BMS 129
Physiological Sciences 1

Table of Contents

WEEK 1
MAJOR THEMES OF ANATOMY AND PHYSIOLOGY AND ORGANIC COMPOUNDS

Define anatomy and distinguish between its subdivisions

Anatomy is the study of structure. The easiest way is through **inspection**, which is simply looking at the body and performing a physical examination or a diagnosis from the surface appearance.

Palpation means feeling a structure with the hands, such as palpating a swollen lymph node. **Auscultation** is listening to the natural sounds made by the body such as heart and lung sounds. **Percussion** is when the examiner taps on the body and feels for abnormal resistance and listens to the emitted sound for signs of abnormalities.

Dissection is carefully cutting and separating tissues to reveal their relationships. This is often done on a cadaver. **Comparative anatomy** is the study of multiple species in order to examine similarities and differences and analyse evolutionary trends.

Exploratory surgery was often used on living people and involved opening the body and taking a look inside to see what was wrong and what could be done about it.
Most exploratory surgery was replaced with **medical imaging**. Structure that can be seen with the naked eye, whether by surface observation, radiology or dissection is called **gross anatomy.**

Histology is the approach where we take tissue specimens, thinly slice and stain them, and observe under a microscope. **Histopathology** is the microscopic examination of tissue for signs of disease. **Cytology** is the study of the structure and function of individual cells. **Ultrastructure** refers to fine detail, down to the molecular level, revealed by the electron microscope.

Developmental anatomy is the study of the structure of the organism from fertilisation to birth.
Regional anatomy is a method of studying gross anatomy where each region of the body is studied separately.
Systemic anatomy is a method of studying gross anatomy where each system of the body is studied throughout the entire body.
Surface anatomy is a method of gross anatomy whereby the surface features of the body are studied in relation to deeper parts.

Define physiology and distinguish between its subdivisions

Physiology is the study of function. **Renal physiology** is the study of kidney function. **Neurophysiology** is the study of the nervous system. **Endocrinology** is the study of hormones. **Pathophysiology** is the study of structural and functional changes in tissues and organs that lead to disease. **Cardiovascular physiology** is the study of the operation of the heart and blood vessels. **Comparative physiology** is the study of how different species have solved problems of life such as water balance, respiration and reproduction.

List levels of human structure from the most complex to simplest

Organism- is a single complete individual. e.g. Human
Organ System- is a group of organs with a unique collective function such as circulation, respiration or digestion. The human body as 11 organ systems.
Organ- is a structure composed of two or more tissue types that work together to carry out a particular function. Organs have definite anatomical boundaries and are visibly distinguishable from adjacent structures.
Tissue- is a mass of similar cells and cell products that forms a discrete region of an organ and performs a specific function. Four classes of tissue are: epithelial, connective, nervous and muscular.
Cells- are the smallest units of an organism that carry out all the basic functions of life. A cell is enclosed in a plasma membrane composed of lipids and proteins.
Organelles- are microscopic structures in a cell that carry out its individual functions. e.g. mitochondria, lysosomes.
Molecules- organelles and other cellular components are composed of molecules. The largest molecules such as proteins, fats and DNA are called macromolecules. A molecule is comprised of at least two atoms.
Atom- chemical level, atoms combine to form molecules.

Define anatomical variation using examples to illustrate

Anatomical variation is the differences between organisms. When we look at the population we can see that we are all different. Organisms are not exactly alike, but often follow a similar pattern. e.g. not all humans have their internal organs structured the way anatomy teaches us. Some humans can have their organs situs inversus, where the organs of the thoracic and abdominal cavities are reversed between right and left. This can create problems during surgery or when diagnosing issues because this change can affect what we see on radiography scans.

Define homeostasis and describe its 3 homeostatic control mechanisms

Homeostasis is the bodies ability to maintain internal stability. It is the bodies ability to detect change, activate mechanisms that oppose it and thereby maintain relatively stable internal conditions.

Receptor is a structure that senses a change in the body and responds to stimuli the produce imbalances in homeostasis.
Integrating (Control) centre is a mechanism that processes this information, relates it to other available information and makes a decision about what the appropriate response should be.
Effector is the cell or organ that carries out the final corrective action.
For example- the stretch receptors that monitor blood pressure have sensed a change, this information is sent to the integrating centre where they compare what blood pressure should be against what it currently is. Then the effector, in this case is the heart, restores normal blood pressure which is sensed by the receptor and the feedback loop has completed.

Explain how negative feedback maintains homeostasis and give examples of its biological use

Negative feedback is a process in which the body senses a change and activates a mechanism that negates or reverses it. Internal conditions is best described as being a dynamic equilibrium, meaning that there is a certain set point or average value for a given variable and conditions fluctuate slightly around this point. EG. body temperature is not set at 37C, rather it fluctuates between 36C to 38C. Negative feedback helps to keep a variable as close to its set point as possible.

Body temperature is an example of negative feedbacks biological use. Body temperature is regulated by nerve cells in the base of the brain that monitor the temperature of the blood. If we become too hot, the nerve cells trigger a heat losing mechanism, such as vasodilation. Vasodilation is the widening of blood vessels which allows for warm blood to flow closer to the body surface and loses heat to the surrounding air. If this is not enough, sweating occurs, and this evaporation of water from the skin has a powerful cooling effect. On the other hand, if it is cold outside and our body temperature drops below 37C, the nerve cells activate a heat conserving mechanism. Vasoconstriction is the narrowing of the blood vessels in the skin, which serves to retain warm blood deeper in the body and reduce heat loss. If this is not enough the nerve cells activate shivering, which generates heat.

Explain positive feedback and give examples of its biological use

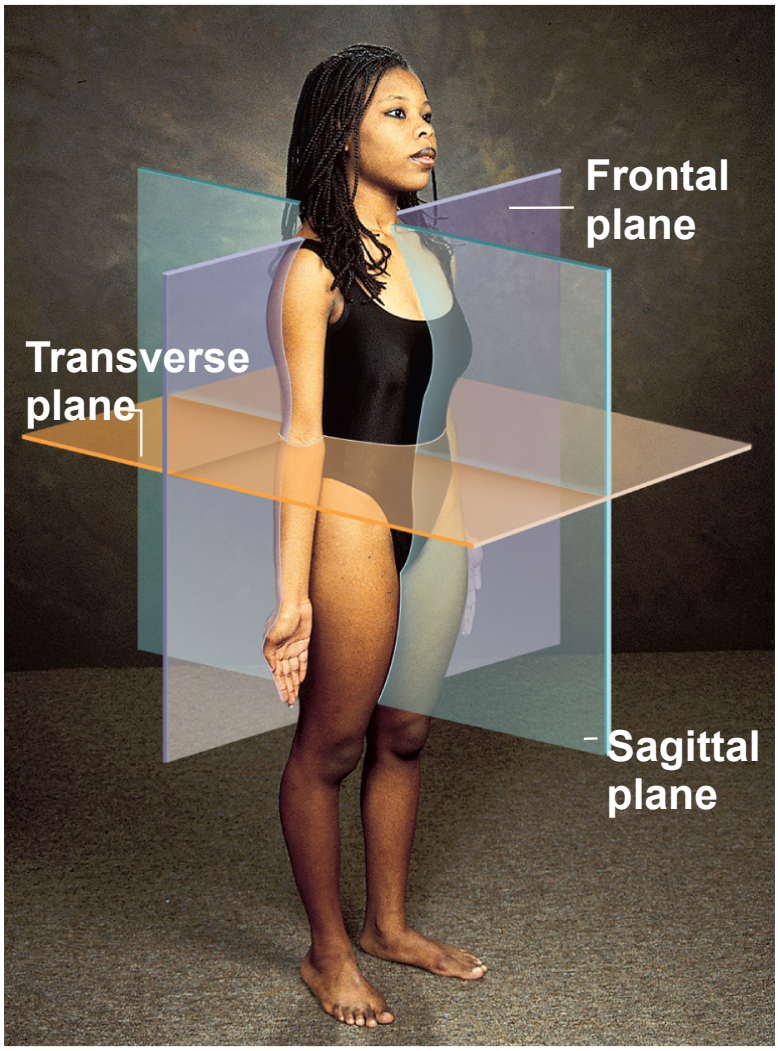
Positive feedback is a self amplifying cycle in which a physiological change leads to even greater change in the same direction, rather than producing a correction like negative feedback. A biological example is child birth. During birth, the head of the foetus pushes against the womens cervix, stimulating the nerve endings. Nerve signals travel to the brain which stimulates the pituitary gland to secrete the hormone oxytocin. Oxytocin travels in the blood and stimulates the uterus to contract, this pushes the foetus down more, stimulating the cervix more and causing the positive feedback loop to be repeated. Therefore, labour contractions become more and more intense until the foetus is expelled.

Other biological examples include blood clotting, protein digestion and the generation of nerve signals.

However, positive feedback can be dangerous. For example, someone with a high fever is beneficial up to a certain point but if the body temperature rises above 40C this can create a dangerous positive feedback loop. The high temperature raises the metabolic rate, which makes the body produce heat faster than it can get rid of. Thus the temperature rises still further, increasing metabolic rate and that production more. This cycle can become fatal at 45C.

Describe the anatomical position and explain why it is used

The anatomical position is the assumed position used by anatomists. This provides a starting point that is the same for everyone when describing the human body. The



anatomical position is that of a person standing upright with the feet flat on the floor, arms at the sides and the palms and face directed forward.

Describe the 3 anatomical planes & identify each in section views

The three anatomical planes are: sagittal, frontal and transverse. A sagittal plane passes vertically through the body or an organ and divides it into right and left portions. A mid-sagittal plane divides the body into equal right and left halves.

A frontal plane extends vertically but it is perpendicular to the sagittal plane and divides the body into anterior (front) and posterior (back) portions.

A transverse plane passes across the body or an organ perpendicular to its long axis; it divides the body or organ into superior (upper) and inferior (lower) portions.