



NBME EXPLANATIONS

NBME 22 Block 4

from CrackNBME

22-Block 4

Q1

A 23-year-old woman develops multiple red, papulovesicular lesions following exposure to poison ivy. Which of the following is the most likely mechanism underlying the development of these lesions?

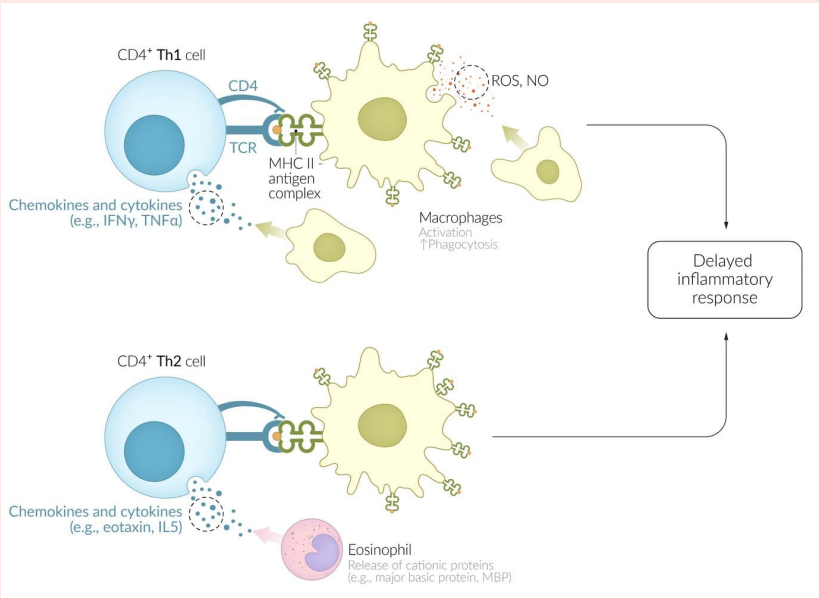
- A. Allergen-mediated vasoconstriction, leading to ischemic tissue injury
- B. Binding of antigen to IgE on the surface of mast cells, leading to mast cell degranulation
- C. Deposition of antigen-antibody complexes within postcapillary venules, leading to activation of complement
- D. Phagocytosis of antigen by neutrophils, leading to oxidant-mediated tissue damage
- E. Processing of antigen by Langerhans cells, leading to activation of CD4+ T cells

▼ Explanation

- **Answer is E (Processing of antigen by Langerhans cells, leading to activation of CD4+ T cells)**
 - **IMP Clues**
 - Multiple, red papulovesicular lesions following exposure to poison ivy (poison ivy Q on the USMLE = Type 4 HS reaction)
 - *Q asks what is the mechanism of developing the lesions?*
 - We know that **poison ivy causes Type 4 HS**, so Q basically asks for the mechanism of Type 4 Hypersensitivity Q
 - **Antigen is presented by APCs to MHC1/2 → CD8/CD4 T-cells activation**
 - **Langerhans cells are macrophages/APCs of the skin.**
 - CD4+ T-cell activation occurs in response to recognition of exogenous antigens on TCR
 - CD8+ T-cells activations occurs in response to recognition of endogenous antigens on TCR
 - Process takes **2-3 days**, hence known as **Delayed Type 4 Hypersensitivity Reaction**

Pictures below show CD4+ vs CD8+ T-cell activation in the pathophysiology of Type 4 Hypersensitivity Reaction:

CD4+ T-cells Pathophysiology:

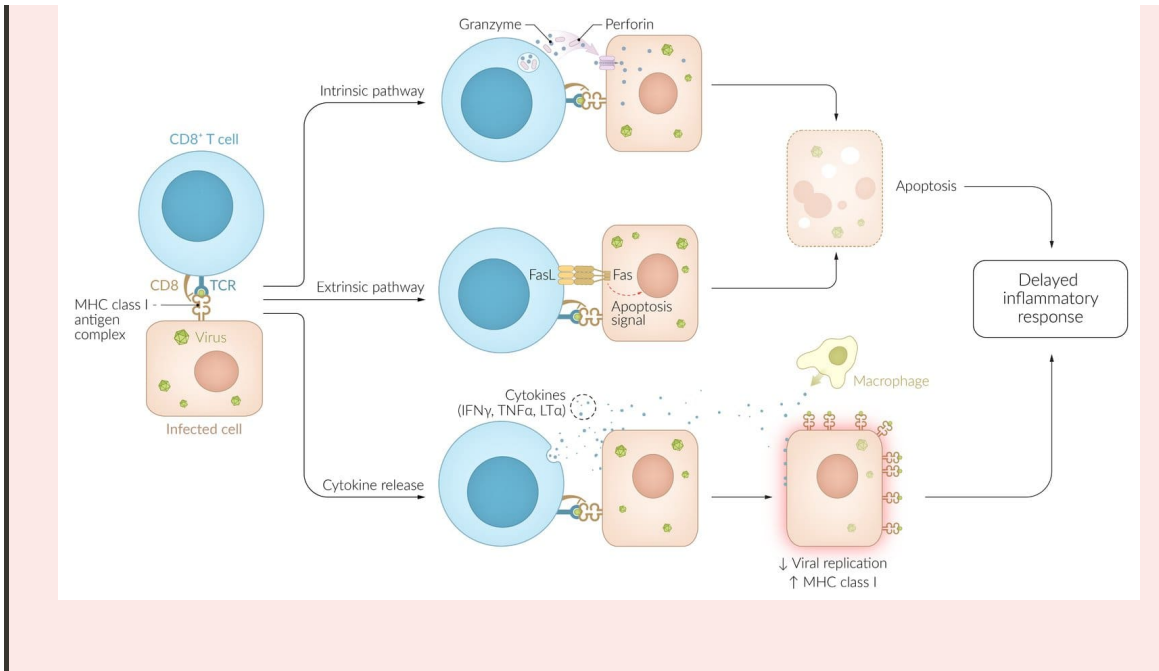


CD8+ T-cell Pathophysiology:

Poison Ivy/Oak/Sumac all contain **urushiol**, which is the antigen that triggers the immune system:

- **Activated Lymphocytes (CD4/8) release cytokines, which increase vascular permeability causing leakage into the epidermis.**
 - This leakage causes the **keratinocytes to separate** from each other (+ fluid accumulated under) → **Blister Formation** "This is referred to as **spongiosis**"
 - So, the final histological appearance seen is "**Spongiosis and Lymphocytic Infiltration, with vesicle/blister formation**"
 - Clinical Features:
 - **Pruritis, Erythema, Vesicles/Blisters, and Linear Streaked Lesions on "contacted" skin.**
 - why are there streaks linear?
 - Basically, when plants come in contact with your skin, **they usually brush your skin in that pattern.**





? What are some HY causes of T4 HS reaction on the USMLE?

▼ Answer

1. Contact Dermatitis

- **Poison Ivy**
- **Nickle** (Necklace, Bracelet, Belts)
- **Latex**

2. Skin Tests

- **PPD**
- **Candida Skin Test**

3. Granuloma Formation

- **TB** (caseating)
- **Sarcoidosis** (noncaseating)
- **Crohn's disease** (noncaseating)

4. Transplant Rejection

- **Graft-versus-Host (GVHD)**
- **Acute/Chronic Rejection**

▼ Other Choices

- **Choice A** → Type 1 HS
- **Choice B** → Type 1 HS
- **Choice C** → Type 3 HS
- **Choice D** → Type 2 HS

Q2

An 18-year-old woman develops sepsis after an abortion. Within 24 hours she becomes dyspneic, oliguric, and develops petechiae, ecchymoses, and bleeding from venipuncture sites. Which of the following is the laboratory finding most consistent with this disease process?

- A. Decreased bleeding time
- B. Decreased plasma fibrinogen concentration

- C. Increased antineutrophil antibody titers
- D. Increased plasma factor VIII (antihemophilic factor) concentration
- E. Increased plasma hemolytic complement activity

▼ Explanation

- **Answer is B (Decreased plasma fibrinogen concentration)**

◦ IMP Clues

- Sepsis (Major Risk Factor for DIC)
- Oliguric (Organ Failure, also a feature of DIC)
- Develops petechiae & ecchymoses (Bleeding disorder ensues) & bleeding from venipuncture sites (MAJOR BUZZY KEYWORD for DIC)

- Q asks for expected Lab values:

- **Dx → Disseminated Intravascular Coagulation (DIC)**

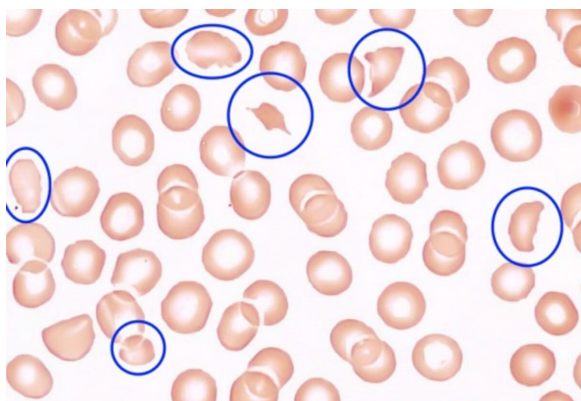
◦ What happens?

- *Disseminated* → Widespread
- *Intravascular Coagulation* → "micro" thromboses formation → **Depletion of clotting factors** → **Severe Bleeding Tendency**
- Additionally, as a result of thromboses formation, the body **depletes its anticoagulation factors** in a *trial* to *lysis the formed thromboses* → **Depletion of thrombolytic factors**

◦ Expected Labs:

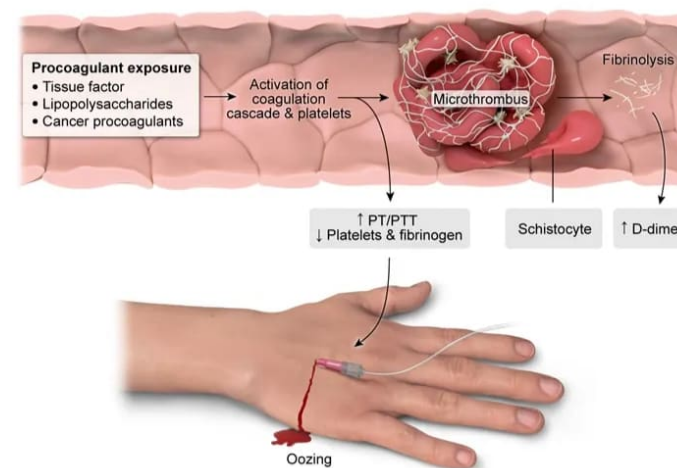
- **Consumption of PLTs** → **Decreased PLT count & Increased Bleeding Time**
- **Consumption of clotting factors** → **Increased PT & aPTT**
- **Formation of Thrombosis** → **Decreased Fibrinogen & Increased Fibrin production**
- **Depletion of Thrombolytic factors** → **Increased Fibrinogen degradation Products (High D-dimer)**

◦ Expected Smear: **Schistocytes (helmet cells)**



◦ So, which of these labs are given correctly in the answer choices?

- **Decreased plasma fibrinogen concentration (Choice B)**



? What are HY causes of Schistocytes on the USMLE?

▼ Answer

1. TTP
2. HUS
3. DIC
4. HELLP Syndrome
5. Mechanical hemolysis by prosthetic heart valves

▼ Other Choices

- **Choice A** → Decreased PLTs causes **Increased Bleeding Time**
- **Choice C** → Increased ANCA antibodies are related to **vasculitis** (Granulomatosis with polyangiitis, Microscopic Polyangiitis, and Churg-Strauss) **not DIC**
- **Choice D** → Depletion of clotting factors (e.g. factor VIII) causes **decreased factor VIII concentration & Increased aPTT levels**
- **Choice E** → Complement activation is related to immunity not DIC

A 21-year-old man is brought to the emergency department 1 hour after the acute onset of left-sided chest pain and shortness of breath. The symptoms began while he was playing basketball with friends. He is 178 cm (5 ft 10 in) tall and weighs 63 kg (138 lb); BMI is 20 kg/m². His pulse is 120/min, respirations are 30/min, and blood pressure is 124/86 mm Hg. Breath sounds are decreased on the left. There is hyperresonance to percussion of the left hemithorax. A chest x-ray shows a sharp line adjacent to a radiolucent region without lung markings on the left side. Which of the following is the strongest predisposing risk factor for this patient's condition?

- A. Collision with another player
- B. Family history of asthma
- C. Gender and body habitus
- D. History of tobacco use
- E. Playing basketball

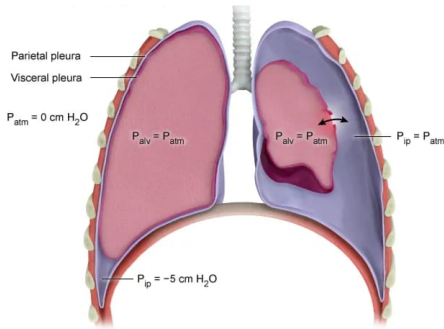
▼ Explanation

- Answer is C (Gender and body habitus)
 - IMP Clues
 - Acute onset left-sided chest pain & SOB while playing basketball with friends (acute onset + activity can mean trauma/rupture)
 - 178cm & 63kg (Major Risk Factor)
 - Pulse is 120/min & respirations are 30/min (Tachycardia & Tachypnea, he's distressed)
 - Breath sounds decreased + hyperresonance on left (hinting to a pneumothorax)
 - CXR shows a sharp line adjacent to a radiolucent region without lung markings on left side (confirms the pneumothorax)
 - Q asks what is the strongest predisposing risk factor for this condition?
 - Patient was healthy & developed a pneumothorax out of nowhere. This is **Primary Spontaneous Pneumothorax**
 - Caused by **rupture of subpleural bleed**
 - Major **risk factor** → **Tall thin young men (Choice C)**
 - Major **Association** → **Smoking**

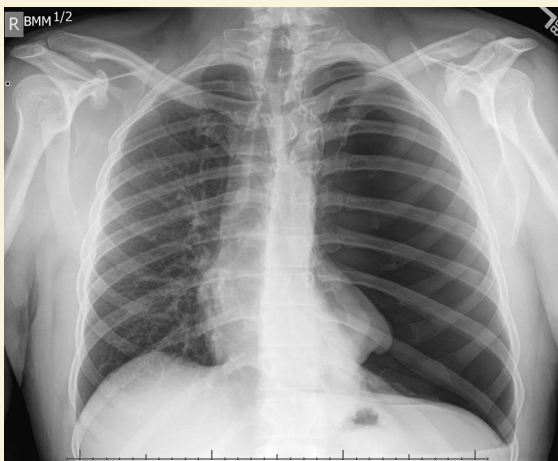
USMLE gives you a patient with pneumothorax & asks for the cause:

- Answer is **Equalization of atmospheric pressure (P_{atm}) & intrapleural pressure (P_{ip})**

*Note that this DOESN'T apply to tension pneumothorax



? NBME Q points to the collapsed lung above & asks which layer is pointed to?



▼ Answer
Visceral pleura

Pneumothorax Classifications Rapid Review:

1. Spontaneous Pneumothorax

a. **Primary**

- **Tall, thin young male** +/- smoker
- Collapsed lung → **ipsilateral** mediastinal shift

b. **Secondary**

- Patient with **Diseased Lung** (COPD - Marfan - Infection)
- **Barotrauma** (High pressure mechanical ventilation)
- Collapsed lung → **ipsilateral** mediastinal shift

2. Traumatic Pneumothorax

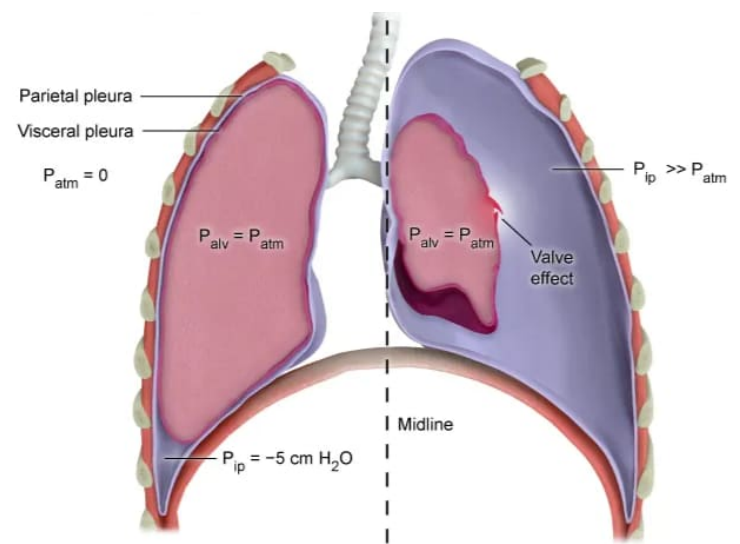
- Caused by **Trauma** (Blunt - Iatrogenic - Penetrating)
- Collapsed lung → **ipsilateral** mediastinal shift

3. Tension Pneumothorax

- Any cause, but characterized by **CONTRALATERAL MEDIASTINAL SHIFT**
- Air gets in & can't get out due to "valve mechanics"
 - Mediastinum is pushed to opposite side
 - Trachea deviates & Vena Cava kinks
 - Decreased VR → Decreased CO → **Obstructive Shock**
 - **Hypotension & JVD**

The pleural pressures in Tension Pneumothorax are unique & HY:

- **Intrapleural pressure (P_{ip}) is greater than atmospheric pressure (P_{atm})**
- This happens due to the valve effects:
 - **Air goes in, but not out**
- This causes **kinking of SVC** → **decreased VR** → **decreased CO** (hypotension)



Q4

A 13-year-old girl is brought to the emergency department 15 minutes after the sudden onset of shortness of breath. She has a 9-year history of episodes of soft tissue swelling, particularly involving her face and extremities, but without urticaria or erythema. Some of these episodes have been accompanied by acute abdominal pain with diarrhea. She has no history of severe or frequent infections. Her temperature is 37°C (98.6°F), pulse is 81/min, respirations are 20/min and labored with marked stridor, and blood pressure is 95/65 mm Hg. Physical examination shows marked facial edema. Treatment with danazol and stanozolol resolves her symptoms. The most likely cause of her condition is a deficiency of which of the following substances?

- A. C1 inhibitor
- B. CD40 ligand
- C. Factor VIII (antihemophilic factor)
- D. IgA
- E. NADPH oxidase
- F. Plasminogen activator

▼ Explanation

• Answer is A (C1 Inhibitor)

◦ IMP Clues

- 9-year history of soft tissue swelling (recurrent)
- Involving face & extremities WITHOUT urticaria or erythema (MAJOR KEYWORD)
- No history of severe or frequent infections (excludes immunodeficiency disorders)
- Marked Stridor + Facial edema (features of angioedema)
- Treatment with danazol resolves her symptoms (bingo)

- Q asks deficiency of which substance is the cause of her symptoms

• Dx → Hereditary Angioedema

- Caused by **C1 esterase inhibitor deficiency**

- C1 inhibitor deficiency → uncontrolled complement activation → massive consumption of complements → **Bradykinin production** → **Increased vascular permeability** → **MASSIVE EDEMA**

◦ Presentation

◦ Recurrent attacks of swelling

- Face & Lips → **Facial Edema**
- Larynx → **Stridor**
- GI tract → **Abdominal pain, diarrhea, and vomiting**

◦ NO urticaria & NO pruritis

- **(Bradykinin, NOT histamine, is the main mediator)**



- Worsens by → **Stress, trauma, ACEi intake**

📌 **Angioedema Algorithm!**

1. **Bradykinin Mediated** - could be either:

[NO ASSOCIATED Pruritis & Urticaria]

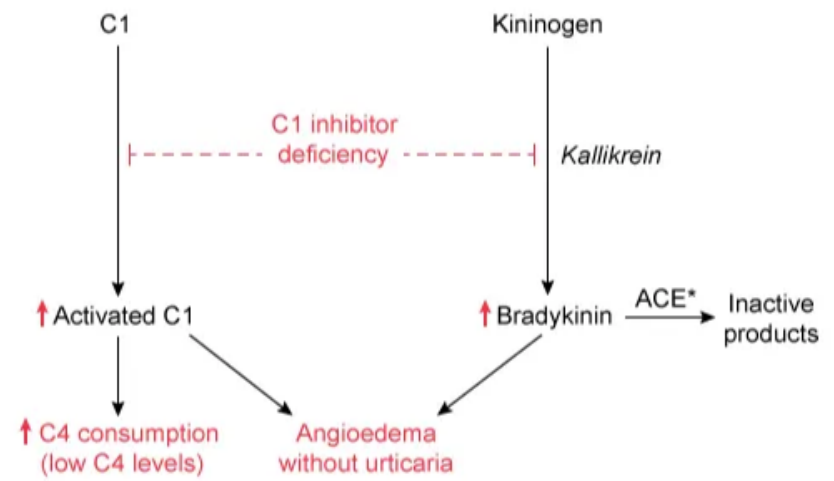
- a. **ACEi induced** - accumulation of Bradykinin due to **inhibited ACE** that normally degrades the Bradykinins (**NOT A SIDE-EFFECT OF ARBs**)
- b. **Hereditary Angioedema (C1 esterase inhibitor deficiency)**

2. **Mast cell Degranulation (Histamine Mediated)** - could be either:

[ASSOCIATED Pruritis & Urticaria]

- a. **IgE-mediated** mast cell degranulation (examples are *atopy* & *eczema*)
- b. **Direct-mast cell degranulation** (most common examples are *morphine* & *Vancomycin* & *IV contrast*)

- Treatment → **Danazol** (increases C1 esterase inhibitor production from liver)



▼ Other Choices

- **Choice B → HyperIgM Syndrome**
 - Excluded because “no history of severe or frequent infections”
 - **NO CD40L** on CD4 cells to bind to CD40 on B-cells.
 - **CD40-CD40L binding causes B-cells to differentiate into plasma cells that produce all sorts of other Immunoglobulins**
 - If it is missing, we only have **super increased IgM & low other immunoglobulins**
- **Choice C → Hemophilia A**
 - Most likely affects males (XLR) & presents as prolonged bleeding or hemarthrosis (blood in joint space)
- **Choice D → IgA deficiency**
 - Excluded because “no history of severe or frequent infections”
 - No history of atopy, or giardia infection or anaphylaxis of blood transfusion
- **Choice E → Chronic Granulomatous Disease**
 - Excluded because “no history of severe or frequent infections”
 - No history of catalase positive organisms infection
- **Choice F → Garbage for the USMLE, but deficiency of plasminogen activator would cause unopposed thromboses formation. Unrelated to what we have here.**

Q5

A 50-year-old man with chronic gastritis is diagnosed with a marginal zone lymphoma of the stomach. Which of the following organisms is most likely associated with the development of this lymphoma?

- A. Cryptosporidium parvum
- B. Cyclospora cayetanensis
- C. Epstein-Barr virus
- D. Helicobacter pylori
- E. HIV-1
- F. HTLV-1

▼ Explanation

- **Answer is D (Helicobacter pylori)**
 - **IMP Clues**
 - Chronic gastritis (one of the most common causes of gastritis is H.pylori infection)
 - Marginal zone lymphoma (another name for MALT Lymphoma of the stomach)
 - Q asks what organism most likely associated with lymphoma development?
 - When you see **Gastritis** on the USMLE, **H.pylori should be on the top of your DD.**
- **Complications of H.pylori are:**

What would be expected to be seen on histopathological biopsy?

- Gastritis
 - Duodenal & Gastric ulcers
 - Gastric Adenocarcinoma
 - **MALT Lymphoma** (what we have here)
- What causes the MALT Lymphoma?
 - **Chronic Inflammation**. Let me explain:
 - **H.pylori infection → Chronic Infection → Chronic Gastritis → Chronic Inflammation**
 - “Chronic” = lymphocyte cells
 - **T-cells release cytokines** that **stimulates B-cells to start proliferating** & form **“mucosa associated lymphoid tissue” (MALT)**.
 - Proliferation → more liability for mutations → uninhibited proliferation → **Lymphoma**.

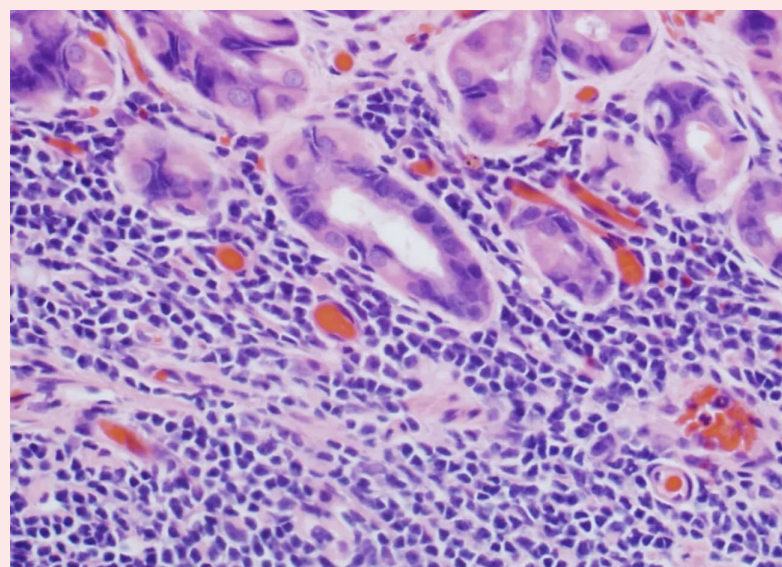
? What Immunological Marker would be expected in this patient?

▼ **Answer**

CD20

- **MALT is a B-cell Lymphoma, so expected marker is B-cell's marker ⇒ CD20**

- Answer is **Dense infiltrate of atypical small lymphocytes between gastric glands**.
- These **lymphoepithelial lesions** represent a characteristic histological feature of gastric MALT Lymphoma.



Q6

A 52-year-old man with stable angina pectoris begins treatment with a medication that decreases cardiac preload and increases coronary artery blood flow. This patient is at greatest risk for which of the following adverse effects of this medication?

- A. Bradycardia
- B. Constipation
- C. Headache
- D. Hearing loss
- E. Nausea
- F. Visual disturbance

▼ **Explanation**

- **Answer is C (Headache)**

- **IMP Clues**

- Man with stable angina pectoris (classically managed with nitrates)
- With a medication that decreases preload & increases coronary blood flow (VD → less VR → decreased preload → decrease LV wall stress → decreased coronary vascular compression)

- Q asks what side effect is the patient at greatest risk of developing?

- Let's review the MOA of nitrates & figure out the side effects from there:

- **Nitrates** are **converted to Nitric Oxide** in **vascular smooth muscles**.
- Nitric Oxide **activates Guanylate Cyclase** → **increase cGMP**
- cGMP causes **myosin-light chain DEphosphorylation** → **Relaxation**
- Relaxation of veins → **Vasodilation** (blood pools into the veins) → **decreased VR → decreased preload → decrease SV → decrease LV wall stress → increased coronary flow**

- What are the expected Side Effects?

1. **Headache [Most Common]**

- “Vasodilation of meningeal veins → stretch of meninges → headache”

2. **Flushing**

- “Vasodilation of cutaneous veins”

3. **Reflex Tachycardia**

- “Decreased SV → decreased BP → causes decreased carotid sinus pressure → decreased parasympathetic signaling → sympathetic takes over → Tachycardia”

▼ **Other Choices**

- **Choice A** → **Nitrates** cause **Tachycardia** **NOT** bradycardia
- **Choice B** → **Verapamil** is the cardiovascular drug known to cause **constipation**
- **Choice D** → **Aminoglycosides & Vancomycin** are the drugs buzzy for **ototoxicity**
- **Choice E** → Garbage
- **Choice F** → **Sildenafil** is a **PDE-5 inhibitor** that causes vasodilation; used for **Erectile Dysfunction & Pulmonary HTN**. It causes **bluish tint in color vision**.

Q7

A 62-year-old man comes to the physician for a follow-up examination. He has hypertensive nephropathy and chronic renal insufficiency. Current medications include clonidine and calcium acetate. His blood pressure is 145/92 mm Hg. Laboratory studies show a serum creatinine concentration of 3.5 mg/dL and serum calcium concentration of 7.8 mg/dL. Which of the following additional sets of serum concentrations is most likely in this patient?

Choice	Inorganic Phosphorus	Parathyroid Hormone	Calcitriol
A	Increased	Increased	Decreased
B	Increased	Decreased	Increased
C	Increased	Decreased	Decreased
D	Decreased	Increased	Increased
E	Decreased	Increased	Decreased

▼ **Explanation**

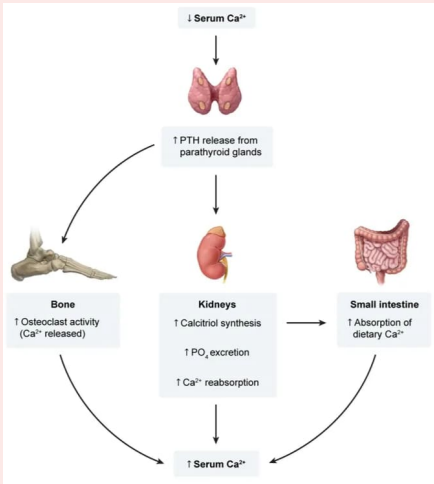
- **Answer is A**
 - **IMP Clues**
 - He has chronic renal insufficiency (Arrows/Labs of Chronic Renal Insufficiency are so HY)
 - Serum creatinine concentration of 3.5 mg/dl (Yep, kidneys are fucked up)
 - Serum Calcium concentration of 7.8 mg/dl (normal is 9-11 mg/dl, so patient has hypocalcemia)

- Q wants expected arrows for Phosphorus, PTH, and Vitamin D
 - First, we need to establish that **Renal Failure on the USMLE causes Secondary Hyperparathyroidism**.
 - In Renal Failure, the kidneys **lose their ability to secrete phosphorus, reabsorb calcium, and synthesize Vitamin D3**
 - High Phosphate & Low Calcium → PTH secretion (**2ry hyperparathyroidism**)
 - **PTH wants to:**
 - Act on **DCt** to **Reabsorb Calcium** → **BUT CAN'T DUE TO RENAL FAILURE**
 - Act on **PCT** to **secrete Phosphorus** → **BUT CAN'T DUE TO RENAL FAILURE**
 - **Upregulate 1-alpha hydroxylase** to make **Vitamin D** → **BUT CAN'T DUE TO RENAL FAILURE**

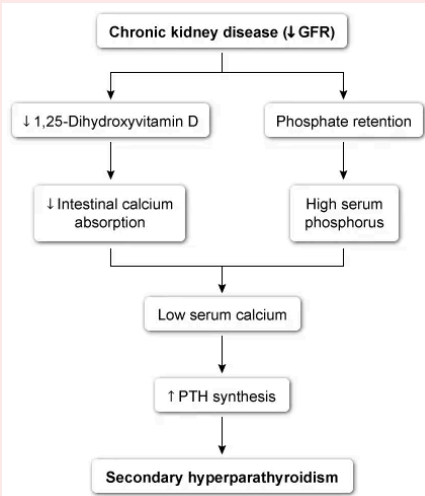
- **As a result:**
 - **Increased PTH**
 - **Increased Phosphate**
 - **Decreased Calcium**
 - **Decreased Vitamin D (1,25-OH-VitaminD) (Calcitriol)**

Shown below are depictions of calcium homeostasis in normal phsyiological circulstances vs CKD:

Normal Physiological Effects:



CKD & 2ry Hyperparathyroidism:



Q8

A 56-year-old man develops brief episodes of ventricular tachycardia 14 hours after having an acute myocardial infarction. The arrhythmia will be treated with a loading dose of lidocaine followed by a continuous infusion of the same drug over the next 24 hours at a rate to maintain a therapeutic steady-state drug concentration (C_{ss}) in plasma. To maintain a C_{ss} of lidocaine, the appropriate rate of infusion of the drug is best determined by which of the following calculations? (CL=drug clearance, V_d=volume of distribution, t_{1/2}=half-life)

- A. CL x C_{ss}
- B. CL / C_{ss}
- C. CL x t_{1/2}
- D. CL / t_{1/2}
- E. V_d x C_{ss}
- F. V_d / C_{ss}
- G. V_d x t_{1/2}
- H. V_d / t_{1/2}

▼ Explanation

- Answer is A (CL x C_{ss})
 - Q asks the formula needed to calculate the maintenance dose of C_{ss} of lidocaine
 - C_{ss} is the therapeutic steady-state concentration of a drug in plasma (in simple words, it is the concentration of the drug in plasma needed to maintain its therapeutic effectiveness)
 - Maintenance dose = (C_{ss} x CL x t) / F
 - CL = clearance of drug
 - t = time between doses (as a continuous infusion of lidocaine is given, there is **no t**)
 - F = bioavailability (IV = 100% = 1.00 bioavailability as it bypasses the liver's first pass metabolism)
 - So = (C_{ss} x CL) / 1.00 = C_{ss} x CL

Q9

A 3-month-old girl is brought to the physician by her mother for a well-child examination. Her mother says that the infant can lift her head when lying prone. The patient is eating well and recently started sleeping about 6 uninterrupted hours through the night. The mother adds that the baby does not yet smile in response to human faces and has not started to coo or gurgle with attention. The patient is at the 25th percentile for length and weight and 10th percentile for head circumference. Physical examination shows no other abnormalities. Which of the following best describes this infant's development?

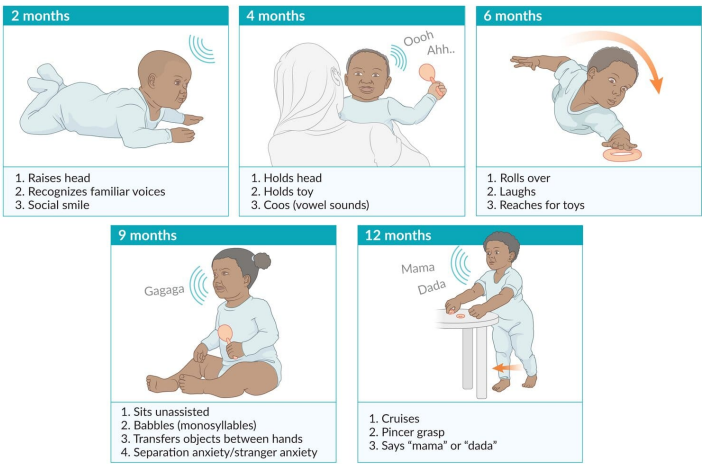
Choice	Motor	Social	Verbal and Cognitive
A	Normal	Normal	Normal
B	Normal	Normal	Delayed
C	Normal	Delayed	Normal
D	Normal	Delayed	Delayed
E	Delayed	Normal	Normal
F	Delayed	Normal	Delayed
G	Delayed	Delayed	Normal
H	Delayed	Delayed	Delayed

▼ Explanation

- Answer is D
 - At **3 months old**, the baby must have the **"3S"**
 - **Support head** (motor) → **Normal** in his baby
 - **Smile** (social) → **Delayed** in this baby
 - **Sounds** (like coos & gurgles) (Verbal/cognitive) → **Delayed** in this baby

Dirty Medicine has a cool video that discusses the HY shit with mnemonics too!

- to be honest, it is STEP 2 shit, but USMLE is known to ask about them sometimes (I'd skip them)



- Below are the UWorld Tables for Developmental Milestones group by Age:

Infants:

Age (months)	Gross motor	Fine motor	Language	Social/cognitive
2	Lifts head when prone	Opens hands briefly	Reacts to loud sounds Makes noises	Social smile Calms when spoken to Eyes track past midline
4	Holds head steady Pushes up on forearms	Brings hands to midline/mouth Holds toy if put in hand	Coos ("ooo") Turns to voice	Seeks attention (eg, smiles, makes sounds) Enjoys looking at hands
6	Rolls over Leans on hands to support seated position	Reaches for toy Puts things in mouth	Blows "raspberries" Squeals	Laughs Recognizes familiar faces
9	Gets to sitting unassisted Sits without support	Transfers object between hands "Raking" grasp	Babbles ("mamama") Turns to name	Stranger anxiety Separation anxiety
12	Pulls to stand Cruises	Pincer grasp	Says "mama" or "dada" Understands "no"	Plays "pat-a-cake" Looks for hidden object

Toddlers:

Age	Gross motor	Fine motor	Language	Social/cognitive
1 year	Pulls to stand Cruises	Pincer grasp	Says "mama" or "dada" Understands "no"	Plays "pat-a-cake" Looks for hidden object
15 months	Takes a few steps	Stacks 2 blocks	Says 1 or 2 words (plus "mama" & "dada")	Follows 1-step command with gesture Points to get something Shows affection
18 months	Walks easily Climbs on/off chair	Scribbles Feeds with fingers	Says ≥3 words (plus "mama" & "dada")	Follows 1-step command without gesture Imitates
2 years	Runs Kicks ball Walks up stairs	Uses spoon	Says 2-word phrases	Knows 2 body parts Parallel play
30 months	Jumps	Removes clothes Turns pages	Says ≥50 words	Follows 2-step command Knows 1 color
3 years	Walks up stairs alternating feet Rides tricycle	Dresses with help Uses fork Copies circle	Says ≥3-word sentences Speech 75% intelligible	Knows age/sex Plays with other children

Children:

Age (years)	Gross motor	Fine motor	Language	Social/cognitive
3	Walks up stairs alternating feet Rides tricycle	Dresses with help Uses fork Copies circle	Says ≥3-word sentences Speech 75% intelligible	Knows age/sex Plays with other children
4	Catches large ball	Draws person with ≥3 body parts Unbuttons clothes Holds pencil between fingers & thumb	Says ≥4-word sentences Names colors	Comforts others Avoids danger Imaginative play
5	Hops on 1 foot	Buttons clothes Writes some letters	Speaks in full sentences/tells story Counts to 10 Names letters	Follows rules; takes turns

Q10

A 29-year-old woman has an inflammatory disease involving her joints, kidneys, serosal surfaces, anterior chamber of the eye, and choroid plexus. Which of the following is the most likely mechanism of this disorder?

A. Antibasement membrane antibody-dependent cell-mediated cytotoxicity

- B. Antibasement membrane antibody-dependent complement-mediated cytotoxicity
- C. Cell-mediated cytotoxicity
- D. Immune complex-mediated cytotoxicity
- E. Release of vasoactive compounds from IgE-stimulated basophils
- F. Systemic release of interleukin-1 (IL-1) and tumor necrosis factor

▼ Explanation

- **Answer is D (Immune complex-mediated cytotoxicity)**

- **IMP Clues**

- 29-year-old woman with an inflammatory disease (Classic Epidemiology of autoimmune diseases)
- Involving her Joints, Kidneys, Serosal Surfaces, Anterior chamber of the eye (uveitis), and choroid plexus (This is classic presentation for SLE)
- Q want to know the mechanism of SLE

- **Systemic Lupus Erythematosus**

- It is a very HY example of **Type 3 Hypersensitivity Reactions** (KNOW THIS PLEASE)

- **T3HS = antigen-antibody complexes deposition → T-cells reaction**

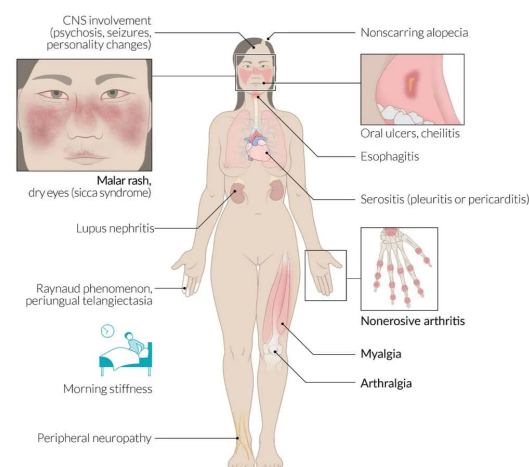
- Associated by **complement deficiencies (C1q, C2, C4)** [asked on NBMEs]

- Features (plenty of them)

- HY Ones Include:
 - **Rash** (usually malar)
 - **Arthritis** (non-erosive)
 - **Serositis** (Pericarditis, Pleuritis)
 - **Hematological Disorders** (especially **Thrombocytopenia**)
 - **Nephritis** (specific for **Anti-dsDNA** complexes deposition on glomerulus) → **Diffuse Proliferative Glomerulonephritis (DPGN)** [asked on NBMEs]
- Others: Uveitis, cerebritis, seizures, psychosis, ulcers, photosensitivity, LSE

- **Most Common Cause of Death → Renal Disease**

- **Pregnant female with SLE, newborn is at risk of → Congenital Heart Block**



USMLE is obsessed with Immuno arrows & antibodies, so let's recap:

- Complement Levels: **Decreased C3 & C4**
- Serology:
 - **ANA (Most Sensitive)**
 - **Anti-dsDNA (Specific)**
 - **Anti-Ro/SSA**
 - **Anti-Sm (Specific)**
 - **APL (Associated APL Syndrome)**

▼ Other Choices

- **Choices A & B** → Type 2 Hypersensitivity, buzzy for **Goodpasture's Disease**
 - **"(2,3,4)"** → Type 2 HS against **3**-alpha chain of Type **4** collagen
- **Choice C** → Type 4 Hypersensitivity
- **Choice E** → Type 1 Hypersensitivity
- **Choice F** → Sepsis

? Patient with sepsis has hypotension & fever. What cytokine mediates the hypotension & fever?

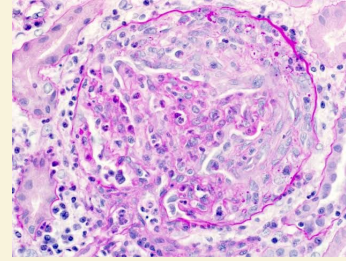
▼ Answer

- Hypotension → **TNF-alpha**
- Fever → **IL-1**

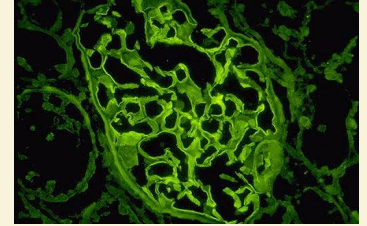
? Patient with hx of hemoptysis & hematuria, suddenly develops worsening of renal function and altered mental status. What is expected to be seen on renal histopathological biopsy?

▼ Answer

Glomerular Fibrin Crescent - Patient has RPGN 2ry to Goodpasture's Disease.
Immunofluorescence would show → **Linear deposits on GBM**



Fibrin Crescent of RPGN (also HY AF)



Linear Immunofluorescence of Goodpasture Syndrome (pic HY AF)

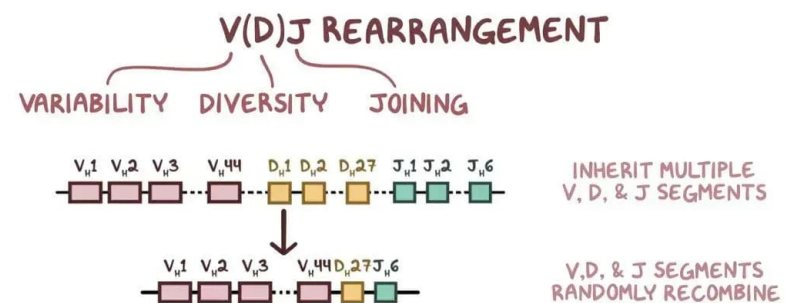
Q11

A 72-year-old man with multiple myeloma agrees to participate in an investigational chemotherapy clinical trial. Prior to enrollment in the study, peripheral blood B and T lymphocytes are isolated and undergo Southern blot analysis of lymphoid cell-specific genes. Using a single B-lymphocyte J-region probe, analysis of the B-lymphocyte DNA shows a 1.5-kb band. Analysis of the T-lymphocyte DNA using the same J-region probe shows a 6-kb band. The 6-kb band most likely signifies which of the following?

- A. Constant region gene rearrangement
- B. D to J gene rearrangement
- C. V to D gene rearrangement
- D. V to J gene rearrangement
- E. Unrearranged immunoglobulin gene

▼ Explanation

- **Answer is E (Unrearranged immunoglobulin gene)**
 - I know you're fucking confused. Let's get you comfortable with garbage immunology
 - **First, you need to understand that B-cells & T-cells both start with the same DNA**
 - **B-cells**, however, then undergo **rearrangement of their Ig genes** → to make antibodies for the "millions & billions" of different antigens
 - **T-cells**, on the other hand, undergo **rearrangement of their TCR genes** → to make different T-cell Receptors for the "million & billions" of different MHC antigens
- **Second, a J-region probe simply means that we measure the "length" of the J region of Ig genes.**
 - We said that **T-cells Ig genes are unchanged** (TCR genes are what changes), so **their value is the original DNA length** → 6-kb band (just know it as 6 "units")
 - **B-cells underwent rearrangement** so their Ig genes → 1.5-kb band (**got smaller due to rearrangement**)
 - **Steps of rearrangement: [For Lifeless Nerds]**
 1. Hematopoietic stem cell (**unrearranged Ig genes**)
 2. Pro-B-cell (**Heavy chain D → J**)
 3. Pre-B-cell (**Heavy chain V → DJ**)
 4. Immature B-cells (**Light chain V → J**)
 5. Mature B-cells (expresses surface IgM)
 6. Activated B-cells (switches classes)
- **Q asks what is meant by 6-kb band found as a result of T-cell J-region probing?**
 - **J-region = Ig genes of T-cells which don't undergo rearrangement.**



- So, answer is “Unrearranged immunoglobulin gene”

Q12

A 38-year-old man with Down syndrome is brought to the physician by his nephew for a follow-up examination. He had lived with his parents until their death 2 years ago, but he now lives with his sister and her children. He receives Social Security insurance benefits from his deceased father's account, and this is currently the family's only income. He has missed his last four scheduled visits. He is unkempt and malodorous, and he appears anxious and hypervigilant. He startles when his nephew speaks, and he shrinks away when the physician reaches to pat his shoulder. The patient used to be pleasant and relaxed. He has had a 6.4-kg (14-lb) weight loss since his last appointment 3 months ago. When the physician asks to interview the patient alone, the nephew refuses to leave the room. Which of the following is the most appropriate initial action by the physician?

- A. Ask the patient with the nephew present if he feels safe at home
- B. Ask the patient's nephew if he often loses his temper around the patient
- C. Contact adult protective services
- D. Determine if the patient's nutritional needs are being met
- E. Meet with the patient's family and advise them on how to care for someone with Down syndrome

▼ **Explanation**

- **Answer is C (Contact adult protective services)**

- **IMP Clues**

- Patient with Down Syndrome (Liable to abuse)
 - Unkempt & malodorous (not cared for)
 - Anxious & hypervigilant + startles when his nephew speaks + shrinks away when the physician pats his shoulders + weight loss (Definitely being abused, him being anxious is him feeling that he's in danger, startling means he gets shouted at often, shrinking away means he probably gets hit + they don't feed him)
 - Patient used to be pleasant & relaxed (this is not how he normally is)
 - Nephew refuses to leave the room when physician asks (nephew is scared to be exposed)

- **Next step is → CALL ADULT PROTECTIVE SERVICES**

- He is in danger & definitely gets abused at home. Don't let him go back home.

Q13

A 53-year-old woman shows evidence of adrenal failure. On CT scan, both adrenal glands appear normal in configuration but decreased in size. Which of the following is the most likely diagnosis?

- A. Autoimmune adrenalitis
- B. Disseminated coccidioidomycosis
- C. Metastatic carcinoma from the lung
- D. Retroperitoneal idiopathic fibrosis
- E. Tuberculosis

▼ **Explanation**

- **Answer is A (Autoimmune adrenalitis)**

- **IMP Clues**

- Adrenal Failure (adrenals don't work)
 - On CT scan. both adrenal glands appear normal in configuration but decreased in size (probably atrophied, but they are symmetrical)

- Dx → Autoimmune Adrenalitis
 - **Most common cause of Primary Adrenal Insufficiency (Addison's Disease)**
 - USMLE can refer to it as “antibodies against 21- α -hydroxylase”
 - Most commonly affects the **Zona Glomerulosa & Zona Fasciculata**
 - Destruction of **Zona Glomerulosa** → **Deficiency of Mineralocorticoids**
 - Destruction of **Zona Fasciculata** → **Deficiency of Glucocorticoids**

- **Presentation**

1. **Deficiency of Aldosterone:**

- Presents as **HIGH K, low Na, low Cl, low pH, low HCO₃, low CO₂**
 - **why?**
 - Aldosterone **secretes K + H** & **reabsorbs Na**, so if deficient → **Hyponatremia, Hyperkalemia, Metabolic Acidosis**

“Neat hack I learned is: Everything follows aldosterone except potassium it is the opposite”

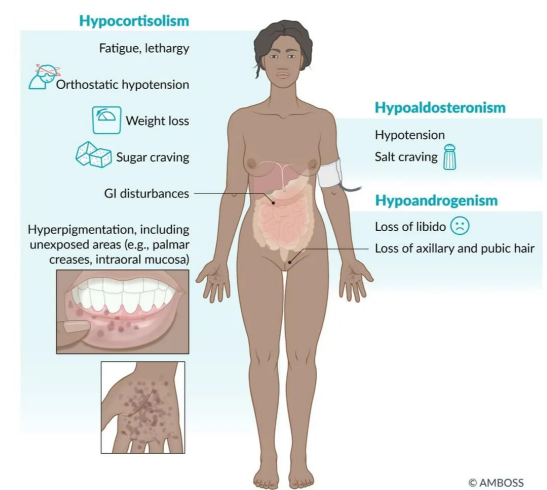
2. **Deficiency of Cortisol:**

- Presents as **Hypotension, Hypoglycemia, Fatigue & Weakness** (Most underrated HY info), and **Skin Hyperpigmentation**
 - **why?**
 - Loss of permissiveness on catecholamines ⇒ **Hypotension**
 - Stress hormones that counters insulin ⇒ **Hypoglycemia**
 - POMC is cleaved into MSH + ACTH; Low cortisol = high POMC → high ACTH + high MSH ⇒ **Skin/Mucous membranes Hyperpigmentation**

? What would be the expected renin levels in this patient?

▼ Answer
Increased Renin

Treatment of this condition is replacement of **glucocorticoids (prednisone) & **mineralocorticoids** (fludrocortisone).**



! In females, primary adrenal insufficiency presents with **loss of libido & loss of sexual hair (axillary & pubic). This is **NOT** present in males, however, as testes produce the majority of the androgen.**

Q14

A 45-year-old woman comes to the physician for a follow-up examination 8 weeks after beginning tamoxifen therapy for estrogen- and progesterone-positive invasive ductal carcinoma of the breast. Her 50-year-old sister also has hormone-sensitive breast cancer treated with tamoxifen. Physical examination shows no abnormalities. Serum studies show decreased concentrations of endoxifen, the active metabolite of the prodrug tamoxifen. Genetic analysis shows the homozygous presence of cytochrome P450 2D6*4 alleles. Which of the following best represents the likelihood that this patient's sister has the same alleles?

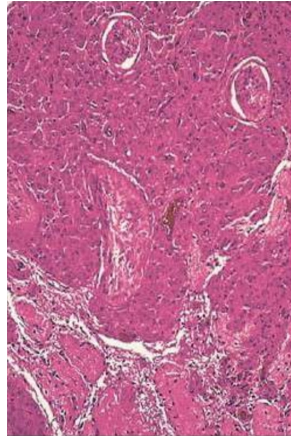
- A. 0%
- B. 25%
- C. 50%
- D. 75%
- E. 100%

▼ **Explanation**

- **Answer is B (25%)**
 - Last 2 sentences again, we have homozygous presence of cytochrome P450 2D6*4 (wtf is that) alleles & the Q asks about the probability of the patient's sister to have the same alleles.
 - Okay so, **Enzymatic deficiencies are normally Autosomal Recessive**
 - So, we know that the Punnett square will be [Aa x Aa]
 - 1/4 = AA (non-affected)
 - 2/4 = Aa (heterozygous/carriers)
 - 1/4 = aa (homozygous/affected)
 - So, patient's sister % is 1/4 = 25%.
 - “This Q is literally just here to assess that you know that enzymatic deficiencies are AR.”

Q15

A 22-year-old man comes to the physician because of infertility. The photomicrograph shows tissue obtained on biopsy of the scrotal testes. Which of the following is the most likely genetic abnormality?



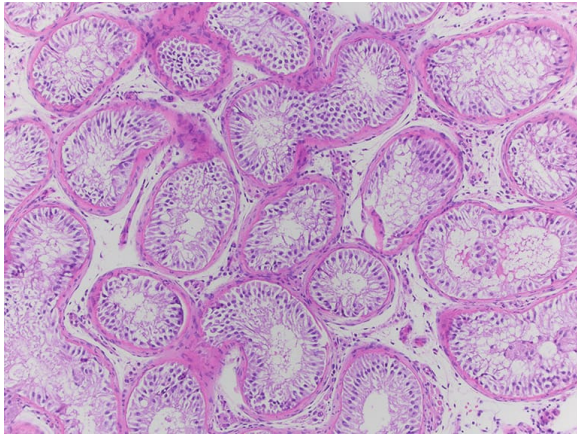
- A. 45,X/46,XY
- B. 46,XX
- C. 46,XY
- D. 47,XXX
- E. 47,XXY

▼ Explanation

- Answer is E (47, XXY)
 - IMP Clues
 - 22-year-old man + fertility (probably a genetic cause, because he's young)
 - Pic of testes biopsy (shows disruption on normal architecture)
 - Dx → Klinefelter Syndrome (47, XXY)
 - You could've solved this Q in 1 of 2 ways:
 - First method is via exclusion:
 - Choice A → Mixed gonadal dysgenesis that would present with ambiguous genitalia at birth not a 20-year-old man
 - Choice B → That's a woman. From my limited experience, I don't think women can undergo testicular biopsies
 - Choice C → A normal male. Why would they give you a normal young + infertility + messed up biopsy. Unlikely
 - Choice D → Nothing like that exists
 - Choice E → Klinefelter Syndrome makes sense. Phenotypically normal male + infertility due to testicular atrophy

- **Method 2 is actually understanding what's going on:**

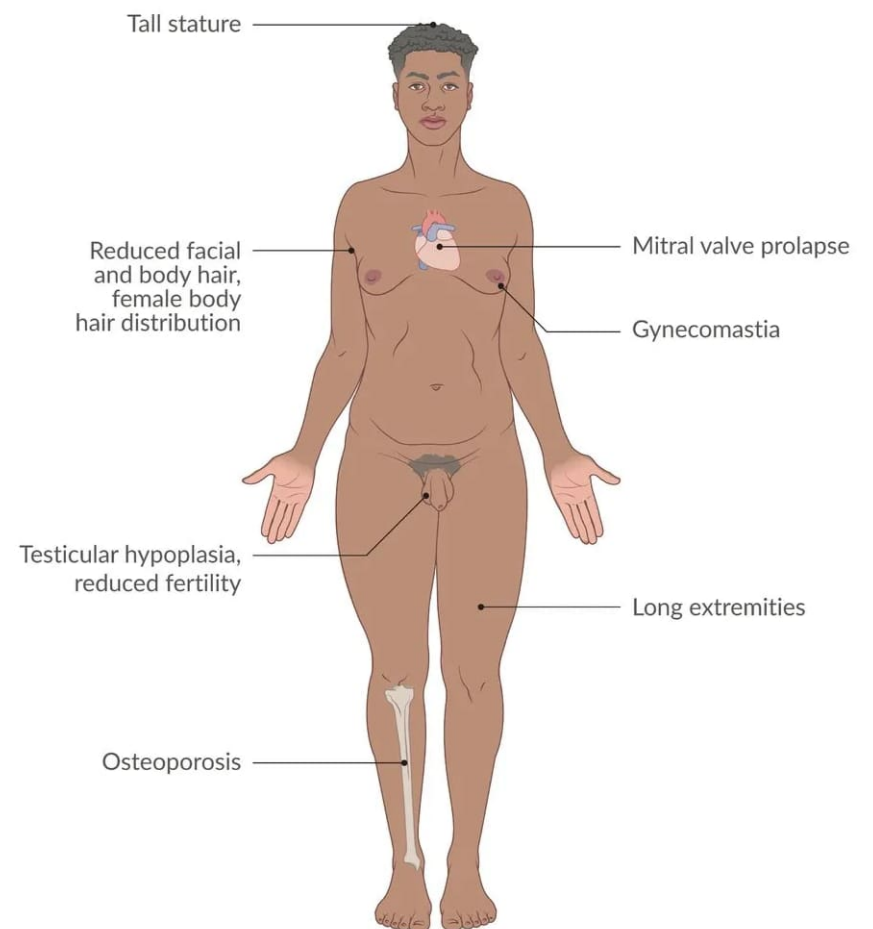
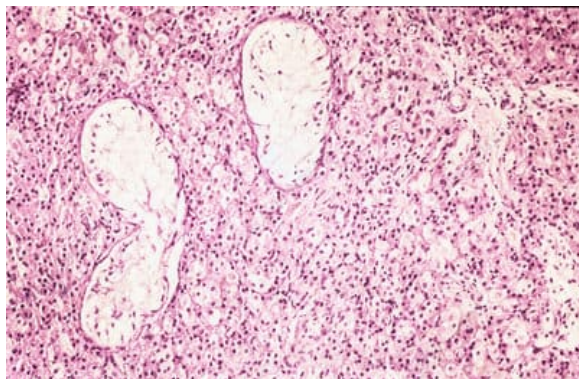
- This is how a **normal testicular biopsy** should look like:



- The **circular structures** are **seminiferous tubules** that has a **basement membrane (the pink outer circle)** + **spermatogonia** (basal stem cells) + **Sertoli cells** + **spermatocytes & spermatids** swimming around.

- **In Klinefelter Syndrome, the seminiferous tubules are "hyalinized". Let me explain.**

- The **extra "X" chromosome** causes *germ cell development disruption*.
- **Germ cells die early** → **Loss of seminiferous tubules lumen content** → **Lumen collapses & is replaced by fibrosis** (fibroblasts deposit connective tissue)
- This "deposited connective tissue" is "**hyalinization**" due to "**Seminiferous Tubule Dysgenesis**"
 - **Appears pink & glassy on biopsy (like picture given in Q)**
- This fibrosis ⇒ **testicular atrophy & infertility**
- This results in the classic "**hyalinized seminiferous tubules biopsy**" shown below:



Klinefelter Syndrome is one of the few HY Male Repro Conditions on the USMLE:

- **Cause:** **Nondisjunction** of sex chromosome during meiosis, resulting in a **47 XXY** karyotype.
- **Presentation:**
 - **Primary Hypogonadism** ⇒ **Low Testosterone & Inhibin B**, causing **increased FSH & LH**
 - **Increased FSH/LH** causes an **increase in Estradiol**
 - **Testicular atrophy** "Small, Firm Testes" & Infertility "azoospermia"
 - **Tall with Long extremities**
 - **BILATERAL Gynecomastia**

Q16

A 42-year-old man is brought to the emergency department because he says he feels as if he is 'frozen in ice.' Examination shows muscle rigidity. Toxicology screen shows evidence of exposure to MPTP (N-methyl-4-phenyl-1,2,3,6-tetrahydropyridine). Which of the following neuronal cell bodies are primarily affected?

- Cholinergic neurons in the nucleus basalis of Meynert
- Dopaminergic neurons in the neostriatum
- Dopaminergic neurons in the substantia nigra
- Serotonergic neurons in the dorsal raphe nuclei
- Serotonergic neurons in the locus ceruleus

▼ **Explanation**

- **Answer is C (Dopaminergic neurons in the substantia nigra)**
 - **IMP Clues**

- Frozen in ice + Examination shows muscle rigidity (Rigidity)
- MPTP (Synthetic Heroine)
- Q asks what neuronal cell bodies are affected?

◦ **Dx → MPTP-induced Parkinsonism**

- MPTP is taken up by **dopaminergic neurons** → selectively accumulates in the **substantia nigra** → mitochondrial enzyme inhibition → ROS generation & Oxidative stress → **Neuronal Death**
- **Loss of dopamine neurons → Parkinsonism (Bradykinesia, Rigidity, Resting Tremors)**
 - Hence the name, **"Frozen Addict"**

Q17

A 3-day-old full-term male newborn is brought to the physician by his mother because of a 24-hour history of yellow skin. He appears healthy. Physical examination shows mild jaundice. Laboratory studies show a hemoglobin concentration of 17 g/dL and a total serum bilirubin concentration of 10 mg/dL, with an indirect component of 8 mg/dL. The jaundice resolves 5 days later. A deficiency of which of the following is the most likely cause of the jaundice in this patient?

- A. Erythrocyte glucose 6-phosphate dehydrogenase activity
- B. Erythrocyte pyruvate kinase activity
- C. Glutathione synthetase activity
- D. Hepatic excretion of bilirubin
- E. Hepatic UDP-glucuronosyltransferase activity

▼ **Explanation**

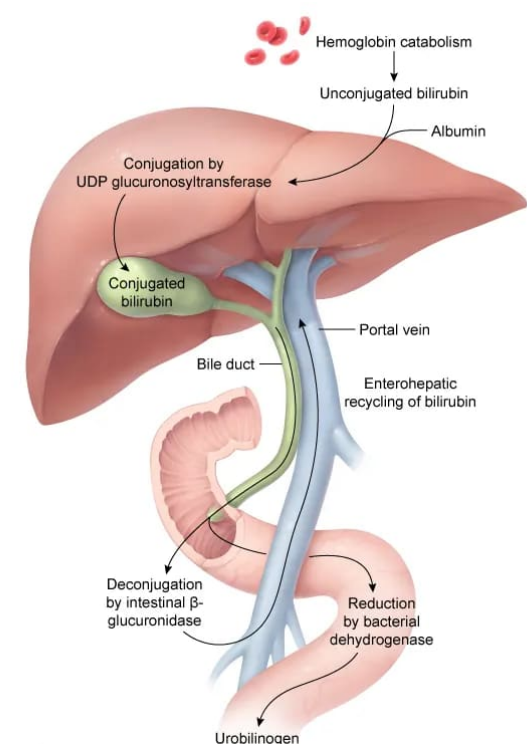
- **Answer is E (Hepatic UDP-glucuronosyltransferase activity)**

◦ **IMP Clues**

- 3-day-old full term male newborn with 24-hour hx of yellow skin (Jaundice onset after first day, so physiological jaundice)
- Hemoglobin concentration of 17g/dL (patient is NOT anemic)
- Total serum bilirubin concentration of 10mg/dL (hyperbilirubinemia) + indirect component of 8mg/dL (indirect hyperbilirubinemia)
- Q asks deficiency of what most likely caused this patient's jaundice?

◦ What causes Physiological Jaundice in Newborn?

1. **Decreased Bilirubin Conjugation:** Newborns have immature liver enzymes still, most commonly UDP-GT, which picks up indirect bilirubin into the liver to get conjugated.
 - If UDP-GT is functioning immaturly, then **inadequate indirect bilirubin uptake → Indirect Hyperbilirubinemia.**
 - After a few days, the baby's organ mature → spontaneous resolution.
2. **Increased Bilirubin Production:** In most neonates, there is a higher concentration of RBCs at birth, which additionally have a shorter lifespan than adult RBCs.
 - **Increased bilirubin production occurs due to rapid RBC turnover.**
3. **Increased Enterohepatic Circulation:** Intestinal sterility at birth limits the reduction of conjugated bilirubin to urobilinogen for excretion in stool. Instead, the majority of conjugated bilirubin is deconjugated by β -glucuronidase.
 - **Deconjugated bilirubin is reabsorbed and reenters circulation (enterohepatic circulation)**



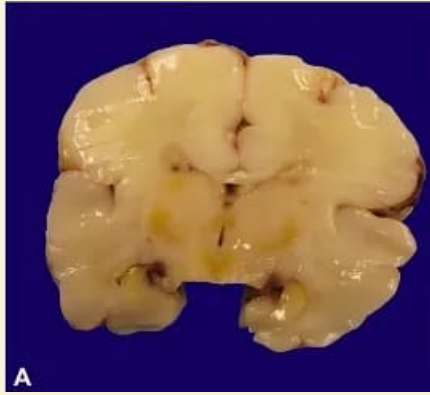
? 6hr newborn baby presented with jaundice + seizures. The patient then died. Autopsy shows the below pic. What is the cause of death?

▼ Answer

Kernicterus - Deposition of **unconjugated bilirubin** in **basal ganglia**.

• Why?

- BBB of newborns are *immature*.
- Unconjugated bilirubin can pass the BBB (CONJUGATED/WATER SOLUBLE bilirubin CAN'T)



▼ Other Choices

- **Choices A & B & C** → These are pathological causes of jaundice (not physiological). How to differentiate?
 - Onset.
 - Onset after first 24hr → Physiological Jaundice
 - Onset within first 24 hrs → Pathological Jaundice
 - Also, pathological jaundice rarely just resolves alone. They frequently progress to kernicterus.
- **Choice D** → Abnormal Hepatic excretion of bilirubin would cause high direct bilirubin as the bilirubin already got conjugated but just can't get excreted.
 - This is either Rotor or Dubin-Johnson Syndromes

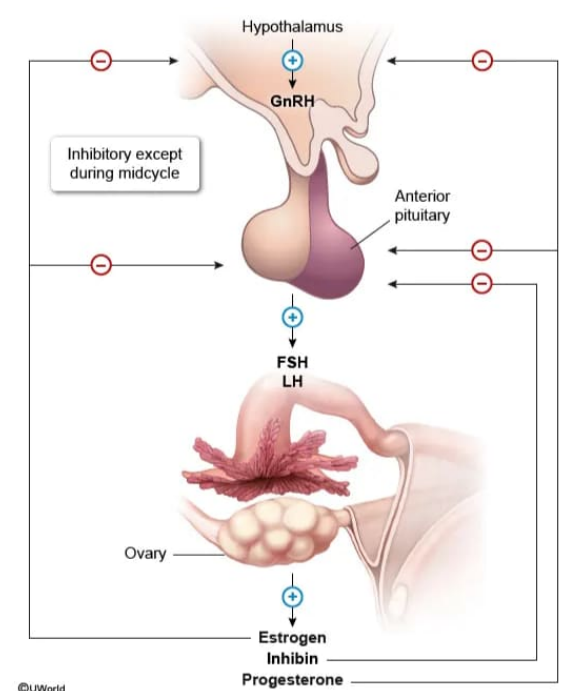
Q18

A 26-year-old nulligravid woman comes to the physician because she has been unable to conceive for the past year. She also has had pain during sexual intercourse. Menses occur at irregular 2- to 3-month intervals. Her last menstrual period was 8 months ago. Physical examination shows no abnormalities. Serum studies show decreased concentrations of estrogen, follicle-stimulating hormone (FSH), and luteinizing hormone (LH). Dysfunction of which of the following is the most likely cause of her infertility and dyspareunia?

- A. Adrenal gland
- B. Hypothalamus
- C. Ovarian FSH receptors
- D. Ovarian LH receptors
- E. Vaginal estrogen receptors

▼ Explanation

- **Answer is B (Hypothalamus)**
 - **IMP Clues**
 - Unable to conceive + menses at irregular intervals + LMP was 8 months ago (Hormones all over the place)
 - Physical Examination shows no abnormalities (Excludes choice A)
 - Serum studies show decreases concentrations of Estrogen, FSH, and LH (okay, so problem is decreased pituitary stimulation, as pituitary is what secretes FSH & LH)
 - Q asks about dysfunction of which of the following is the cause of the pain & infertility?
 - The labs genuinely are all you need:
 - **Low Estrogen?**
 - Is the problem in the **ovaries themselves (Primary)** or due to something else?
 - **If Primary** → High FSH & LH
 - **Low FSH & LH** → **pituitary is not getting stimulated** to produce FSH & LH
 - What stimulates the pituitary?
 - **Hypothalamus** (via GnRH)



? What are the 2nd Messengers of Estrogen, LH, FSH, and GnRH?

▼ Answer

Estrogen → Binds to Intracytoplasmic Receptors with Translocation into the nucleus

LH & FSH → Increases cAMP (Binds to G-coupled Protein Membrane Receptor)

GnRH → Increases IP3 (Binds to G-coupled Protein Membrane Receptor)

▼ Other Choices

• **Choice A → Adrenal Dysfunction**

- Increased Activity:
 - Increased Aldosterone → high Na, Cl, pH, HCO₃, pCO₂ & low K
 - Increased Cortisol → high BP + cushingoid appearance
 - Increased Androgens → Increased Sexual Hair, Clitoromegaly, Deeper voice, increased muscle mass...
- Decreased Activity:
 - 21-alpha hydroxylase → low aldosterone, high androgen effects
 - 11-alpha hydroxylase → high aldosterone, high androgen effects
 - 17-alpha hydroxylase → high aldosterone, low androgen effects

• **Choice C & D → Ovarian FSH & LH receptors dysfunction** would cause low estrogen yes. But that low estrogen would cause NO negative feedback, so we would have high FSH & LH

• **Choice E →** Would explain the dry atrophic vagina (the cause of dyspareunia), but would most likely not cause the infertility (if it is just limited to the vagina) + FSH & LH levels wouldn't be also low

Q19

An 86-year-old man who lives in a skilled nursing care facility is brought to the physician because of a 3-week history of chronic nonproductive cough. He says that he is tired in the mornings because the cough interrupts his sleep. Physical examination shows no abnormalities except for the cough. A chest x-ray shows no abnormalities. In addition to further evaluation to determine the cause of his cough, which of the following drugs is most appropriate to treat this patient while avoiding the adverse effect of constipation?

- A. Codeine
- B. Dextromethorphan
- C. Diphenhydramine
- D. Morphine
- E. Tiotropium

▼ Explanation

• **Answer is B (Dextromethorphan)**

- Patient has cough, nothing else + Q asks for ttt that won't cause constipation.
- **Dextromethorphan is a NMDA receptor antagonist used for cough suppression.**
 - Acts **centrally** on the **cough center** *[For Nerds → In Medulla]*
 - It has **low addictive potential** (in comparison to opioids) & weak peripheral effect

▼ Other Choices

- Choice A → Cough suppressant yes. However, it's an opioid. Opioids cause constipation, sedation, and respiratory depression. So, can't be correct answer choice here.
- Choice C → 1st gen H1 blocker. H1 blockers are associated with severe nasty anticholinergic effects → Constipation, urine retention, ...
- Choice D → Not used as anti-cough medication. Opioid. So, yah CONSTIPATION IS THERE.
- Choice E → Tiotropium is a LAMA used as first line for COPD and can be used in asthma. Not really used for cough. Muscarinic antagonist so can cause constipation.

Q20

Which of the following drug effects is the most common reason for noncompliance with cyclic antidepressant therapy?

- A. Antiadrenergic
- B. Anticholinergic
- C. Antihistaminic
- D. Cholinomimetic
- E. Sympathomimetic

▼ Explanation

- **Answer is B (Anticholinergic)**
 - What I'm about to say is exceedingly HY so listen up.
 - **TCA, D2 antagonists, and 1st gen H1-blockers** cause the following triad: **ANTI-alpha 1, ANTI-cholinergic, ANTI-H1**
 - **alpha 1 antagonist**
 - Presents as → **orthostatic hypotension + fainting**
 - **anti-cholinergic**
 - Presents as → **hot, red, dry patient with a full bladder & constipation +/- dry mouth and dry eyes**
 - **anti-H1**
 - Presents as → **Sedation**
 - So, when you get a Q that says a patient takes one of these medication classes, automatically assume he may have the following side effects.

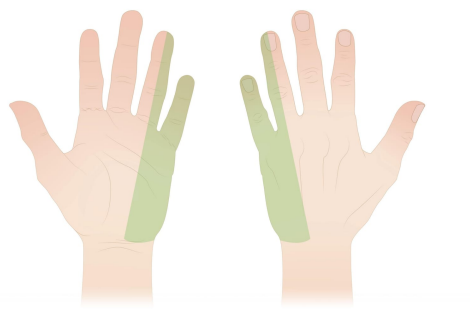
Q21

A 65-year-old man comes to the physician for a follow-up examination. He has a 15-year history of poorly controlled type 2 diabetes mellitus, resulting in multiple peripheral neuropathies. Neurologic examination shows wasting of the interosseous muscles of the left hand and inability to abduct the fingers of this hand; plantar flexion of the right foot is absent. The function of which of the following pairs of nerves is most likely impaired in this patient?

- A. Median and common fibular (peroneal)
- B. Median and tibial
- C. Radial and common fibular (peroneal)
- D. Radial and tibial
- E. Ulnar and common fibular (peroneal)
- F. Ulnar and tibial

▼ Explanation

- **Answer is F (Ulnar and tibial)**
 - **IMP Clues**
 - Type 2 DM resulting in multiple peripheral neuropathy (a HY complication)
 - Wasting of interosseous muscles + inability to abduct fingers (that's the ulnar nerve)
 - Planter flexion of foot is absent (that's the tibia nerve)
 - Let's get to know the functional anatomy of the different hand/leg nerves.
 - **HY Hand Nerves**
 - **Ulnar Nerve**
 - Sensation:
 - **HY Leg Nerves**
 - **Tibial Nerve**
 - Sensation:



- **Motor:**
 1. Flexion of ulnar fingers (medial half of FDP)
 2. Abduction & Adduction of fingers (interossei muscles)
 3. Thumb adduction (Adductor Pollicis)

■ Median Nerve

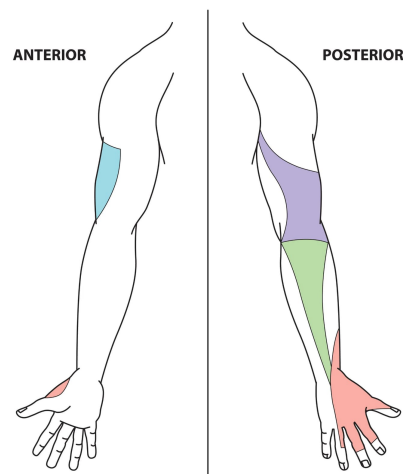
- **Sensation:**



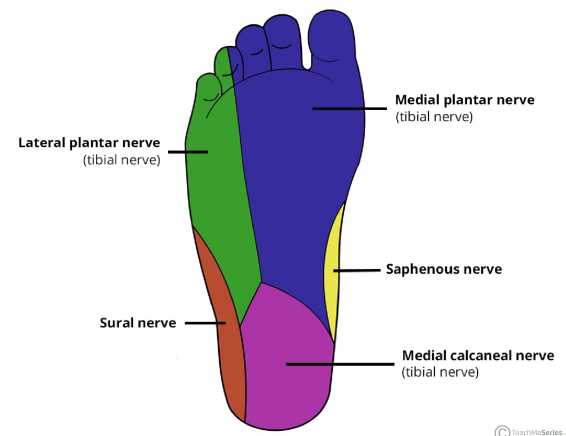
- **Motor:**
 1. Flexion of lateral fingers
 2. Remaining Thumb function (Opponens pollicis, Abductor pollicis brevis, Flexor pollicis brevis)

■ Radial Nerve

- **Sensation:**



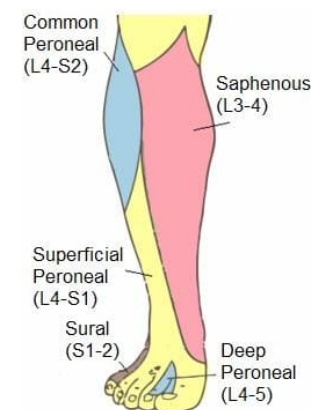
- **Motor:**
 1. Wrist Extension (Forearm extensors)
 2. Pronation (Pronator muscle)
 3. Arm Extension (Triceps)



- **Motor:**
 1. Inversion
 2. Planter Flexion

○ Common Fibular (Peroneal)

- **Sensation:**



- **Motor:**
 1. Eversion (Superficial Fibular nerve)
 2. Dorsiflexion (Deep Fibular nerve)

Q22

A 72-year-old man is given ketorolac for pain control after an abdominal operation. He has a 20-year history of hypertension and type 2 diabetes mellitus. He is at greatest risk for which of the following drug-induced adverse effects?

- A. Acute renal failure
- B. Addiction to the pain medication

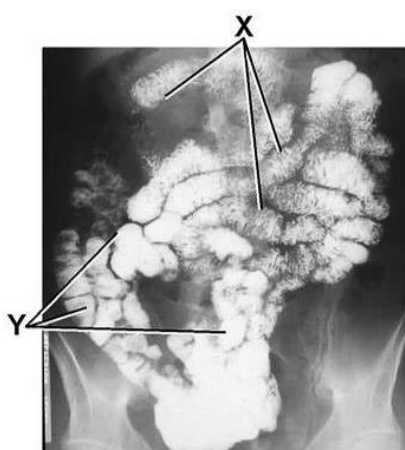
- C. Disorientation
- D. Hypotension
- E. Sepsis

▼ **Explanation**

- **Answer is A (Acute Renal Failure)**
 - **IMP Clues**
 - Given ketorolac for pain control (Ketorolac is a NSAID)
 - **NSAIDs are a very HY cause of Renal Failure**

Q23

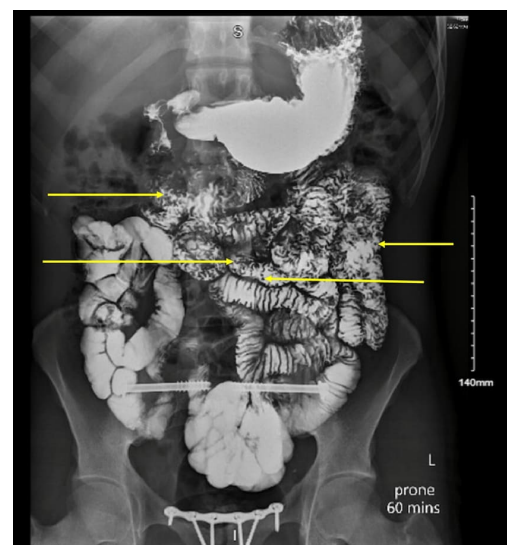
A 62-year-old man is being evaluated for rectal bleeding. An x-ray of the gastrointestinal tract with contrast material is shown. Which of the following is the most likely explanation for the feathery appearance in the portion of the gastrointestinal tract indicated by X when compared with the portion indicated by Y?



- A. Absence of circular muscle
- B. Fewer villi
- C. Greater bowel motility
- D. Greater mucosal surface area
- E. Less circular and longitudinal smooth muscle

▼ **Explanation**

- **Answer is D (Greater mucosal surface area)**
 - Easy Q that asks what gives the “feathery” appearance of the GI tract with the X label?
 - **X labels the small intestines (specifically the jejunum)**, while Y labels the terminal ileum & the beginning of the large intestines
 - If you paid attention in your anatomy/histology lectures, you’d know that **small intestines have villi** while large intestines don’t. **The villi are there to increase the absorptive surface area so that more nutrients can be absorbed.** (Small intestines absorb nutrients)
 - Why does the jejunum have that “feather appearance”?
 - Due to the **plicae circularis** (taller and more prominent, and more numerous than other parts of the small intestines) + the **villi** ⇒ **FEATHERY APPEARANCE ON ORAL CONTRAST**



? What are some HY differentiation points between duodenum, jejunum, ileum, and colon?

▼ Answer

1. Duodenum

- a. Villi & **Microvilli**
- b. **Brunner Glands** (**Bicarbonate**-secreting submucosal glands)
- c. Crypts of Lieberkühn (has stem cells & Paneth cells)
- d. **Distal** Duodenum → Plicae circularis

2. Jejunum

- a. Villi
- b. Crypts of Lieberkühn
- c. **plicae circularis** (**taller** and **more prominent**, and **more numerous**) → feathery appearance

3. Ileum

- a. Villi
- b. **Payer patches** (lymphoid aggregates)
- c. Crypts of Lieberkühn (**LARGEST NUMBER OF GOBLET CELLS IN SI**)
- d. **Proximal** Ileum → Plicae circularis

4. Colon

- a. **NO** Villi
- b. Crypts of Lieberkühn (with abundant goblet cells)

Q24

A 35-year-old man comes to the physician because of a 3-year history of an enlarging nose, coarsening of his facial features, muscle weakness, and increased hand and foot size. Physical examination shows a large fleshy nose and prognathism. Serum studies show an increased insulin-like growth factor-I concentration. An MRI of the brain shows a pituitary adenoma. Morphologic analysis of a biopsy specimen of the tumor shows a densely granulated somatotroph adenoma. Further studies show that the $G_{\alpha s}$ subunit of G proteins in the tumor lack GTPase activity. The tumor cells in this patient most likely have an increased activity of which of the following enzymes?

- A. Adenylyl cyclase
- B. Guanylyl cyclase
- C. Janus kinase
- D. Phospholipase C
- E. Tyrosine kinase

▼ Explanation

• Answer is A (Adenylyl Cyclase)

- Last 2 sentences says that G_s subunit of G protein lacks GTPase & asks what enzyme would the tumor cells in this patient have increased activity
 - We know that $G_s \rightarrow \text{increases adenylyl cyclase} \rightarrow \text{increases cAMP} \rightarrow \text{"activation of pathway or whatever"}$
 - **GTPase inactivates $G_s \rightarrow \text{decreases adenylyl cyclase} \rightarrow \text{decreases cAMP} \rightarrow \text{"deactivation of pathway or whatever"}$**
- **If we have no GTPase, this means we have no "off-switch", so what we get is $\rightarrow \text{indefinitely activated } G_s \rightarrow \text{increases adenylyl cyclase} \rightarrow \text{increases cAMP} \rightarrow \text{"activation of pathway or whatever"}$**
 - In this case, it is IGF-1 $\rightarrow$ **Acromegaly** (enlarged nose, coarsened facial features, muscle weakness, and increased hand & foot size)

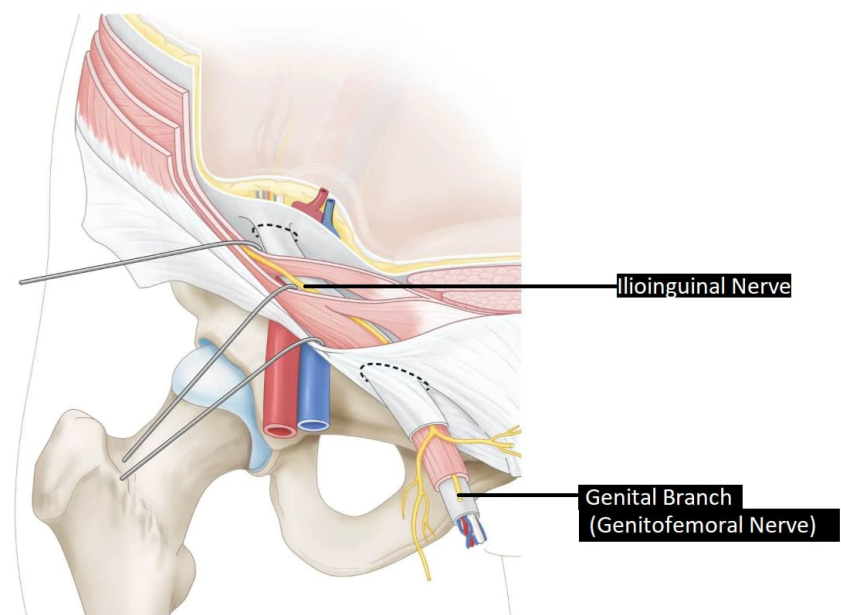
Q25

A 52-year-old man comes to the physician because a lump in his inguinal region, which had been present for 4 months, has recently enlarged and become painful. It is determined that a direct inguinal hernia is present, and a segment of gut has pushed through the superficial inguinal ring. Which of the following will be impaired if the herniated gut compresses the nerve that lies on the external surface of the spermatic cord at the superficial inguinal ring?

- A. Motor innervation to the bulbocavernosus muscle
- B. Motor innervation to the lower portion of the rectus abdominis muscle
- C. Sensation from the anterior surface of the scrotum
- D. Sensation from the dorsal surface of the penis

▼ Explanation

- **Answer is C (Sensation from the anterior surface of the scrotum)**
 - This Q assess the different anatomical nerves in relation of the spermatic cord.
 - We have 2 HY nerves you need to differentiate:
 1. **Genitofemoral nerve (genital branch)** → **Inside** the spermatic cord
 - **Motor** to *cremasteric muscle*
 - Provides **sensation** to **lateral scrotum**
 2. **Ilioinguinal nerve** → **Outside** the spermatic cord (on external surface)
 - Provides **sensation** to **upper medial thigh & anterior scrotum/labia majora**



? What provides sensation to the posterior scrotum?

▼ Answer
Pudendal nerve

So, to recap:

- Anterior scrotum → Ilioinguinal nerve
- Lateral → Genital branch of genitofemoral
- Posterior → Pudendal nerve

Q26

Clostridium perfringens- α toxin affects cells and facilitates the spread of gas gangrene by which of the following mechanisms?

- A. ADP-ribosylation of elongation factor-2
- B. Formation of pores
- C. Preventing release of inhibitory neurotransmitters
- D. Proteolytic cleavage
- E. Splitting lecithin to phosphorylcholine and diglyceride

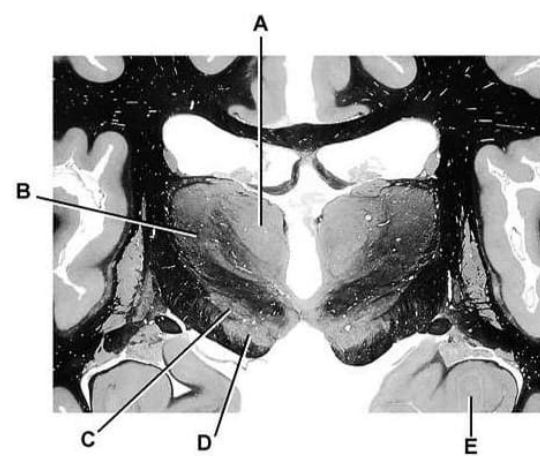
▼ Explanation

- **Answer is E (Splitting lecithin to phosphorylcholine and diglyceride)**
 - Remember sketchy?
 - **alpha toxin produced by *Cl.perfringens* is also called lecithinase/phospholipase.**



Q27

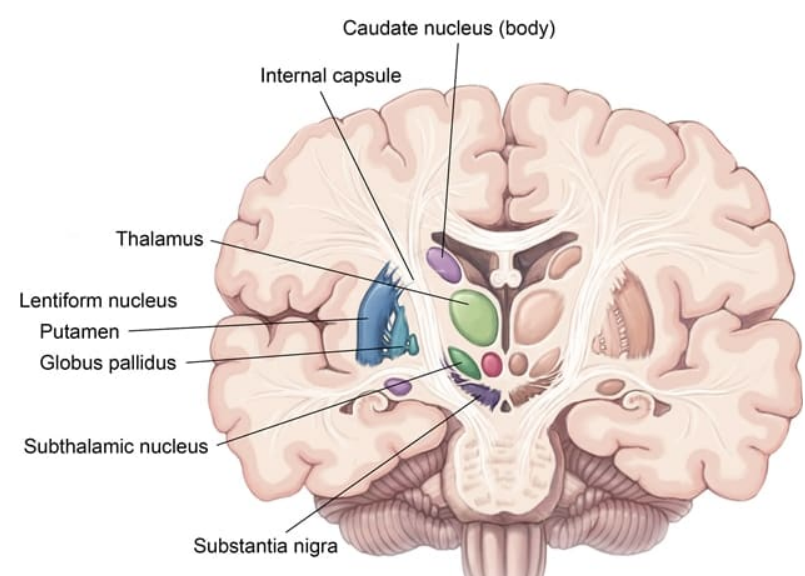
A 63-year-old man has had progressive stiffness over the past 2 years and now has difficulty initiating movements. He has a tremor of his head and hands that is worse when he sits quietly. Which of the following labeled structures in the photograph undergoes degeneration in this condition?



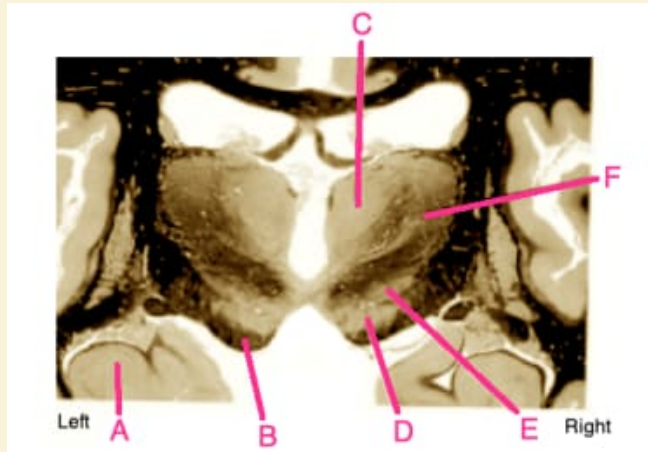
- A. A
- B. B
- C. C
- D. D
- E. E

▼ Explanation

- Answer is D
 - IMP Clues
 - Progressive stiffness + has difficulty initiating movements (sounds like rigidity)
 - Has tremors of his head and hand that is worse when he sits quietly (resting tremors. This + the rigidity is screaming Parkinson's)
 - Q asks about the site of the degeneration?
 - The easy part is that we know that **Parkinson's is degeneration of the Substantia Nigra.**
 - The hard part is pinpointing the neuroanatomy, so you need to get familiar with the neuroanatomy:
 - Choices A & B are the **Thalamus**
 - A → is the **Ventromedial nucleus** of the thalamus
 - B → is the **Ventrolateral nucleus** of the thalamus
 - Choice C is the **Subthalamic nucleus**
 - Choice D is the **Substantia nigra** (what the Q asks to pinpoint)
 - Choice E is the **Hippocampus**



? Now your turn: Label the following:



▼ Answer

- A is **Hippocampus**
- B is **Crus Cerebri**
- C is **Ventromedial nucleus of the thalamus**
- D is **Subthalamic nucleus**
- E is **Substantia Nigra**
- F is **Ventrolateral nucleus of the thalamus**

Q28

A 40-year-old woman comes to the physician because of a 6-month history of dryness of her mouth and itching and burning of her eyes. Physical examination shows inflammation of both corneas and sclerae, enlarged salivary glands, and a paucity of saliva. Serum antinuclear antibody assay is positive. She is told that she is at risk for developing a lymphoma. Which of the following is the most likely mode of inheritance?

- A. Autosomal dominant
- B. Autosomal recessive
- C. X-linked dominant
- D. X-linked recessive
- E. Multifactorial

▼ Explanation

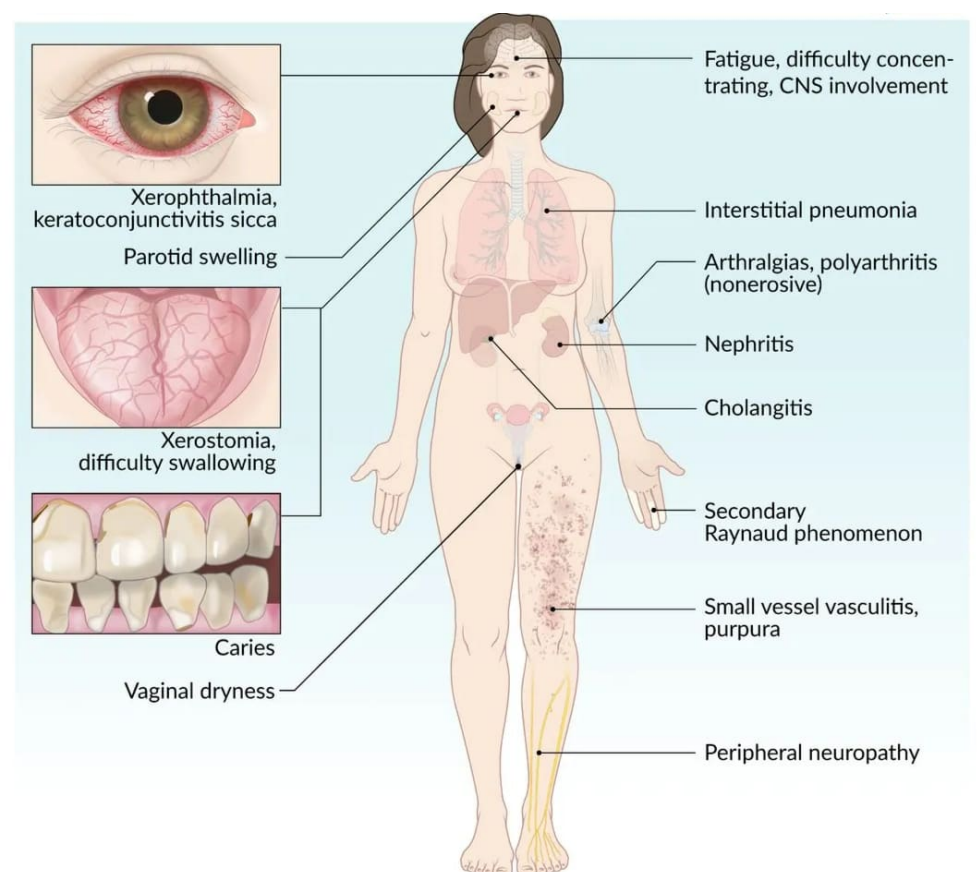
- Answer is E (Multifactorial)

◦ IMP Clues

- Dryness of her mouth and itching and burning of her eyes (Dry eyes + Dry mouth)
- Inflammation of both corneas and sclerae, enlarged salivary glands, and a paucity of saliva (again, classic presentation of Sjogren Syndrome, we need antibody assay confirmation)
- Serum ANA is positive (here it is)

- Q asks what is the mode of inheritance?

- Well, all immune disease are **NOT** acquired via "pure genetics".
- It is usually **multifactorial etiology** involving **hormones**, **genetic predisposition**, and **environmental factors**.

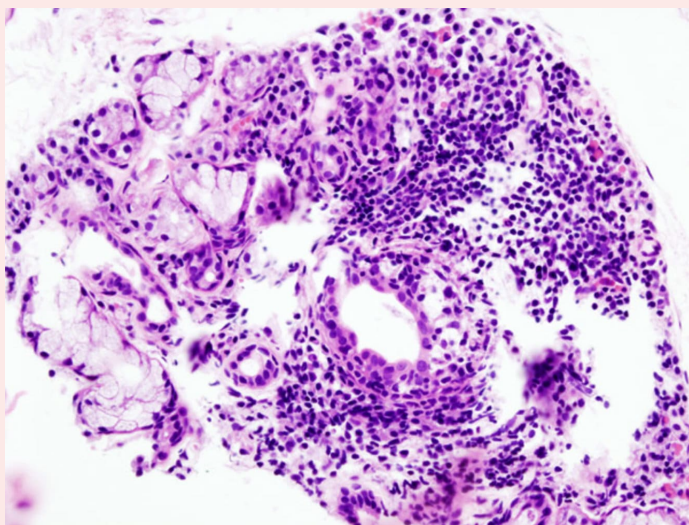




Let's Review Sjogren Syndrome:

- Etiology → **Autoimmune disease**
- Primary affected organs → **Exocrine glands (Salivary & Lacrimal)**
- Biopsy shows → **Lymphocytic infiltration [asked on NBME]**
- Antibodies → **ANA, Anti-RNP, Anti-SS-A(Ro), Anti-SS-B(La)**
- HY Features
 - **Dry eyes** (**Keratoconjunctivitis Sicca**: decreased tears production → corneal damage)
 - **Dry mouth** (**Xerostomia**: decreased saliva production → mucosal atrophy & fissuring)
 - **Bilateral Parotid gland enlargement**
- Complications:
 1. **Dental caries**
 2. **MALT Lymphoma**

They can give you a female with dry eyes + mouth & show you the below picture & ask for diagnosis/antibodies/possible complications.



*** Don't worry you don't to know what you're looking at (I don't know too)

- They will tell you that this biopsy is taken from an **exocrine gland** (Salivary Gland most commonly)
- You see these **small blue/purple cells (lymphocytes)** everywhere
- So, answer is **"Lymphocytic Infiltration of salivary gland"**

Q29

An 18-month-old boy is admitted to the hospital because of generalized tonic-clonic seizures. He has a history of mild developmental delay. There is no family history of seizure disorder or major medical illnesses. He is at the 25th percentile for length, the 25th percentile for weight, and the 25th percentile for head circumference. Physical examination shows six hypopigmented macules scattered on the torso and a raised, flesh-colored lesion on the back. An MRI of the brain shows multiple lesions in the cerebral cortex. Which of the following is the most likely diagnosis?

- A. Ataxia-telangiectasia
- B. Incontinentia pigmenti
- C. Neurofibromatosis 1
- D. Sturge-Weber syndrome
- E. Tuberous sclerosis complex

▼ Explanation

• Answer is E (Tuberous Sclerosis Complex)

◦ IMP Clues

- Generalized tonic-clonic seizures + mild developmental delay + MRI shows multiple lesions in cerebral cortex (Tubers causing seizures & CNS delay)
- Six hypopigmented macules scattered on the torso (Ash-leaf spots)
- Raised flesh-colored lesion on the back (Shagreen spots)

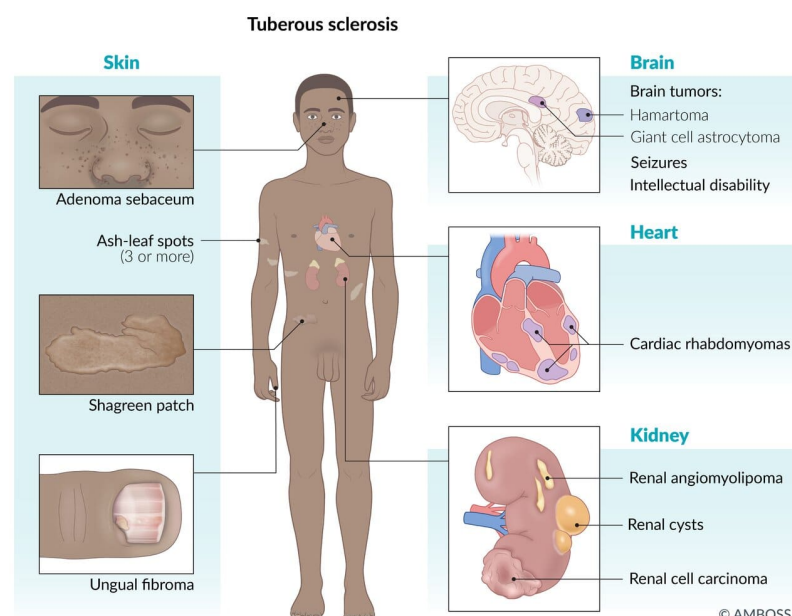
• Dx → Tuberous Sclerosis

- AD Neurocutaneous disorder
- **TSC1/TSC2 (Hamartin/Tuberin)** gene mutation on **chromosomes 9 & 16, respectively.**

[] TSC2 (Two) = Tuberin = six Teen

◦ HY Features include:

- **Tubers "Periventricular Nodules"** (causes seizures & mental retardation/Autism)
- **Ash-Leaf spots (Hypopigmented lesions)**
- **Shagreen patches (Hyperpigmented lesions)**
- **Cardiac rhabdomyoma** (can present on the USMLE as a ball-in-valve murmur that disappears when patient is repositioned or child with obstructive symptoms)
- **Renal angiomyolipoma**
- Others: **Angiofibromas & Subungual fibromas**



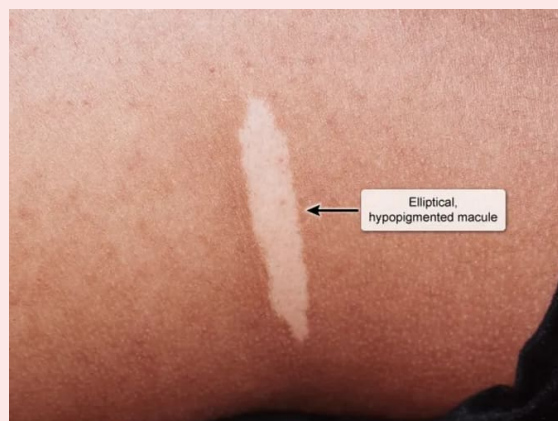
? What are TSC1/TSC2?

▼ Answer

Tumor Suppressor Genes

Pictures of Tuberous Sclerosis Complex Features:

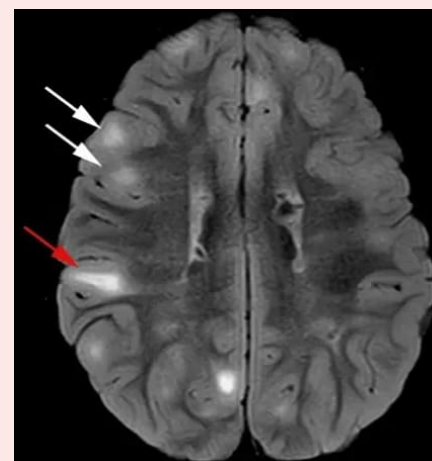
Ash-leaf Spots:



Shagreen Patches:



Periventricular Nodules:



▼ Other Choices

- **Choice A → Ataxia-Telangiectasia** is a patient with **ataxia & telangiectasia**. (Duh)
 - They give you a vignette with the above presentation & ask what caused it → **"Failure of double-stranded DNA break repair"** [asked on NBME]
- **Choice B →** Not assessed on the USMLE, just a stupid distractor. Forget about it.

- **Choice C → Neurofibromatosis 1**

- **AD** Neurocutaneous disorder
- **NF1** gene mutation on **chromosome 17**
- HY Features:

[☐] "CICLOPSS"

- Cafe-au-lait patches (hyperpigmented macules) & axillary/groin freckling
- Intellectual development delay
- Cutaneous fibromas
- Lisch Nodules (**Iris hamartomas**)
- Optic glioma [**asked on NBME**]
- Pheochromocytoma
- Seizures (**oligodendroglioma & ependymoma**)
- Sphenoid bone aplasia

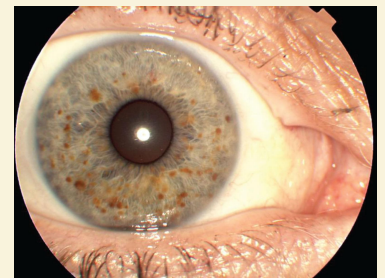
Cafe-au-lait Patches:



Cutaneous Fibromas:



Lisch Nodules:



- **Choice D → Sturge-Weber Syndrome**

- Not inherited; **Somatic mosaicism of GNAQ gene**
- This causes **abnormal capillary vascular malformation** causing:
 - **Portwine stain birth mark (Nevus Flammeus)**
 - **Leptomeningeal angioma (causes seizures)**
 - **Episcleral hemangioma (causes glaucoma)**

Portwine Stain Birth mark:



Q30

A 62-year-old woman comes to the physician 3 days after discovering a painless mass in her left breast during self-examination. She has not had any weight loss or other recent symptoms. Mammography 18 months ago showed no abnormalities. Menopause occurred at the age of 50 years. She takes no medications. She has no family history of breast cancer. Physical examination shows a 2-cm, firm, nontender mass in the upper outer quadrant of the left breast. There is no axillary lymphadenopathy or nipple discharge. Mammography shows an extremely radiodense mass with irregular margins; it contains clustered irregular microcalcifications. Which of the following is the most likely diagnosis?

- A. Breast abscess
- B. Carcinoma of the breast
- C. Fibroadenoma
- D. Fibrocystic changes of the breast
- E. Intraductal papilloma

▼ **Explanation**

• **Answer is B (Carcinoma of the Breast)**

◦ **IMP Clues**

- 62-year-old woman + menopause was at age 50 (Age checks out, also this excludes also Choice D & Choice C)
- Painless mass (presentation checks out, also this excludes Choice A)
- Examination shows a 2-cm firm nontender mass (painless breast mass in a postmenopausal woman is a RED FLAG, probably cancer)
- No nipple discharge (Excludes Choice E as it presents mostly with bloody nipple discharge)
- Mammography shows an extremely radiodense mass with irregular margins + microcalcifications (microcalcifications on mammography is + irregular mass = IDC)

◦ **Dx → Carcinoma of the Breast**

- This is probably **Invasive Ductal Carcinoma**
 - **Postmenopausal woman + painless breast mass with irregular margins + calcification on mammogram**
 - IDC is also the *most common malignant breast cancer*
- Why not DCIS (Ductal carcinoma in situ)?
 - "In situ" = still hasn't invaded basement membrane
 - ***Incidental finding of Microcalcifications on mammography in a woman with NO breast mass is DCIS until proven otherwise***
- Complications:
 1. Metastasis
 2. **Paget's Disease** (Eczematous nipple + mass due to underlying malignancy)

▼ **Other Choices**

- **Choice A →** No hectic fever, no throbbing pain, and no risk factor for developing an abscess at that age. Not breast feeding.
- **Choice C → Fibroadenoma**
 - Most common benign breast tumor.
 - Presents as a **rubbery mobile nontender mass** in a **childbearing age woman (20-40y)**
 - Has **no calcification**
- **Choice D → Fibrocystic Changes of the Breast** has 2 presentations on the USMLE:
 1. **Waxing & waning *bilateral or unilateral* breast tenderness/masses** over the course of the menstrual cycle.
 2. **Painless *unilateral* breast cyst/mass** that **drains brown/green fluid**
 - Biopsy shows:
 - *"Sclerosing Adenosis", "Apocrine metaplasia", or "blue dome cyst"*
- **Choice E → Intraductal Papilloma**
 - **Unilateral bloody/rusty nipple discharge is Intraductal papilloma until proven otherwise**

Q31

A 65-year-old man comes to the emergency department because of a 1-day history of shortness of breath. He has hypertension and type 2 diabetes mellitus. There is no history of heart disease. Current medications include hydrochlorothiazide, ramipril, and metformin. He does not smoke. His temperature is 37°C (98.6°F), pulse is 110/min, respirations are 28/min, and blood pressure is 152/92 mm Hg. Pulse oximetry on room air shows an oxygen saturation of 90%. Cardiac examination shows an S₃. A grade 2/6 systolic murmur is heard over the lower left sternal border radiating to the axilla. The point of maximal impulse is diffuse and most prominent in the axillary line. Which of the following findings is most likely on pulmonary auscultation?

A. Crackles

- B. Egophony
- C. Unilateral decreased breath sounds
- D. Wheezing
- E. Whispered pectoriloquy

▼ Explanation

- **Answer is A (Crackles)**
 - **IMP Clues**
 - Cardiac examination shows an S3, A grade 2/6 systolic murmur is heard over lower left sternal border radiating to the axilla (S3 is buzzy for HF, especially in the older population. The murmur is Mitral Regurgitation)
 - The point of maximal impulse is diffuse and most prominent in the axillary line (eccentric LVH)
 - Q asks what is expected on pulmonary auscultation?
 - **Mitral Regurgitation** → blood regurgitates back into LA
 - → LA dilated → Blood backs up into pulmonary vasculature (**cause of crackles on auscultation**)
 - → LA volume overload → LV volume overload → LVH (eccentric hypertrophy)
 - **The backed-up blood in the lung vasculature → increased hydrostatic pressure → extravasation of fluid into interstitial space causes crackles on auscultation & shortness of breath on history.**
- ▼ Other Choices
 - **Choice B** → Egophony is when you ask the patient to say “E”, but you hear it as “A”. Caused by **consolidation**.
 - **Choice C** → Pulmonary congestion if severe to cause pulmonary effusion can cause decreased breath sounds, however, it would be **BILATERAL**.
 - **Choice D** → You know wheezing. The musical high-pitched sound heard due to narrowed airways. Can be caused by **asthma or bronchitis**.
 - **Choice E** → It is when the patient whispers “1 2 3”, but you hear it loudly. Also caused by **consolidation**.

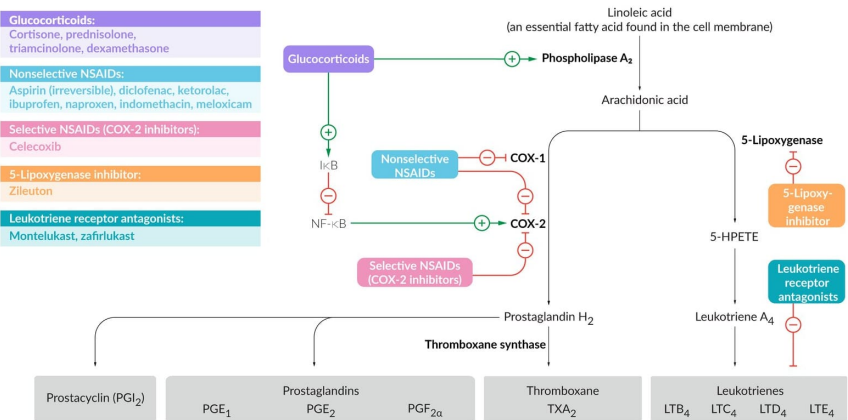
Q32

Thirty minutes after taking 2 aspirin tablets for a tension headache, a 17-year-old girl has difficulty breathing. An adverse reaction to the aspirin is suspected. In the future, she should take which of the following drugs to treat her headaches?

- A. Acetaminophen
- B. Ibuprofen
- C. Ketorolac
- D. Naproxen
- E. Sumatriptan

▼ Explanation

- **Answer is A (Acetaminophen)**
 - **IMP Clues**
 - After taking 2 aspirin tablets, girl has difficulty breathing (sounds like Samter’s Triad)
 - Adverse reaction to the aspirin is suspected (yep, it is)
 - Q asks what should be taken to treat her future tension headaches?
 - **What’s Samter’s Triad?**
 - This is **Aspirin-Induced-Hypersensitivity** or **Aspirin-Induced-Asthma**
 - Aspirin **inhibits the COX pathway** → all the Arachidonic acid is shunted into the **LOX pathway** → **LTs production increases** → **bronchoconstriction & asthma-like symptoms**
 - **Presents as: Nasal polyps - Aspirin Hypersensitivity - Asthma-like symptoms**



- Okay, so the patient **can't take NSAIDs**
 - **Choices B, C, and D → NSAIDs, so exclude them**
- **Sumatriptans (Choice E)** are used for **Migraine headaches & Cluster Headaches** NOT Tension headaches.
- This leaves out **Choice A → Acetaminophen**.

? Patient was playing soccer then had really bad muscle aches after. He took aspirin then developed wheezy chest. What is the treatment of this condition?

▼ **Answer**

Leukotriene Receptor Antagonists (Montelukast & Zafirlukast) or LOX-5 inhibitors (Zileuton)

Q33

A 38-year-old man is admitted to the hospital after sustaining multiple injuries in a farm implement accident. The day after admission, his plasma fibrinogen concentration is increased. Which of the following is the most likely cause of this finding?

- A. Acute-phase response
- B. Anaphylaxis
- C. Disseminated intravascular coagulation
- D. Hemoconcentration
- E. Histamine triple response

▼ **Explanation**

- **Answer is A (Acute-phase response)**

- Q asks for what is the cause of increased plasma fibrinogen concentration after multiple injuries?
 - **Fibrinogen is a positive acute phase reactant that increases in response to stress**
 - Acute phase reactants are **produced by the liver** and are **regulated by cytokines (IL-6, IL-1, TNF-alpha)**

Positive APRs

1. CRP & ESR
2. **Fibrinogen & Ferritin**
3. **Hepcidin**

Negative APRs

1. Albumin
2. Prealbumin (Transthyretin)
3. **Transferrin**

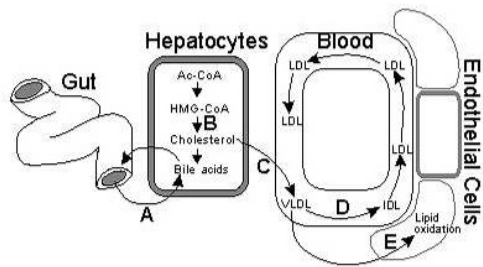
- This is the basis for why, for example, in **anemia of chronic disease** we have **increased ferritin** (stored iron), **increased hepcidin** (decreased mobilization/absorption of iron), and **decreased transferrin** (decreased iron mobilization).

▼ **Other Choices**

- **Choice B** → Anaphylaxis isn't really a cause of decreased or increased fibrinogen levels, except if it was sooo severe that it caused DIC? Unlikely and unnecessary for the USMLE. Keep it simple.
- **Choice C** → DIC causes consumption of clotting factors & thrombolytic factors. Fibrinogen is decreased not increased.
- **Choice D** → Hemoconcentration can technically cause increased concentration of fibrinogen, in addition to most other factors in the plasma. However, them not telling us anything about hypovolemia or bleeding makes us lean more to APRs.
- **Choice E** → Garbage. Forget about it.

Q34

Nicotinic acid acts at which of the following labeled sites in the diagram of lipid metabolism?



- A. A
- B. B
- C. C
- D. D
- E. E

▼ Explanation

- Answer is C
 - **Niacin (Nicotinic Acid)** is used as anti-lipid drug via the following mechanisms:
 1. **Decreased VLDL synthesis & export from the liver** (what we have here)
 2. **Inhibits hormone-sensitive lipase (HSL)**
 - If USMLE asks you **what increases HDL more than any other agent** → Niacin

? What are the HY side effects of Niacin?

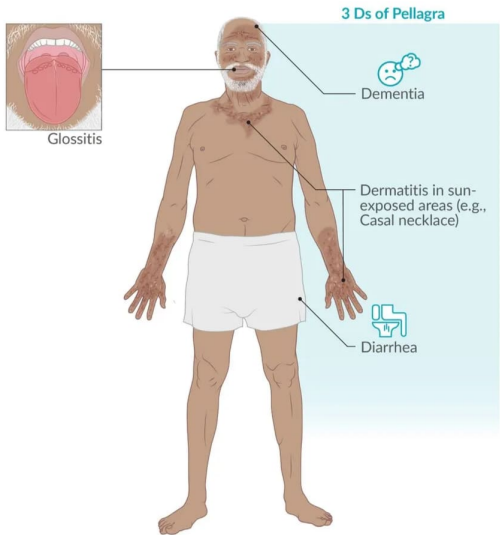
▼ Answer

1. **Hyperuricemia**
2. **Insulin Resistance & Type 2DM**
3. **Flushing** (treated with **NSAIDs** not antihistamines)

Let's go off-track here & review Niacin Deficiency:

Pellagra

- "4Ds": **D**iarrhea, **D**ementia, **D**ermatitis (Sun-hypersensitivity → hyperpigmented rash on sun-exposed areas), and **D**eath
- HY causes of niacin deficiency: Decreased Intake (duh), **Hartup disease**, **Carcinoid Syndrome**, **INH therapy**
 - *Basically, niacin can be made endogenously from tryptophan, so disorders that decrease tryptophan predisposes Pellagra:*
 - **Hartup disease**: defective tryptophan absorption/reabsorption
 - **Carcinoid Syndrome**: Increased serotonin synthesis causes depletion of tryptophan
 - **INH therapy**: depletes vitamin B6 (HY), which impairs tryptophan → niacin



Q35

A 31-year-old woman in the second trimester of pregnancy is brought to the emergency department because of vaginal bleeding. Blood pressure is 140/95 mm Hg. Ultrasound examination shows a conceptus with patches of tissue containing vesicular structures but no apparent embryo. The tissue is surgically removed and genetic analysis shows a 69,XXY karyotype. The presence of which of the following would indicate that an embryo had been formed within this conceptus?

- A. Cytotrophoblast
- B. Hematopoietic stem cells
- C. Primary stem villus
- D. Syncytiotrophoblast
- E. Trophoblastic lacunae

▼ Explanation

- Answer is B (Hematopoietic Stem Cells)

- Last line in the Q is all you need. Q asks presence of what indicates that an embryo has been formed. In other words, which of the following is NOT A PART OF THE PLACENTA?
- Cytotrophoblast, Syncytiotrophoblast, Trophoblastic lacunae, and Primary stem villus are all **placental structures**.
- **Hematopoietic Stem Cells (Choice B) are embryonal structures**. Easy Q.

Q36

A new virus has been isolated that causes encephalitis. The viral particle contains an RNA-dependent DNA polymerase. Which of the following types of RNA is most likely to be the genome of this virus?

- A. Double-stranded circular
- B. Double-stranded linear
- C. Single-stranded negative-sense
- D. Single-stranded positive-sense

▼ **Explanation**

- **Answer is D (Single-stranded positive-sense)**
 - Q here wanted to assess if you understand what an **RNA-dependent DNA polymerase** is.
 - It basically means **making DNA from RNA**. Sounds familiar? YES. This is basically **Reverse Transcriptase**.
 - **Normally, you use DNA to make RNA. But Retroviruses has this “Reverse Transcriptase” that does the opposite: RNA → DNA.**
- What’s the most common retrovirus you can think of? **HIV**.
 - Let’s use HIV’s genome to answer the Q.
 - It is a **Single-Stranded Positive-Sense RNA virus**

Q37

A 53-year-old woman with a long history of fibromuscular dysplasia involving the left renal artery develops hypertension. Her left kidney is 7.4 cm (N = 10 cm). She is being evaluated for a revascularization procedure; a left kidney biopsy is performed. Which of the following histologic findings is most likely?

- A. Deposition of fibrinoid deposits within interlobular arteries
- B. Diffuse infiltrate of neutrophils within tubules and interstitium
- C. Diffuse mesangial hypercellularity
- D. Severe atherosclerosis involving interlobular arteries and hyaline arteriosclerosis involving arterioles
- E. Tubular atrophy

▼ **Explanation**

- **Answer is E (Tubular atrophy)**
 - **IMP Clues**
 - Long history of fibromuscular dysplasia involving left renal artery develops hypertension (FMD is tunica media hypertrophy → decreased renal flow → increased renin & AT-2 → HTN)
 - Left kidney is 7.4cm (N=10cm, so the kidney with low blood flow got smaller = Atrophy)
 - Q asks what would be seen on histological biopsy?
 - **Ischemia → Hypoxia → Tubular atrophy.**
 - **Why the tubules? [asked on NBME]**
 - They have A LOT of **ATPases**, which are veryyy susceptible for hypoxia, so they atrophy.
 - Na/K ATPases are one of the most energy (ATP) demanding channels in our bodies, this makes them very liable to hypoxia.
 - **Hypoxia = decreased Oxygen = decrease aerobic respiration = decreased Oxidative phosphorylation = decreased ATP production**

▼ **Other Choices**

- **Choice A** → **Fibrinoid deposits** is found in **Malignant HTN** (*hyperplastic arteriosclerosis* can also be found in Malignant HTN too) or **Polyarteritis nodosa**
- **Choice B** → Would be seen in acute pyelonephritis
- **Choice C** → Could hint to **DPGN which is associated with SLE**
- **Choice D** → Usually seen in postmenopausal women or men with cardiovascular diseases, but the woman here is diagnosed with FMD already.

Q38

A 76-year-old man with a 1-month history of a pulsatile abdominal mass is diagnosed with an abdominal aortic aneurysm. CT scans of the abdomen with contrast also showed an incidental finding of a horseshoe kidney. In this setting, the surgical approach to repair of the aneurysm in this patient is most likely to be further complicated by the presence of which of the following?

- A. Abnormal origin of the superior mesenteric artery
- B. Anomalous origins of multiple renal arteries to each kidney
- C. Friability of vascular tissue as a result of collagen synthesis abnormalities
- D. Multiple ureters with abnormal courses
- E. Tumors with malignant degeneration

▼ **Explanation**

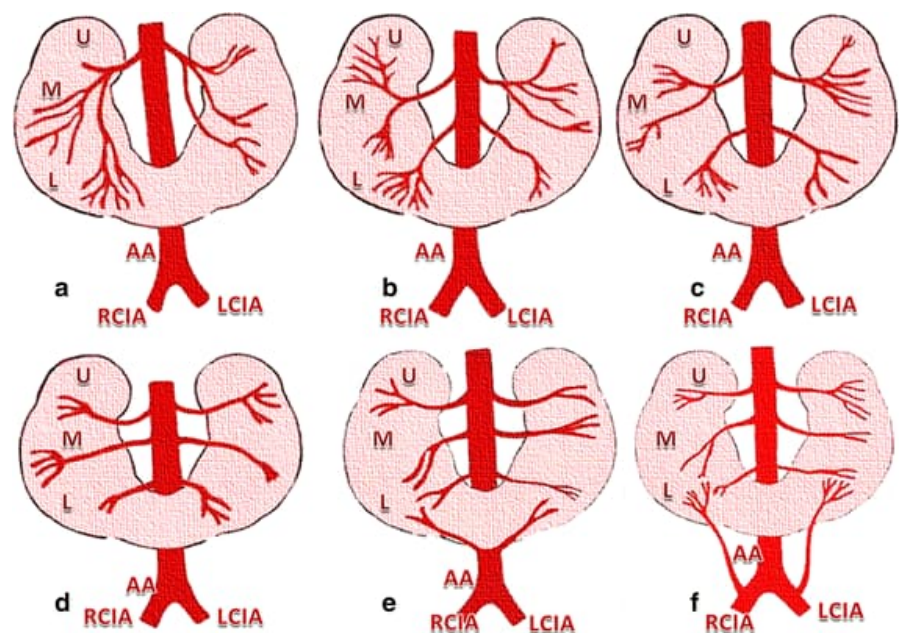
- **Answer is B (Anomalous origins of multiple renal arteries to each kidney)**
 - **Kidneys are actually formed in the pelvis then ascend into their normal abdominal sites.**
 - They take blood supply from *nearby arteries* which obliterate & reform as they ascend.
 - If a person has **horseshoe kidney**, the lower "U" gets stuck on the **Inferior Mesenteric Artery** [asked on NBME]
 - The "temporary" blood supply stays there, so you get this "anomalous origins of multiple renal arteries to each kidney"

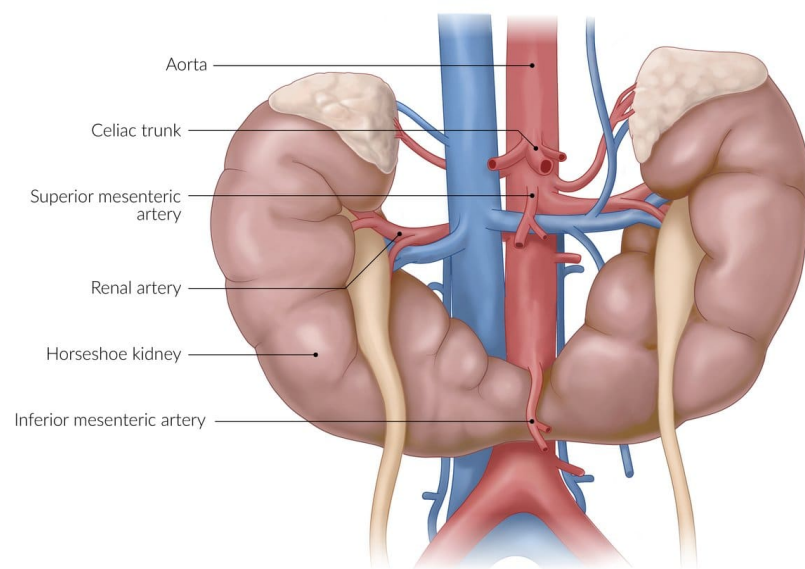
? What syndrome is HY for horseshoe kidneys?

▼ Answer
Turner Syndrome

? What tumor are patients with horseshoe kidneys at risk of developing?

▼ Answer
Wilm's Tumor





Q39

A 73-year-old woman dies 7 years after the onset of progressive memory loss and depression. She had severe intellectual deterioration at the time of death. A coronal section of the brain at autopsy is shown. Histologic sections showed numerous neuritic plaques in the cerebral cortex and numerous neurofibrillary tangles in cortical neurons. Which of the following is the most likely cause of the ventricular enlargement?



- A. Communicating hydrocephalus
- B. Hydrocephalus ex vacuo
- C. Noncommunicating hydrocephalus
- D. Normal pressure hydrocephalus
- E. Oversecretion hydrocephalus

▼ Explanation

• Answer is B (Hydrocephalus ex vacuo)

◦ IMP Clues

- Progressive memory loss & depression + intellectual deterioration (Sounds like Alzheimer's)
- Histology shows numerous neuritic plaques + numerous neurofibrillary tangles (yep, Alzheimer's)
- Pic shows ventricular enlargement

◦ Q asks about the cause of ventriculomegaly

- Patients with Alzheimer's do experience **cortical atrophy**, which gives the illusion that the ventricles are enlarged.
- This is called **Hydrocephalus ex vacuo**
- HY common causes on the USMLE are **Alzheimer's & Schizophrenia**

▼ Other Choices

- **Choice A** → CSF flows freely between the ventricles & the subarachnoid space.
 - Cause of hydrocephalus is → **“failure of CSF reabsorption by arachnoid granulations.” [asked on NBME]**
 - HY causes include → **meningitis** (inflammatory cells clog up the arachnoid granulations)
- **Choice C** → An obstruction blocks the flow of CSF between the ventricles & the subarachnoid space
 - Cause of hydrocephalus is → **“Obstruction that impedes CSF free flow”**
 - HY causes include → **Spinal Cord Tumors, Aqueduct Stenosis, Colloid Cyst**
- **Choice D** → **Triad of “Wet, Wacky, Wobbly” +/- Parkinsonism**
 - Caused by → **impingement on the corona radiata [asked on NBME]**
 - Presentation:
 - **Urinary incontinence** (caused by **failure of voiding reflex inhibition [asked on NBME]**)
 - **Cognitive Dysfunction**
 - **Ataxia**
- **Choice E** → Oversecretion hydrocephalus is caused by choroid plexus adenoma. This is basically non-existent on the USMLE

Q40

A 24-year-old man who is comatose is admitted to the hospital because of a drug overdose and pneumonia. On admission, he is intubated and mechanically ventilated. While receiving a tidal volume of 500 mL, the patient's end-expiratory pressure is +5 cm H₂O, and his end-inspiratory airway pressure is +25 cm H₂O. An esophageal balloon is inserted, and an end-inspiratory pleural pressure of +20 cm H₂O is measured. Which of the following best represents this patient's respiratory system compliance?

- A. 0.01 cm H₂O/mL
- B. 0.04 cm H₂O/mL
- C. 0.05 cm H₂O/mL
- D. 20 mL/cm H₂O
- E. 25 mL/cm H₂O
- F. 100 mL/cm H₂O

▼ Explanation

- **Answer is E (25mL/cm H2O)**
 - Q asks for **compliance**.
 - Formula is → **Compliance = TV / (End inspiratory airway pressure - End expiratory airway pressure).**
 - $500 / (25-5) = 500/20 = 25\text{mL/cm H2O}$
 - The end-inspiratory pleural pressure is just to throw you off

Q41

An 1814-g (4-lb) male newborn is delivered in the hospital at 39 weeks' gestation to a 40-year-old woman, gravida 4, para 4 via an uncomplicated vaginal delivery. Shortly after delivery, he develops respiratory distress and dies 8 hours later. At autopsy, examination of the pancreas shows congenital absence of the pancreatic islets. The most likely cause of this congenital abnormality is a defect in the initial differentiation of islet cells from which of the following precursor cells?

- A. Endodermal cells
- B. Epithelial cells in the yolk sac wall
- C. Neural crest cells
- D. Paraxial mesodermal cells
- E. Splanchnic mesodermal cells

▼ Explanation

- **Answer is A (Endodermal Cells)**

- This is why you always start by reading the last 2-3 sentences.
- Q says congenital absence of the pancreatic islets & asks about defect in which of the following initial differentiation. **Basically, where the hell does pancreatic islets come from?**
 - Basic embryology ⇒ **Endodermal Cells**
 - Embryo is basically LY so know what you can.

Q42

A 36-year-old woman comes to the physician because of a 4-month history of chronic fatigue. Physical examination shows a macular rash over the face. Serum studies show the presence of antibodies against nucleosomes but not against histones. Urinalysis shows blood and 3+ protein. A biopsy specimen of renal tissue is consistent with lupus nephritis. Treatment with prednisone is begun. This drug acts by binding to its receptor in which of the following sites?

- A. Cytosol with translocation into the nucleus
- B. Lysosome
- C. Outer mitochondrial membrane
- D. Outer nuclear membrane with translocation into the inner nuclear membrane
- E. Peroxisome
- F. Plasma membrane with translocation into the endosome

▼ **Explanation**

- **Answer is A (Cytosol with translocation into the nucleus)**

- Again, last 2-3 sentences. Patient has **lupus nephritis & treatment with prednisone** is begun & asks about the **site of the receptor** that it binds to?
 - Okay, **Corticosteroids act via intracellular receptors (in the cytosol) then is translocated into the nucleus for it to act on transcription factors.**
- Molecules that act via intracellular receptors are the “cholesterol-derived hormones”
 - Examples: **Estrogen, Progesterone, Testosterone, Cortisol, Vitamin D, Aldosterone**
 - Additionally, **T3/T4** also acts in this way despite it being **not** a “cholesterol-derived” hormone (fun fact, they are the only amino acid derived hormones that use Intracellular receptors)

Q43

A 10-year-old boy has bruised easily since swallowing some of his grandfather's pills 2 days ago. Aspirin and dicumarol are found in the medicine cabinet. Which of the following laboratory findings would suggest that he took dicumarol rather than aspirin?

- A. Decreased plasma fibrinogen concentration
- B. Decreased partial thromboplastin time
- C. Decreased platelet count
- D. Normal clotting time
- E. Prolonged prothrombin time

▼ **Explanation**

- **Answer is E (Prolonged Prothrombin Time)**

- **Dicumarol** is similar to warfarin
- MOA: **Depletes Vitamin K stores**
- **No Vitamin K = decreased active vitamin K-dependent clotting factor (especially 7) = Prolonged PT**

? Why do we use PT to monitor Warfarin?

▼ **Answer**

Warfarin inhibits Vitamin K epoxide reductase → decreased active/reduced Vitamin K

- Vitamin K is a **co-factor** for **carboxylation of Vitamin K-dependent clotting factors** (10, 9, 7, 2)
- **Factor 7** has the **shortest half-life (4-5 hours)**, and it is **monitored by PT**.
 - So, if factor 7 decreases and PT prolongs, we know that the Warfarin is working.

▼ Other Choices

- **Choice A** → Aspirin & Dicumarol **don't affect plasma fibrinogen level**, so if the patient has used them, it wouldn't have told us anything. **DIC causes a decrease in fibrinogen concentration.**
- **Choice B** → Decreased PPT? No. **Dicumarol prolongs PTT** (later tho, due to **longer half-life** of **common pathway clotting factors 10 & 2**)
- **Choice C** → Neither aspirin nor Dicumarol decrease PLT count. **Aspirin affects platelet function NOT count.**
- **Choice D** → **Dicumarol** causes **prolonged Clotting Time** & **aspirin** causes **prolonged Bleeding Time**

Q44

A 62-year-old man with dyslipidemia is brought to the emergency department by his wife because of a 6-hour history of severe muscle aches, generalized weakness, and brown urine. His wife says that he recently started a new lipid-lowering drug that was added to his medication regimen including simvastatin, losartan, chlorthalidone, and atenolol. His pulse is 90/min and regular, and blood pressure is 96/72 mm Hg. Physical examination shows no other abnormalities. His serum creatinine concentration is 10.2 mg/dL. Urinalysis shows 4+ blood but no RBCs. Which of the following medications was most likely added to this patient's drug regimen?

- A. Cholestyramine
- B. Colesevelam
- C. Ezetimibe
- D. Gemfibrozil
- E. Niacin

▼ Explanation

- **Answer is D (Gemfibrozil)**
 - **IMP Clues**
 - Man with dyslipidemia (probably taking anti-lipidemic drugs)
 - Severe muscle aches, weakness, and brown urine (Sounds like Rhabdomyolysis, muscles are breaking down hence the muscle pain & weakness → liberating myoglobin → Brown Urine)
 - He recently started a new lipid-lowering drug (so probably a drug interaction, hint it is)
 - Simvastatin (bingo)
 - Serum creatinine concentration is 10.2 mg/dL (Myoglobinuria → deposition in kidney → Renal Failure)
 - Urinalysis shows 4+ blood but no RBCs (confirming that the cause of brown urine IS NOT BLOOD, but in fact myoglobin)
 - **Fibrates** (can be referred to as "**fibric acid derivative**")
 - Stimulates **PPAR-α** → **upregulates LPL** → causes **FFA** (from TAGs in chylomicrons & VLDLs) to **enter** adipose cells → **decreases TAG serum levels [MAJOR EFFECT]**
 - **PPAR-α** is a *nuclear transcription factor* which also causes **increases Apo-A I & Apo-A II transcription** → **Increases HDL production.**
 - This is why **Fibrates are the most effective drug class in patients with high TAGs & low HDL**
 - **Statins + Fibrates = Myopathy** (muscle pain & soreness) + **high CK levels** (muscles are breaking down)
 - **Fibrates + Statins = Rhabdomyolysis**
 - Caused by **CYP450 Inhibition**

? What are the HY side effects of fibrates?

▼ Answer

1. **Hepatotoxicity**
2. **Myopathy** (especially gemfibrozil when combined with statins)
3. **Gallstone formation** (due to **inhibition of 7-α-hydroxylase** → decreased bile salts formation → less solubility of fats in bile → increased liability of gallstones formation)



Don't Get It Mixed-up:

PPAR-α ⇒ **Fibrates**

PPAR-γ ⇒ **Thiazolidinediones** (pioglitazone, rosiglitazone)

▼ Other Choices

- **Choices A & B → Bile Acid Sequestrants** which bind to acids & prevent their recycling (in the enterohepatic circulation), so the body pulls cholesterol from the blood into the liver to make more bile acids (**via upregulation of LDL receptors**) → Lowers Cholesterol levels
- **Choice C →** Blocks cholesterol absorption from brush border & as a result → Lowers Cholesterol levels
- **Choice E → Niacin** causes **decreased VLDL production & export. Also inhibits HSL.**
 - **Increases HDL levels more than any other agent.**
 - Side effects are HY → **Hyperuricemia, IR & T2DM, and Flushing**

? Patient with dyslipidemia & got a vitamin prescribed as a ttt. The patient then developed flushing. What is appropriate ttt?

▼ **Answer**

Aspirin - Flushing is caused by **PGs-mediated vasodilation (NOT HISTAMINE)**

Q45

A 38-year-old single woman with a history of chronic headaches comes to the physician for a follow-up examination. She has three sons with sickle cell disease, for which they have required frequent hospitalizations. She tells the physician that she used to feel angry and abandoned by her family, as they have provided little to no support in helping her with her sons. She states that she recently started taking kickboxing lessons, and now she feels happier and more relaxed. She adds that her headaches also have improved. This patient is most likely using which of the following types of coping mechanisms?

- A. Displacement
- B. Projection
- C. Rationalization
- D. Reaction formation
- E. Suppression

▼ **Explanation**

- **Answer is A (Displacement)**

- **IMP Clues**

- She used to feel angry and abandoned by her family, as they have provided little to no support in helping her with her sons (triggering emotions)
- She states that she recently started taking kickboxing lessons, and now she feels happier and more relaxed (channeled into a substitutive action)

- Q asks what coping mechanism is this patient using?

- Well, poorly written answer choices here, because it should be **Sublimation**
- **Sublimation is defined as "Redirecting unacceptable drives or impulses into socially acceptable behaviors"**, which is what we see here.
 - **Unacceptable drives/impulses** = "Feeling angry and abandoned by her family"
 - **Socially acceptable behaviors** = "Started taking kickboxing lessons"

- Basically, sublimation is when you feel like punching someone (socially unacceptable), so you start punching the boxing bag (socially acceptable)

- Now why did we choose **displacement (Choice A)?**

- It was the closest to sublimation. Let's go through the answer choices & you decide for yourself.
 - **Choice A → Displacement** is when you displace your emotions/feelings towards someone/something else.
 - E.g. Your boss yells at you, so you go home and yell at your wife because you're angry.
 - Sounds like a valid answer choice
 - **Choice B → Projection** is when a person attributes his/her own feelings/thoughts onto another person
 - E.g. A cheating husband becomes very suspicious of his wife and starts accusing her for cheating for no reason
 - **Choice C → Rationalization** is crafting a positive explanation for thoughts and actions that are adverse.

- E.g. Justifying that sneaking into a movie theater is okay because "everyone does it."
- **Choice D → Reaction Formation** is doing the exact opposite of what you think/feel to hide the true feelings
 - E.g. Woman angry at her family that they don't support her, so she starts being super nice and kind to them
- **Choice E → Suppression** is consciously removing unwanted thoughts/memories
 - E.g. A patient's mother dies, so he doesn't mention her death ever again.

? Differentiate between Suppression, Repression, and Denial.

▼ **Answer**

1. **Suppression** → **Voluntary/Conscious** decision to remove unwanted thoughts/memories
2. **Repression** → **Involuntary/Unconscious** decision to remove unwanted thoughts/memories
3. **Denial** → **Refusing to believe** that the unwanted thoughts/memories did actually happen
 - **Suppression & Repression DO BELIEVE** that they happened

Q46

Parenterally administered cholera vaccines consisting of killed whole bacterial cells have very limited efficacy. Which of the following is the primary reason for this failure?

- A. Ability of *Vibrio cholerae* to produce multiple antigenic types of enterotoxins
- B. Antigenic variation in adhesive pili
- C. Inability of the vaccine to elicit secretory antibody at the epithelial surface
- D. Toxicity of the vaccine preparation

▼ **Explanation**

- **Answer is C (Inability of the vaccine to elicit secretory antibody at the epithelial surface)**
 - Basically, Q asks why taking IV/IM vaccine of cholera isn't really effective?
 - **Cholera** is characterized by **intestinal mucosa damage that causes severe diarrhea**.
 - **IgA** is needed to fend off the infection **as it is limited to the mucosa**.
 - **Oral Vaccines do stimulate local mucosal reaction to the antigen → better response**
 - **Parenteral vaccines** (what we have here) **stimulate an IgG/IgM predominant reaction → limited response AT THE MUCOSAL SURFACES**.
 - *I underlined, bolded, and capitalized the red part because IgG/IgM responses are farr more robust than IgA, but here we are talking about mucosal surfaces, where their number one defense is IgA.*

Q47

A 17-year-old primigravid woman at 16 weeks' gestation has a mucopurulent vaginal discharge. Culture of the discharge grows *Chlamydia trachomatis*. Which of the following is the most appropriate pharmacotherapy?

- A. Ampicillin
- B. Azithromycin
- C. Chloramphenicol
- D. Doxycycline

E. Trimethoprim-sulfamethoxazole

▼ Explanation

- **Answer is B (Azithromycin)**
 - **IMP Clues**
 - Primigravid woman at 16 weeks gestation (pregnant female, important for drug side effects)
 - Mucopurulent vaginal discharge + grows Chlamydia trachomatis + (okay, noted)
 - Q asks for most appropriate ttt?
 - Well, Sketchy told us that ttt is **either Macrolides (Azithromycin) or Tetracyclines (Doxycycline)**.
 - However, patient is **pregnant**.
 - **Tetracyclines are contraindicated in pregnancy & children below 8 years**
 - **Binds to bone/teeth and causes deformities/dyscoloration**
 - This is because **Tetracyclines chelates to calcium**, NBME assess this by asking a Q: patient has disease X which requires tetracycline ttt, but the patient takes his pills with milk to help him swallow. Why is the drug not working? **[Asked on NBME]**
 - Another Side Effect of Tetracyclines is **photo-sensitivity**
 - So, we will go with **Azithromycin (Choice B)**

? 6F + went on a camping trip with family two days ago + today has a rash on her left leg with a central clearing; what's the most appropriate treatment for this patient?

- A) Amoxicillin
- B) Doxycycline
- C) Gentamicin
- D) Linezolid
- E) Vancomycin

▼ Answer

Amoxicillin - Patient has **Lyme disease**, which is treated by **tetracyclines**; however, the child here is **<8 years** → **Give Amoxicillin to these patients instead**

? **Antibiotics MOA Pop-Quiz!**

▼ **MOA of Ampicillin?**

- **Inhibits bacterial cell wall synthesis/cross-linking**

▼ **MOA of Azithromycin?**

- **Inhibits 50S ribosomal subunit** - 23s RNA of peptidyl transferase cavity; does not block peptidyl transferase; blocks tunnel that channels nascent peptides away from peptidyl transferase center

▼ **MOA of Chloramphenicol?**

- **Inhibits 50S ribosomal subunit** - 23S rRNA of peptidyl transferase cavity; blocks peptidyl transferase; prevents tRNA from binding to A site

▼ **MOA of Doxycycline?**

- **Inhibits 30S ribosomal subunit** - prevents aminoacyl-tRNA from binding to the A site

▼ **MOA of TMP-SMX?**

- TMP → **Inhibits Dihydrofolate Reductase**
- SMX → **Inhibits Dihydropteroate Synthase**

Q48

A 6-month-old boy has recently been diagnosed with developmental delay. He has had difficulty feeding and recurrent vomiting since early infancy. He was found to have hepatosplenomegaly and lymphadenopathy during a routine examination at age 3 months. Examination of a biopsy specimen of bone marrow shows numerous foam cells. A defect in which of the following metabolic pathways is the most likely cause of this disorder?

- A. Cholesterol-ester degradation
- B. Chylomicron transport
- C. Lipoprotein degradation
- D. Sphingomyelin degradation
- E. VLDL synthesis

▼ Explanation

- **Answer is D (Sphingomyelin degradation)**
 - **IMP Clues**
 - Difficulty feeding & recurrent vomiting since early infancy (metabolic disorder)
 - Developmental delay + HSM + lymphadenopathy + bone marrow shows foam cells (classic Niemann-Pick Disease)

- Dx → Neimann-Pick Disease

Mnemonic: "*PICK* your nose with a *BIG FOAMY SFINGER*"

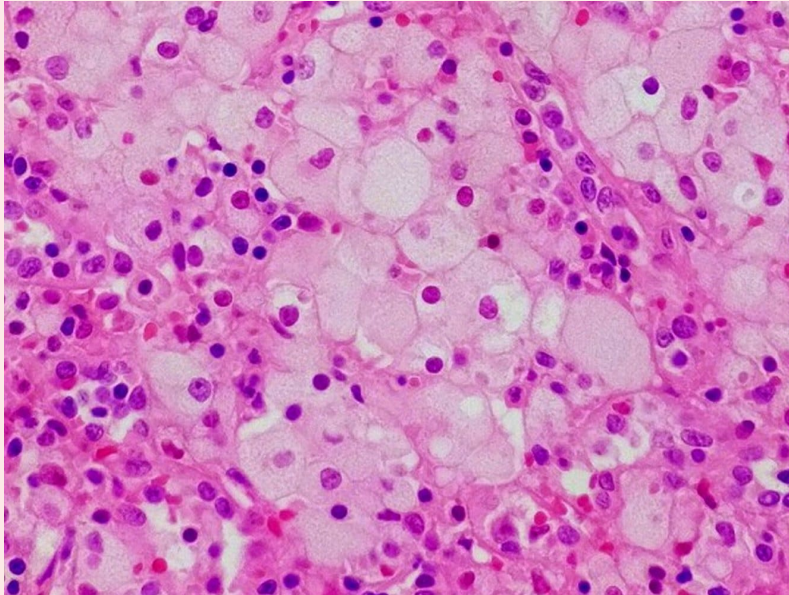
- Deficiency of → **sphingomyelinase**
- Accumulation of → **Sphingomyelin**
- HY Features → **Cherry-Red Macula + HSM + Foam cells (Lipid laden macrophages)**

? Cherry Red Macula on the USMLE?

▼ Answer

1. **Neimann-Pick Disease** (HSM)
2. **Tay-Sachs Disease** (No HSM)
3. **CRAO** (painless loss of vision in one eye)
 - HY Risk Factors include **AFib, Carotid atherosclerosis**

Picture below shows "Foam Cells":



Q49

During the first week of life, a male newborn has vomiting, severe dehydration, hyponatremia, and salt wasting. Serum 17-hydroxyprogesterone concentration is increased. The most likely cause of his disorder is a defect in which of the following enzymes?

- A. Desmolase
- B. 17 α -Hydroxylase
- C. 21-Hydroxylase
- D. 11 β -Hydroxylase
- E. 3 β -Hydroxysteroid dehydrogenase

▼ Explanation

- Answer is C (21-Hydroxylase)

◦ IMP Clues

- During first week of life vomiting + severe dehydration (Most likely a metabolic disorder)
- Hyponatremia & Salt wasting + serum 17-hydroxyprogesterone concentration is increased (17-compounds increased means it's not 17-hydroxylase deficiency + hyponatremia means low aldosterone)

- Dx → 21-hydroxylase

- 21-hydroxylase deficiency presents as **LOW aldosterone**
 - **high K**
 - **low Na**
 - **low Cl**
 - **Dehydration)**



Algorithm to differentiate between 11,17,21-hydroxylase:

1. Look at 17-OH products:

- If *LOW* → **17-hydroxylase (features of Increased aldosterone & cortisol)**
- If *HIGH* → either **11-hydroxylase** or **21-hydroxylase**

2. If 11-hydroxylase

- Features of **Increased androgen (ambiguous genitalia)**
- Features of **Increased aldosterone & cortisol (low K + high BP)**

3. 21-hydroxylase

- Features of **Increased androgen**

Mnemonic:

Aldosterone/Cortisol		Testosterone/Androgen
↑	11	↑
↑	17	↓
↓	21	↑

made by @_ahmadraef

First number presents Aldo/Cort, and Second number presents Testosterone(androgen)

If the number is 1, then the arrow is UP.

If the number is NOT 1, then the arrow is DOWN.

e.g. 21-hydroxylase: DOWN Aldo/Cortisol & UP Testosterone/Androgen

▼ Other Choices

- **Choice A** → Garbage & non-existent on the USMLE
- **Choices B & D** → Discussed already
- **Choice E** → Presents as **swelling/edema + high-ish BP + low K + low Aldosterone + low renin + high cortisol: cortisone ratio. [asked on NBME]**
 - **Dx** → **Apparent Mineralocorticoid Excess**
 - Pathophysiology:
 - 11B-hydroxysteroid dehydrogenase inactivates cortisol to cortisone in the kidney as cortisol is much more available than aldosterone
 - If 11B-hydroxysteroid dehydrogenase is inhibited, Cortisol acts similar to aldosterone causing Reabsorption of Na & excretion of K
 - The increased water volume causes negative feedback & decreased Aldosterone
 - Expected Labs:
 - **Low Aldosterone, Low K**
 - **High BP, high cortisol: cortisone ratio**
 - Usually caused by **licorice** (stem will say that the patient has been using a supplement bought online)

Q50

A 52-year-old man with a history of alcoholic cirrhosis is brought to the office by his wife because of a 4-hour history of rectal bleeding. He has a history of alcohol use disorder and hemorrhoids. His pulse is 100/min, and blood pressure is 110/80 mm Hg. Physical examination shows pallor. The varicosities in this patient are most likely located in direct tributaries of which of the following veins?

- A. Inferior mesenteric
- B. Inferior rectal
- C. Superior mesenteric
- D. Superior rectal

▼ Explanation

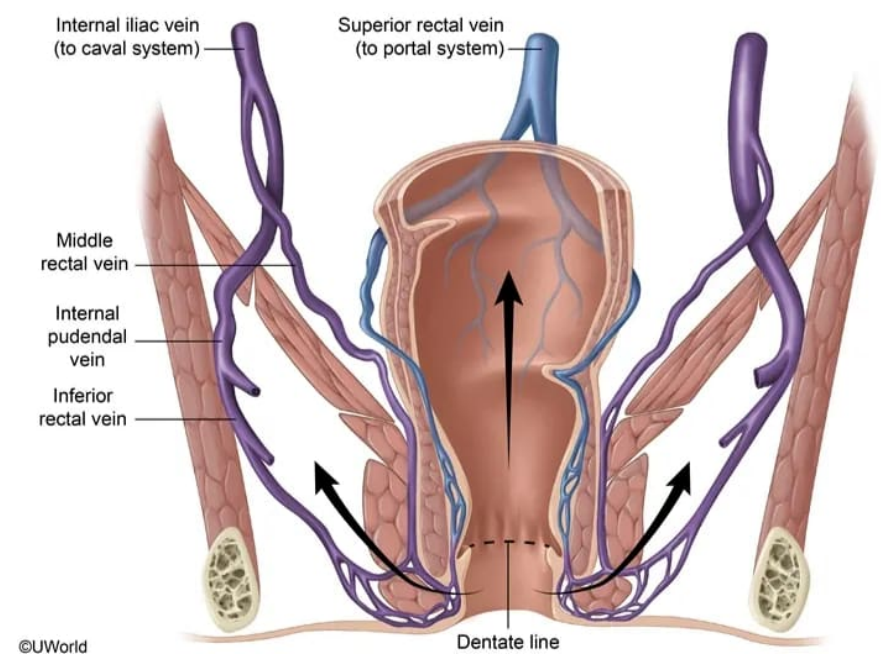
- Answer is D (Superior rectal)

- IMP Clues

- 52-year-old man with a hx of alcoholic cirrhosis because of 4hr hx of rectal bleeding (must be hemorrhoids due to portal hypertension)
 - Hx of alcohol use disorder and hemorrhoids (we know that because we're just amazing & so clinically oriented (this is the final Q of the NBME & I'm happy it's over))

- Q asks the varicosities drain in what veins?

- We know the cause is **portal HTN**, so it must be **a vein that drains into the portal circulation**
 - **Superior rectal veins, Middle rectal veins, and Inferior rectal veins form the rectal venous plexus (the source of hemorrhoidal bleeding)**
 - **Superior Rectal Vein → Portal Circulation** (specifically drains into the **IMV**)
 - **Middle Rectal Vein → Systemic Circulation** (specifically drains into **internal iliac vein**)
 - **Inferior Rectal Vein → Systemic Circulation** (specifically drains into the **internal pudendal vein**)
 - Basically, what happened is **cirrhosis & fibrosis of intrahepatic venous sinusoids** → **blood backs up into portal vein** → **backs up into SMV & splenic vein** → **back up into IMV** → **superior rectal vein** → **Hemorrhoids** → **Bleeding**
 - So correct answer is **Superior Rectal Vein (Choice D)**



▼ Other Choices

- Choice A → Yes part of the portal circulation but **not A DIRECT TRIBUTARY**
- Choice B → Part of systemic circulation & drains into internal pudendal vein → Internal Iliac vein → Common Iliac Vein → IVC
- Choice C → SMV is part of the portal circulation, however, it drains the right side of the intestines up to the splenic flexure



Reading explanations isn't the hard part.

Knowing which mistakes are costing you points is.

That's what we do in our CrackNBME Mentorship Program™.

More free NBME explanations: cracknbme.com/nbme-explanations

Follow on X: @_ahmadraef