Anatomy I: Human Anatomy

- Spring Semester 2013
- 5 Units
- Lab: Tues Thurs 8:00-9:15, Room L1850
- Lecture: Tues Thurs 9:45-12:35, Room L1850

Leonardo da Vinci

Developed by
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John Gallagher, BS, MS, DVM

- Colorado State University
  - BS, Animal Sciences, 1974
  - MS, Clinical Sciences, 1976
  - DVM, Veterinary Medicine, 1980

Body Worlds
A Few Details:

Turn off your Cell Phone! No texting, either.
Review the Safety Rules and microscope guidelines in the syllabus.
Don’t bother to telephone me. Email is much better!

Email:
jgallagher@laspositascollege.edu

My web site:
http://lpc1.clpccd.cc.ca.us/lpc/jgallagher/index.htm

Blackboard:
http://clpccd.blackboard.com/
The Books:


Optional:

- Kapit and Elson, The Anatomy Coloring Book
First Assignment!
Send me an email before Sunday, 11:00 PM, the first week of class
(3 points!)

- Always put Anatomy in the subject line.
  - Did you take Bio 31 at LPC? Who was your instructor?
  - Why are you taking this class?
  - What is your college background?
  - Do you have a job? Where?
  - What special interests do you have?
Anatomy =

- The study of external and internal structures
- The physical relationships among body parts
- Temnein (Gr.) = cut

Leonardo da Vinci
Organization

- Atoms
- Molecules and
- Macromolecules, such as proteins
- Organelles
- Cells
- Tissues
- Organs
- Organ Systems
- Organism
The Systems

(a) Integumentary System
Forms the external body covering; protects deeper tissues from injury; synthesizes vitamin D; site of cutaneous (pain, pressure, etc.) receptors, and sweat and oil glands.

(b) Skeletal System
Protects and supports body organs; provides a framework the muscles use to cause movement; blood cells are formed within bone; stores minerals.

(c) Muscular System
Allows manipulation of the environment, locomotion, and facial expression; maintains posture; produces heat.

(d) Nervous System
Fast-acting control system of the body; responds to internal and external changes by activating appropriate muscles and glands.

(e) Endocrine System
Glands secrete hormones that regulate processes such as growth, reproduction and nutrient use (metabolism) by body cells.

(f) Cardiovascular System
Blood vessels transport blood which carries oxygen, carbon dioxide, nutrients, wastes, etc.; the heart pumps blood.
(g) Lymphatic System/Immunity
Picks up fluid leaked from blood vessels and returns it to blood; disposes of debris in the lymphatic stream; houses white blood cells (lymphocytes) involved in immunity. The immune response mounts the attack against foreign substances within the body.

(h) Respiratory System
Keeps blood constantly supplied with oxygen and removes carbon dioxide; the gaseous exchanges occur through the walls of the air sacs of the lungs.

(i) Digestive System
Breaks down food into absorbable units that enter the blood for distribution to body cells; indigestible foodstuffs are eliminated as feces.

(j) Urinary System
Eliminates nitrogenous wastes from the body; regulates water, electrolyte and acid-base balance of the blood.

(k) Male Reproductive System
Overall function is production of offspring. Testes produce sperm and male sex hormone; ducts and glands aid in delivery of sperm to the female reproductive tract. Ovaries produce eggs and female sex hormones; remaining structures serve as sites for fertilization and development of the fetus. Mammary glands of female breasts produce milk to nourish the newborn.
Planes

- **Frontal**
  - Think front!
- **Transverse**
  - “Trans” = across
- **Sagittal**
  - Especially mid-sagittal
- **Oblique**
  - Any Diagonal
Quadrants Surrounding the Umbilicus

- **RUQ:** Gall Bladder, Rt kidney
- **RLQ:** Appendix, Rt ovary
- **LUQ:** Lt liver lobe, stomach, Lt kidney
- **LLQ:** Small intestine, Lt ovary
These words are used all the time, including this class!

Note the Anatomic Position.
Get used to them!

**Superficial:** Toward the skin

**Deep:** Farther inside

**Medial:** Toward the midline

**Lateral:** Away from the midline
Body Cavities

**BODY CAVITIES**

- Appear during embryonic development

**Ventral Body Cavity (Coelom)**

- Provides protection, allows organ movement; lining prevents friction

**Thoracic Cavity**

- Surrounded by chest wall and diaphragm

  **Right Pleural Cavity**
  - Surrounds right lung

  **Mediastinum**
  - Contains the trachea, esophagus, and major vessels

  **Pericardial Cavity**
  - Surrounds the heart

  **Left Pleural Cavity**
  - Surrounds left lung

**Abdominopelvic Cavity**

- Contains the peritoneal cavity

  **Abdominal Cavity**
  - Contains many digestive glands and organs

  **Pelvic Cavity**
  - Contains urinary bladder, reproductive organs, last portion of digestive tract

**Cranial Cavity**

- Contains brain

**Spinal Cavity**

- Contains spinal cord
Body Cavity Membranes

More later!

- Outer balloon wall (comparable to parietal serosa)
- Air (comparable to serous cavity)
- Inner balloon wall (comparable to visceral serosa)
Body Cavities

(a) Lateral view

- Cranial cavity (contains brain)
- Thoracic cavity (contains heart and lungs)
- Vertebral cavity (contains spinal cord)
- Abdominal cavity (contains digestive viscera, kidneys, and peritoneal cavity)
- Pelvic cavity (contains bladder, reproductive organs, rectum, and peritoneal cavity)

(b) Anterior view

- Cranial cavity
- Vertebral cavity
- Thoracic cavity (contains heart and lungs)
- Mediastinum, with heart and pericardial cavity
- Diaphragm
- Abdominal cavity (contains digestive viscera, kidneys, and peritoneal cavity)
- Pelvic cavity (contains bladder, reproductive organs, rectum, and peritoneal cavity)

Key:
- Yellow: Dorsal body cavity
- Red: Ventral body cavity

- Superior mediastinum
- Lung and pleural cavity
- Diaphragm
- Ventral body cavity (thoracic and abdominopelvic cavities)
Lab Safety (details in syllabus)

1. no open-toe or open-heel shoes allowed in the labs;
2. no eating or drinking (including WATER), nothing by mouth in the labs EVEN if it is only lecture, no fingers in mouth or eyes (contact replacement, taking medication, etc);
3. nothing down the drains, but water (and hand & dish detergents/soaps);
4. nothing into the regular trash cans but paper towels from hand-washing and clean office paper.
Medical Imaging

- Light Microscopy (cytology)
- Electron Microscopy (ultrastructure)
  - TEM
  - SEM
- Radiography (X-Rays)
  - CT Scanning
- Ultrasound
- Positron Emission Tomography (PET)
- Magnetic Resonance Imaging (MRI)
Light Microscopy

Schematic Drawing of a Microscope
(From Peter H. Barrie, p. 8, A Manual of Cytotechnology)

1. Stand
2. Base
3. Light Source
4. Mirror
5. Field Iris Diaphragm
6. Substage Condenser
7. Rack and Pinion
8. Centering Screws
9. Iris Diaphragm (Aperture Stop)
10. Condenser’s Top Element
11. Microscope Stage
12. Control Knobs for Stage
13. Coarse Adjustment
14. Fine Adjustment Focus
15. Microscope Arm
16. Objective Lens (3.2 X, 10 X, 40 X, 100X)
17. Revolving Nosepiece
18. Binocular Tube
19. Oculars
20. Observation Tube
Light Microscopy, cont’d

1. The specimen is **fixed**
   1. Usually in 10% formalin
2. Then embedded in paraffin
3. **Sectioned** with a microtome
   1. Approx 5 µ sections
4. and **stained**
   1. Enhances contrast for better visualization
   2. Many types of stains
      1. H & E = Hematoxylin and Eosin
      2. May add “**artifact**”
The Light Microscope

- Always start with low power objective
- Close iris diaphragm, then open as more light is needed
- Focus on the specimen (low power first)
- Move to medium objective
  - Parfocal

http://www.udel.edu/biology/ketcham/microscope/joelle.mov
Microscope Adjustments

- **Interpupillary distance** and focus of oculars
  - Binocular ‘scopes only
- **Condensor**: usually nearly as high as it will go (Koehler illumination)
  - Iris diaphragm
- Clean slide with **Kim Wipe**
- Clean lenses with **lens paper**
Concepts Important for Viewing

**Magnification** – the ratio of the size of an image to the size of the object

**Resolution** – “the ability to discriminate two close objects as separate.”

**Depth of Field** - depth that focus is clear

**Contrast Formation** - (e.g. absorption contrast)

**Illumination Source** - diascopic vs. episcopic
  - from below (compound) vs. from above (dissecting)

**Artifact** – Distortion from preparation of the specimen
Electron Microscopy

Uses a beam of electrons (instead of visible light) to view topography, morphology, composition, and crystallography. EM was developed for 10,000 – 25,000 X magnification. Properties of light limit magnification of light microscopes to 1000 X and resolution to 0.2 µm.
| Summary Chart for Microscope # | | | | |
|---|---|---|---|
| **Scanning** | **Low power** | **High power** | **Oil immersion** |
| Magnification of objective lens | | | |
| Magnification of ocular lens | 10 | 10 | 10 | 10 |
| Total magnification | | | |
| Working distance | | | |
| Detail observed Letter e | | | |
| Field size (diameter) | | | |

Move the iris diaphragm lever while observing the field. What happens?

... Turn the revolving nosepiece in the other direction to the low-power lens and recenter and re-focus the object. Then move the immersion lens back into position, again avoiding the 40× lens. Sketch the letter e in the... What new details become clear?