

Lecture 1.1 Human Anatomy, Bio 11, Saddleback College, Dr. D. Iacino

Branches of Anatomy

Gross

Regional

Systemic

Surface

Microscopic

Histology

Developmental

Embryology

Pathological

Radiographic

Functional

Structural Hierarchy

Chemical

Atoms

Molecules

Cellular

Tissues

Organ

Organ system

Organismal

Intro to Gross Anatomy (In lab)

Anatomic Position

Directional Terms (medial, lateral, superior, inferior, etc.)

Axial and Appendicular Skeleton

Planes of Section

Frontal (coronal)

Transverse (cross section)

Sagittal (and midsagittal, parasagittal)

Human Body Plan shared with Vertebrates

Tube within a tube

Bilateral symmetry

Dorsal nerve cord, notochord

Segmentation

Pharyngeal Pouches

Body Cavities

Dorsal

Cranial

Vertebral

Ventral

Thoracic

Pleural

Mediastinum

Pericardial

Abdominopelvic

Abdominal

Pelvic

Peritoneal Cavity

Serous Cavities (includes pleura, pericardium, peritoneum)

Parietal layer

Visceral layer

Serous fluid

Functions to reduce friction between layers

Abdominal Quadrants (omit regions)

Upper, lower, right, left

Microscopy

Level of resolution

Light Microscopy

Tissue Preparation (histology)

Fixation

Staining

Electron Microscopy (EM)

Transmission

Scanning

Medical Imaging

X rays (radiographs)

Computed Tomography (CT and CAT)

Positron emission tomography

Sonography (ultrasound)

Magnetic Resonance Imaging (MRI)

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Multicellular Organisms

50-100 trillion cells (100 trillion = 1×10^{14})

Compartments

Organelles

Enzyme Action

Controlled environment

Metabolism

Anabolism

Catabolism

Cell Differentiation

Plasma Membrane (plasmalemma)

Structure

Fluid Mosaic Model

Phospholipid bilayer

Proteins

Integral

Peripheral

Cholesterol

Modifications

Glyco-

Lipo-

Functions

Sequestration, compartmentalization

Semipermeability

Transport

Endo- and exocytosis

Phago- and pinocytosis

Osmosis and diffusion

Carrier-mediated transport

The Cytoplasm (cytosol)

Organelles

Mitochondria

Outer and inner membranes

Cristae

Matrix

ATP

Aerobic Respiration

Ribosomes

Ribosomal RNA (rRNA)

Translation

Messenger RNA (mRNA)

Free ribosomes or associated with the ER

Endoplasmic Reticulum (ER)

Rough ER (RER)

cisternae

Smooth ER (SER)

Golgi Apparatus

Packaging, addressing

Vesicles (secretory granules)

Lysosomes

Hydrolytic enzymes

Tay-Sach's Disease

Peroxisomes

Oxidases, catalases

Peroxidases

Cytoskeleton

Microtubules

Microfilaments

Actin

Myosin-like

Centrosome

Centrioles (9 sets of 3 microtubules)

Nucleus

Nuclear envelope

pores

Chromatin

Histones

Deoxyribonucleic acid (DNA)

Chromosomes

Humans = 23 pairs, or 46

Nucleoli

Cell Cycle

Interphase

G₁, S, G₂

Things Cells Do To Stay Alive and Well

1) Protein Synthesis:

This is the process of making proteins from the blueprints contained in the genetic information within the nucleus. The genetic information is contained within the structure of the chromosomes, in molecules of DNA. Each segment of a chromosome which contains the blueprint for making a single polypeptide (a small protein) is called a **gene**.

Transcription:

Translation:

2) Cell Division

Two Types:

Mitosis (regular cell division)

1. Each “parent cell” divides into two identical “daughter cells”
2. Each parent cell must replicate its entire set of chromosomes before it divides, so that each daughter gets one complete set.
3. Each new daughter cell has the full set (**diploid number**) of chromosomes, the same number the parent cell originally had.
4. Occurs in *most somatic* human cells as a way to replace and replenish the stock of older cells; it also occurs as a tissue grows in size.

Meiosis (this is a two-stage process of specialized division for the purpose of reducing the chromosomal number in the cell to half the original number!) This process is also known as “reduction-division.”

1. Parent cell eventually gives rise to four new daughter cells
2. The complete set of chromosomal material must be replicated before this process begins in the parent cell.
3. Each of the four new daughter cells contains only half of the total number of chromosomes contained in the parent, that is, if the parent cell had 46 chromosomes, each daughter cell only contains 23. This is called the **haploid** number.
4. This is a type of division that is restricted to only the sex cells, namely, the developing sperm and developing egg cells.

Mitosis

Interphase

Prophase

Metaphase

Anaphase

Telophase

Cytokinesis

Cellular Diversity

Clinical Terms

Apoptosis

Dysplasia

Hyperplasia

Hypertrophy

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Basic Embryology

Prenatal Period

Embryonic period

Fetal period

Basic Body Plan

Skin

Outer body wall

Peritoneal cavity and digestive tube

Kidneys and gonads

Limbs

The Embryonic Period

Week 1

Conception

Zygote

Cleavage

Morula

Blastocyst

Inner cell mass

Trophoblast

Implantation

Week 2

Bilaminar Embryonic Disc

Inner cell mass divides into two sheets of cells called

Epiblast - becomes the amniotic sac

Hypoblast - becomes the yolk sac (which later gives rise to the digestive tube)

Week 3

Gastrulation - invagination of epiblast cells toward the Primitive streak

Epiblast cells that have migrated form the "primary germ layers"

Endoderm

Mesoderm

Ectoderm

Notochord

From the primitive node

Neurulation

Neural plate

Neural groove

Neural tube

Neural crest cells

Mesoderm

Somites

Lateral plates

Coelom

Week 4

Primitive gut

Germ layers

Ectoderm derivatives

Endoderm derivatives

Mesoderm

Myotomes

Dermatomes

Weeks 5-8

Limb buds

The Fetal Period

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Tissues

Epithelia and Glands

Special characteristics of epithelia

Cellularity

Specialized contacts

Polarity

Support by connective tissue

Avascular but innervated

Regeneration

Classifications

Squamous

Cuboid

Columnar

Simple

Stratified

Pseudostratified

Surface Features

Microvilli and cilia

Cell Junctions

Desmosomes

Tight junctions

Gap junctions

Basal lamina or basement membrane

Glands

Exocrine

Ducts

Products: mucous, goblet cell

Simple or compound, tubular or alveolar

Endocrine

Hormones

Connective Tissue

Connective Tissue Proper

Fibers

Cells

Matrix or Ground substance (tissue fluid)

Areolar Tissue (loose CT)

Adipose Tissue

Dense CT

Regular

Irregular

Cartilage

Bone

Blood

Membranes

- Mucous

- Serous

Muscle Tissue

- Skeletal

- Cardiac

- Nervous

Tissue Response to Injury

- Inflammation

 - Edema

- Repair

 - Regeneration

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Integumentary System: Skin

Functions

Two major layers

1. Outer epidermis
2. Inner dermis

Below the skin - hypodermis

I. Epidermis

Avascular, cell distance from vessels results in death

Keratinocytes

Melanocytes

Thick skin vs. thin skin

Working our way to the surface:

Stratum basale

Keratinocytes

Melanocytes

Melanin

Melanoma

Skin color from melanin, carotene, hemoglobin pigments

Cyanosis

Stratum spinosum

Named for appearance

Also contains dendritic Langerhans cells - immune function

Stratum granulosum

Distance from blood vessels

Keratohyaline granules, toughening, waterproofing

Stratum lucidum

Not found in thin skin

Few layers only

Stratum corneum

Dead cells, multilayered

Keratohyaline glue with embedded filaments

Glycolipid between cells for waterproofing

Sloughed cells

Dermis

Highly vascularized & rich in nerve fibers

Functions in thermoregulation

Papillary Layer - Dermal Papillae (20%)

Friction ridges, gripping ability

Reticular Layer (80%)

Dense irregular CT

Collagen fibers

Reticular fibers

Rich in nerve endings, hair roots, blood vessels

Hypodermis

Superficial fascia

Adipose tissue

Appendages in Skin

Hair -dead keratinized cells

- Hair shaft- above skin
- Hair root - below skin
- Hair bulb - expanded part of follicle
- Hair root plexus - nerve ending around bulb
- Hair root papilla - extension of dermis into very tip of bulb containing a knot of capillaries
- Arrector Pili muscle
-

Sebaceous glands

Sebum - oily holocrine secretion sent down central duct to skin surface

Found everywhere except palms and soles

Affected by hormone stimulation

Sweat glands = sudoriferous glands

Water product derived from plasma, salts, some wastes. Acidic to retard bacterial growth

Eccrine sweat gland

More numerous

Produce true sweat, found on palms, soles and forehead

Coiled tubular gland lies in deep dermis and hypodermis, runs up to pore in skin

Apocrine sweat glands

Confined to axillary, anal and genital areas

Larger glands

Ducts open onto hair follicles

Secretions contain fats and proteins, in addition to true sweat products

Odorless, but bacterial action can change that

Mammary glands- modified sweat glands which secrete milk

Nails

Root and nail bed

Burns

First degree

Sunburn

Epidermal involvement

Heal in few days

Second degree

Involve epidermis and upper dermis

blistering

scarring

Third degree

Full thickness burn - epidermal and dermal involvement

Fluid loss, infection

Grafting necessary

Skin Cancer - Carcinoma

Malignant

Benign

Basal cell carcinoma

Cells of stratum basale invading dermis

Easiest to treat

Squamous cell carcinoma

Arises from keratinocytes of the stratum spinosum

Melanoma

Cancer of melanocytes

Arise from existing moles

Can metastasize rapidly into blood vessels

Chemotherapy and immunotherapy resistant

ABCDE rule

Assymetry

Border irregularity

Color

Diameter (6mm)

Elevation