

## 1. Course Success

- Course topics



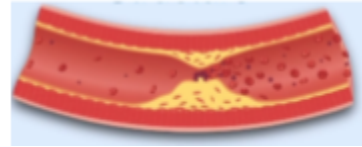
Anatomy: structure of cells, organs



Health: maintaining function

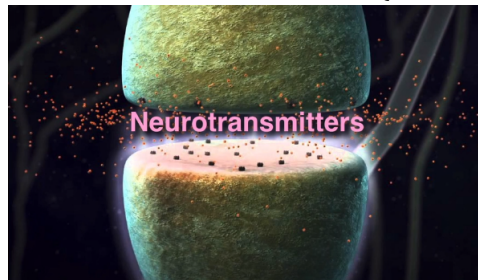


Physiology: function of an anatomy



Disease: altered function/a change in the physiology

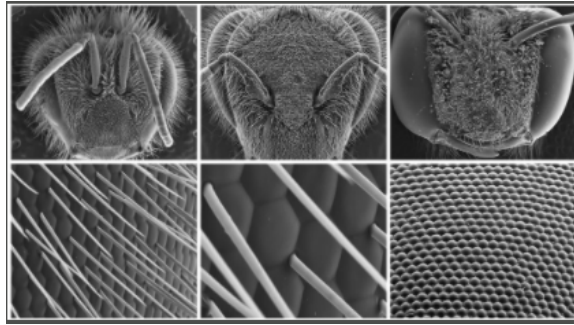
- Biology you can use: consumer, culture, citizen
  - Consumer: health and prevention (what to eat, personal medicine)
  - Culture: global impacts, community
  - Citizen: government & health care, medical research
- People are constantly learning how to learn by making a physical connection between nerve cells
  - Synapse: the connection between nerve cells (also known as memory)



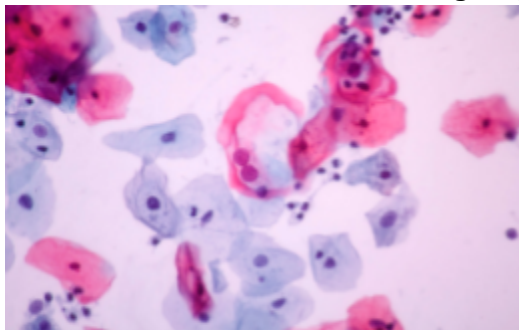
- Neurotransmitters: thing that transfers between neurons
- Things necessary for synapse: food & sleep
- Goal insight: identify goals, barriers & motivation, construct a scaffold
- Trial & error: includes both successes and failures, use reward or punishment
- Repetition: practice what you want to do
- Reduce interferences: they reduce focus and the connection of synapse, develop strategies for refocusing attention

## 2. Science discovery

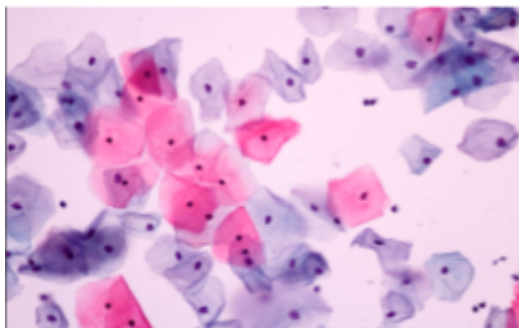
- Objectives
  - list and describe the three aspects of scientific discovery?
  - explain the basics of microscope use (microscopy), including history, magnification, and the use of stains?
  - distinguish between the four major types of tissues?
- The process
  - Exploration: Investigating new natural phenomena. Can be a new location, or a new way of viewing familiar surroundings
  - Description: Providing accurate details about a natural phenomenon. Can include a portrait of an organism, or the steps of a process
  - Explanation: Providing information on how or why something happens. Can be a simple cause and effect, or a much more detailed process of steps with complex variables
- Microscopes
  - The earliest optical or “light” microscopes date back to the seventeenth century, magnifying specimens beyond the range of normal human vision. Early magnification was approximately 10x, or ten times the unaided eye
  - Now microscopes that shine light through specimens can magnify over 1500x and electron microscopes developed in the 20th century magnify 200,000x. Most of the research topics discussed in this course requiring microscopic examination, or “microscopy,” would use an optical “light” microscope



- One consideration in looking at microscope images throughout this course is that you are typically just looking at a small piece of a larger specimen
- Total magnification is the magnification of the eyepiece times (x) the magnification of the objective being used
- A bright light shines through a thin tissue of cells and finely ground glasses magnify the image. Both the eye pieces and specialized lenses called “objectives” magnify. From this image, if you have a 10x eye piece and a 10x objective. The total magnification is 100x
- Antique microscope slides were frequently prepared with chemicals that are now known carcinogens (cancer-causing agents), that are no longer used. Unfortunately the high quality coloring and contrast produced by these stains has not been fully replicated.
- Slides are stained to show different parts of the sample. Stains can turn clear cells that are difficult to read into powerful sources of information. Using a medical example, women get regular pap smears to detect possible abnormal growth in the cells lining the cervix. These cells are colorless under bright light until stain is added



Normal cells (200x): The normally colorless cells are staining shades of pink and purple, which indicates different stages of the cells. The pink was on the surface being sloughed off, the purple was a bit deeper in the lining tissue. They are all about the same size with similar size and shape nuclei (dark purple dots).



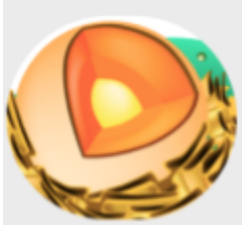
Abnormal cells: At first this may look similar, but look at the different colors and sizes of the nuclei (small circles) within the cells. They are especially different in the bluer cells that are from deeper in the cervical lining. This indicates abnormal growth and could not be easily detected without stains.

- Cells & tissues
  - Science matters: different fields acquire knowledge in different ways. Scientists conduct research of observable phenomena
  - Cell structure: plasma membrane, organelles
  - Tissue: group of cells
    - Epithelial tissue (lining issue): lining outside of organs
    - Connective tissue: a matrix (structure) of an organ
    - Muscle tissue: movement
    - Nervous tissue: communication
  - Science is based on observation (acquiring sensory information). Based on observation, an inference can be made. Conclusion based on evidence and reasoning. Misconceptions can be made because they are incorrect opinion or view based on

faulty information or reasoning. Things like fat-free is bad because our body needs fat

### 3. Cell structures

- Objectives
  - Identify various organelles within a cell
  - Match different cellular activities to specific organelles
  - Describe the structure of the plasma membrane including how it relates to diffusion
- All organisms are made of cells from a single-celled bacterium to a human with trillions of cells. Many features are similar, even between two dramatically different species like an animal and a plant
- Organelles



**Nucleus:** Often called the “brain” of a cell, it contains the cell’s genetic material. Large cells like skeletal muscle cells can have several nuclei instead of just one.



**Golgi Complex:** Where the amino acid chains from the endoplasmic reticulum are processed to make functioning proteins



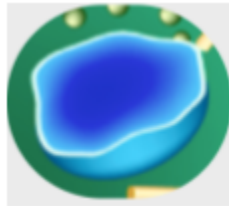
**Mitochondrion:** Often called the “powerhouse” of a cell, producing energy-rich ATP molecules. A single cell can have many mitochondria.



**Lysosome:** Has enzymes that break down bacteria, old organelles, and other unneeded substances

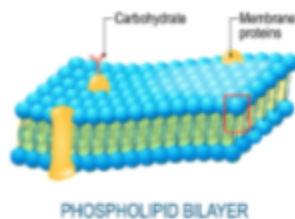


**Endoplasmic Reticulum:** Rough endoplasmic reticulum (RER) produces proteins, smooth endoplasmic reticulum (SER) produces lipids and more.



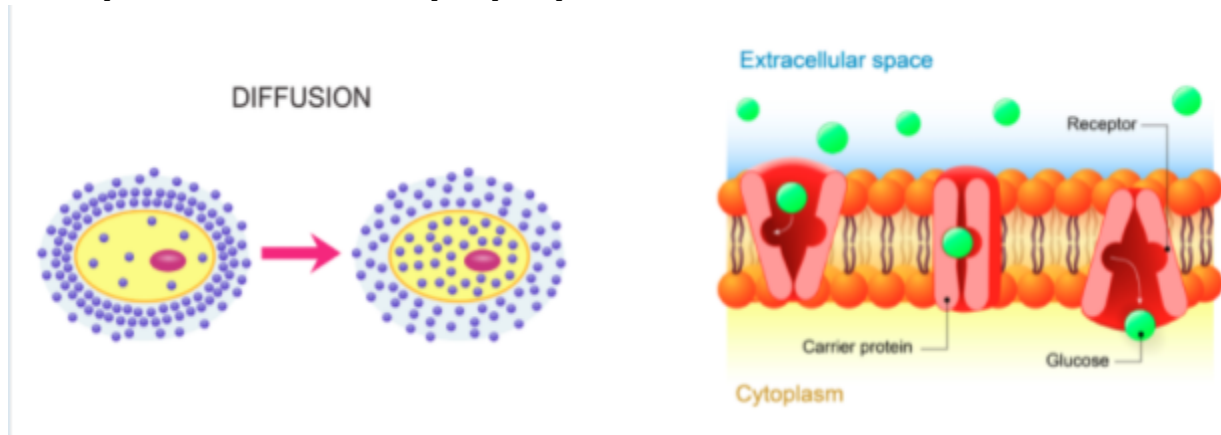
**Vesicle:** Contains substances a cell produces, including hormones, and secretes them at the plasma membrane

- The plasma membrane that surrounds cells has to let some things into the cell, move some substances out of the cell, and block other substances completely.
- Facilitated diffusion
  - a protein that goes into the surface of the plasma membrane and then the molecules can move through the protein channel without any energy required from a high to a low concentration
  - Another protein could change shape to help move the molecules through
  - Active transport: a channel where energy is required to move the molecules from low to high concentration
- The plasma membrane has structural features that make diffusion and active transport possible
  - ATP energy: helps move things from low to high concentration
- The plasma membrane is the barrier between a cell and its environment. It needs to allow the movement of beneficial materials into the cell and harmful materials out of the cell.



The plasma membrane consists of two layers of phospholipids. Each phospholipid molecule has two parts, commonly referred to as the “head” and the “tail.” The heads are water-soluble and face outward, and the tails are water-insoluble and face inward.

- Some substances move simply across membranes; other need to travel with the assistance of proteins embedded in the phospholipid membrane.

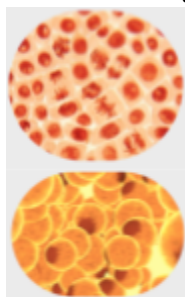


Simple diffusion: Substances move down their concentration gradient. If the concentration is lower in the cell, they can move inside.

Protein assistance: Proteins assist substance movement through facilitated diffusion and the more energy-expensive active transport.

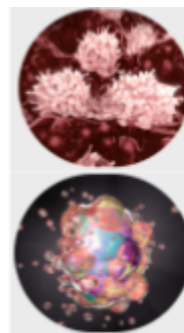
#### 4. Cell lives

- Objectives
  - List the steps involved in taking a cell from the body and preparing it for examination under the microscope.
  - Provide examples of cells that have different structures related to their functions.
  - Explain different cellular life stages, including mitosis, hypertrophy, differentiation, and apoptosis
- The cheek cells are squamous (flattened) epithelial cells and they almost look like the “generic” round cell models. However, most cells in the human body have different shapes that match their functions. In each of the upcoming guide, you will be introduced to different cells that form the tissues that makeup organs
- Four cellular life stages



Mitosis: One cell divides and becomes two daughter cells.

Hypertrophy: A cell grows in size over time.



Differentiation: A cell changes its structure and function over time

Apoptosis: A cell is programmed to die at a certain time.

