

MSS

EVERYTHING IN ONE FILE
SUMMARY & TESTBANK



PREPARED BY



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pathology

DEVELOPMENT:

LONG BONES :Endochondral ossification

FLAT BONES : Intramembranous ossification

increase osteoclast differentiation :

1-PTH

2-IL-1

3-Steroids

decrease osteoclast differentiation :

1-BMPs (bone morphogenic proteins)

2-Sex hormones

RANK receptor + RANK Ligand = differentiation of osteoclast

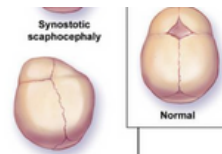
Osteoprotegerin blocks interaction between RANK receptor + RANK Ligand = **NO** differentiation of osteoclast

DYSOSTOSIS :abnormal (+ / -)

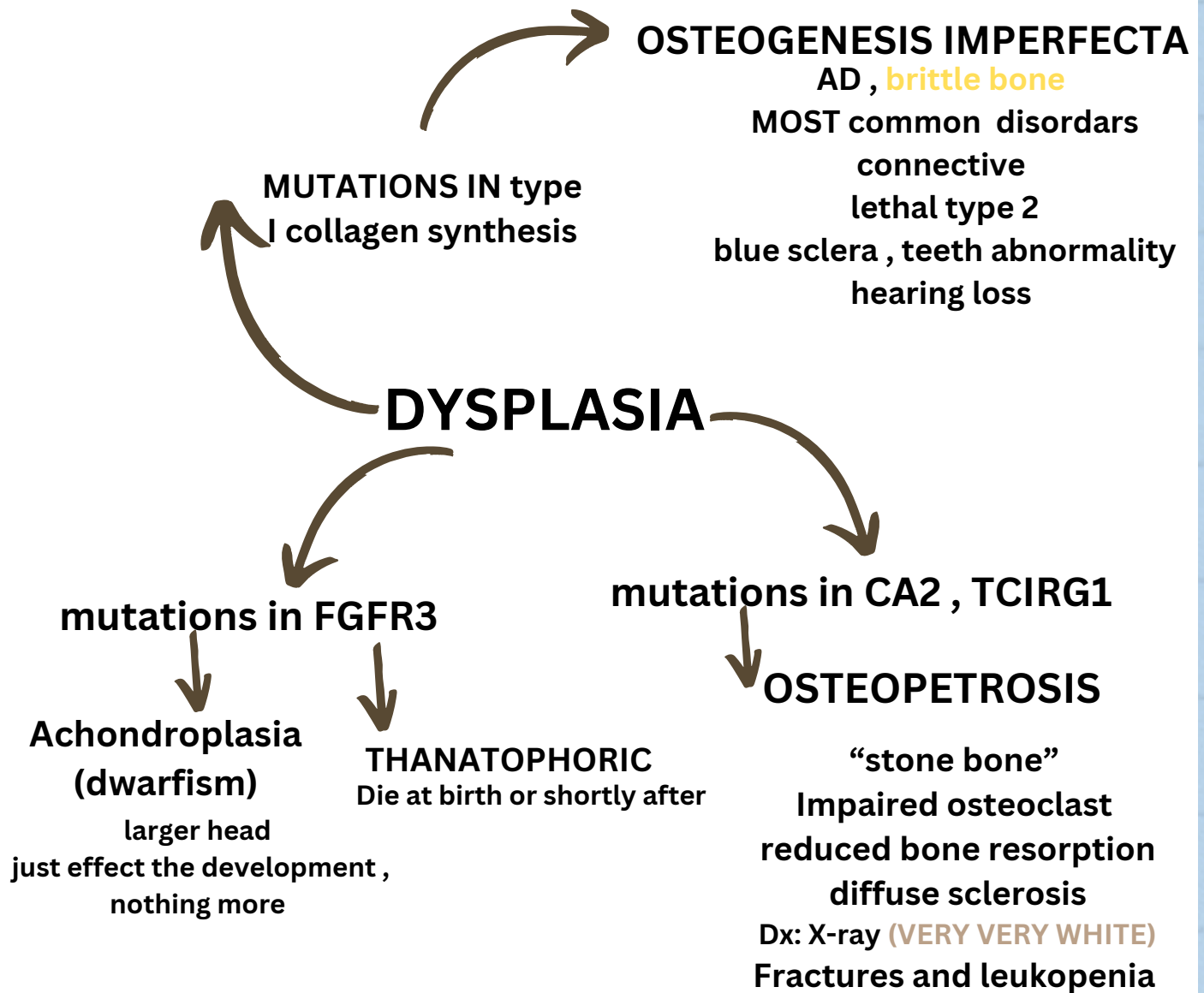
aplasia -

Supernumerary digit ++

Syndactyly & craniosynostosis



DYSPLASIA = Disorganized bone & cartilage =Gene mutations that control development and remodeling



mini testbank

----- is also known as brittle bone disease.

Select 1 correct answer

A Achondroplasia

B OSTEOPETROSIS

C THANATOPHORIC

D OI

Osteogenesis imperfecta is most often an (inheritance) ----- bone disorder caused by defective type I collagen synthesis.

Select 1 correct answer

A Autosomal disease

B X-linked disease

----- classically presents with blue sclera resulting from defective type I collagen.

Select 1 correct answer

A Achondroplasia

B THANATOPHORIC

C OI

D OSTEOPETROSIS

Genetic mutations in achondroplasia result in activation of fibroblast growth factor receptor 3 on chromosome 4, resulting in inhibited/increased)----- chondrocyte proliferation.

Select 1 correct answer

A increased

B inhibited

Achondroplasia is the most common cause of _____.

Genetic mutations in achondroplasia result in activation of the-----on chromosome 4, resulting in inhibited chondrocyte proliferation.

Select 1 correct answer

A CA2

B TCIRG1

C COLLAGEN 1

D FGFR3

Achondroplasia does not affect ----- ossification

Select 1 correct answer

A FLAT BONE

B LONGUITUDINAL BONE

D , A , C , B , Dwarfism , D , A

histology

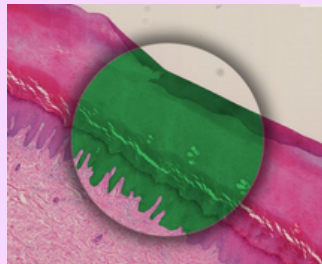
Major Skin Functions : Protection ,Sensory Perception ,Temperature Regulation ,Excretion ,Formation of Vitamin D

1- epidermal

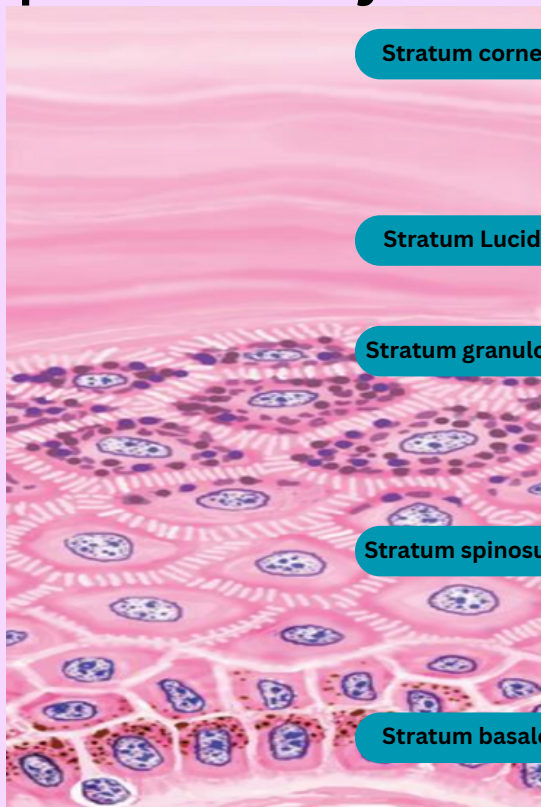
Avascular , from ectoderm

rich in a tough keratin

epidermal ridges Prevents the two layers of skin from separating = fingerprints & blisters



epidermal 4 layers



- Stratum corneum** - much keratin filaments with plasma membranes surrounded by lipid-rich layer
- Stratum Lucidum** - lack nuclei or organelles and are dead In thick skin only
- Stratum granulosum** - Cells filled with dense basophilic keratohyalin granules and membrane- bound lamellar granules Lamellar granules discharge lipid to waterproof the skin
- Stratum spinosum** - Spines represent sites of desmosome attachments keratin filaments that become assembled into tonofilaments
- Stratum basale** - basophilic columnar to cuboidal attached to one another by desmosomes and hemidesmosomes intense mitotic activity



Stratum germinativum : generate cells



Psoriasis: speeds up of mitotic activity that results in scares

Thin skin	Thick skin
Dominant and lines most of the body surface	Palms of the hands and soles of the feet
hairy	non hairy

EPIDERMAL CELLS

keratinocytes:
Produce keratin ,
Produce lamellar
granules that helps
waterproof the skin , 2-4
weeks
change to flat - die in
the end

Melanocytes :
our natural SPF
derived from the neural
crest
Have protrusions
Synthesize the dark brown
pigment melanin
protect from UV
in the stratum basale

Langerhans cells :
(MONO)from bone
marrow
in the stratum
spinosum
recognize, phagocytose,
and process foreign
antigens

Merkel cells :
in the stratum
basale
IN fingertips
afferent (sensory)
for light touch

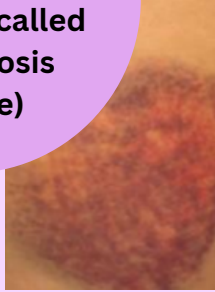
2- Dermis

beneath epidermal , much thicker , for
strength , blood vessels and nerves
from mesoderm
two layers :

Reticular layer of dermis :
Dense irregular
connective tissue
collagen 1

**Papillary layer of
dermis :** Loose
connective tissue

Hemorrhage
from the
cutaneous blood
vessels is called
ecchymosis
(bruise)



Sensory receptors

Unencapsulated receptors

Merkel disc :
light touch
sensing
texture

**Root hair
plexuses :**
Detect
movements of
hair

Free nerve endings:
Temperature, pain,
itching, tactile
sensation

encapsulated receptors

Meissner corpuscles :
light touch
decline with aging

**Ruffini
corpuscles :**
Stretch (tension)
and twisting
(torque)

**Pacinian
corpuscles :** deep
Coarse touch,
pressure
(sustained touch)
and vibrations

Types of hair:

- 1- Lanugo: fetal hair
- 2- Down hair: light colored hair of child
- 3- Terminal (adult) hair: thicker, darker hair that begins to grow at puberty

Hair follicle is a tube of stratified squamous epithelium, invaginated into the dermis

INNER ROOT SHEATH

Disintegrates at the level of the sebaceous gland

Hair matrix

➤ Contains the proliferating cells that generate the hair and the internal root sheath

➤ Located just above the dermal papilla

➤ Melanocytes located in the matrix produce hair color.

Sebaceous glands

➤ secrete an oily or waxy matter, called **sebum**, to lubricate and waterproof the skin and hair

➤ Secrete by holocrine mode of secretion

acne , comedo

Arrector pili muscles are small muscles extend from hair follicles to the dermal papilla

➤ Contraction of these muscles causes the hairs to stand on end (goose bumps)

➤ Innervated by the autonomic nervous system (sympathetic)



when its cold

MEDULLA

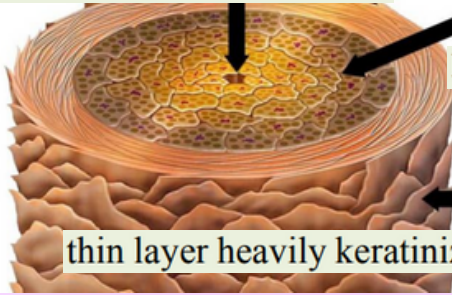
large vacuolated and moderately keratinized cells

CORTEX

heavily keratinized and densely packed cells

CUTICLE

thin layer heavily keratinized squamous cells covering the cortex



anagen

catagen

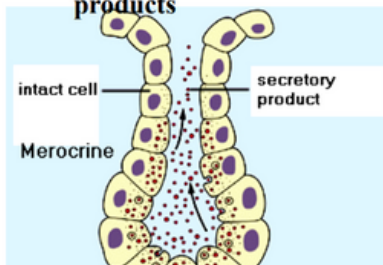
telogen

most of hair life

Sweat Glands

Eccrine sweat gland

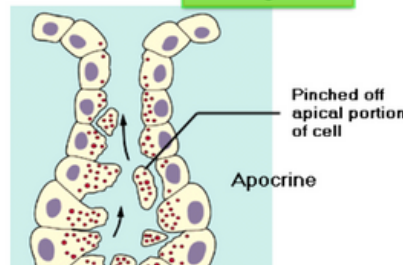
- Merocrine secretion
- Empty directly **onto skin surface**
- Location: most all over body (esp. abundant on **palms & soles**: ~ 500/cm²)
- Clear, watery secretion (99% H₂O; rest NaCl + some waste products)



Apocrine sweat gland

- Empty into **hair follicle**
- Location: armpits, groin, nipples
- Viscous, cloudy secretion → good nutrient source for bacteria (**odor !!**)
- Secretion may contain Pheromones
- Secretion **begins at puberty** and is stimulated during emotional distress

Scent glands



mini testbank

Melanocytes are located in the _____ layer of the epidermis.

-----within the skin help synthesize vitamin D when exposed to UV light from the sun.

Select 1 correct answer

A keratinocytes

B melanocytes

The ----- layer of the epidermis is 2 to 3 cell layers thick and is only found in thick skin like on the palms and soles of the feet.

Select 1 correct answer

A lucidum layer

B corneum layer

----- is the thickest layer of the epidermis and is made up of dead keratinocytes.

Select 1 correct answer

A corneum layer

B basale layer

The main cell type of the epidermis is the _____ which migrates upwards and form multiple layers.

Which cell is found in the dermis?

- A. Langerhans cell
- B. Melanocyte
- C. Fibroblast

What is a characteristic of the cells in the epidermis of the skin?

- A. Microvilli
- B. Stereocilia
- C. Cilia
- D. Keratinization

6-Which of the following layers is only present in thick and hairless epidermis?

- A. stratum basale
- B. stratum spinosum
- C. stratum granulosum
- D. stratum lucidum

Which cell is a macrophage found in the skin?

- a. Kupffer cells
- b. Histiocyte
- c. Dust cell
- d. Langerhans cell

basale
B
a
a
keratinocyte
c
d
d
d

Physiology

MEMBRANE POTENTIALS AND ACTION POTENTIALS summary :
an electrical potential difference across membrane (positive outside and negative inside)

The equilibrium potential

for any univalent ion at normal temperature can be calculated by Nernst equation.

When more ions are involved in creating the potential, we can calculate the potential according to Goldman-Hodgkin-Katz equation. According to this equation the permeability of the membrane to an ion is very important in determining the membrane potential.

In excitable cells the membrane potential is not constant.

The recorded membrane potential for a cell under resting conditions when no stimulus is involved is known as resting membrane potential = (- 90 mV).

hexamethonium is blocker and prevents Ach from binding

Na⁺ -K⁺ pump and action potential **has no role** in the electrical activity

Origin of resting membrane potential :

Contribution of K⁺ diffusion:
the calculated E_{K^+} is about (-94mV).

The contribution of Na⁺ diffusion: The permeability of the plasma membrane for Na⁺ is much less than that of K⁺(100 times). the calculated E_{Na^+} = + 61mV.

Contribution of Na⁺ - K⁺ pump:

this pump is electrogenic. It moves more positive charges outside the cell (3 for 2). This will bring the membrane potential to a higher negativity (about -4mV additional negativity)

at the membrane. Any increase in permeability of membrane to Na⁺ will result in diffusion of (+) charges inward. This event will decrease the membrane potential (becomes less negative). And conversely any increase in K⁺ diffusion (movement outward) will result in an increase in membrane potential (becomes more negative).

increase in Na⁺ permeability will even reverse the membrane potential (becomes positive inside and negative outside) (this is known as the **overshot** in the action potential)

reason induction of an action potential in excitable cells follows the **NONE OR ALL PRINCIPLE**.

the plateau in this type of cells is important in prolonging the time of an action potential, giving more time for the cell to be able to respond to another stimulus

From the **firing stage to the end of first third of falling phase** the cell will **not respond** at all even by a stronger stimulus. In this stage the cell is said to be in **absolute refractory period**.

From the **beginning of the second phase until the resting membrane potential** is achieved the cell cannot respond the usual stimulus, but a stronger **stimulus can change** the membrane potential. In this period the cell is in **relative refractory period**.

During all the falling phase of an action potential, Na channels remain closed and not capable for opening. They closed and capable for opening when the membrane potential returns to its normal level or to a more negative potential than resting potential

cells are responsible for myelination of axons : In the CNS these cells are **oligodendroglia**. In the peripheral nervous system, these cells are **Schwann cells**.

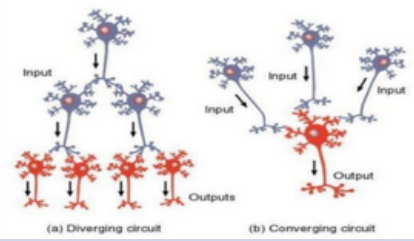
TRANSMISSION OF ACTION POTENTIAL ALONG NERVE FIBERS :
Continuous conduction
Saltatory conduction: In myelinated fibers (50 times faster)between nodes of Ranvier .

Larger fibers conduct impulse with higher velocity.

decrease in membrane potential, is called EPSPs , while the increase in membrane potential is called IPSPs . (more response for inhibitory)

Synaptic organization:

1. **Converging circuit:** many presynaptic neurons synapsing with one neural
2. **Diverging circuit:** presynaptic neuron terminals synapsing with many post synaptic neurons.



muscles

striated (cardiac and skeletal muscle) and unstriated (smooth muscle) fibers

voluntary (have somatic innervation), an example: skeletal muscle, and involuntary (have autonomic innervation), example: cardiac and smooth muscle

The I band is formed only from thin filaments. While the A band is formed from thick filaments with the portion of thin filaments that 2 overlap on both ends on thick filaments. The area of thick filaments that is not overlapped by thin filaments is known as H zone
The area between 2 Z discs is known as sarcomere

6 thin filaments around one thick filament and 3 thick filaments around one thin filament

Tropomyosin is protein molecules that wrap around the F-actin helix. In resting state this protein covers the active site (myosin binding site)

In the presence of high Ca^{++} concentration, the inhibitory effect of tropomyosin-troponin complex on myosin and actin binding was inhibited (4 to 1)

During contraction, the two Z lines become closer. This will result in a decrease in the H zone, I band and the whole sarcomere length.

Bending (tilting) of myosin head is known as **power stroke**

myosin head needs 2 ATP : one for binding and one for detachment

rigor mortis (a stiffness of skeletal muscle after 3-4 hours of death) (no ATP)

ATP FROM :

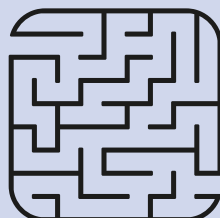
Glycolysis = lactic acid = pain (2ATP)

Oxidative phosphorylation(32ATP)

creatine phosphate to ADP(5-8 sec)

Less O2 = fatigue

no change in tension = isotonic
no change in length = isometric



علاقة الـ Tension بالطول الأولي تبع العضلة لما يكون عنا خلية عضلية ممكن ازيد طولها او اضغطها ف اقل طولها هسه هل راح يعطينا contraction بنفس القوة في الحالات السابقة؟ طبعا لا لانو في عنا علاقة بين الـ tension والـ length تبع الـ muscle هذا الشي يعمل optimal level يعني طول مناسب للعضلة اقل او اكثر من هيك الموضوع يصير سيء طيب على شو يعتمد؟ يعتمد على الـ overlap بين الـ myosin والـ actin يعني يعتمد على طول كل sarcomere طول الـ sarcomere اذا تقريبا ماكان في 2.2 overlap micro m هون بيمسك only one head بالـ actin فيعمل less contraction طيب لو زدنا الـ overlap شو راح يصير؟ راح يصير أحسن لانو more heads راح يمسكوا بالـ actin ف بالتالي more tension طيب لو قللنا الـ length؟ راح نعمل اقوى قوة ممكنه لما ازيد الـ overlap اقصى ما يمكن = optimal length اخر شي اذا رحنا وقللنا الطول يعني راح نزيد التداخل اكثر واكثر فيضعف الـ contraction لانو راح يصير overlap مع الـ opposite site وبس

The maximum tension that can develop is at the sarcomere length of 2.0-2.2 mm

types of muscles fibers :

red (slow , marathon , myoglobin , O₂ , High ↑ oxidative phosphorylation , small , mitochondria)
white (fast , meters race , less myoglobin , no O₂ , less mitochondria , ↑ Glycolysis , fatigue)

titin : is a structural protein , like a spring in the contractile units

relaxation :

- 1- Nerve impulse Stop's
- 2- Ach is no longer released at neuromuscular junctions
- 3- Ca ions are removed , so there is no binding
- 4- ATP causes linkage between myosin to actin to break
- 5- Muscle fibers relax

Q: What happens to sarcomere during contraction?

Sarcomere → Shorten
A band → There is no change / fixed ✓
I band → Shorten
H zone → Shorten
Myosin → There is no change / fixed ✓
Actin → There is no change / fixed ✓

Clinical connection

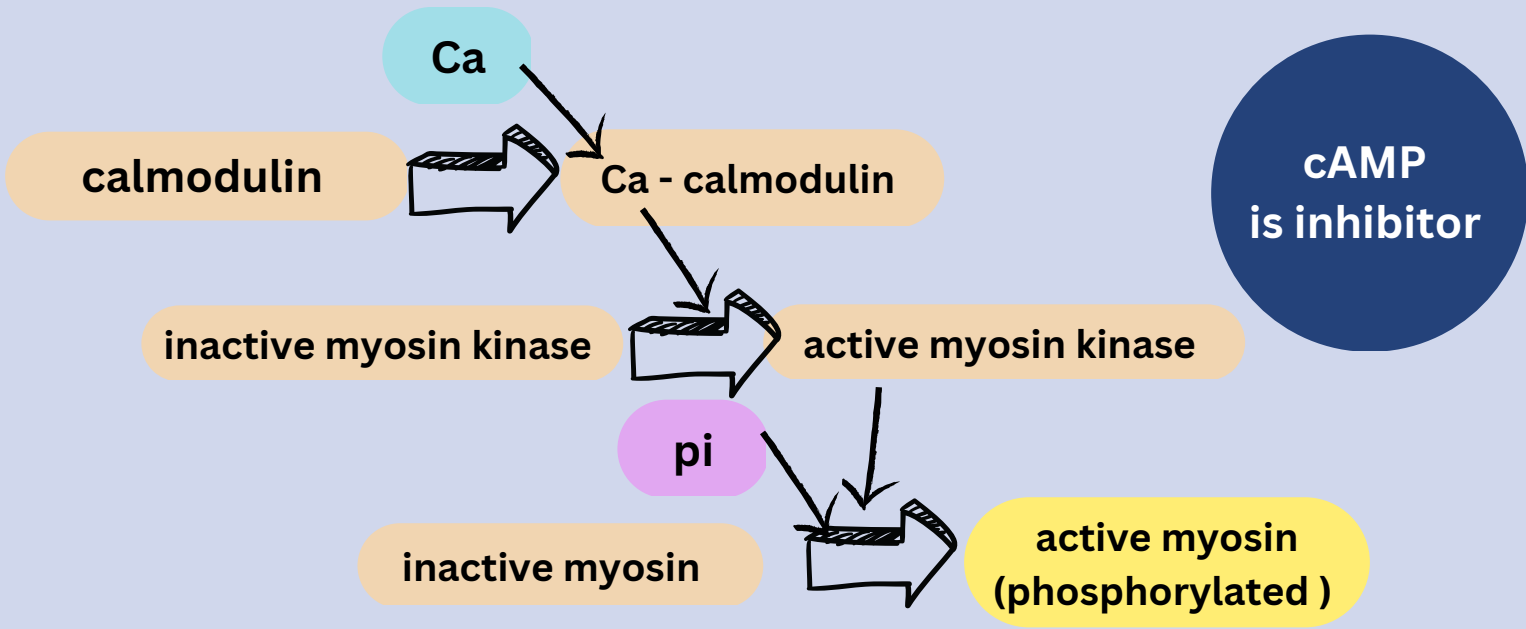
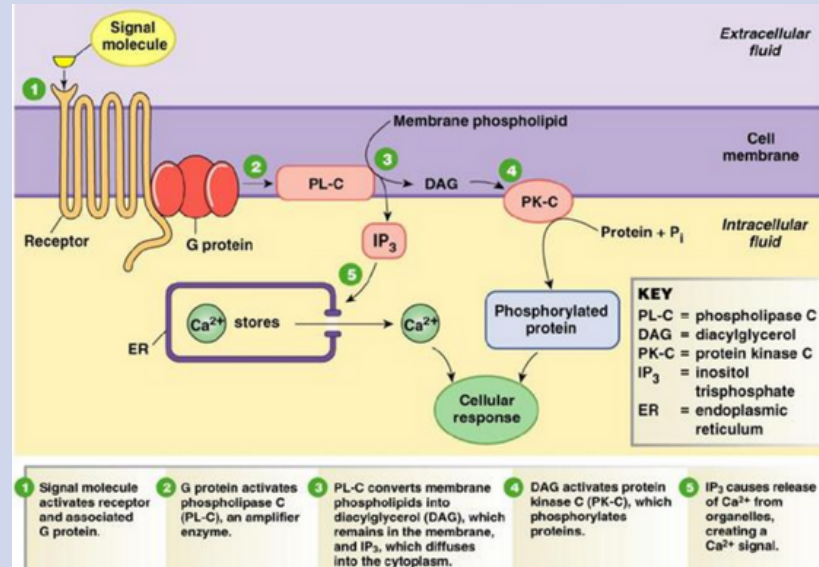
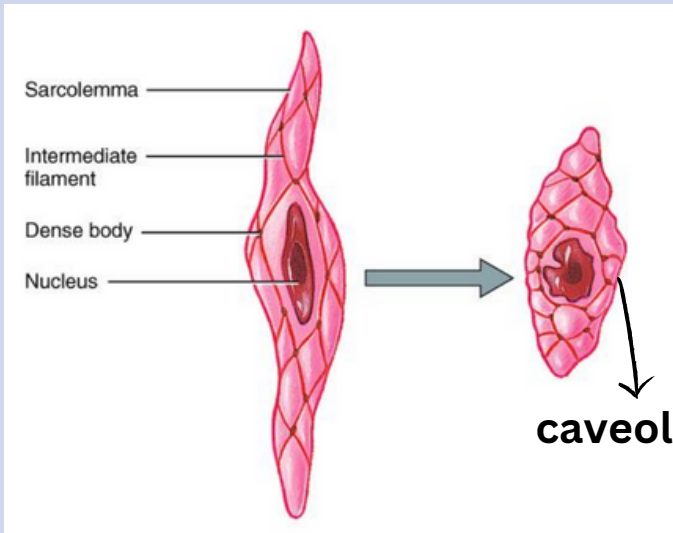
- ① • Botulinum toxin (Botox): **blockage of the presynaptic release of acetylcholine** at the neuromuscular junction.
→ Block Ach release
wrinkles and TMJ are just examples of the many cosmetic and therapeutic uses of Botox
It's used usually to decrease wrinkles .
Also it's used for therapeutic reasons for patients who are clenching their teeth which cause temporomandibular joint pain.
- ② Myasthenia Gravis : -c Ach receptors
Anti body →

2 Ach molecules to bind one nicotinic receptor

in fetus , it is five units

In the adult an epsilon protein substitutes for the gamma protein in this receptor complex.

smooth muscles :

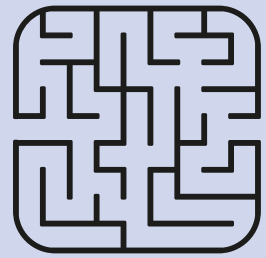


Skeletal Muscle
Striated; actin and myosin arranged in sarcomeres
Well-developed sarcoplasmic reticulum and transverse tubules
Contains troponin in the thin filaments
Ca ²⁺ released into cytoplasm from sarcoplasmic reticulum
Cannot contract without nerve stimulation; denervation results in muscle atrophy
Muscle fibers stimulated independently; no gap junctions

Smooth Muscle
Not striated; more actin than myosin; actin inserts into dense bodies and cell membrane
Poorly developed sarcoplasmic reticulum; no transverse tubules
Contains calmodulin, a protein that, when bound to Ca ²⁺ , activates the enzyme myosin light-chain kinase
Ca ²⁺ enters cytoplasm from extracellular fluid, sarcoplasmic reticulum, and perhaps mitochondria
Maintains tone in absence of nerve stimulation; visceral smooth muscle produces pacemaker potentials; denervation results in hypersensitivity to stimulation
Gap junctions generally present



mini test bank



. The action potential reaches all muscles fiber due to presence of :

- a. Z line
- b. M line
- c. T tubules
- d. Titin

All of the following contribute to the resting state of action potential except:

- a. High concentration of Na outside the cell
- b. More Na channel in plasma membrane than K channel
- c. The selective permeability of plasma membrane doesn't allow for protein and ATP to leave the cell
- d. Electrogenic nature of the Na / K ATPases

. what is the difference between red and white fibers:

- a. red fibers have slow contraction velocity than white fibers
- b. white fibers have an extensive sarcoplasmic reticulum compared with red fibers
- c. red fibers have less glycogen store than white fibers
- d. all of the above

. The first source of energy that reconstitute the ATP is :

- a. Oxidative phosphorylation
- b. Aerobic glycolysis
- c. Anaerobic glycolysis
- d. Phosphocreatine

Following the contraction cycle which one is wrong:

- a. The contraction of muscle requires Ca
- b. The myosin head need ATP to detachment from the actin
- c. The myosin head tilt the actin filament away from the arm of the cross bridge
- d. Before contraction ATP attach to the myosin head to become oriented and energized

. one of the following is true regarding botulinum toxin :

- a. block the acetylcholine gated channels
- b. block the synthesis of acetylcholine
- c. block the release of the acetylcholine from the presynaptic neuron
- d. block the Ca voltage gated channel