angles toward the ring finger.
  - Dominant (L): Bent on both hands
  - Recessive (l): straight on one or both hands

- **Proximal finger hair:** Examine the dorsum of the proximal phalanx of fingers 3 and 4.
  - Dominant (H): hair on the proximal phalanx
  - Recessive (h): no hair on the proximal phalanx
- **Freckles**
  - Dominant (F): freckles
  - Recessive (f): no freckles

- **Blaze**: A lock of hair different in color from the rest of the scalp hair
  - Dominant (B): blaze
  - Recessive (b): no blaze

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<tr>
<th>Characteristic</th>
<th>Phenotype</th>
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<tr>
<td><strong>Example:</strong></td>
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<tr>
<td>Yes, you have dimples (D, d)</td>
<td>+ dimples</td>
<td>D--</td>
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<tr>
<td>No, you do not have dimples (D, d)</td>
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<td>Interlocking fingers (I, i)</td>
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<td>Sex (X, Y)</td>
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<td>Blaze (B, b)</td>
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Lab Evaluation Form  BI 233

Forms should be collected by a student and returned to HT 305 on the last day of class.

Lab instructor: ___________________________  Lab day & time ___________________________

Lab instructor preparedness & overall effectiveness:

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Comments:

Survival Guide

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Comments:

Lab: Did the lab objectives increase your overall understanding of A&P?

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Comments: