



NBME EXPLANATIONS

NBME 20 Block 3

from CrackNBME

NBME 20 - Block 3

Q1

A 50-year-old man is brought to the physician by his wife because of personality changes for 2 years and cognitive decline for 3 months. His wife says, "He used to be such a kind and shy man, but now he screams at strangers for no apparent reason. The other day, he yelled at a woman at a convenience store for not ordering extra cheese in her sandwich. He said she needed the extra calcium." She adds, "This has been going on for a while, but last month he almost invested all of our savings in a start-up company that was going to produce different kinds of hats strictly for dogs. He wasn't like this before. He was a respected accountant. I stopped him, thank goodness, and it turned out to be a scam, anyway." She adds, "I'm worried about his physical safety, too, because I've had to search for him five times within the past couple of months after he got lost wandering around our neighborhood. We've lived there for 20 years." Neurologic examination shows a palmomental reflex and hyperreflexia throughout the upper and lower extremities. His mood appears normal except for occasional inappropriate cursing at the physician. His Mini-Mental State Examination score is 21/30. A CT scan of the head shows disproportionate atrophy of the frontal lobes bilaterally. Which of the following is the most likely diagnosis?

- A. Dementia, Alzheimer type
- B. Huntington disease
- C. Multi-infarct (vascular) dementia
- D. Parkinson disease
- E. Pick disease

▼ Explanation

• Answer is E (Pick disease)

◦ IMP Clues

- Personality changes for 2 years and cognitive decline for 3 months
- He used to be such a kind and shy man + Now he screams at strangers for no apparent reason + He yelled at a woman at a convenience store for not ordering extra cheese (Personality changes)
- He almost invested all of our savings in a start-up company (Disinhibition)
- Had to search for him five times within the past couple of months after he got lost wandering around the neighborhood. They lived there for 20 years (Cognitive decline)
- Palmomental reflex and hyperreflexia throughout the upper and lower extremities (UMNL signs)
- His mood appears normal except for occasional inappropriate cursing at the physician (Disinhibition)
- His Mini-Mental State Examination score is 21/30 (Cognitive decline)
- CT scan of the head shows disproportionate atrophy of the frontal lobes bilaterally (CT here confirm the diagnosis)

• Dx → Pick Disease

- Also known as **Frontotemporal Dementia**
- Presents as **personality changes, disinhibition, and cognitive decline**
- Biopsy shows **intracytoplasmic** accumulation of **hyperphosphorylated tau proteins** in **round silver staining inclusion bodies, named Pick Bodies**
- These Pick Bodies accumulate predominantly in the Frontal & Temporal parts of the brain, which causes ⇒ **atrophy of Frontal & Temporal Lobes**



What would be seen on brain biopsy of Alzheimer patient?

▼ Answer

Alzheimer Disease → **Extracellular** β -amyloid plaques & **Intracellular** hyperphosphorylated tau proteins in **tangles**, named Neurofibrillary tangles

Pick's Disease → **NO** β -amyloid plaques & the intracellular hyperphosphorylated tau proteins are in **round silver-staining inclusion bodies** NOT tangles. Yes, the shape matters.

▼ Other Choices

- **Choice A** → **Alzheimer Dementia** presents as **cognitive decline with low MMSE score (low 20s)** like here; however, **the cognitive decline is early** & is usually the only worry of the patient on the USMLE.
 - On the USMLE, the order of Alzheimer Dementia in most Q is **short-term memory affection** → **cognitive decline**.
 - CT scan will show **diffuse cortical atrophy**, not just localized to the frontal & temporal lobes like Pick disease



What Alzheimer-related genetics are HY on the USMLE?

▼ Answer

1. **Early-onset Alzheimer Disease** → associated with Down Syndrome due to the presence of **"Amyloid Precursor Protein"** gene on **chromosome 21**, they have 3 chromosomes 21s, so higher chance.
2. **Presenilin Gene** mutation → Presenilin is a protein that cleaves Amyloid → if mutated → amyloid accumulates.
3. **ApoE $\epsilon 4$** ⇒ **Late-Onset Alzheimer Disease**; however, **ApoE $\epsilon 2$** ⇒ **Protective from Alzheimer Disease**.

- **Choice B → Huntington Disease** presents as **dementia + abnormal limb movement + psychiatric symptoms** on the USMLE.
 - **AD** disease that is caused by **CAG TNR expansion of HTT gene on chromosome 4** → abnormal accumulation of proteins in **Basal ganglia** (**Caudate** is HY on the USMLE) → **Atrophy ⇒ Neurodegeneration & Choreoathetosis**

? 34M has cognitive decline + jerky movement of left side of the body. His father had the same symptoms that started at 65 years. What are the expected arrows of Ach, GABA, and Dopamine in this patient?

▼ **Answer**

Decreased Ach - Decreased GABA - Increased Dopamine

Note that his symptoms started at a younger age than his father, this is HY and called **anticipation**.

- **Choice C → Vascular Dementia** presents as a patient with **dementia + sensory/motor affection**. The **hyperreflexia is NOT motor affection**.
 - Motor affection will be weakness or paralysis due to a previous stroke.
- **Choice D → Parkinson Disease** presents as **rigidity (Cogwheel), Slow movement (bradykinesia), resting tremors, short-steppage gait, monotone voice, micrographia, and a mask face**.
 - Due to **alpha-synuclein gene mutation** → accumulation of **alpha-synuclein** in **pars compacta (substantia nigra)** of the midbrain → **loss of dopaminergic neurons**.

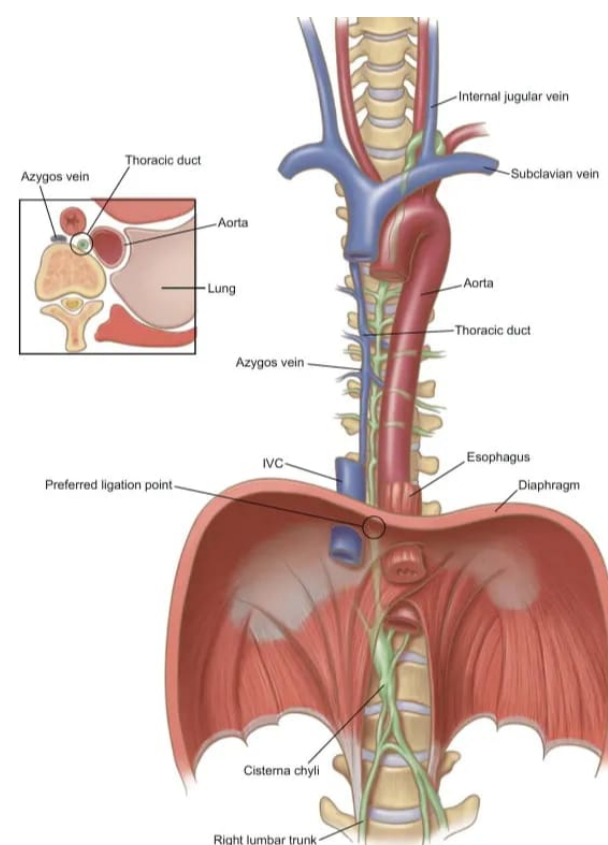
Q2

A 72-year-old woman with dysphagia is undergoing surgical evaluation of a mass in the posterior mediastinum. During this procedure, the thoracic duct is inadvertently damaged near the mass. This injury is most likely to impair the normal lymphatic return of which of the following structures?

- A. Heart
- B. Left breast
- C. Left upper extremity
- D. Right kidney
- E. Right lung

▼ **Explanation**

- **Answer is D (Right kidney)**
 - One of the most confusing Q on all of NBME's history. Garbage Q, but this is how I interpreted it.
 - First, let's discuss the thoracic duct:
 - Starts at **Cisterna Chyli** & runs up to the **junction between the Left IJV and the SCV**
 - Drains
 - Everything **below** the diaphragm
 - **Left Thorax**
 - **Left Upper Extremity**
 - **Left Head & Neck**
 - Q says the patient had a mass in the posterior mediastinum & the thoracic duct go nicked. **The trick here is to realize that what is DISTAL to the thoracic duct will be affected. In other words, the Left Upper Extremity will not be affected as it inserts into the thoracic duct at a higher level than the injury.**
 - So, Everything **BELOW THE DIAPHRAGM** will be affected ⇒ **The Right Kidney (Choice D)**



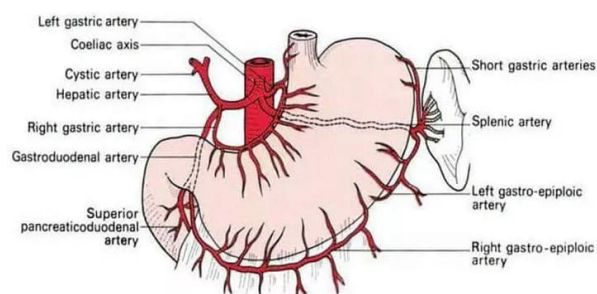
Q3

A 26-year-old man undergoes an abdominal exploratory operation after sustaining a stab wound in the left upper quadrant. He is found to have a laceration of the fundus of the stomach. During mobilization and repair of the stomach, he develops heavy bleeding due to damage to one of the short gastric arteries. The short gastric arteries branch from which of the following arteries?

- A. Celiac
- B. Left gastric
- C. Pancreatic
- D. Right gastroepiploic
- E. Splenic

▼ **Explanation**

- **Answer is E (Splenic)**
 - Simple GI anatomy. **Short gastric arteries** (which supply the *fundus of the stomach*) branch from the **splenic artery**.

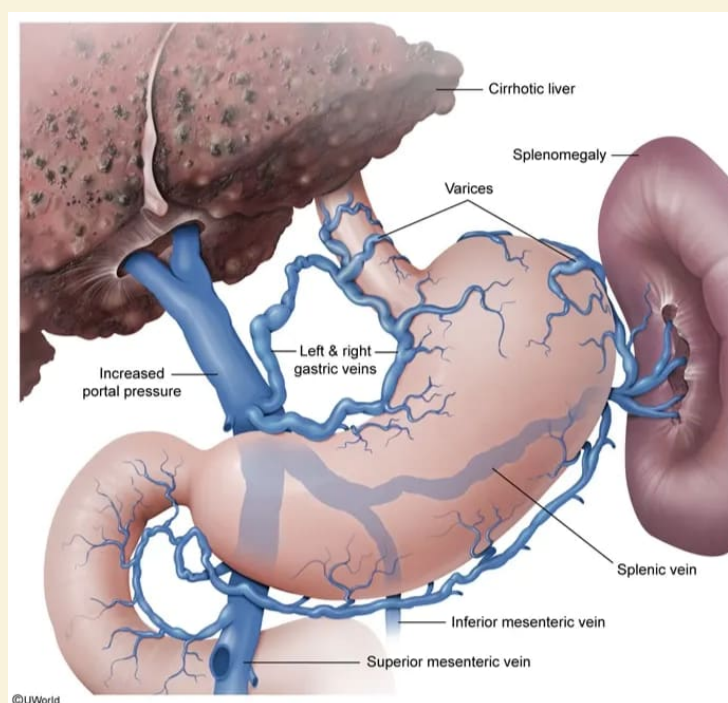


HY Related Anatomy:

USMLE might present you a patient with **hematemesis** with **hx of chronic liver disease/cirrhosis** + endoscopy shows **dilated veins on the fundus of the stomach**. *The Q asks you the bleeding veins drain into which vein* → **Splenic Vein**

"The below draining is super HY, so please know that the above scenario can present as either one of these."

- **Fundal varices** → **Short Gastric Vein** that drains into **Splenic Vein**
- **Esophageal varices** → **Esophageal veins** that drains into **Left Gastric Vein**



Q4

A 56-year-old man comes to the physician because of a 6-month history of worsening fatigue and moderate lower extremity edema. He has a 15-year history of poorly controlled hypertension. His blood pressure is 195/110 mm Hg. Serum urea nitrogen (BUN) concentration is 70 mg/dL, and serum creatinine concentration is 7.0 mg/dL. A 24-hour urine sample contains 300 mg of protein. Which of the following is the most likely pathologic finding in the kidneys?

- A. Coagulation necrosis of renal tubules
- B. Fibromuscular hyperplasia of arterioles
- C. Inflammatory cell infiltrate in the interstitium
- D. Large electron-dense deposits in the glomeruli
- E. Multiple renal artery aneurysms
- F. Multiple wedge-shaped cortical infarcts

▼ **Explanation**

- **Answer is B (Fibromuscular hyperplasia of arterioles)**
 - **IMP Clues**
 - 56-year-old man (Age + Sex is important. I will tell you why later)
 - 15-year history of poorly controlled hypertension. His blood pressure is 195/110 mm Hg + BUN is 70mg/dL + creatinine is 7 (HTN 2ry to Renal disease)
 - A 24-hour urine sample contains 300 mg of protein (the cause of lower limb edema)

- **Dx → Fibromuscular Dysplasia**
 - Can sometimes be referred to as **“Renal Artery Dysplasia”** on NBMEs
 - It is not a dysplasia really, it is **hyperplasia of the tunica media**
 - It is an **autoimmune disease that affects classically middle-aged women with NO hx of cardiovascular disease**
 - Causes the **“string of beads”** appearance on CT angiography
 - My opinion, knowing the CT scans will not help you as much as looking for risk factors like Age, hx of CVD, or other HY findings (listed below)

“Reading this Q, I was looking for atherosclerosis as it is the usual suspect in older males, however, upon looking at the answer choices the only plausible answer was FMD, which is also true, however the epidemiology is unusual from most FMD Qs.”

You will get this type of Q on every NBME, so let’s run through what you need to know:

- **50-60y Male OR Female + hx of cardiovascular disease / atherosclerosis / smoking?**
 - **Dx → Atherosclerosis**
 - Vignettes can be tricky by saying **“BMI is 35”** or **“a carotid bruit is heard on examination”** instead of atherosclerosis.
 - BMI is high usually means he’s atherosclerotic especially in this age group
 - If a patient has a carotid bruit, which is due to atherosclerosis, chances are he also has atherosclerotic arteries in other sites (Renal Artery)
- **20-40y F + NO hx of cardiovascular disease / atherosclerosis / smoking?**
 - **Dx → FMD**
- **20-40y F + was given ACEi/ARBs + Creatinine levels have risen. What is diagnosis?**
 - **FMD**
- **64M + was given ACEi/ARBs + Creatinine levels have risen. What is diagnosis?**
 - **Atherosclerotic Renal Artery**
- **55F + was given ACEi/ARBs + Creatinine levels have risen. What is diagnosis?**
 - **Atherosclerotic Renal Artery**

Reason is in **FMD or Atherosclerosis**, the renal blood supply is **decreased**, but the body adapts by **producing renin & AT-2**, which causes **vasoconstriction** of the **efferent renal arterioles** → **maintains GFR**

If **ACEi/ARBs** are administered, efferent arterioles dilate → **decreased GFR** → **creatinine rises**.

? Which site in this patient’s kidney is most likely to have the highest concentration of renin?

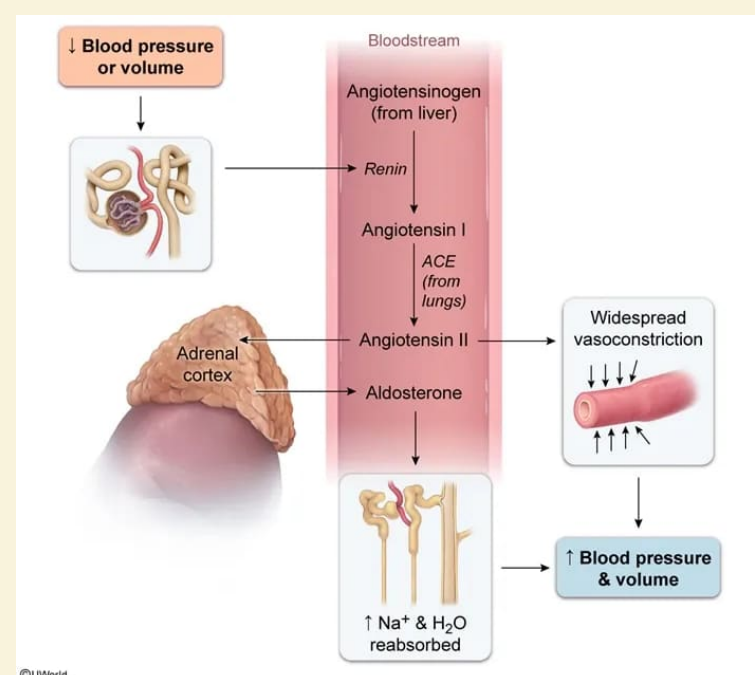
▼ **Answer**

Cortex - Renin is **produced by Juxtaglomerular cells** found in the **cortex**.

- Renin is secreted in response to **low volume / perfusion**.
- It makes sense that **the site that secretes renin is the site that would have THE MOST renin**.

! Hyperplasia of renal artery tunica media causes **decreased renal flow, which causes activation of RAAS:**

- **High Renin → Conversion of angiotensinogen to AT-I → AT-I is converted to AT-II via ACE, which causes:**
 - **Vasoconstriction of renal efferent arterioles → maintains GFR**
 - **Vasoconstriction of systemic arterioles → hypertension** (headache, blurred vision, papilledema)
 - **Activation of Zona Glomerulosa → aldosterone Secretion**
 - Causes **increased Na & Water reabsorption**, in addition to potassium & hydrogen **secretion**.



Q5

An otherwise healthy 4-month-old girl is brought to the physician because of the lesion shown. The lesion has been present for 2 months but has grown rapidly over the past 3 weeks. Which of the following is expected over the next 5 years?



- A. Continued enlargement as the child grows
- B. Development of similar distant lesions
- C. Hypertrophy of underlying tissue
- D. Involvement of adjacent structures
- E. Involvement of internal organs
- F. Malignant degeneration
- G. Neurologic damage
- H. Spontaneous involution

▼ Explanation

- **Answer is H (Spontaneous involution)**

◦ IMP Clues

- Healthy 4-month-old girl (Age is important)
- Lesion has been present for 2 months but has grown rapidly over past 3 weeks.
- Q asks what is expected over the next 5 years

◦ Dx → **Strawberry Hemangioma**

- 2 HY types of skin hemangiomas on the USMLE you need to know:

1. **Strawberry Hemangioma**

- Benign vascular tumor in children
- Enlarges rapidly **BUT REGRESSES OVERTIME**
- Biopsy → **densely packed capillaries on microscopic examination**
densely packed capillaries on microscopic examination (as it is just abnormal angiogenesis)

*Mnemonic I use to remember that strawberry is for children is
"Strawberry Shortcake," Children are short.*



2. **Cherry Hemangioma**

- Benign vascular tumor in adults
- Slowly grows overtime **AND DOESN'T REGRESS**
- **Smaller** in size in comparison to Strawberry hemangiomas



Q6

A 50-year-old woman comes to the physician because of a 3-month history of a discharge from both breasts. She has a history of hypertension and type 2 diabetes mellitus. She takes hydrochlorothiazide. Physical examination shows a thin, milky discharge from both breasts. Which of the following mechanisms is most likely responsible for this patient's condition?

- A. Breast cancer
- B. Diabetes mellitus
- C. Drug effect
- D. Hypertension
- E. Systemic mastocytosis

▼ Explanation

- **Answer is C (Drug effect)**

◦ IMP Clues

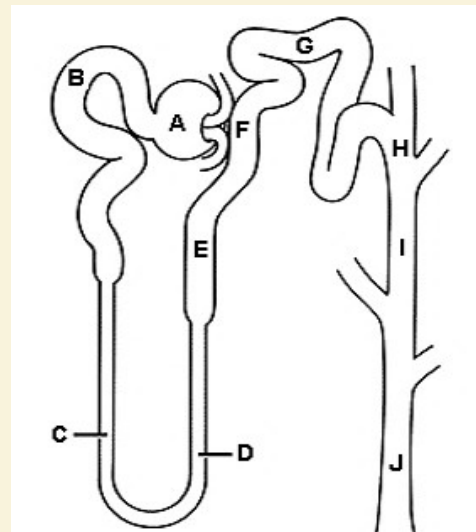
- 50-year-old woman + 3-month history of discharge from both breasts + examination shows thin, milky discharge from both breasts (Woman with galactorrhea; we need to find the cause)
- She takes hydrochlorothiazide (rare, but can cause hyperprolactinemia)

- Q asks for cause of galactorrhea
 - **Thiazide diuretics CAN cause hyperprolactinemia.** Weird, but USMLE tests this so know that Thiazides cause hyperprolactinemia by **inhibiting dopamine action on pituitary/hypothalamus.**
 - Let's review our NEW list of thiazide diuretics side effects:

[] mnemonic: "**hyperGLUC** + others"

1. **HyperGlycemia**
2. **HyperLipidemia**
3. **HyperUricemia**
4. **HyperCalcemia**
5. Others → **Hyperprolactinemia, Hyponatremia, Hypokalemia, Metabolic alkalosis, Lithium toxicity**

? Label site of action of thiazides.



▼ Answer

Choice G ⇒ Distal Convoluted Tubules

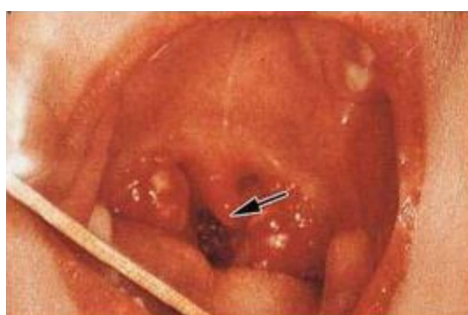
- Thiazides block Na/Cl channels in DCT

▼ Other Choices

- **Choice A** → Breast cancer is usually NOT bilateral + usually bloody.
- **Choice B** → No DM drugs cause hyperprolactinemia.
- **Choice C** → HTN itself doesn't cause hyperprolactinemia or galactorrhea.
- **Choice E** → Nonexistent on USMLE, just a stupid distractor. It is a clonal proliferation of mast cells.

Q7

A 38-year-old woman comes to the physician because of a 3-day history of sore throat. During the examination, the patient is asked to protrude the tongue and say "ah," which causes elevation of the area at the tip of the arrow in the photograph shown. Function of which of the following nerves most likely is being tested by this maneuver?



- Facial
- Glossopharyngeal
- Hypoglossal
- Spinal accessory
- Vagus

▼ Explanation

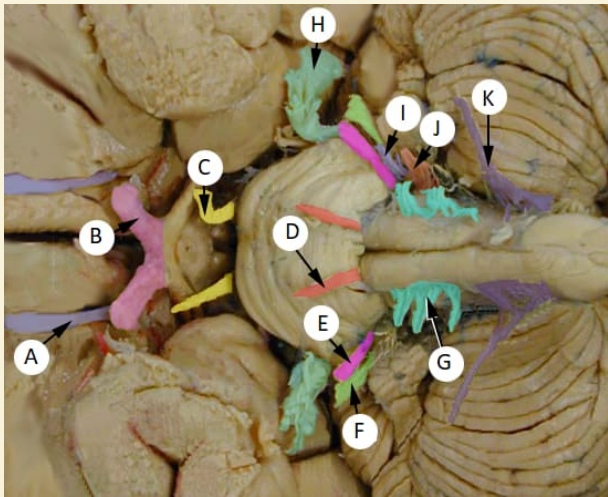
- **Answer is E (Vagus)**
 - Picture shown reveals un asymmetrically elevated uvula.
 - **Uvula** is controlled by the **Vagus nerve.**
 - **Vagus nerve → Levator Veli Palatini muscle → pulls up on uvula.**
 - **Picture shows uvula pulled to the LEFT SIDE, so left Vagus nerve is intact. So, dysfunctional nerve is RIGHT Vagus Nerve.**



HY Related Cranial Nerves Actions:

- **Vagus Nerve** → **Pulls on Uvula**
 - Lesion ⇒ Uvula deviates **AWAY** from side of lesion
- **Hypoglossal Nerve** → **Pushes out Tongue**
 - Lesion ⇒ Tongue deviates **TOWARD** side of lesion
- **Trigeminal Nerve** → **Pushes out pterygoid muscle**
 - Lesion → Jaw deviates **TOWARD** side of lesion

? Point to the Vagus Nerve in this patient.



▼ Answer

Choice J is the **VAGUS NERVE**

Other Choices

- A → Olfactory Nerve (CN I)
- B → Optic Nerve (CN II)
- C → Oculomotor Nerve (CN III)
- D → Abducens Nerve (CN VI)
- E → Facial Nerve (CN VII)
- F → Vestibulocochlear Nerve (CN VIII)
- G → Hypoglossal Nerve (CN XII)
- H → Trigeminal Nerve (CN V)
- I → Glossopharyngeal Nerve (CN IX)
- K → Spinal Accessory Nerve (CN XI)

▼ Other Choices

- **Choice A** → Facial Nerve lesion causes Bell's palsy + hyperacusis
- **Choice B** → Glossopharyngeal lesion causes absence of gag reflex
- **Choice C** → Hypoglossal nerve lesion causes tongue deviation
- **Choice D** → Spinal Accessory nerve lesion causes inability to shrug/turn head.

Q8

A 34-year-old man who is HIV positive is brought to the emergency department because of severe abdominal pain for 12 hours. He has been receiving antiretroviral therapy for the past 2 weeks. Prior to starting the medication, his CD4+ T-lymphocyte count was $35/\text{mm}^3$ ($N \geq 500$). In addition, he was diagnosed 14 days ago with disseminated *Mycobacterium avium*-intracellulare infection by a positive blood culture and enlarged intra-abdominal lymph nodes on CT scan. His temperature is 39°C (102.2°F), pulse is 104/min, and blood pressure is 110/84 mm Hg. The lungs are clear to auscultation. Abdominal examination shows tenderness. A CT scan of the abdomen shows further enlargement of the lymph nodes since the previous CT. Improved function of which of the following cells is required for the development of these findings?

- A. B lymphocytes
- B. CD4+ T lymphocytes
- C. CD8+ T lymphocytes
- D. Monocytes
- E. Natural killer cells

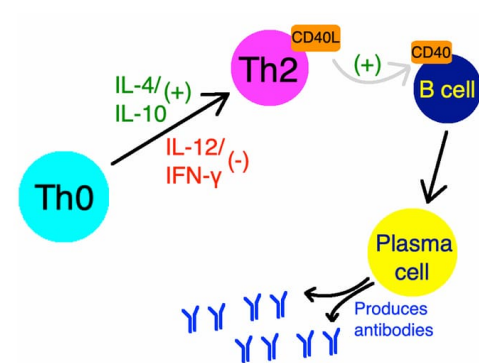
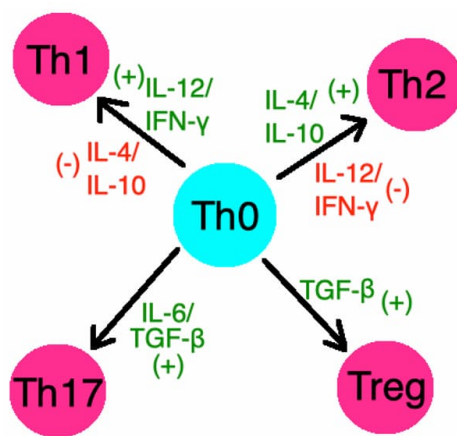
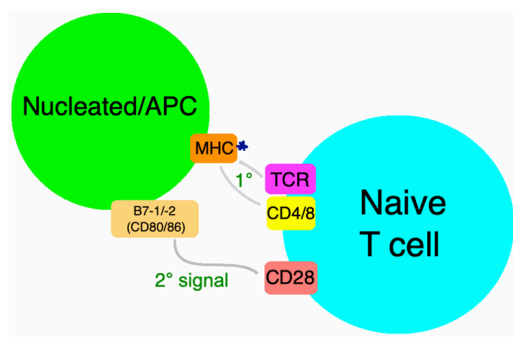
▼ Explanation

- **Answer is B (CD4+ T lymphocytes)**
 - This patient has HIV and wasn't adherent to his medication, so he got *Mycobacterium avium*-intracellulare infection + enlarged lymph nodes on CT. After he started his meds, the CT shows further enlargement of the lymph nodes.
 - What are lymph nodes made of?
 - **Germinal Centers**, which are **made up of B-cells**. This means that his **B-cell number has enlarged** → bigger germinal centers → bigger lymph nodes.
 - What increases number of B-cells?
 - **CD4+ T lymphocytes.**
 - How? (Super HYYY)
 1. MHC 2 on APC binds to CD4 + TCR on CD4 T-cells
 2. CD80/86 (B7-1/2) of APC binds to CD28 on CD4 T-cells → naive CD4 cells → Th0
 3. Stimulation of Th0 by IL-4 & IL-10 → Th2 activation
 4. CD40L on Th2 binds to CD40 on B-cells → B-cell activation & proliferation

[STEPS 1 & 2]

[STEP 3]

[STEP 4]



Q9

A 6-week-old girl is brought to the physician by her mother because of a 6-day history of vomiting a small amount of milk 2 to 3 times daily. She appears well. She is at the 50th percentile for length and weight. Physical examination shows no abnormalities. Which of the following is the most likely cause of this patient's findings?

- A. Esophageal spasm
- B. Gut malrotation
- C. Immature lower esophageal sphincter
- D. Neuromuscular abnormality of the esophagus
- E. Pyloric stenosis
- F. Tracheoesophageal fistula

▼ Explanation

- Answer is C (Immature lower esophageal sphincter)

◦ IMP Clues

- Vomiting a small amount of milk 2-3 times daily (Just milk, with no bile)
- She appears well (Not distressed/poor feeding/not irritable is a good sign in peds)
- She is at 50th percentile for length and weight (Again, good stats)
- Physical examination shows no abnormalities (She's just fine)

◦ Dx → Gastroesophageal Reflux

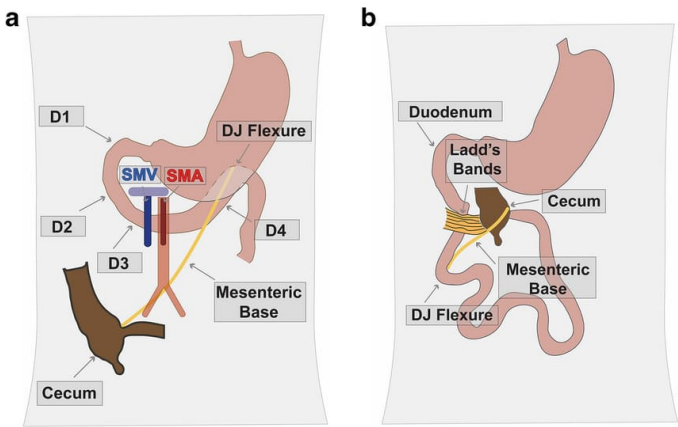
- **NOT** to be confused with GERD. GERD is a disease, while **GER is NOT a disease**.
- Babies have **smaller abdominal space + short esophagus with an immature lower esophageal sphincter** → Milk Reflux
 - **Physiological & doesn't affect babies' mood, growth, or feeding.**

▼ Other Choices

- Choice A → **Diffused Esophageal Spasm** is rarely seen on the USMLE. **It is literally diffuse spasm of the esophagus → Corkscrew appearance**
 - Patients with DES usually present to the clinic as "angina" however cardiac findings are negative. **A barium is then done, which reveals the corkscrew appearance.**
 - **Manometry** can also be done, which shows **high pressure all through the esophagus** [asked on NBME]



- Choice B → **Gut malrotation** is when the normal rotation of the Midgut doesn't happen + the presence of abnormal fibrous peritoneal bands (**Ladd's Bands**) **compresses the duodenum & SMA**
 - Duodenum compression** → **Bilious Vomiting**
 - SMA compression** → **SMA Syndrome**
 - How do we know that it is Migut Malrotation?
 - The **Duodenojejunal Flexure** is normally on the **left**.
 - Barium shows that it is on the **Right**
 - Duodenal Obstruction**
 - This is caused by **Ladd's Bands**



- Choice D → **Achalasia**
 - Increased LES tone due to loss of Myenteric (Auerbach/Enteric) plexus Nitric-Oxide secreting neurons**
 - Increased tone of LES cause dysphagia to **BOTH solids and liquids FROM THE START.**
 - Obstruction causes dilation of above esophagus, causing **Bird's beak sign** on barium.
 - Can be caused by **Chagas disease**
 - Manometry shows decreased esophageal pressure all through with a sudden increase in lower portion



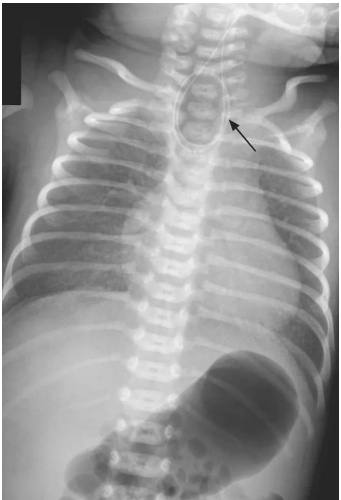
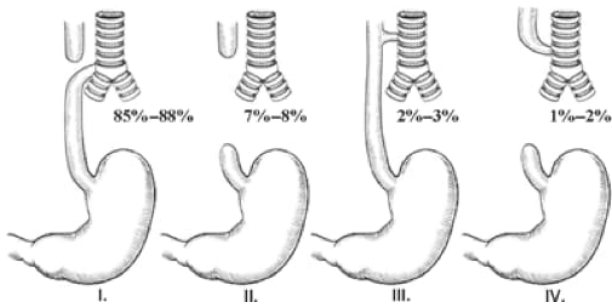
- Choice E → **CHPS (Congenital Hypertrophic Pyloric Stenosis)**
 - Pylorus is congenitally thickened, causing an obstruction.
 - Obstruction causes **nonbilious projectile vomiting**, leaving the child *dehydrated & hungry* ("child is eager to eat").
 - USMLE tests the concept of Pyloric Stenosis by:
 - Asking for a diagnosis**
 - They give you **non-bilious vomiting + olive-like abdominal mass +/- abdominal peristalsis**.
 - Dx is → **CHPS**
 - Asking for expected arrows:**
 - They give you an arrows Q asking for **K, Cl, Na, HCO3, PCO2, and pH**
 - Answer is → **low K, low Cl, normal/low Na, high HCO3, high Pco2, high pH**
 - Vomiting causes **hypokalemic hypochloremic metabolic alkalosis**.

? Vomiting vs Diarrhea arrows [K - Cl - Na - HCO3 - PCO2 - pH]

▼ Answer

Vomiting	Diarrhea
low K	low K
low Cl	normal Cl
normal/low Na	normal/low Na
high HCO3	low HCO3,
high PCO2	low Pco2,
high pH	low pH
"Hypokalemic Hypochloremic Metabolic Alkalosis"	"Non-Anion Gap Metabolic Acidosis"

- Choice F → **Tracheoesophageal fistula**
 - Has many presentations; **most common Atresia of esophagus + Fistula between lower part of esophagus & trachea.**
 - presents as **non-bilious vomiting/choking/coughing immediately after feeding.**
 - They can also show you a scan, where a **feeding tube can't go all the way in & coils mid-esophagus**
 - also note the **gastric bubble/air in intestines**, this tells us that there is a **distal fistula**
 - If **absent** → **pure esophageal atresia WITH NO fistula.**



Q10

A 66-year-old man has had fatigue, shortness of breath, and temperatures to 40°C (104°F) for a week. An x-ray of the chest shows a cavitary lesion with a fluid level in the right lower lobe of the lungs. Culture of sputum grows *Klebsiella pneumoniae*. Symptoms resolve with antibiotic treatment. Which of the following is most likely to be found in the right lower lobe 6 months later?

- A. Focal pulmonary fibrosis
- B. Granulomatous inflammation
- C. Liquefactive necrosis
- D. Metaplastic pulmonary epithelium
- E. Normal pulmonary parenchyma

▼ Explanation

- **Answer is A (Focal pulmonary fibrosis)**
 - Q tells us that this patient had a cavitary lesion with air-fluid level (an abscess basically) and asks what is expected to be found at the site of that abscess 6 months later
 - Most people will choose either Focal pulmonary fibrosis (Choice A) or Normal pulmonary parenchyma (Choice E)
 - **Large lesions (like an abscess) usually destroy pneumocytes + underlying basement membrane → regeneration by fibrosis**
 - For **normal pulmonary parenchyma** to be restored, the **basement membrane should be intact** *[asked on NBME]*

? In this patient, what are expected arrows? [Type 1 pneumocytes - Type 2 pneumocytes - Fibroblasts]

▼ Answer

- **Decreased** Type 1 pneumocytes (the normal epithelium lining)
- **Increased** Type 2 pneumocytes (causes regeneration of type 1 pneumocytes & itself)
- **Increased** Fibroblasts (produces and deposits collagen, the fibrotic tissue)

Note that macrophages & cytokines + direct ROS damage is what causes activation of fibroblasts → collagen deposition. So, if Q asks what cell mediates/induces fibrosis → **Macrophages**.

Q11

A 75-year-old woman comes to the physician because of a burning, itching sensation on the right side of her chest for 7 days and a rash in this same area for the past 3 days. Her temperature is 37.3°C (99.1°F). Examination shows clustered skin lesions overlying two ribs near the right axillary line in the mid-thorax and on the back near the right scapula. Some of the lesions are fluid-filled blisters and others have crusty scabs. Light microscopy is most likely to show which of the following findings?

- A. Branching fungal hyphae without yeast forms
- B. Diffuse separation of dermis and epidermis
- C. Granular deposits of IgA at the tips of dermal papillae
- D. Immunofluorescent staining for C3 along the epidermal basement membrane
- E. Multinucleated giant cells and neutrophil infiltrates
- F. Nonbranching fungal hyphae with abundant yeast forms

▼ Explanation

- **Answer is E (Multinucleated giant cells and neutrophil infiltrates)**
 - **IMP Clues**
 - Burning, itching sensation + Rash in the same area + rash is clustered skin lesions some of which are fluid-filled blisters and other have crusty scabs (clustered fluid filled lesions sounds like vesicles, some ruptured and some are intact, which means they have different stages of healing)
 - Overlying ribs near the right axillary line in the mid-thorax and on the back near the right scapula (Dermatomal distribution that doesn't cross the midline; on one side)
 - **Dx → Shingles**
 - Caused by **VZV reactivation**.
 - Primary infection of VZV is **chickenpox**. The Virus then remains latent in the **dorsal root ganglion** *[asked on NBMEs]*. Once immunosuppressed, sick, or stressed, **VZV reactivates as shingles**
 - Rash → Painful, burning, itching **vesicular lesions** in **dermatomal distribution** that later crust & form ulcers
 - **Tzanck** test → Smear of vesicular fluid showing **multinucleated giant cells** (seen in VZV & HSV)
 - Treatment → **Acyclovir** (**HSV/VZV DNA Polymerase inhibitor**)

? Where does HSV1/2 remain latent at?

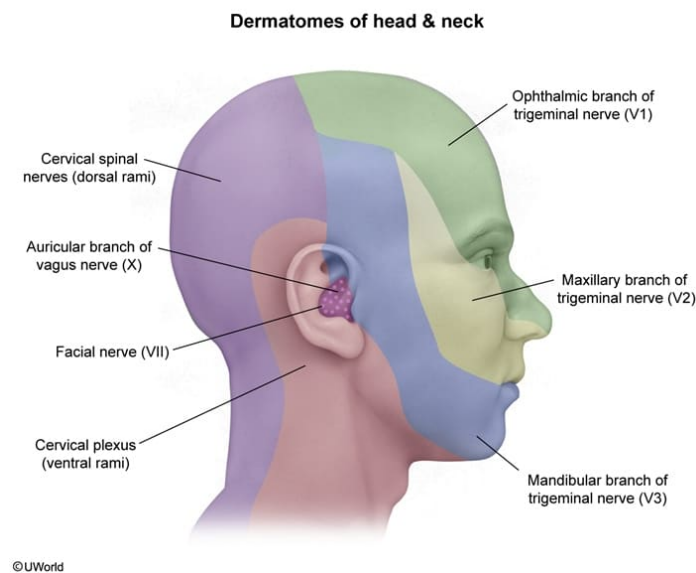
▼ Answer

- HSV 1 → **Trigeminal Ganglia**
- HSV 2 → **Sacral Ganglia**

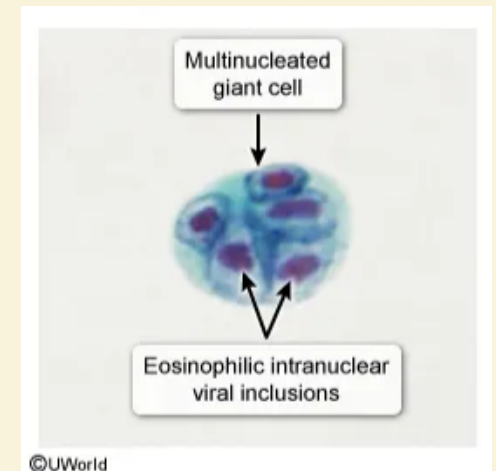
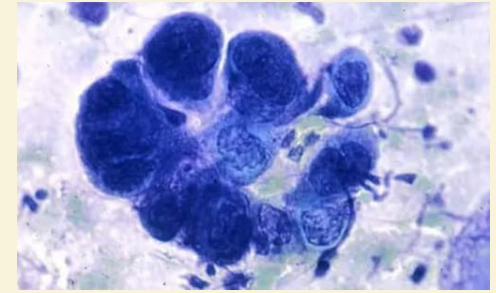
? What is the cause of Acyclovir resistance?

▼ Answer

Altered/Absent Thymidine Kinase



Tzanck Smear:



VZV Reactivation in the **ophthalmic division (V1)** can cause **VZV Keratitis (Herpes Zoster Ophthalmicus)**, which is characterized by **pseudodendritic corneal ulcer**, **vesicular lesions**, and **pain** in V1 dermatome.

- Presence of vesicular lesions on **tip of nose (Hutchinson's Sign)** indicated **nasociliary branch involvement** & is associated with **high risk of keratitis**.

Ramsay Hunt Syndrome (Herpes Zoster Oticus) is reactivation of VZV in the **geniculate ganglion of Facial nerve**, resulting in **ipsilateral ⇒ facial pain, ear pain, and vesicular rash on the external ear canal, pinna, or ear drum**.

Q12

A 60-year-old woman with type 2 diabetes mellitus is brought to the emergency department because of a 16-hour history of substernal chest pain that radiates to the left arm. Her pulse is 110/min, respirations are 18/min, and blood pressure is 96/60 mm Hg. Cardiac examination shows no murmurs. A diagnosis of acute myocardial infarction is made. Two days later, the patient develops acute respiratory distress. Physical examination shows jugular venous distention to the angle of the jaw. Crackles are heard over the lower half of the lung fields. A grade 4/6, apical systolic murmur is now heard. Which of the following is the most likely mechanism of this patient's worsening condition?

- A. Cardiac tamponade
- B. Necrosis of membranous interventricular septum
- C. Pericarditis
- D. Right ventricular aneurysm
- E. Rupture of a papillary muscle

▼ Explanation

- Answer is E (Rupture of a papillary muscle)

◦ IMP Clues

- Substernal chest pain that radiates to the left arm (Classic USMLE MI description)
- Pulse is 110/min (tachycardic) + respirations are 18/min (tachypneic) + blood pressure is 96/60 mmHg (hypotensive, probably due to LV dysfunction)
- No murmurs + 2 days later the patient develops acute respiratory distress + JVD + crackles + apical systolic murmur (Patient had no murmur then 2 days later develops MR murmur, causing JVD + crackles)

- **Dx → Papillary Muscle Rupture**

- One of the most HY post-MI complications on the USMLE.
- Patient develops MI then 2-7 days later → Papillary muscle rupture → **Acute Mitral Regurgitation** → Decreased CO & Blood backs up into Left atrium → blood backs up into lungs (causing **acute pulmonary edema**) → blood backs up into right side of the heart (causing **JVD**)

USMLE can assess this also by giving you an arrows Q [CO - PCWP - SVR]

- **Acute MR** causes **cardiogenic shock**, so expected arrow would be:
 - **decreased CO - increased PCWP - increased SVR**

- **Knowing the murmurs is pass-level;** the same stem exactly +

- **Systolic murmur at apex → Mitral Regurgitation**
- **Systolic murmur at LSB → VSD**
- **Muffled Heart sounds → Tamponade**



Post-MI Complications Timing:

- ~ **0-48hr** post-MI ⇒ **Arrhythmias** **[MOST COMMON CAUSE OF DEATH]**
- ~ **Days** post-MI ⇒ **Ruptures** (Papillary muscle → MR; IV septum → VSD; Free wall → Tamponade)
- ~ **Weeks** post-MI ⇒ **Ventricular Aneurysm**

"Chances are you will get the complication by the physical findings + vitals; however, some Qs on the real deal can be confusing as fuck, so knowing the timing can help exclude/include answer choices."



Which papillary muscle is more liable for rupture post-MI?

▼ **Answer**

Posteromedial papillary muscle as it is supplied by **PDA only**
Anterolateral papillary muscle is supplied by **BOTH LAD & LCX**

"Never seen it asked directly on a NBME, but FA obsesses over it so good to know."

▼ **Other Choices**

- **Choice A** → As I said, Cardiac Tamponade would be the same stem + **Beck's Triad (JVD + hypotension + muffled heart sounds)**
- **Choice B** → **Necrosis of membranous interventricular septum** would cause a post-MI **VSD**. Again, same stem + **pansystolic murmur heart at LSB**.
- **Choice C** → **Pericarditis** present as **stitching chest pain + friction rub**.
 - 2 types:
 - Friction rub on auscultation **hours-days** post-MI ⇒ **Peri-infarction pericarditis**
 - Friction rub on auscultation **weeks** post-MI ⇒ **Dressler Syndrome** (also can be referred to as "**post-infarction pericarditis**," or "**Fibrinous pericarditis**")
 - Dressler Syndrome is caused by **deposition of antigen-antibody complexes** in the pericardium
- **Choice D** → Week after MI, **scar tissue forms and causes a ventricular aneurysm**. Presents as an **outward bulge with contractions "Dyskinesia."**

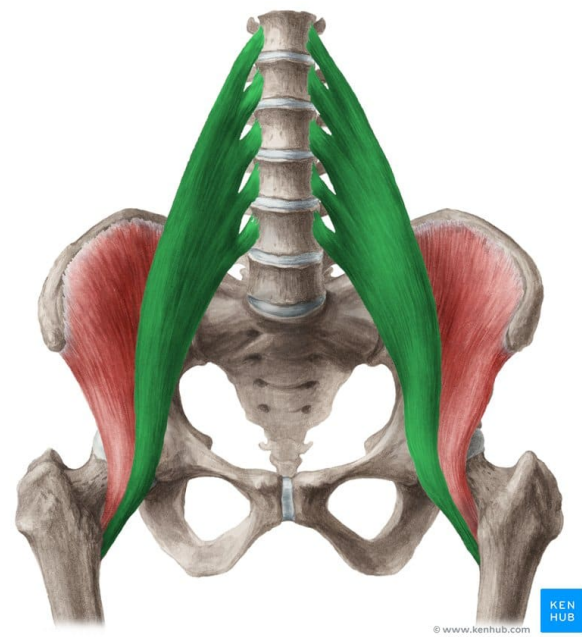
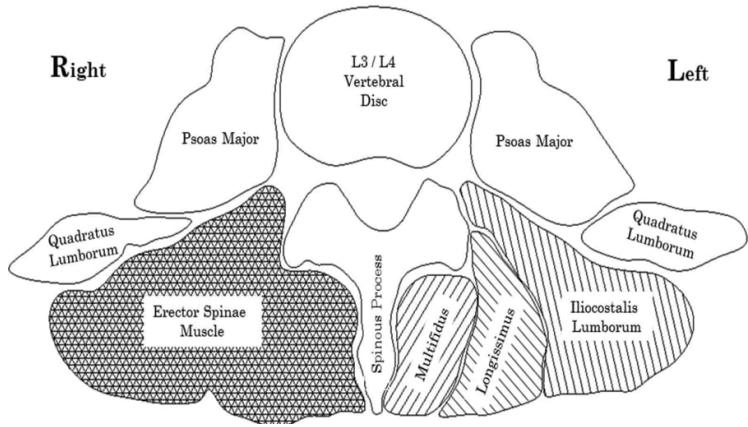
Q13

A 28-year-old man who is a migrant worker comes to the clinic because of fatigue and back pain for 6 weeks. He has had a 6-kg (13-lb) weight loss during this period. His temperature is 38.3°C (100.9°F). When placed in the supine position, the patient holds his right lower extremity in rigid extension. A PPD skin test result shows 16 mm of induration. X-rays of the chest and spine confirm the diagnosis of tuberculosis with infection of the lumbar vertebrae. Spread of this infection from the lumbar vertebrae is most likely causing this patient to guard which of the following muscles while he is in the supine position?

- A. Erector spinae
- B. External abdominal oblique
- C. Iliacus
- D. Psoas major
- E. Quadratus lumborum

▼ **Explanation**

- Answer is D (Psoas major)
 - You can answer this Q is 3 ways:
 - You know that a **very common complication of Pott's disease is Psoas Major Abscess**
 - You infer that **the closest muscle to the lumbar vertebrae is the Psoas Major**, so spread to that muscle is most likely
 - You don't know neither the anatomy nor the common complication. So, you can see that the patient *"holds his right lower extremity in rigid extension,"* which means **he doesn't want to flex his leg as it causes pain**. What muscle here flexes the leg? **Psoas Major**.



Q14

A 60-year-old man comes to the physician because of a 6-week history of cough productive of blood-tinged sputum. He also has had a 3-kg (6.6-lb) weight gain during the past 8 weeks. He has smoked 1 pack of cigarettes daily for 30 years. His blood pressure is 165/101 mm Hg. The lungs are clear to auscultation. A CT scan of the chest shows a pulmonary lesion. Laboratory studies show a serum sodium concentration of 122 mEq/L. The physician suspects that this laboratory abnormality is related to the pulmonary lesion. Which of the following sets of additional laboratory findings is most likely in this patient?

Choices	Urine Na ⁺	Serum Osmolality
A	Increased	Increased
B	Increased	Decreased
C	Normal	Increased
D	Decreased	Increased
E	Decreased	Normal
F	Decreased	Decreased

▼ Explanation

- Answer is B
 - IMP Clues
 - Cough productive of blood-tinged sputum + Smoker + CT scan shows a pulmonary lesion (Sounds like lung cancer, smoker tells us it's mostly SCLC or SCC)
 - 3-kg weight gain + Blood pressure is 165/101 mmHg + serum sodium concentration is 122 mEq/L (this means that the patient is retaining water → hypervolemic → relative hyponatremia)

Dx → Small Cell Lung Cancer

- Neuroendocrine tumor of the lung derived from Kulchitsky cells
- Central mass that most commonly affects smokers



"SSSS"

Sentral (Central) lung cancers are Small cell carcinoma & Squamous cell carcinoma and are associated with Smoking.

- HY paraneoplastic syndromes are:
 - SIADH (Ectopic ADH secretion)
 - ADH causes increased Free water reabsorption, resulting in:
 - Hyponatremia & decreased serum osmolality
 - Increased urine sodium & increased urine osmolality

- Cushing's syndrome → Ectopic ACTH secretion
- Lambert-Eaton Syndrome → antibodies against presynaptic voltage-gated calcium channels
- Neurological Syndromes → anti-Hu/Yo



Lambert-Eaton Syndrome Rapid Review:

Etiology: Antibodies against pre-synaptic voltage-gated calcium channels

- normally, Action potential → pre-synaptic voltage-gated calcium channels → Calcium influx → release of ACh vesicles into synapses → binds to ACh Receptors → Muscle contraction

Associated Tumor: SCLC

Behavior: Weakness improves with repeated movements

- more APs → APs overcome number of calcium channels → Calcium influx → ACh released from vesicles into synapses → Muscles contraction
- Qs can say "swings chair multiple times before getting up" instead of repeated movements.

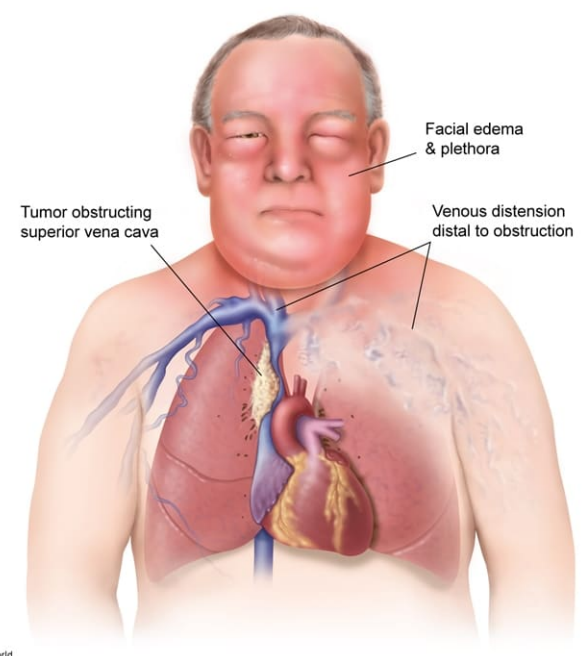
Response to Tensilon test (edrophonium): NO improvement

- Biopsy: “**round cells with little cytoplasm that are twice the size of lymphocytes**” is a description used on NBME, “**small blue round cells**” can also be found
- HY Underrated Complication: **Superior Vena Cava Syndrome**
 - SCLC can present as a **central (mediastinal) mass** that causes **obstruction/compression of SVC**
 - Presents as **progressive facial swelling** (+/- upper limb swelling) + **JVD** + **engorged face, neck, and UL veins**.
 - USMLE may give you the above presentation in a **smoker + hyponatremia**.



Note that **SVC Syndrome** can also be caused by a **Pancoast Tumor (NSCLC peripheral tumor)**.

Superior vena cava syndrome



Q15

A 9-year-old girl is brought to the physician because of poor growth during the past year. She is below the 3rd percentile for height and at the 10th percentile for weight. Physical examination shows no other abnormalities. Visual field testing shows bitemporal hemianopia. Laboratory studies show growth hormone deficiency. An MRI of the brain shows a calcified cystic mass in the suprasellar region. This tumor is most likely derived from which of the following?

- A. Diverticulum of the roof of the embryonic oral cavity
- B. Ependymal layer of the median eminence
- C. Hypophyseal cartilage
- D. Neural crest cells of the rhombencephalon
- E. Neuroectoderm of the diencephalon

▼ Explanation

- **Answer is A (Diverticulum of the roof of the embryonic oral cavity)**

◦ IMP Clues

- 9-year-old girl + poor growth + 3rd percentile for height + 10th percentile for weight (Growth Delay)
- Bitemporal Hemianopia + Growth hormone deficiency (So pituitary is affected, causing decreased GH secretion → cause of growth delay above)
- MRI shows a calcified cystic mass in the suprasellar region (Calcifications in pituitary is buzzy for Craniopharyngioma)

• Dx → Craniopharyngioma

- **Most common supratentorial tumor in children & teens**
- Remnants of **Rathke's pouch (Ectoderm)**

Calcification is **C**ommon & histology reveals **C**holesterol **C**rystals in “motor-oil” like fluid

- Most HY Complications are **bitemporal hemianopia** & **pituitary compression**, causing affection of hormone release.
 - In this Q here, **the GH secretion was affected** → **Poor Growth**
 - Other possible presentations are **DI (decreased ADH)** and **Delayed Puberty (decreased FSH & LH)**



Pituitary Gland Embryology Rapid Review:

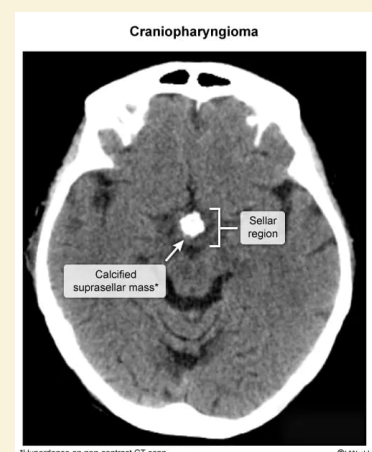
Pituitary Gland is made up of **2 parts** → The **anterior (adenohypophysis)** & **posterior (neurohypophysis)**

- **Adenohypophysis** is formed by the **Rathke's pouch** (an **ectodermal** diverticulum from the primitive **oral cavity**) growing **UPWARDS**
- **Neurohypophysis** is formed from a **DOWNWARD** extension of the **diencephalon (neuroectoderm)**

Both parts meet in the **Sella turcica** → The Pituitary Gland.



USMLE can give you the following CT in a child with signs of increased ICP/bitemporal hemianopia/Poor Growth and ask for diagnosis.



Q16

The sequence surrounding the first two exons of the human β -globin gene is shown, with the exons given in bold capital letters. The translation start codon is underlined. A mutation from G $\rightarrow$ A at position 355 (Highlighted with blue) is most likely to lead to β -thalassemia by which of the following mechanisms?

```
1 cectgtggag ccacacccta gggttggcca atctactcce agggagcaggg agggcaggag
61 ccagggctgg gcataaaagt cagggagag ccatctattg cttACATTG CTCTGACAC
121 AACTGTGTTT ACTAGCAACC TCAAACAGAC ACCATGGTGTC ACCTGACTCC TGAGGAGAAG
181 TCTGCCGTTA CTGCCCTGTG GGGCAAGGTG AACGTGGATG AAGTTGGTGG TGAGGCCCTG
241 GGCAGgttgg tatcaagggtt acaagacagg tttaaggaga ccaatagaaa ctgggcatgt
301 ggagacagag aagactcttg ggtttctgat aggcactgac tctetctgec tattgtctta
361 ttttccace cttagGCTCG TGGTGGTCTA CCCTTGACC CAGAGGTICT TIGAGTCCTT
421 TGGGGATCTG TOCACTCCTG ATGCTGTTAT GGGCAACCCT AAGGTGAAGG CTCATGGCAA
481 GAAAGTGCTC GGTGCCTTTA GTGATGGCCT GGCTCACCTG GACAACCTCA AGGGCACCTT
541 TGCCCACTG AGTGAGCTGC ACTGTGACAA GCTGCACGTG GATCCTGAGA ACTTCAGGgt
```

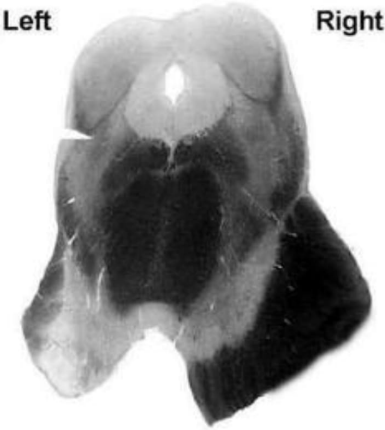
- A. Creation of a missense mutation that leads to the synthesis of a defective β -globin
- B. Disruption of normal splicing by creation of a new 3' splice site
- C. Disruption of polyadenylation of the mRNA
- D. Inhibition of the replication of this gene

▼ Explanation

- **Answer is B (Disruption of normal splicing by creation of a new 3' splice site)**
 - Exons = Capital Letters (Exons are the actual code)
 - Introns = non-capital letters (Introns are spliced out)
 - Q says a mutation happened which is highlighted in blue (G $\rightarrow$ A)
 - Now the trick here is to try and recognize the splicing site.
 - To determine the splicing, we need to find the area where the **Exons and Introns meet** (the capitalized and non-capitalized letters)
 - The exons **end at AG (244-245)** & the introns **(to be removed) start at "gt" (246-247) and end at "ag" (374-375)**
 - So, segments starting with "gt" and ending with "ag" are spliced out
 - Now with the mutation in mind (G $\rightarrow$ A at position 355), an **"a"** is made which is followed by a **"g"**, now we have a **NEW "ag"** instead of the original "ag" at **374-375**
 - **This results in "disruption of normal splicing by creation of a new 3' splice site" (Choice B)**

Q17

A 70-year-old man dies of coronary artery disease. He had a cerebral infarction 8 years ago. A photograph of a specimen of the brain stem is shown. Which of the following neurologic deficits was most likely present in this patient after his cerebral infarction?



- A. Dysmetria on the left
- B. Dysmetria on the right
- C. Loss of joint position sense in the left extremities
- D. Loss of joint position sense in the right extremities
- E. Spastic hemiparesis on the left
- F. Spastic hemiparesis on the right

▼ Explanation

- **Answer is E (Spastic hemiparesis on the right)**
 - Pass-level Q here.
 - **Myelin stains black**
 - **So, right side is myelinated, while left side is demyelinated (defective)**

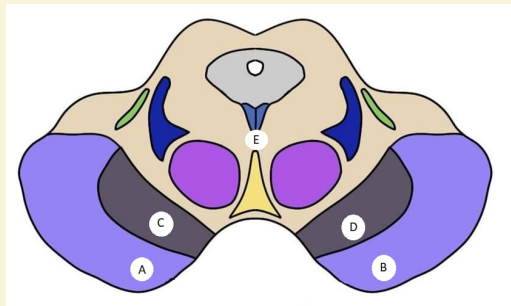
◦ What is the demyelinated part called?

▪ **Crus Cerebri**

- Crus Cerebri contains the **corticospinal tract fibers** (they decussate in the *medulla*)
- **Demyelinated Left Crus Cerebri → Dysfunctional Right Corticospinal Tract → Spastic hemiparesis on the right.**



Label the following midbrain slide.



▼ **Answer**

- A → Right Crus Cerebri
- B → Left Crus Cerebri
- C → Right Substantia Nigra
- D → Left Substantia Nigra
- E → Oculomotor nerve nucleus

▼ **Other Choices**

- **Choice A** → Caused by left cerebellar lobe lesion
- **Choice B** → Caused by right cerebellar lobe lesion
- **Choice C** → Caused by left Dorsal column lesion
- **Choice D** → Caused by right Dorsal column lesion
- **Choice E** → Caused by right Crus Cerebri lesion

Q18

A 33-year-old woman comes to the emergency department 1 hour after she slipped on an icy sidewalk and fell onto her outstretched right hand. Physical examination shows swelling and tenderness to palpation centrally of the palmar side of the right wrist. Palpation of the right anatomical snuffbox and the remaining portion of the wrist elicits no pain. The most likely cause of the findings in this patient is dislocation of which of the following bones?

- A. Hamate
- B. Lunate
- C. Pisiform
- D. Scaphoid
- E. Trapezium
- F. Triquetrum

▼ **Explanation**

- **Answer is B (Lunate)**
 - **IMP Clues**
 - Fell onto her outstretched hand (FOOSH has a lot of DD)
 - Swelling and tenderness to palpation centrally + palpation of anatomical snuffbox elicits no pain (snuffbox no pain = NOT scaphoid; Center of hand is classically lunate on the USMLE)
 - **Dx → Lunate Dislocation**
 - Fall On Outstretched Hand (FOOSH) + **Central Palm pain** + **NO** pain on Snuffbox palpation ⇒ **Lunate Bone Injury**
 - What is an expected complication of Lunate bone dislocation?
 - Median Nerve Compression → **Carpal Tunnel Syndrome**
 - **Median Nerve Compression would affect:**
 - Sensation:



Fall On Outstretched Hand (FOOSH) + **PAIN** on Snuffbox palpation ⇒ **Scaphoid Bone Injury**

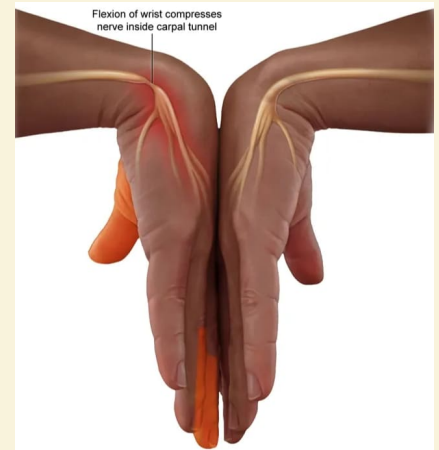


- Motor:
 1. Flexion of lateral fingers
 2. Remaining Thumb function (Opponens pollicis, Abductor pollicis brevis, Flexor pollicis brevis)
- What are the HY maneuvers that are used to help in the diagnosis?
 - **Phalen maneuver:** Hyperflexion (~90 degrees) of the wrist, causing increased carpal tunnel pressure.
 - **Tinel Test:** Tapping the carpal tunnel over the median nerve and is positive when percussion elicits pain or paresthesia.

Phalen → Flex of wrist

Tinel → Tap on wrist

Carpel Tunnel Syndrome Maneuvers: Phalen Maneuver:



Tinel Test:



Wrist X-Ray Review:



"Knowing the X-ray is important, as they can give you a presentation of either Lunate, Scaphoid, or Hamate bone injuries & ask you to choose the bone from the X-ray."

[] mnemonic: "She Looks Too Pretty, Try To Catch Her."

▼ Other Choices

- **Choice A → Hamate Bone Injury** (usually hook of hamate) presents as **a biker with Guyan Canal Syndrome (Ulnar Nerve Compression)**
- **Choice C →** Not assessed on USMLE.
- **Choice D → FOOSH + Pain on palpation of anatomical snuff box.** HY complication is **Avascular Necrosis.**
- **Choices E & F →** Not assessed on USMLE.

Q19

A 36-year-old man comes to the physician because he has not urinated for the past 24 hours. He has a 3-day history of decreased urine output. He has had intermittent renal calculi during the past 5 years. His temperature is 36.9°C (98.4°F), pulse is 112/min, and blood pressure is 150/96 mm Hg. Physical examination shows no other abnormalities. Serum studies show:

Test	Value
Na ⁺	138 mEq/L

Test	Value
Cl ⁻	104 mEq/L
K ⁺	5.9 mEq/L
HCO ₃ ⁻	22 mEq/L
Creatinine	5 mg/dL

Ultrasonography of the abdomen shows bilateral hydronephrosis. Bilateral nephrostomy tubes are placed. Which of the following best predicts the most likely changes in urine output and urine potassium excretion that will occur during the next 24 hours?

Choices	Urine Output	Urine Potassium
A	Decreased	Decreased
B	Decreased	Increased
C	Decreased	No change
D	Increased	Decreased
E	Increased	Increased
F	Increased	No change
G	No change	Increased
H	No change	No change

▼ Explanation

- Answer is E
 - IMP Clues
 - Not urinated for the past 24 hours + 3-day history of decreased urine output (Kidneys are shutting down for some reason)
 - He has had intermittent renal calculi + US shows bilateral hydronephrosis + Creatinine is 5mg/dL (Post-renal azotemia, the reason)
 - Q says that nephrostomy tube are places + asks what will change in next 24 hours?
 - Dx → Post-Obstructive Diuresis
 - Following an obstruction, the kidneys shut down → this causes **decreased urine output + failure of kidney function (in this case failure of potassium secretion, causing hyperkalemia)**
 - After relieving of obstruction (placing bilateral nephrostomy tubes) → Kidneys turn back on & try to recorrect the electrolyte imbalance ⇒ **Increased Diuresis + Increased urine potassium secretion.**

Q20

A 56-year-old man is admitted to the hospital after an automobile collision that resulted in crush injuries to both legs. Thirty-six hours later he develops oliguria, hyperkalemia, and an increased serum urea nitrogen (BUN) concentration. Which of the following is the most likely cause of these findings?

- A. Contusion of the kidney
- B. Fat emboli
- C. Pyelonephritis
- D. Renal vein thrombosis
- E. Rhabdomyolysis

▼ Explanation

- Answer is E (Rhabdomyolysis)
 - IMP Clues
 - Crash Injury to both legs (Hx of muscle injury, buzzy)
 - 36 hours later, he develops oliguria, hyperkalemia, and increased BUN (Features of Renal Failure)
 - Dx → Rhabdomyolysis
 - It is **breakdown of muscle**, causing release of cellular content → **Myoglobin** (most HY & assessed on the USMLE), K, and PO4
 - Myoglobin → Kidneys → precipitates in the renal tubules → **Acute Tubular Necrosis**
 - ATN is associated with **high-anion gap metabolic acidosis** (the U for Uremia in **MUDPILES**)
 - Presents as **Muscle Pain & Weakness with dark-colored/tea-colored urine with negative RBCs on urinalysis** after:
 1. **Severe exercise** (marathon running is buzzy on USMLE)
 2. **Crush injury** (widespread death of muscle tissue causing release of myoglobin)
 3. **Statins use** (especially if combined with **fibrates**; due to CYP450 inhibition) *[asked on NBME]*
 4. **Metabolic Diseases** (McCardle's disease is HY)

Q21

A 37-year-old nurse is accidentally stuck with a needle used to obtain blood from a patient who is HIV positive. Because of the severity of the exposure, she receives three antiretroviral agents. Four weeks later, she develops anemia and neutropenia. Which of the following best describes the mechanism of action of these antiretroviral agents that is most likely responsible for the anemia and neutropenia?

- A. Inhibits reverse transcriptase
- B. Inhibits viral integrase
- C. Inhibits viral protease
- D. Prevents binding to the CD4 molecule
- E. Prevents release of virus from the infected cell

▼ Explanation

- **Answer is A (Inhibits reverse transcriptase)**
 - **IMP Clues**
 - She receives three antiretroviral agents + 4 weeks later developed anemia & neutropenia (Patient on HIV meds + developed bone marrow suppression)
 - Q asks which HIV drugs are responsible for the anemia & neutropenia
 - **NRTIs (Nucleoside Reverse Transcriptase Inhibitors) Side effects:**
 - **Lactic Acidosis**
 - **Bone Marrow Suppression** (the cause of the anemia & neutropenia here)
 - *If USMLE asks which NRTI is specifically notorious for the BMS, choose Zidovudine [asked on NBME]*
 - Unique NRTIs Side Effects:
 - **Abacavir** causes **hypersensitivity** in patients who are **HLA-B5701**.
 - USMLE will ask what to do before starting abacavir? → **HLA-B5701 testing**
 - **Didanosine** causes **Pancreatitis [asked on NBME]**
 - NNRTIs (Non-Nucleoside Reverse Transcriptase Inhibitors) Side effects:
 - **Rash**
 - **Hepatotoxicity**
 - Unique NNRTIs Side Effects:
 - **Efavirenz** causes **vivid dreams**

▼ Other Choices

- **Choice B** → **Integrase Inhibitors** causes *increased creatinine kinase*
- **Choice C** → **Protease inhibitors** generally cause common side effects like **Hyperglycemia & Lipodystrophy**.
 - *USMLE can ask you a patient with HIV started antiretroviral therapy then started having Cushing's syndrome-like features, choose drugs ending with "-navir" (Protease inhibitors) [asked on NBME]*
- **Choice D** → No specific side effects on USMLE
- **Choice E** → No HIV drug that acts via this mechanism.

Q22

A 1-month-old male newborn is brought to the emergency department by his mother because of a 5-day history of vomiting after feedings. His mother says the vomiting is forceful, and appears to contain only formula. She says he seems eager to feed after each episode. He appears irritable. He is at the 25th percentile for length and weight. His temperature is 37.6°C (99.7°F), pulse is 140/min, respirations are 24/min, and blood pressure is 80/40 mm Hg. Physical examination shows decreased skin turgor. Which of the following sets of serum findings (in mEq/L) is most likely in this newborn at this time?

Choices	Na ⁺ (N=134–146)	K ⁺ (N=3–6)	Cl ⁻ (N=95–115)	HCO ₃ ⁻ (N=20–28)
A	132	3.2	90	37
B	132	3.2	100	25
C	132	4.9	90	35
D	135	3.5	110	14
E	138	4.6	90	16
F	138	4.6	110	23

▼ Explanation

- **Answer is A**
 - **IMP Clues**

- Forceful vomiting after feeds + appears to contain only formula (Non bilious projectile vomiting basically)
 - He seems eager to feed after each episode + appears irritable + blood pressure is 80/40 mmHg + decreased skin turgor (Vomiting causes the child to be hungry & dehydrated)
- **Dx → Congenital Hypertrophic Pyloric Stenosis (CHPS)**
 - Pylorus is congenitally thickened, causing an obstruction.
 - Obstruction causes **nonbilious projectile vomiting**, leaving the child *dehydrated & hungry ("child is eager to eat")*.
 - USMLE tests the concept of Pyloric Stenosis by:
 1. **Asking for a diagnosis**
 - They give you **non-bilious vomiting** + **olive-like abdominal mass** +/- **abdominal peristalsis**.
 - Dx is → **CHPS**
 2. **Asking for expected arrows:**
 - They give you an arrows Q asking for **K, Cl, Na, HCO3, PCO2, and pH**
 - Answer is → **low K, low Cl, normal/low Na, high HCO3, high Pco2, high pH**
 - Vomiting causes **hypokalemic hypochloremic metabolic alkalosis**

?

Vomiting vs Diarrhea arrows [K - Cl - Na - HCO3 - PCO2 - pH]

▼ Answer

Vomiting	Diarrhea
low K	low K
low Cl	normal Cl
normal/low Na	normal/low Na
high HCO3	low HCO3,
high PCO2	low Pco2,
high pH	low pH
"Hypokalemic Hypochloremic Metabolic Alkalosis"	"Non-Anion Gap Metabolic Acidosis"

Q23

A 2-year-old boy is brought to the physician because of increased thirst, urinary frequency, and failure to thrive. He appears frail. He is at the 5th percentile for length and 7th percentile for weight. His temperature is 38°C (100.4°F). Physical examination shows dehydration and decreased muscle tone. The diagnosis of Fanconi syndrome is made. Which of the following sets of changes in fractional reabsorption in the kidneys is most likely in this patient?

Choices	Amino Acids	Glucose	Phosphate	HCO ₃ ⁻
A	Increased	Increased	Increased	Increased
B	Increased	Increased	Decreased	Decreased
C	Increased	Decreased	Increased	Increased
D	Increased	Decreased	Decreased	Decreased
E	Decreased	Increased	Increased	Increased
F	Decreased	Increased	Decreased	Decreased
G	Decreased	Decreased	Increased	Decreased
H	Decreased	Decreased	Decreased	Decreased

▼ Explanation

- Answer is H
 - Dx → **Fanconi Syndrome**
 - It is the inability of the PCT to reabsorb what it normally reabsorbs → **decreased reabsorption of amino acids, glucose, phosphate, and bicarb.**
 - Caused by ingestion of **expired tetracyclines**
 - USMLE might ask you for type of RTA caused by Fanconi Syndrome
 - Decreased **Reabsorption of HCO3** ⇒ **Type 2 Renal Tubular Acidosis**
 - RTA Type 2 Findings:
 - **Hypokalemia**
 - **Metabolic Acidosis**
 - **Urine pH starts alkaline (>5.5) but as HCO3 gets depleted → acidic urine (<5.5)**

?

Child with dehydration + decreased muscle tone + bowing of legs + crystals in corneas + serum studies shows hypophosphatemia, hypokalemia, and non-anion gap metabolic acidosis + urine pH is 5 + glucosuria + phosphaturia + aminoaciduria. What is Diagnosis?

▼ Answer

Cystinosis

- Cystinosis is an **AR** disease, characterized by a **defect in Cystinosis**, a lysosomal cystine transporter.
- Clinical Features = **Crystals in the cornea + Fanconi Syndrome**

"USMLE can ask for the diagnosis or ask for one of the above labs/urine findings."

Q24

A 3-month-old boy is brought to the office by his mother because of a 1-week history of a lump on the right side of his groin. The mother says that when the patient cries, the bulge increases in size, and when he is quiet, it disappears. Physical examination shows a soft mass in the right groin region that decreases easily. Which of the following best describes the relationship of the hernia sac?

- A. Lateral to the inferior epigastric artery and inferior to the inguinal ligament
- B. Lateral to the inferior epigastric artery and superior to the inguinal ligament
- C. Medial to the inferior epigastric artery and inferior to the inguinal ligament
- D. Medial to the inferior epigastric artery and superior to the inguinal ligament

▼ Explanation

- Answer is B (Lateral to the inferior epigastric artery and superior to the inguinal ligament)
 - IMP Clues
 - 3-month-old boy (Age is important, as indirect hernias are common in newborns)
 - Lump on the right side of his groin + increases in size when he cries & disappears when he is quiet + soft mass that decreases easily (classic description of hernia)
 - Q asks for relation of the hernia sac
- Dx → Indirect Hernia
 - Common in children due to **failure of processus vaginalis to close**
 - USMLE can say “patent processus vaginalis”
 - **Above** Inguinal ligament
 - Indirect hernias are **lateral** to Inferior epigastric vessels.



How To Answer USMLE Hernia Site Qs:

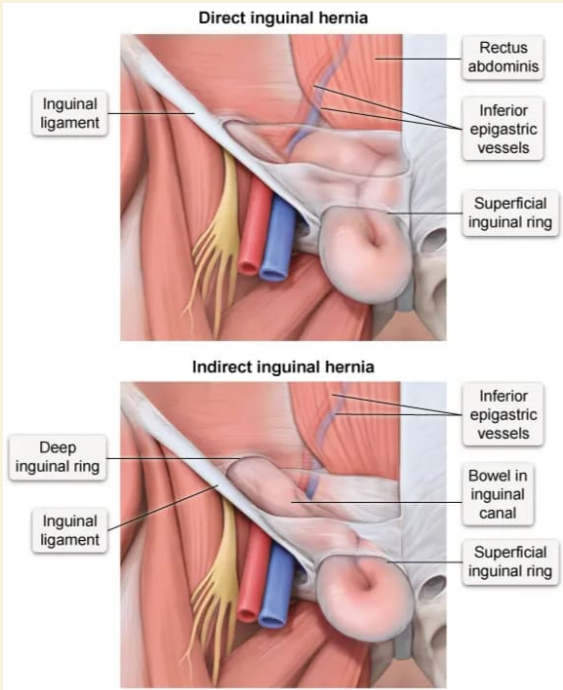
1. Above or Below Inguinal Ligament?
 - Below → Femoral Hernia
 - Above → Direct or Indirect Inguinal Hernia
2. Relationship to Inferior Epigastric vessels?
 - a. **lateral** → **I**ndirect hernia
 - b. **M**edial → **D**irect hernia **“MD”**

Hernias Rapid Review:

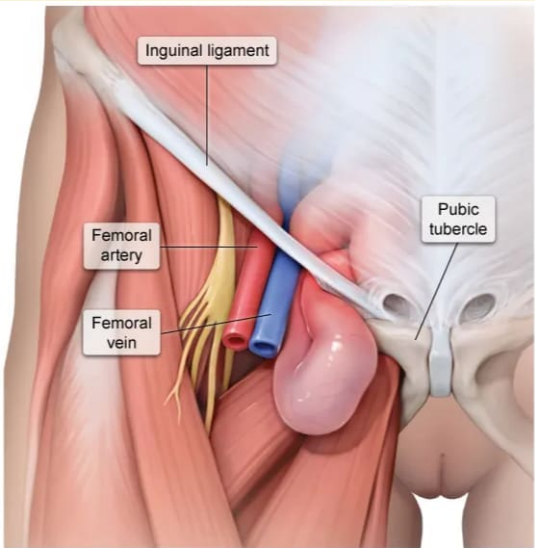
Groin hernias			
Type	Classic presentation	Pathophysiology	Anatomy
Indirect inguinal	Male infants	Patent processus vaginalis	Originates lateral to inferior epigastric vessels Protrudes through the deep inguinal ring into inguinal canal May extend into the scrotum (following spermatic cord)
Direct inguinal	Older men	Weakness of transversalis fascia	Protrudes medial to the inferior epigastric vessels into Hesselbach's triangle May pass through superficial inguinal ring No direct route into the scrotum
Femoral	Women	Widening of the femoral ring	Emerges inferior to inguinal ligament Protrudes through the femoral ring into the femoral canal



Hernias:
Inguinal Hernias:



Femoral Hernia:



Q25

A 25-year-old primigravid woman at 42 weeks' gestation is admitted to the hospital for failure to begin spontaneous labor. She has no history of major medical illness. Pregnancy has been uncomplicated. Her vital signs are within normal limits. Physical examination shows a uterus consistent with a 42-week gestation. Intravenous infusion with oxytocin is initiated. Activation of which of the following signaling pathways most likely mediates the therapeutic effect of this drug for this patient?

- A. cAMP synthesis
- B. cGMP synthesis
- C. Gene transcription
- D. Phosphoinositide hydrolysis
- E. Tyrosine phosphorylation

▼ **Explanation**

- **Answer is D (Phosphoinositide hydrolysis)**
 - **Oxytocin**
 - **Synthesized in the hypothalamus** (Paraventricular & Supra-optic nuclei, like ADH)
 - **Stored in posterior pituitary gland** (like ADH)
 - **Mechanism: Activation of Gq → increased IP3 → increases intracellular calcium → Contraction of smooth muscle**
 - 2 HY Actions:
 - Contraction of Myoepithelial cells in **breast** → **Milk Let-down Reflex** [Stimulated by suckling]
 - Contraction of **Uterine muscles** *in response to cervical dilation* → **Birth Canal Reflex** (also known as Ferguson Reflex) **[asked on NBME]**

Q26

Monoclonality of neoplastic cells in endometrial carcinoma can be best determined by analysis of which of the following?

- A. HLA subtypes
- B. Laminin receptor density
- C. Metalloproteinase activity
- D. Mitotic rates
- E. X chromosome-linked isoenzymes

▼ **Explanation**

- **Answer is E (X chromosome-linked isoenzymes)**
 - What is monoclonality?
 - Cells coming from the same original cells, so they have identical genes & DNA.
 - To determine monoclonality of a neoplastic cell, we need to find its “mother cell origin”. To do that we need something that is unique to THAT cell.
 - **Choice E → CORRECT answer**
 - Females have XX chromosomes. One gets activated **RANDOMLY** in each cell, so each cell either expresses the maternal X or paternal X
 - So, if we take a culture of **normal** endometrial tissue, we’d find that there is **mixture of paternal X-chromosome expressing cells and maternal X-chromosome expressing cells**.
 - If one of these cells turned **malignant**, it would replicate with **ITS OWN chromosomes**, so you’d see cancerous endometrial tissue, all coming from the **same original cell, all containing the original cell’s unique X-chromosome**. Get it?
 - Basically, the answer is **“look for an enzyme linked to the specific X-chromosome in these cells”**

▼ **Other Choices**

- **Choice A → ALL** cells in our bodies have the same HLA subtype, so this is **incorrect** as **both the cancer cells and ALL the healthy cells have the same HLA subtypes**.
- **Choices B, C, D →** Factors that affect tumor **invasion (staging) and grading**

Q27

A randomized clinical trial is conducted to compare wound healing and cosmetic differences between two surgical procedures for closing skin wounds following cesarean delivery. A total of 500 women undergoing cesarean delivery during a 6-month period are enrolled in the study. A research assistant is assigned to conduct outcome assessments of each participant at 2 weeks and 6 weeks following delivery. Both procedures require the expertise of surgical specialists who cannot be blinded to the procedure. Results show that Procedure A has a lower rate of wound infection compared with Procedure B (relative risk of 0.66 with a 95% confidence interval of 0.30 - 1.45); the two procedures also have similar cosmetic results 6 weeks after delivery. Which of the following statements most accurately represents the comparison between Procedure A and Procedure B in a clinical care setting?

- A. Neither procedure is superior
- B. Procedure A is superior to Procedure B

- C. Procedure B is superior to Procedure A
- D. The two procedures should not be used in a clinical care setting

▼ **Explanation**

- **Answer is A (Neither procedure is superior)**
 - If the RR between 2 procedures *equals 1*, then there is **NO CLINICALLY SIGNIFICANT DIFFERENCE**.
 - If $RR > 1$ → **Increases Risk**
 - If $RR < 1$ → **Protective**
 - However, we also need to look at the Confidence Interval.
 - **If CI ranges include "1" then it is also → NOT CLINICALLY SIGNIFICANT**
 - Example CI of 0.8-2 → **NOT CLINICALLY SIGNIFICANT**
 - Example CI of 1.2 - 2 → **CLINICALLY SIGNIFICANT**

Q28

A 5-year-old girl with AIDS develops a progressive generalized vesicular rash. High-dose antiviral therapy for the agent that causes these lesions is ineffective, and the lesions become hyperkeratotic. The genetic mutation responsible for the absence of susceptibility to antiviral therapy involves the activity of which of the following enzymes?

- A. DNA polymerase
- B. Protease
- C. Protein kinase
- D. Reverse transcriptase
- E. Ribonucleotide reductase
- F. Thymidine kinase

▼ **Explanation**

- **Answer is F (Thymidine kinase)**
 - **IMP Clues**
 - Girl with HIV develops progressive generalized vesicular rash (Vesicular rash in HIV patients is most likely disseminated VZV, could be HSV too)
 - High-dose antiviral therapy for the agent that causes these lesions is ineffective (So, the virus is drug resistant)
 - Q asks mutation causing absence of which of the following is the cause of this resistance?
 - Discussed this previously on the NBME.
 - **VZV/HSV are treated with *Acyclovir (VZV/HSV DNA Polymerase Inhibitor)***
 - Acyclovir needs *viral thymidine kinase* to work.
 - **Altered/Absent Thymidine Kinase causes → Drug Resistant VZV/HSV**

Q29

A 24-year-old African American man comes to the physician because of a 3-month history of red bumps on his face and chin. He says that the bumps are itchy and painful. Physical examination shows hyperpigmented papules over the cheeks, jawline, and neck. Which of the following is the most likely diagnosis?

- A. Acne vulgaris
- B. Cutaneous lupus erythematosus
- C. Keloids
- D. Pseudofolliculitis barbae
- E. Rosacea

▼ **Explanation**

- **Answer is D (Pseudofolliculitis barbae)**
 - **IMP Clues**
 - African American man (They have curly, coarse hair)
 - Red painful and itchy bumps on his face and chins + hyperpigmented papules over cheeks, jawline, and neck (Distribution is consistent with his facial hair)

- Dx → Pseudofolliculitis barbae ("Razor Bumps")
 - Chronic **non-infectious** inflammation of the skin due to ingrown hairs (act as foreign bodies) after shaving
 - Common in **men** (more facial hair) with **curly hair (African Americans & Hispanics)**
 - Curly hair after shaving is more likely to "curl" into the skin instead of growing out → **inflammation of the skin, causing hyperpigmented papules over the distribution of the shaved facial hair**



Can be complicated by **secondary infection** or **hypertrophic scars (keloids)**

Q30

A mother who has toxoplasmosis gives birth to an asymptomatic female newborn. Which of the following tests on the newborn will indicate that the newborn has congenital *Toxoplasma gondii* infection?

- A. Antitoxoplasma IgG antibody concentrations
- B. Antitoxoplasma IgM antibody concentrations
- C. Culture on blood agar
- D. Natural killer cell count
- E. Serum complement concentrations

▼ Explanation

- Answer is B (Antitoxoplasma IgM antibody concentrations)
 - This Q assess a simple concept → **IgG passes the placental barrier** from the mother to the child, so the presence of IgG means maternal immunity
 - **IgM on the other hand doesn't pass the placental barrier, meaning that if a newborn has IgM antibodies ⇒ Made by the child in response to infection.**
 - Mother here as Toxoplasmosis, so she has IgM and IgG.
 - The IgG is passed to the child.
 - If we want to know if the child is infected, we test for Newborn's IgM concentration.

Q31

Serum cholesterol concentrations are measured as part of a community study. The mean and standard deviation are given for women by age group:

Age (years)	Cholesterol (mg/dL)
45-49	229 ± 47
50-54	246 ± 50
55-59	255 ± 48
60-62	244 ± 36

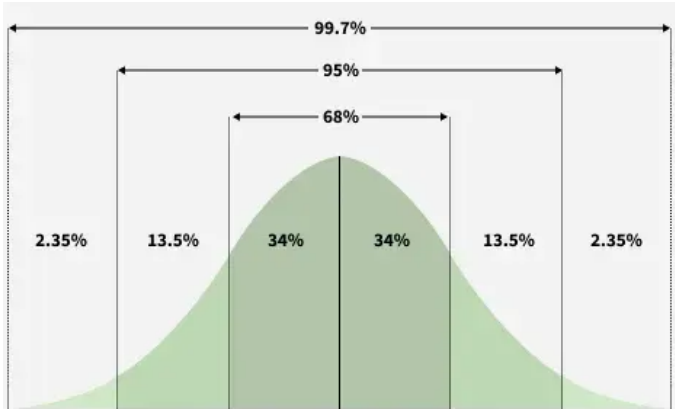
Assuming serum cholesterol concentrations follow a normal (gaussian) distribution, which of the following is the probability that a woman between the ages of 50 and 54 years has a serum cholesterol concentration greater than 296 mg/dL?

- A. 1%
- B. 2.5%
- C. 5%
- D. 16%
- E. 95%

▼ Explanation

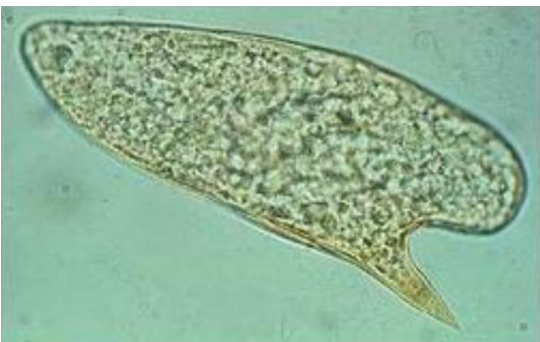
- Answer is D (16%)
 - For women between ages of 50 and 54 years, the mean is 246 and the SD is 50
 - Q wants % of women in that age with cholesterol concentration GREATER THAN 296 (Mean + 1SD)
 - 100 - 50 - 34 = 16%

- 100 is the total
- 50 is the negative SD
- 34% is 1SD



Q32

A 53-year-old woman comes to the physician because of a 1-year history of intermittent abdominal pain. She has a history of multiple episodes of traveler's diarrhea and urinary tract infections. She is an avid traveler to the Middle East, South America, and Asia. Physical examination shows no abnormalities. Her leukocyte count is 10,300/mm³ (55% segmented neutrophils, 10% eosinophils, and 35% lymphocytes). A photomicrograph of a stool sample is shown. Which of the following infectious agents is the most likely cause of the findings in this patient?



- A. Cyclospora cayetanensis
- B. Entamoeba histolytica
- C. Giardia lamblia
- D. Isospora belli
- E. Schistosoma mansoni

▼ Explanation

- **Answer is E (Schistosoma mansoni)**
 - **IMP Clues**
 - Based on the picture alone, you can answer this Q (Picture shows a parasite egg with lateral spine ⇒ Schistosoma mansoni)
- **Dx → Schistosoma mansoni**
 - Parasitic Infection which is associated with **travel to Africa/middle east & swimming** there.
 - If USMLE asks you for **intermediate host**, choose **snails**
 - Skin penetration → lodges itself into **mesenteric & hepatic venules** → lays eggs which cause a **granulomatous reaction & fibrosis** of venules:
 - Intestinal Disease → **Abdominal Pain with bloody diarrhea**
 - Liver Disease → **Portal HTN, Splenomegaly, ascites, varices, and hematemesis**
 - **Egg with Lateral Spine pic is SUPER HY**
 - Treated with **Praziquantel**, which causes **influx of calcium** resulting is **parasite paralysis and death** *[asked on NBME]*

? What is a HY cause (hint: a parasite) of SCC of the bladder?

▼ Answer
Schistosoma Haematobium - Egg with large terminal spine



Q33

A 56-year-old woman is brought to the emergency department because of progressive shortness of breath during the past month. Two weeks ago, she underwent coronary artery bypass grafting. Her respirations are 26/min. There is dullness to percussion at the left base of the chest. A chest x-ray shows substantial fluid in the left pleural cavity. Thoracentesis yields 1200 mL of pale, milky fluid that is identified as chyle. Which of the following procedures during the operation most likely produced the iatrogenic chylothorax?

- A. Dissection of the internal thoracic artery
- B. Midsternal thoracotomy
- C. Placement of the central line via the left internal jugular vein
- D. Placement of the epicardial pacemaker lead
- E. Placement of the pulmonary artery catheter via the right subclavian vein

▼ Explanation

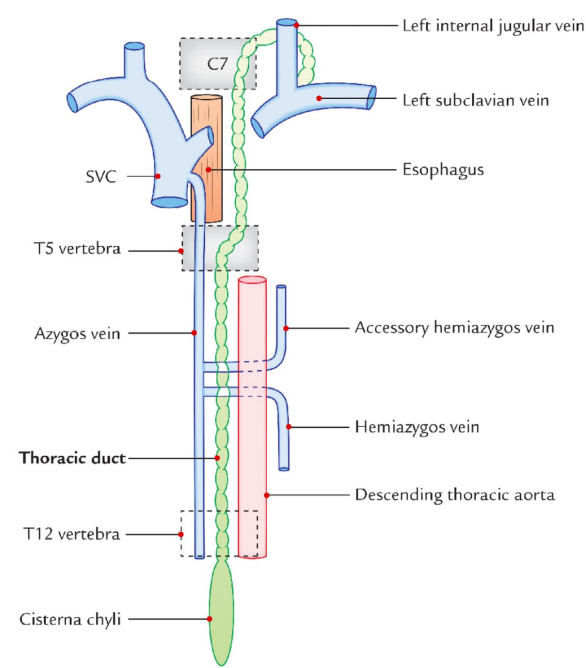
- Answer is C (Placement of the central line via the left internal jugular vein)
 - Chylothorax most commonly occurs as an iatrogenic injury to the thoracic duct during central line placement.
 - The Thoracic duct inserts at the *junction between the Left Internal Jugular Vein and the Left Subclavian Vein*.
 - This is why during central line placement in the left IJV, injury to the thoracic duct is a possible complication

?

What are the other HY possible complications of placement of a central line?

▼ Answer

Damage to the common carotid artery & apex of lung



Q34

A 60-year-old man has two-pillow orthopnea, severe dyspnea, and edema of the lower extremities. The onset of these symptoms was preceded by an episode of prolonged substernal chest pain 5 days ago. Which of the following additional findings on examination of the neck is most consistent with these findings?

- A. Bifid carotid pulse
- B. Carotid bruit best heard at the carotid bifurcation
- C. Jugular "cannon waves"
- D. Jugular venous pressure of 12 mm Hg
- E. Slow-rising, decreased-volume carotid pulse

▼ Explanation

- Answer is D (Jugular venous pressure of 12 mm Hg)
 - IMP Clues
 - Orthopnea, severe dyspnea, and edema of lower extremities (Sounds like symptoms of Heart Failure)
 - Preceded by an episode of prolonged substernal chest pain (Classic MI description)
 - Dx → Heart Failure
 - MI → LV dysfunction → **decreased CO** & blood backs up into LA → blood backs up into lungs (causing orthopnea & dyspnea) → **RV afterload increases** → Blood backs up into RA → Edema of extremities & JVD.
 - Normal JVP is 6-8, so **JVD is caused by increased JVP (Choice D)**

?

What would this patient's arrows be?
 [Pulmonary Capillary Hydrostatic pressure - Interstitial Hydrostatic pressure - Interstitial Oncotic pressure]

▼ Answer

• High Pulmonary Capillary Hydrostatic pressure
 • High Interstitial Hydrostatic pressure
 • Low Interstitial Oncotic pressure

▼ Other Choices

- Choice A → Seen in Aortic Stenosis or Aortic Regurgitation
- Choice B → Seen in atherosclerosis of Common Carotid Artery
- Choice C → Cannon waves are seen in Complete Heart Block (3rd degree AV block) as ventricles contract independently of atria. When Atria contracts against closed Tricuspid valve ⇒ Cannon Waves are seen.

- **Choice E** → Seen in Aortic Stenosis

Q35

A 30-year-old man who completed a successful course of treatment for Hodgkin disease 2 months ago calls his physician on an increasingly frequent basis. He takes his temperature several times daily and contacts the office whenever it is above 37.2°C (99°F). He also has episodes of tingling of his fingers that last several seconds. Although evaluation has shown no evidence of recurrence, he is increasingly fearful that Hodgkin disease may not be detected rapidly enough for successful treatment. Which of the following is the most likely diagnosis?

- A. Adjustment disorder with anxiety
- B. Dependent personality disorder
- C. Generalized anxiety disorder
- D. Obsessive-compulsive disorder
- E. Somatic symptom disorder

▼ **Explanation**

- **Answer is A (Adjustment disorder with anxiety)**

- **IMP Clues**

- Completed a successful course of treatment for Hodgkin disease 2 months ago (The stressor has ended < 6 months ago)
- Calls his physician on an increasingly frequent basis + takes his temperature several times daily + tingling of his fingers (Symptoms of anxiety)

Dx → **Adjustment Disorder with Anxiety**

- Emotional symptoms (it is anxiety in this patient) that occur **within 3 months** of an identifiable psychosocial stressor (Fearful of Hodgkin's lymphoma recurrence) lasting < 6 months once the stressor has ended.

▼ **Other Choices**

- **Choice B** → **Dependent Personality Disorder**

- Pervasive/excessive need to be taken care of; clinging behavior and fear of separation. Patient will often go to great lengths to avoid being alone, constantly seeking to be physically close to intimate partner

- **Choice C** → If adjustment disorder persists for more than 6 months then this is **Generalized anxiety disorder**

- **Choice D** → **Obsessive-Compulsive Disorder (OCD)**

- Made up of 2 things

- **Obsessions** → Unwanted and intrusive thoughts, images, or urges that cause significant anxiety or distress
- **Compulsions** → Repetitive behaviors a person performs in response to an obsession

- In OCD, the patient **hates** that he/she is OCD (they are aware that they have these obsessions & compulsions, and they **HATE IT**)

- Treatment → **SSRIs & Clomipramine** (a *TCA*)

- Sertraline is an SSRI

- **Choice E** → **Somatic Symptom Disorder**

- Patient has one or more REAL symptoms that are causing distress or socio-occupational dysfunction; however, examination and investigations can't find any abnormalities

Q36

A previously healthy 16-year-old girl comes to the physician because of a 4-day history of severe vaginal itching and a yellowish discharge. She is sexually active and uses condoms inconsistently. Pelvic examination shows a bubbly, yellowish vaginal discharge. Saline wet mount preparation of the discharge and a vaginal wall scraping show motile organisms and numerous leukocytes. Which of the following is the most likely causal organism?

- A. *Candida albicans*
- B. *Chlamydia trachomatis*
- C. *Escherichia coli*
- D. *Gardnerella vaginalis*
- E. *Haemophilus ducreyi*

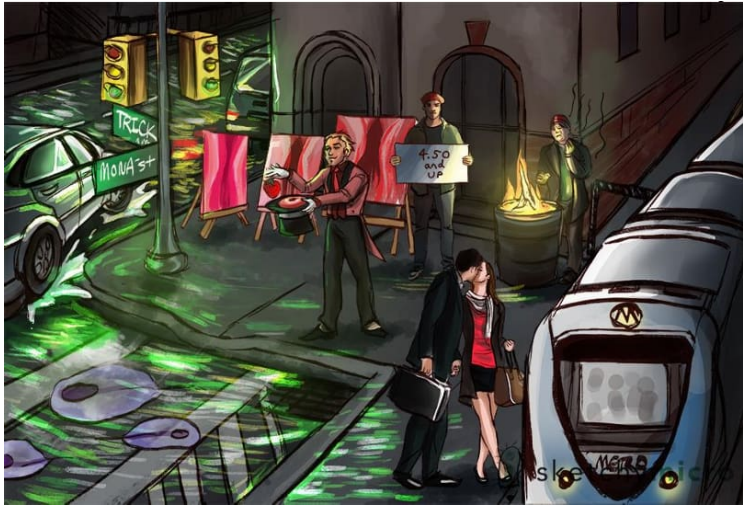
- F. Mycoplasma genitalium
- G. Neisseria gonorrhoeae
- H. Phthirus pubis
- I. Staphylococcus aureus
- J. Streptococcus agalactiae (group B)
- K. Treponema pallidum
- L. Trichomonas vaginalis
- M. Ureaplasma urealyticum

▼ Explanation

- **Answer is L (Trichomonas vaginalis)**
 - **IMP Clues**
 - Severe vaginal itching + bubbly yellowish vaginal discharge (Itching + yellow-green discharge is buzzy for Trichomonas vaginalis)
 - Wet mount shows motile organisms and numerous leukocytes (Diagnostic test of Trichomonas vaginalis)
 - Sexually active and uses condoms inconsistently (STD)
- **Dx → Trichomonas vaginalis**
 - Sexually Transmitted Disease that causes **itching yellow-green malodorous vaginal discharge**.
 - HY Complication is **Strawberry Cervix** (Cervicitis with punctuate lesions)
 - Vaginal pH is usually 4.5+ (VS candida <4.5)
 - **Diagnosis → Wet Mount showing motile trophozoites**
 - Treatment → **Metronidazole** (given to both partners)

? What is mechanism of action of metronidazole

- ▼ Answer
 - Converted into an active metabolite that produces ROS → DNA Damage



 Differentiating the 3 main causes of vaginal discharge on the USMLE:

Features	Vaginal Candidiasis	Bacterial Vaginosis	Trichomoniasis
CA	Candida Albicans	Gardnerella Vaginalis	Trichomonas Vaginalis
Discharge	"Thick white discharge", "clumpy white", "cottage cheese-like"	"Thin Gray-White discharge", "Fishy"	"Frothy", "Yellow-Greenish discharge", 'malodorous'
Vaginal pH	Acidic (<4.5)	> 4.5	> 4.5
Microscopy	Budding yeast & pseudohyphae	Clue Cells	Flagellated Motile Trophozoite
Vaginal Mucosa	Erythematous & Inflamed	Normal	Strawberry Cervix
STD?	No	No	Yes

Q37

A 77-year-old woman has been having difficulty fastening buttons. She has weakness of the intrinsic muscles of the hands and loss of sensation in the little fingers. Which of the following is the most likely cause of these findings?

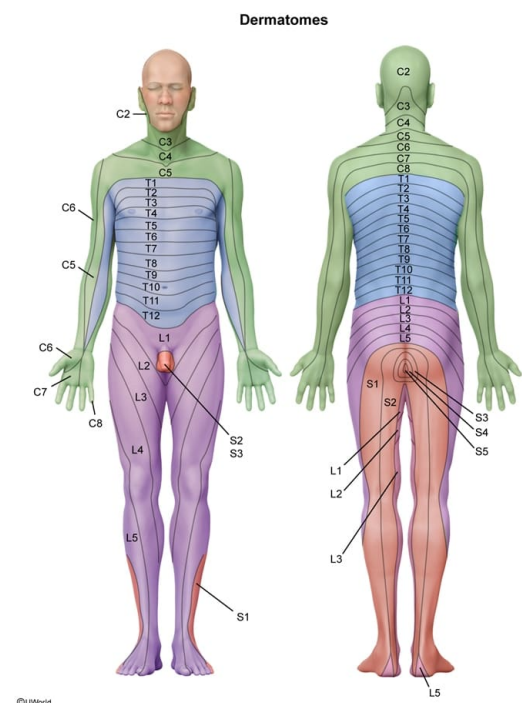
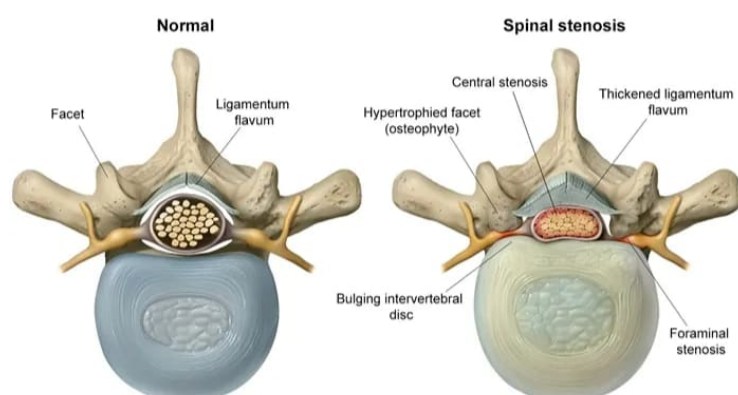
- A. Chronic lunate subluxation with median nerve compression
- B. Compression of the radial nerve in the spiral groove
- C. Compression of the ulnar nerve in the carpal tunnel
- D. C7-T1 foraminal stenosis

▼ Explanation

- **Answer is D (C7-T1 foraminal stenosis)**
 - **IMP Clues**
 - Weakness of intrinsic muscles of the hands and loss of sensation in the little fingers

- **Dx → C7-T1 Foraminal Stenosis**

- Neural Foramina is an opening in the spine where the nerve roots exit.
 - So, its **stenosis causes radiculopathy**
- **Intrinsic muscles of the hand are supplied by C8-T1**, so the affection of these roots (by foraminal stenosis) causes **weakness, wasting, and loss of sensation in the distribution of that neural segment**.
- **Ulnar nerve** takes roots from **lower brachial plexus (C8-T1)**, hence **loss of sensation in the little finger**



▼ **Other Choices**

- **Choice A → Lunate bone** subluxation or displacement can cause compress the median nerve, causing carpal tunnel syndrome. Th median nerve, however, supplies the palmer aspect of the lateral 3 and half digits. Not the little fingers.
- **Choice B → Compression of radial nerve in the spiral groove** would cause loss of triceps extension, wrist extension, sensation of dorsal aspect of lateral 3 and half fingers.
- **Choice C → Ulnar nerve** is found in the Guyon canal NOT the carpal tunnel.

Q38

A 50-year-old man comes to the physician because of a persistent cough for the past 2 months. He has had a 5-kg (11-lb) weight loss during this period. He is a farmer and started itraconazole therapy 4 weeks ago for histoplasmosis acquired after contact with chicken coops. Current medications also include hydrochlorothiazide, enalapril, atenolol, omeprazole, and metoclopramide for hypertension and gastroesophageal reflux. He appears thin. Physical examination shows no other abnormalities. An interaction between itraconazole and which of the following drugs most likely accounts for the lack of effect of itraconazole?

- A. Atenolol
- B. Enalapril
- C. Hydrochlorothiazide
- D. Metoclopramide
- E. Omeprazole

▼ **Explanation**

- **Answer is E (Omeprazole)**
 - Patient has been taking itraconazole for histoplasmosis infection with no effect due to drug interactions
 - Alot of med students don't know that **Itraconazole** (and other “-azoles”) require **acidic media to be absorbed**.
 - **So, patients on H2-blockers, antacids, or PPIs have decreased drug absorption 2ry to effects of decreased gastric acidity.**

Q39

A strain of Escherichia coli produces a temperature-sensitive tryptophan synthase and therefore requires exogenously supplied tryptophan for growth at 42°C but not at 30°C. Which of the following mutations is most likely responsible for this phenotype?

- A. Deletion
- B. Frameshift
- C. Insertion
- D. Missense
- E. Nonsense

▼ Explanation

- **Answer is D (Missense)**

- What happened here is a “**Conditional Mutation**,” in which a **mutation only causes a change in the organism’s traits or phenotype** UNDER SPECIFIC ENVIRONMENTAL CONDITIONS (here it is temperature)
- Conditional mutations are a type of **missense mutation**.
 - **Missense mutation is when a codon sequence is altered, resulting in new codon coding for different amino acid (basically, one amino acid is substituted for another) → Results in a functional protein still, but its characteristics maybe altered.**
 - Here it is the temperature needed for the tryptophan synthase enzyme.

▼ Other Choices

- **Choice A → Deletion** is when a segment of DNA is left out during replication. This causes the formation of a truncated, non-functional protein.
- **Choice B → Frameshift** is insertion/deletion of one or two bases, resulting in all following codons being read off-frame. This causes the formation of a truncated, non-functional protein.
- **Choice C → Insertion mutation** is when one or more bases are segment into the DNA sequence. This causes the formation of a truncated, non-functional protein.
- **Choice E → Nonsense mutation** is when a codon sequence is altered such that a stop codon is formed, resulting in a truncated, non-functional protein.

Q40

A 16-year-old student has uncontrollable sleepiness, falling asleep several times a day while sitting in class. The slightest noise or touch is enough to awaken him. Which of the following most likely characterizes the onset of his sleep at night?

- A. Direct transition from wakefulness to REM sleep
- B. Direct transition from wakefulness to sleep stage 4
- C. Gradual transition from wakefulness to sleep stage 1
- D. Immediate transition from wakefulness to sleep stage 2

▼ Explanation

- **Answer is A (Direct transition from wakefulness to REM sleep)**

- **IMP Clues**
 - 16-year-old + uncontrollable sleepiness + falling asleep several times a day while sitting in class (Teenager + excessive day time sleepiness is classic for Narcolepsy)
 - The slightest noise or touch is enough to awaken him (Light sleep, so he’s in NREM stages 1 or 2)
 - Q asks what happens at onset of sleep at night

- **Dx → Narcolepsy**

- When studying for my STEP exam, I couldn’t understand what was happening here, but now I know, so let’s discuss it.
- “*Narco*” means **sleep**; “*Lpsy*” means **attacks**. So, *narcolepsy* is **attacks of sleep**.
- Pathophysiology → **Deficiency** of neurotransmitter **hypocretin (orexin)** synthesis from **lateral hypothalamus**
 - Hypocretin (orexin) Functions:
 1. **Keeps you awake & alert**
 2. **Mediates transition between Sleep Cycles**
 3. **Regulation of sleep/wakefulness with other brain regions** (especially areas of reward/motivation; Dopamine & Serotonin is involved)
 - Normal Sleep Cycles
 - Non-REM **Stage 1 (Lightest Sleep) → Stage 2 (Light Sleep) → Stage 3 (Deep Sleep) → REM**
 - Average Sleep Cycle ~90 mins
- **What Happens in Narcolepsy?**
 - **Deficiency of hypocretin (orexin) causes abnormal sleep cycle transition**



What is the treatment for a patient with narcolepsy?

▼ **Answer**

Modafinil (Dopamine Reuptake Inhibitor & Promotes hypocretin(orexin) secretion form lateral hypothalamus)



How is Cerebral Flow affected during normal REM sleep?

▼ **Answer**

RR *decreases* → *increase* in PCO2 → cerebral vessels vasodilation → *increased cerebral blood flow*.

- At night-time, the **normal progression *doesn't* occur** → Patients **enter REM sleep *directly* (without going through the stages of sleep)**, so the patient ***doesn't get into DEEP SLEEP***. (The reason why he is always sleepy)
- At daytime, **naps should be REM sleep directly** (hence you get wild dreams when you nap at 4'Oclock, I'm not the only one right? "ahlam el asr literally"); however, **patients with Narcolepsy enter Stage 1 (Lightest sleep stage), hence "the slightest noise or touch is enough to awaken him.'**
- Other Features of Narcolepsy:
 - **Sudden episodes of muscle weakness (cataplexy)**
 - **Sleep paralysis**
 - **Hallucinations (hypnagogic "prior to sleep", or hypnopompic "upon waking up")**
- So, what happen at onset of sleep in this patient?
 - **Direct transition from wakefulness to REM sleep directly (Choice A)**

Q41

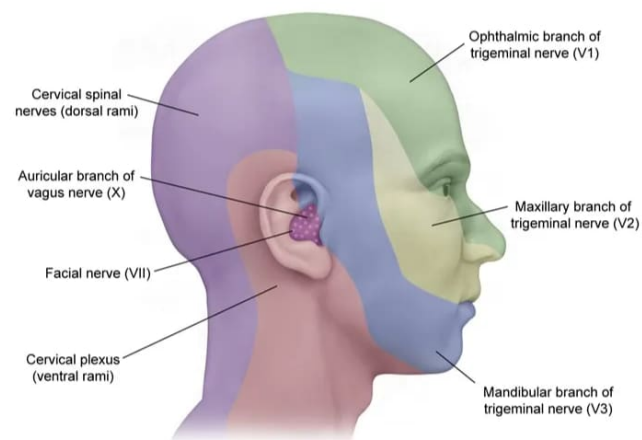
A 30-year-old woman with multiple sclerosis comes to the physician because of a 2-week history of severe shooting pains in her right cheek. Each pain lasts less than 1 second. The pains sometimes occur spontaneously and sometimes are precipitated by a light touch to the right cheek. The most likely cause of this new finding is a plaque in which of the following locations?

- A. Cerebral hemisphere
- B. Medulla
- C. Midbrain
- D. Pons
- E. Spinal cord
- F. Thalamus

▼ **Explanation**

- **Answer is D (Pons)**
 - **IMP Clues**
 - Woman with multiple sclerosis
 - Severe shooting pains in her right cheek + lasts less than 1 second + occurs spontaneously or precipitated by light touch (Classic description of Trigeminal Neuralgia)
 - Q asks for site of plaque causing these symptoms

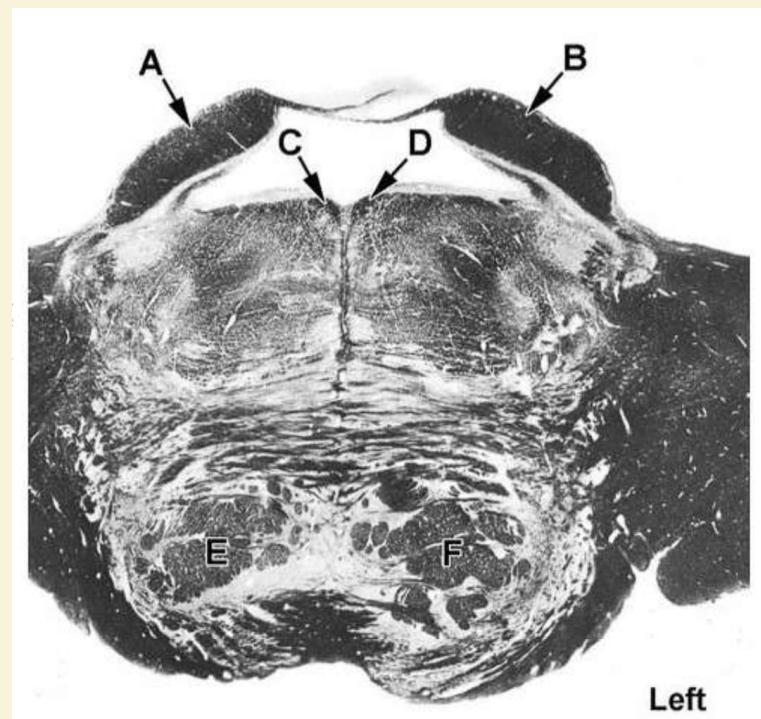
- Dx → Trigeminal Neuralgia secondary to Multiple Sclerosis
 - Multiple Sclerosis is an autoimmune disease characterized by T-cells attacking *oligodendrocytes & myelin basic protein* → *demyelination*
 - Site of demyelination is what dictates the symptoms/signs of the patients.
 - This patient here has Trigeminal Neuralgia, which is due to irritation of the Trigeminal Nerve (Maxillary Division, V2) or its origin, the Pons (Choice D)



There is this “Rule of 4s” that I learned about during neurology rounds:

- 4 Cranial Nerves **ABOVE** the **brainstem** → CN 1, 2, 3, 4
- 4 Cranial Nerves **IN Pons** → CN 5, 6, 7, 8
- 4 Cranial Nerves **IN Medulla** → CN 9, 10, 11, 12

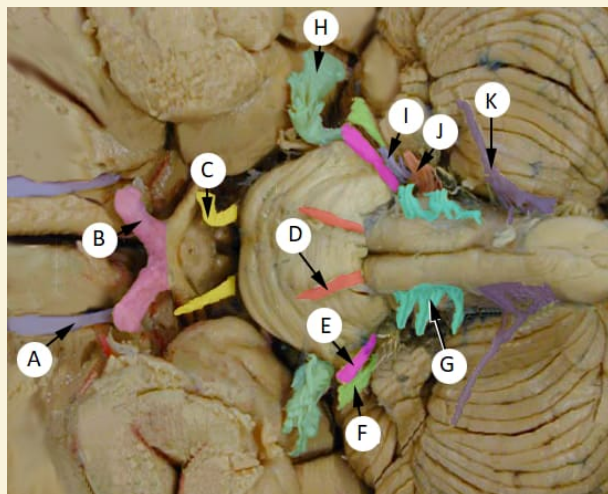
? Patient with MS can't adduct his right eye when looking during left gaze, however, when the right eye is tested alone adduction was normal. What is the site of pathology in this patient?



▼ Answer

Choice C (Right Medial Longitudinal Fasciculus) - Patient has Internuclear Ophthalmoplegia (INO)

? Point to the Trigeminal Nerve in this patient.



▼ Answer

Choice H → Trigeminal Nerve (CN V)

Other Choices

- A → Olfactory Nerve (CN I)
- B → Optic Nerve (CN II)
- C → Oculomotor Nerve (CN III)
- D → Abducens Nerve (CN VI)
- E → Facial Nerve (CN VII)
- F → Vestibulocochlear Nerve (CN VIII)
- G → Hypoglossal Nerve (CN XII)
- J → Vagus Nerve (CN X)
- I → Glossopharyngeal Nerve (CN IX)
- K → Spinal Accessory Nerve (CN XI)

Q42

A 50-year-old man is brought to the emergency department by his wife because of a 3-hour history of confusion and difficulty seeing. He says he is seeing flickering "snowflake-like white spots" that interfere with his vision. He has a 3-year history of alcohol use disorder. His wife says he has been drinking a commercial product containing methanol. He appears anxious, confused, and incoherent. His temperature is 36.8°C (98.2°F), pulse is 100/min, respirations are 26/min, and blood pressure is 120/80 mm Hg. Physical examination shows dilated pupils and diminished pupillary reflex. Serum studies show a pH of 7.25 and an anion gap of 24 mEq/L (N=10-12). The most likely cause of this patient's visual symptoms is an excess of which of the following metabolites?

- A. Acetaldehyde
- B. Acetic acid
- C. Formic acid
- D. Glutaraldehyde
- E. Glyceraldehyde
- F. Lactic acid

▼ Explanation

- Answer is C (Formic acid)

- IMP Clues

- Confusion + difficulty seeing + seeing flickering "snowflake-like white spots" that interfere with his vision (Ocular symptoms)

- He has 3-year history of alcohol use disorder + he has been drinking methanol (Probably methanol OD)
- Examination shows dilated pupils and diminished pupillary reflex (Optic neuritis)
- pH of 7.25 and an anion gap of 24mEq/L (high anion gap metabolic acidosis)
- Q asks for excess metabolite causing these symptoms

• **Dx → Methanol Toxicity**

◦ **Methanol → Formaldehyde → Formic acid (the toxic metabolite)**

- *Methanol* → *Formaldehyde* via ***Alcohol Dehydrogenase (ADH)***
- *Formaldehyde* → *Formic acid* via ***Aldehyde Dehydrogenase (ALDH)***

◦ **Formic acid inhibits mitochondrial cytochrome C oxidase → inhibits oxidative phosphorylation → inhibits ATP synthesis**

- This results in **impaired aerobic respiration**, so cells **switch to anaerobic respiration** → **Lactic Acidosis (High Anion Gap Metabolic Acidosis)**
- Increased ROS formation → Cell apoptosis

◦ The **decreased ATP + Apoptosis + good ocular penetration + hypoxic vulnerability of the retina** ⇒ **Ocular Symptoms**

- Blurry vision, Scotomas, Optic neuritis (dilated pupils + diminished pupillary reflex), and progression to blindness

◦ Treatment

- **Fomepizole (ADH inhibitor)** must be used **EARLY** to reverse the ocular damage
 - Inhibition of Alcohol dehydrogenase causes **decreased production of Formaldehyde**, and by doing so **decreased production of Formic acid**
- Ethanol can also be used if fomepizole is unavailable, as ADH has higher affinity to ethanol when compared to methanol.

? What are the causes of high-anion gap metabolic acidosis?

▼ **Answer**

Causes of high anion gap: "MUDPILES"

- **M** = Methanol
- **U** = Uremia (Renal Failure acute or chronic)
- **D** = DKA
- **P** = Phenformin (NON-EXISTANT ON THE USMLE)
- **I** = Iron (HY) or Isoniazid (HY)
- **L** = Lactic acidosis
- **E** = Ethylene glycol
- **S** = Salicylates (Aspirin)

Q43

A 55-year-old woman comes to the physician for a follow-up examination. She has a family history of skin cancer and rigorously avoids exposure to the sun. Her dietary intake of vitamin D meets current recommendations. Physical examination shows no abnormalities. Serum studies show a decreased 25-hydroxycholecalciferol concentration. Decreased production of which of the following precursors in skin is most likely to occur in this patient?

- A. Cholesterol
- B. Cholecalciferol
- C. 7-Dehydrocholesterol
- D. 1,25-Dihydroxycholecalciferol
- E. Ergocalciferol

▼ **Explanation**

• **Answer is B (Cholecalciferol)**

◦ **IMP Clues**

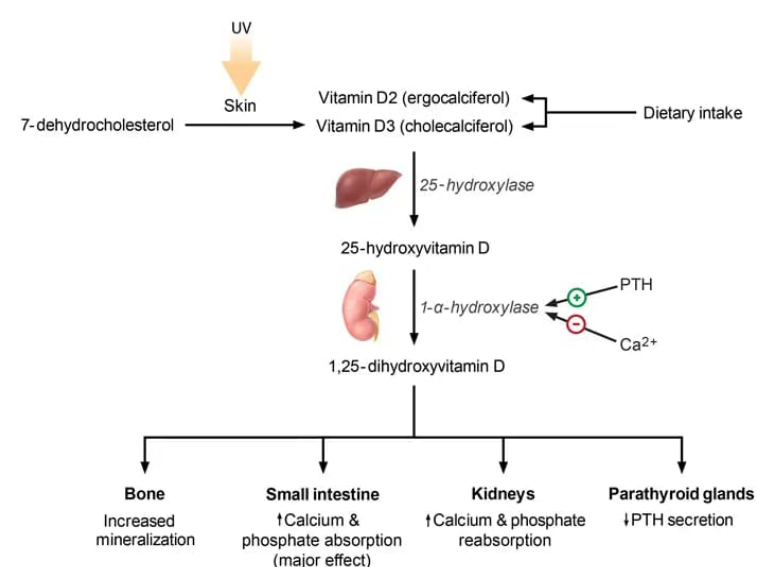
- She has a family history of skin cancer and rigorously avoids exposure to the sun (Patient has vitamin D deficiency due to decreased sun exposure)
- Her dietary intake of vitamin D meets current recommendations (Excludes a dietary intake deficiency)
- Serum studies show a decrease in 25-OH-Cholecalciferol concentration

- Q asks decreased production of which of the following **precursors** in the skin is most likely?

- Body synthesizes **7-dehydrocholesterol** & deposited in the skin → UV exposure catalyzes conversion of **7-dehydrocholesterol to Cholecalciferol (Vitamin D precursor) (Choice B)**
- Cholecalciferol is then carried to the **liver** for **hydroxylation into 25-OH-Cholecalciferol via 25-hydroxylase**
- 25-OH-Cholecalciferol is then carried to the **kidney** for **hydroxylation into 1,25-OH-Cholecalciferol via 1-alpha-hydroxylase**

- Patient has decreased 25-OH-Cholecalciferol, which means its precursor is decreased → Decreased Cholecalciferol**

- They say “Her dietary intake of vitamin D meets current recommendations” to excludes a dietary intake deficiency.



? What type of 2nd messenger does Vitamin D use?

▼ **Answer**

Intracellular Receptors - USMLE can refer to this as “**Binds to receptors in cytoplasm with translocation into the nucleus**”

Q44

A 45-year-old man has fever, chills, dysuria, and a tender, enlarged prostate. Which of the following is the most likely causal organism?

- A. Adenovirus
- B. Chlamydia trachomatis
- C. Escherichia coli
- D. Pseudomonas aeruginosa
- E. Ureaplasma urealyticum

▼ **Explanation**

- Answer is C (Escherichia coli)**
 - The patient has **prostatitis** (Enlarged Tedner prostate + fever, chills, and dysuria).
 - USMLE wants you to know that the causative agent of prostatitis is either:
 - Chlamydia or Gonorrhea** in men **under the age of 35 years** OR men that the stem makes it exceedingly evident **that they are sexually active**.
 - Escherichia coli** in men **above the age of 35 years**.

Q45

An 8-year-old boy is evaluated for ventricular systolic overload. The standard-lead ECG shows severe left axis deviation of the main QRS vector (upward in lead I and downward in lead II). Which of the following is the most likely explanation for this patient's condition?

- A. Coarctation of the aorta
- B. Mitral valve stenosis
- C. Pulmonary valve stenosis
- D. Right atrial hypertrophy
- E. Right ventricular hypertrophy

▼ **Explanation**

- Answer is A (Coarctation of the aorta)**
 - IMP Clues**
 - ECG shows severe left axis deviation (On the USMLE left axis deviation = LVH)
 - Dx → Left Ventricular Hypertrophy secondary to Coarctation of the Aorta**
 - On the USMLE **LVH** can be described as “**Left Axis deviation on ECG**” or “**Left Bundle Branch Block**” or “**Paradoxical Splitting of S2**”
 - On the USMLE **RVH** can be described as “**Right Axis deviation on ECG**” or “**Right Bundle Branch Block**” or “**Wide Splitting of S2**”

- So basically, this child here has **coarctation of the aorta** → **increased** left ventricle afterload → compensatory left ventricle hypertrophy

▼ Other Choices

- **Choice A** → **Mitral valve stenosis** causes **Left Atrium Hypertrophy**, which is the **greatest risk factor for AF**. USMLE can give you a barium swallow where the **esophagus is compressed, then ask which atrium/ventricle is enlarged; the answer is Left atrium.**
- **Choices C** → **Pulmonary valve stenosis** causes increased right ventricle afterload, causing RVH
- **Choice D** → Conditions that cause RVH can cause right atrial hypertrophy. The ECG shows a **tall, peaked p-wave, called "P pulmonale"**
- **Choice E** → **RVH** can be described as **"Right Axis deviation on ECG"** or **"Right Bundle Branch Block"** or **"Wide Splitting of S2"**

Q46

A 48-year-old man comes to the physician for a routine examination. He has a 6-month history of angina. His mother died at the age of 56 years of coronary artery disease. Physical examination shows no abnormalities. Serum studies show a total cholesterol concentration of 450 mg/dL; LDL-cholesterol concentration is increased, and HDL-cholesterol and triglyceride concentrations are within the reference range. Following angiography and angioplasty of his circumflex coronary artery, treatment with a statin is begun. Statins are most likely to decrease this patient's serum cholesterol concentration by which of the following mechanisms?

- A. Decreased synthesis of VLDL
- B. Downregulation of the LDL receptors
- C. Downregulation of lecithin-cholesterol acetyltransferase (LCAT)
- D. Increased synthesis of VLDL
- E. Upregulation of the LDL receptors
- F. Upregulation of lecithin-cholesterol acetyltransferase (LCAT)

▼ Explanation

- **Answer is E (Upregulation of the LDL receptors)**
 - Q asks Statins decrease this patient's serum cholesterol concentration by which mechanism?
 - **Statins** *Inhibits HMG CoA reductase* (rate limiting enzyme of cholesterol synthesis) → less cholesterol synthesized by the body.
 - This causes **up-regulation of LDL receptors** → Cholesterol scattered around the body is picked-up by the LDL-receptors to the liver
 - Side effects: **Hepatotoxicity & Myopathy (especially if combined with fibrates)**



Statins + Fibrates = Myopathy (muscle pain & soreness) + **high CK levels** (muscles are breaking down)

- Fibrates + Statins ⇒ **Rhabdomyolysis** ⇒ **Acute Tubular Necrosis**



What are the mRNA levels of HMG CoA reductase in a patient that uses statins?

▼ Answer

mRNA levels of HMG CoA reductase **INCREASED**.

- You inhibit the production of the enzyme. This makes the body want to produce more, hence increase mRNA levels of that enzyme.



Patient taking statins & fibrates developed muscle pain, weakness, and dark urine. Why does combining these drugs cause these symptoms?

▼ Answer

CYP450 Inhibition

Q47

During an experiment, an investigator isolates an abnormal elastin with unusual instability from the connective tissue of mice. Analysis of the elastin shows a decreased number of desmosine cross-links. Upon amino acid analysis, the concentration of which of the following amino acids in the abnormal protein would be most likely different when compared with normal elastin?

- A. Arginine
- B. Glycine
- C. Histidine
- D. Lysine
- E. Proline

▼ Explanation

- **Answer is D (Lysine)**
 - Q says unstable form of connective tissue analysis of the elastin shows decreased number of desmosine cross-links, and asks this is due to decreased concentration of which amino acid?
 - **Cross-linking** is the final step in collagen synthesis pathway
 - **Lysyl Oxidase** (Copper-dependent enzyme) **cross-links tropocollagen molecules to form a collagen fibril.**
 - **Abnormal Cross-Linking causes Ehler Danlos Syndrome or Menkes Syndrome (Copper deficiency)**

Q48

A 35-year-old woman with newly diagnosed hypertension comes to the physician for a follow-up examination. Her blood pressure today is 153/106 mm Hg in the right upper extremity and 156/104 mm Hg in the left upper extremity. A bruit is heard just lateral to the umbilicus on the right side of the abdomen. Laboratory studies show:

Serum	
K ⁺	3.3 mEq/L
Urea nitrogen	14 mg/dL
Glucose	80 mg/dL
Creatinine	1 mg/dL
Urine	
Blood	none
Protein	1+

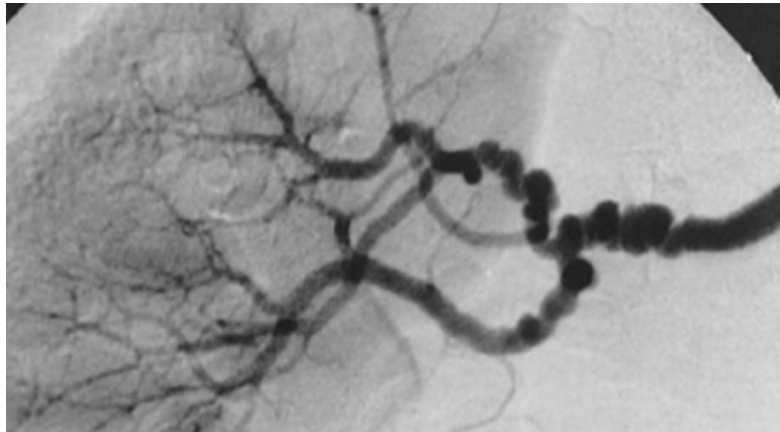
Which of the following additional diagnostic tests is most appropriate to establish the cause of this patient's hypertension?

- A. Measurement of plasma aldosterone concentration
- B. Measurement of plasma metanephrine concentration
- C. Measurement of urine free cortisol concentration
- D. CT scan of the adrenal glands
- E. MR angiography of the renal arteries

▼ Explanation

- **Answer is E (MR angiography of the renal arteries)**
 - **IMP Clues**
 - 35-year-old woman with newly diagnosed hypertension (Hypertension by that age in a woman is a red flag for secondary HTN)
 - A bruit is heard just lateral to the umbilicus on the right side of the abdomen (A 35F + HTN + renal bruit, cmon this is FMD)
 - Serum K low (Low K usually means high aldosterone, which makes sense here as FMD causes decreased renal flow, causing high AT-2 & Aldosterone, causing HTN & hypokalemia)

- Dx → **Fibromuscular Dysplasia (FMD)**
 - Can sometimes be referred to as **“Renal Artery Dysplasia”** on NBMEs
 - It is not a dysplasia really, it is **hyperplasia of the tunica media**
 - It is an **autoimmune disease that affects classically middle-aged women with NO hx of cardiovascular disease**
 - Causes the **“string of beads”** appearance on CT angiography (or MR Angiography like here, doesn't matter just angio)
 - My opinion, knowing the CT scans will not help you as much as looking for risk factors like Age, hx of CVD, or other HY findings (listed below)



You will get this type of Q on every NBME, so let's run through what you need to know

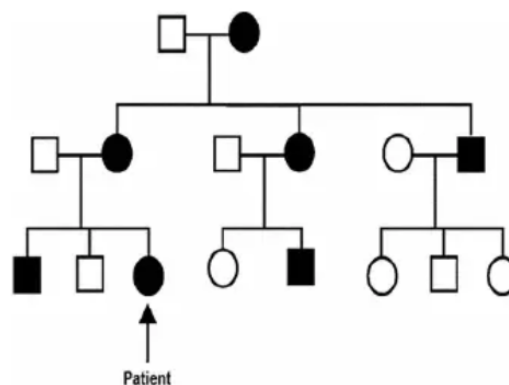
- **50-60y Male OR Female + hx of cardiovascular disease / atherosclerosis / smoking?**
 - Dx → **Atherosclerosis**
 - Vignettes can be tricky by saying **“BMI is 35”** or **“a carotid bruit is heard on examination”** instead of atherosclerosis.
 - BMI is high usually means he's atherosclerotic especially in this age group
 - If a patient has a carotid bruit, which is due to atherosclerosis, chances are he also has atherosclerotic arteries in other sites (Renal Artery)
- **20-40y F + NO hx of cardiovascular disease / atherosclerosis / smoking?**
 - Dx → **FMD**
- **20-40y F + was given ACEi/ARBs + Creatinine levels have risen. What is diagnosis?**
 - **FMD**
- **64M + was given ACEi/ARBs + Creatinine levels have risen. What is diagnosis?**
 - **Atherosclerotic Renal Artery**
- **55F + was given ACEi/ARBs + Creatinine levels have risen. What is diagnosis?**
 - **Atherosclerotic Renal Artery**

Reason is in **FMD or Atherosclerosis**, the renal blood supply is **decreased**, but the body adapts by **producing renin & AT-2**, which causes **vasoconstriction** of the **efferent renal arterioles** → **maintains GFR**

If **ACEi/ARBs** are administered, efferent arterioles dilate → **decreased GFR** → **creatinine rises**.

Q49

A 17-year-old girl comes to the emergency department because of a 4-day history of constant headache and vomiting following mild exercise. Today, she developed right-sided weakness and slurred speech. She has no history of major medical illness and takes no medications. Her vital signs are within normal limits. Physical examination shows right-sided hemiparesis. Serum studies show increased concentrations of pyruvate and lactate. Immunohistochemical staining of a muscle biopsy specimen shows a deficiency of NADH dehydrogenase activity. A pedigree is shown; the patient is indicated by the arrow. Which of the following is the most likely mode of inheritance of the disorder in this patient?



- Autosomal dominant
- Autosomal recessive
- Mitochondrial
- Multifactorial
- X-linked dominant

▼ Explanation

- **Answer is C (Multifactorial)**

- **IMP Clues**

- Headache and vomiting following mild exercise
- Right-sided weakness and slurred speech + Right-sided hemiparesis (Stroke-like episodes IN A 17-YEAR-OLD GIRL)
- Serum studies show increase concentrations of pyruvate and lactate
- Immunohistochemical staining of a muscle biopsy specimen shows a deficiency of NADH dehydrogenase activity (Don't get freaked out by this sentence here, basically NADH dehydrogenase is a mitochondrial enzyme, complex 1 ETC)

- **Dx → MELAS**

- MELAS stands for **Mitochondrial Encephalopathy, Lactic Acidosis, and Stroke-like Episodes**

- **Mitochondrial Encephalopathy** (Migraine-like headaches, Multiple left-sided focal seizures, Hearing loss)
- **Lactic Acidosis** (CSF & Serum concentrations of lactic acid are increased)
- **Stroke-like Episodes** (Weakness of the right upper & lower extremities, Loss of vision in one half of visual field)

- It is one of the **mitochondrial diseases**, which follow a **maternal pattern of transmission (female → all of her children)**

┆ *"The pedigree shown here is bullshit. The real deal will have an accurate one. You don't even need the pedigree to answer these Q tbn."*

- **Pathophysiology**

- **Mutation in mitochondrial tRNA genes** (most HY & worth knowing is → **MT-TL1, "mitochondrial-tRNA Leu"**)
- Fucked up mitochondria → **impaired oxidative phosphorylation → impaired ATP production → increased anaerobic respiration → Increased Lactic acid & Pyruvate accumulation**
 - *NADH dehydrogenase is an ETC (complex 1) enzyme. If the mitochondria are all fucked up, then chance are most of their enzymes will be too. Don't freak out.*
- Biopsy shows **Ragged-red Fibers** (seen with **Gomori stain**, which stains mitochondria red) & USMLE can refer to it as **"abnormal accumulation of mitochondria under sarcolemma"**

Q50

A 10-year-old girl is brought to the physician by her mother for a well-child examination. She has not yet had a menstrual period. She is at the 50th percentile for height and weight. Physical examination shows absence of breast bud development and no pubic or axillary hair. The mother asks how she will know when her daughter begins puberty. It is most appropriate for the physician to tell the mother that the first objective sign of puberty will be which of the following?

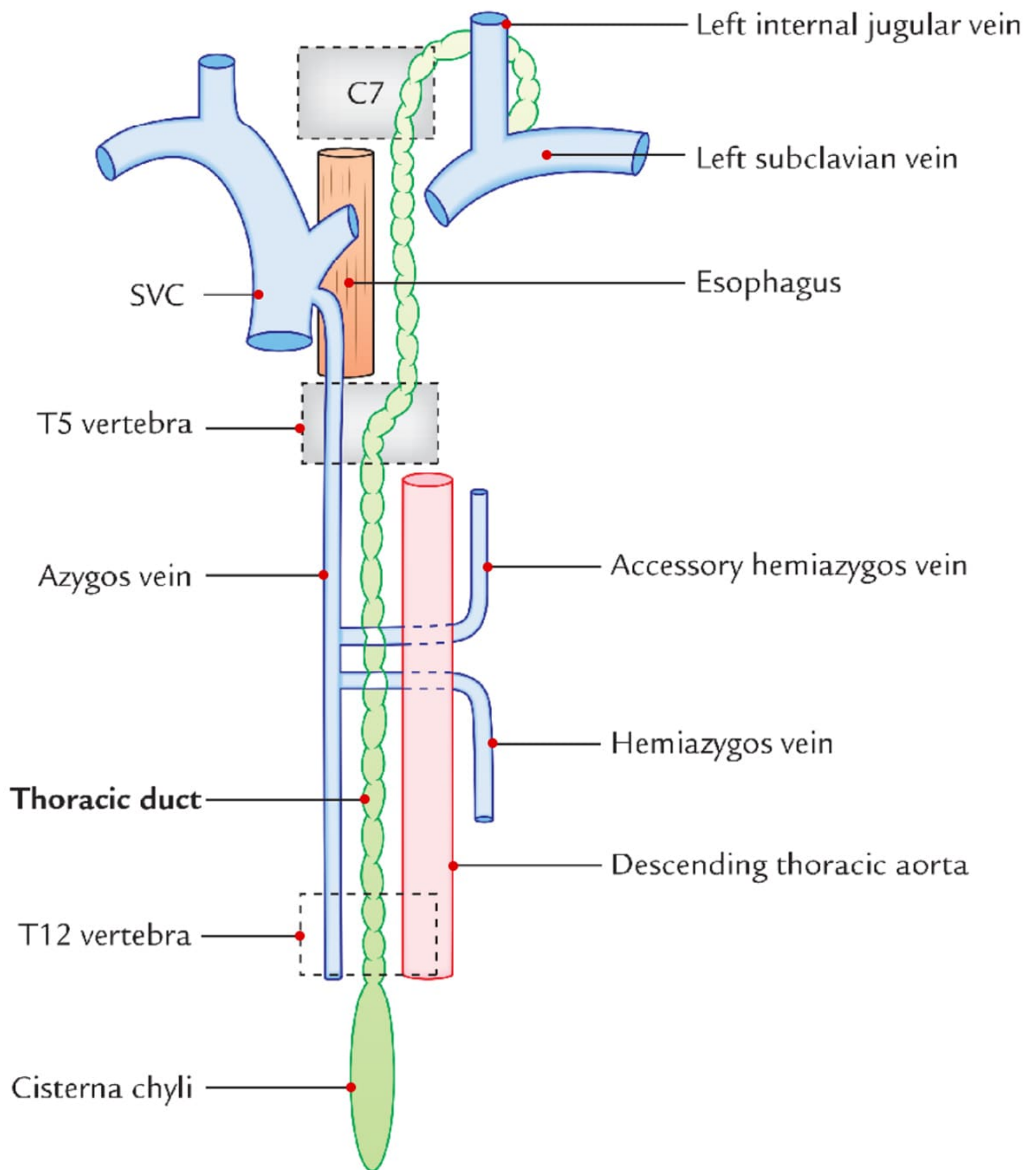
- A. Breast bud development
- B. Development of axillary hair
- C. Development of pubic hair
- D. Onset of menses
- E. Rapidly increasing height

▼ Explanation

- **Answer is A (Breast bud development)**

- This is simple. For USMLE all you need to know regarding puberty is:

1. **First Objective Sign of Puberty in females is Thelarche (Breast bud development), and Testicular enlargement in males.**
2. **In girls, puberty starts at age 8-11**, so if a mother came to you with her daughter, which upon examining her found **breast bud & few pubic hairs** in these years, then **SHE IS NORMAL**.
3. **Bilateral gynecomastia** (can be described as **tender breast in a teenage boy**) is **NORMAL** and requires no intervention. **Follow-up** will be the answer to these Qs.
4. Puberty causes surge in androgens level, which **stimulate apocrine glands** in the armpits & groin ⇒ **Source of the sweaty, bad odor.**





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