Forberedelseskurs MD/DDS opptaksprøven i Krakow

Del 2: Biologi

Forberedelseskurs 3

- **AMANDA AASBERG BRUKAAS**
- 28 ÅR, OSLO
- *3 MD*
- *B.SC BIOINGENIØR, NTNU*
- *2 ÅR KIROPRAKTOR, SDU*
- 9 ÅR SYKEHJEM
- 6 ÅR LEGEKONTOR
- 2 ÅR SYKEHUS
- **AMANDA-AB@HOTMAIL.COM**

Dagens slagplan: 45 min

- Taktisk kartlegging av opptaksprøven
- Gjennomgang av utvalgte spørsmål
- Oppsummering/tips og triks

Spørsmål på chat
Ikke lov med opptak

Taktisk kartlegging av opptaksprøven

Taktisk kartlegging av opptaksprøven: Pensum

- *DNA composition: 4 underkategorier*
- *RNAs diversity: 9 underkategorier*
- *Gene expression: 8 uk*
- *Enzymes: 4 underkategorier*
- *Cell life: 12 underkategorier*
- *Metabolism of the cell: 5 uk*
- *Cell communication and signaling: 6 uk*
- *Cell division: 6 uk*
- *Cancer: 6 uk*
- *Microbiology: 8 uk*

- *Specialized eukaryotic tissues:*
  - *Nerve cell structure (4)*
  - *Muscle cell structure (4)*
  - *Skeletal structure (3)*
  - *Epithelial cells*
  - *Endothelial cells*
  - *Connective tissue*
  - *Endocrine system (9)*
  - *Sensory reception and processing (4)*
  - *Circulatory system (6)*
  - *Blood (4)*
  - *Immune system (8)*
  - *Digestive system (8)*
  - *Excretory system (3)*
  - *Respiratory system (3)*
  - *Skin system (1)*
  - *Reproduction system (3)*

Embryogenesis (4)

Taktisk kartlegging av opptaksprøven forts.

PENSUM

- Totalt: 68+63+4 = 135 underkategorier
  - **Specialized eukaryotic tissues:** 63/135= 47%
  - **The cell:** 60/135= 44%
  - Microbiology: 8/135= 6%
  - Embryogenesis= 4/135= 3% → OBS 2022

Taktisk kartlegging av opptaksprøven: Opptaksprøven

OPPTAKSPRØVEN

- 2021 MD: 47 biologi/33 kjemi/20 logikk (100)
- 2021 DDS: 47/33/20 (100)
- 2020 MD: 35/42/19 (97)
- 2020 DDS: 38/42/10 (91)
- 2019 MD: 37/33/28 (100)
- 2019 DDS: 40/36/33 (100)

- I år: 100 spml/180min = 108 sek/oppg (Ca 1.5 min)

Oppgavetype

- Biologi: Kombinasjon av tekstoppgaver, regneoppgaver og rene faktaoppgaver
- Kjemi: -
- Logikk: Lengre oppgaver, mange oppg i én tekst

Senere år: Mer teksttungt og korte regneoppgaver

OPPGAVER

Spørsmål 1 og 2

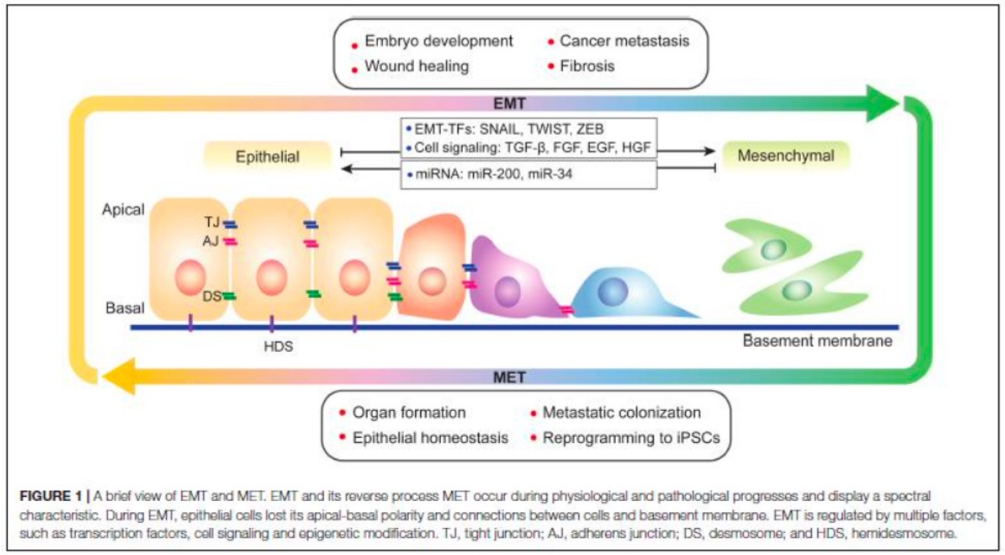


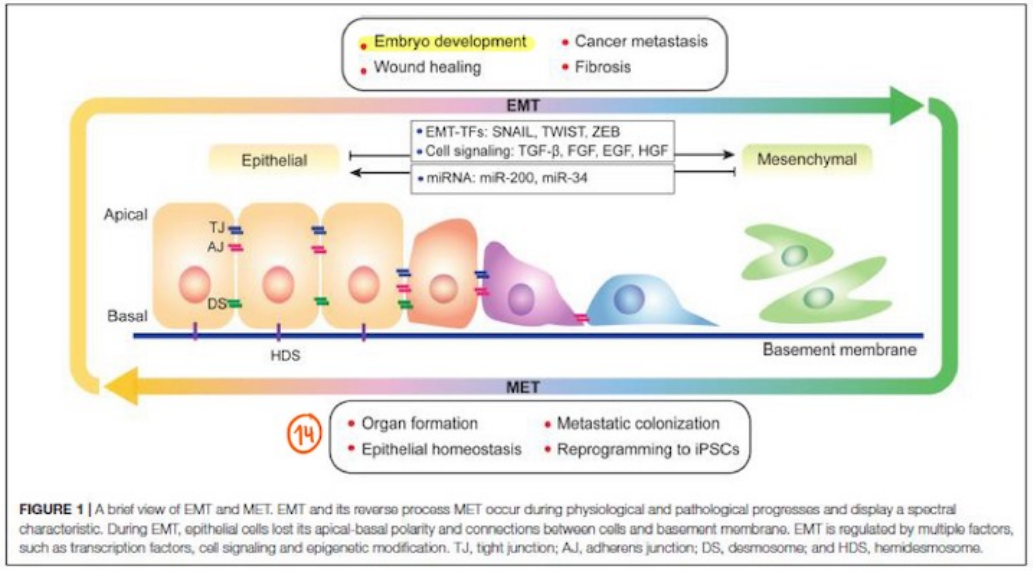
FIGURE 1 | A brief view of EMT and MET. EMT and its reverse process MET occur during physiological and pathological progresses and display a spectral characteristic. During EMT, epithelial cells lost its apical-basal polarity and connections between cells and basement membrane. EMT is regulated by multiple factors, such as transcription factors, cell signaling and epigenetic modification. TJ, tight junction; AJ, adherens junction; DS, desmosome; and HDS, hemidesmosome.

Epithelial-mesenchymal transition (EMT) is defined as a biological process in which epithelial cells lose their characteristics and acquire mesenchymal features. During EMT, epithelial cells lose cell-cell junctions, apical-basal polarity, epithelial markers, and acquire cell motility, a spindle-cell shape, and mesenchymal markers. (…) EMT and its reverse process: mesenchymal-epithelial transition (MET), display fundamental principles in diversified physiological and pathological progresses. During metazoan development, cells may sequentially undergo rounds of EMT and MET, as is seen in somite formation and heart development. EMT also occurs during wound healing in adults. (…) EMT also plays important roles in cancer progression and tissue fibrosis (Nieto et al., 2016; Pastushenko and Blanpain, 2019; Williams et al., 2019). Interestingly, during the processes of embryonic stem cells (ESCs) differentiation and induced pluripotent stem cells (iPSCs) formation, EMT and MET are highly relevant to the loss and acquisition of pluripotency (Peiet al., 2019). EMT and MET are widely involved in various biological scenarios and display highly plastic and dynamic manners during cell fate transitions (Figure 1). Epithelial-mesenchymal transition is regulated at different levels by multiple factors, including cell signaling, transcriptional control, epigenetic modification, and post-translational modifications (Figure 1).

14. In which of the processes listed below is EMT not involved?
    A. Cancer progression
    B. Wound healing
    C. Epigenetic modification
    D. Tissue fibrosis
    E. Stem cells differentiation

13. What conclusion can be drawn based on the information provided in the text?
    A. MET increases the motility and invasiveness of cancer cells from the primary tumor.
    B. iPSCs are involved in the embryonic development.
    C. EMT can be induced by RNA interference.
    D. MET takes place only in mesenchymal stem cells.
    E. EMT causes a reorganization of the cytoskeleton of the epithelial cell.

Svar spørsmål 1



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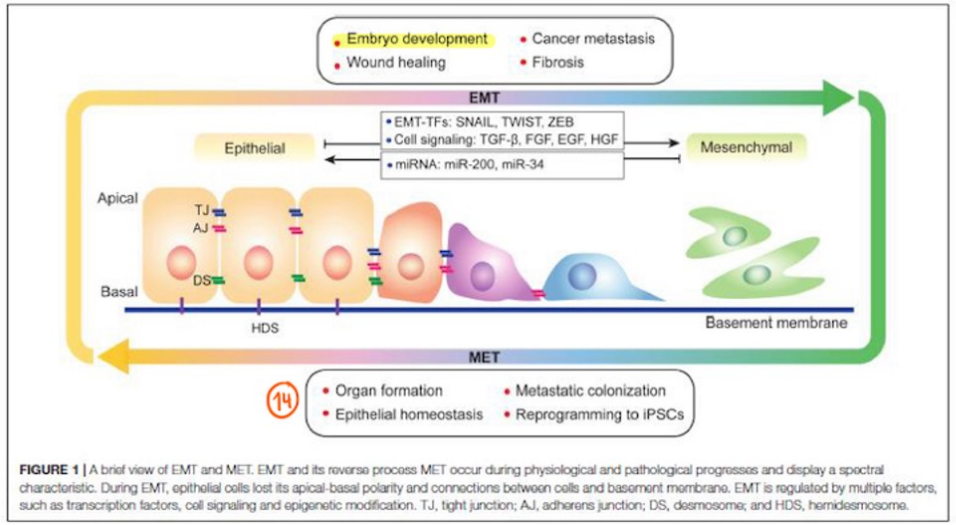
13. What conclusion can be drawn based on the information provided in the text?
    A. MET increases the motility and invasiveness of cancer cells from the primary tumor. /
    B. iPSCs are involved in the embryonic development. / → EMT
    C. EMT can be induced by RNA interference. / – MET
    D. MET takes place only in mesenchymal stem cells. /
    E. EMT causes a reorganization of the cytoskeleton of the epithelial cell.

Svar spørsmål 2



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14. In which of the processes listed below is EMT not involved?
    A. Cancer progression (cancer metastases)
    B. Wound healing
    C. Epigenetic modification
    D. Tissue fibrosis
    E. Stem cells differentiation (embryo development)

Spørsmål 3, 4 og 5

The following information refers to questions no. 15-17.

Bone is a dynamic organ composed of cells, matrix, and minerals. A healthy bone is made of osteoblasts, osteoclasts, osteocytes, and matrix. In humans, normal bone repair begins when the osteoclasts resorb old bone in order to create space for the new one. Meanwhile, the osteoblasts lay down a new bone in that area. The simultaneous occurrence of these processes allows the bone to maintain its strength. With age, however, bone modeling may be disrupted. Dissolved bone can be diverted to the serum, as a result of which bone loss exceeds bone replacement. The new bone created this way is prone to fracture. Osteoporosis results from reduced bone mass (osteopenia) while the bone matrix remains normally mineralized. Optimal serum levels of calcium are crucial to maintaining a healthy bone. Under-absorption of calcium by the gastrointestinal tract (GI) leads to reduced bone mass. Low levels of serum calcium activate a biofeedback system involving calcium, vitamin D, and parathyroid hormone. The activated system causes bone destruction in order to release calcium into the blood stream. Hyperparathyroidism, renal failure, and vitamin D deficiency also affect bones negatively. Drugs implicated in the development of osteoporosis include corticosteroids, which reduce bone mass, and phenytoin, which alters the vitamin D metabolism in the liver. Another factor that affects bone turnover is Paget's disease. In pagetic bone, the processes of resorption and formation are accelerated and result in dense and chaotic structure. Pagetic bone bears little structural resemblance to the honey-comb appearance of a healthy one. Moreover, osteoclasts contain fifty to one hundred nuclei per cell, while in a healthy bone there are four to ten. These osteoclasts are also bigger and more numerus than in a healthy bone.

15. Which of the following statements is true:
    A. Because of Paget's disease, bones are more prone to fracture.
    B. Corticosteroids are used in the treatment of osteoporosis.
    C. Thyroid function does not affect bone formation.
    D. The functioning of the digestive tract has no impact on bone structure.
    E. Phenytoin reduces the vitamin D metabolism in the liver.
16. What kind of pharmaceutical would you administer to a patient with osteoporosis? The one that:
    A. Inhibits the effects of osteoblasts.
    B. Increases the production of osteoclasts.
    C. Decreases both bone resorption and bone formation.
    D. Decreases bone resorption without affecting bone formation.
    E. Decreases the mineralization of bone matrix.
17. In Paget's disease, increased vascularization is observed in the affected bone. Indicate which of the possible effects on the body listed below is NOT likely to occur as a result of that:
    A. Pagetic bone can pose a risk of serious bleeding if fractured.
    B. Pagetic bone can exert an extra strain on cardiac tissue.
    C. Increased warmth can be detected directly over the site of pagetic bone.
    D. Decreased hemoglobin concentrations can occur in areas of non-pagetic bone.
    E. Abnormal bone formation is associated with recruitment of abnormal blood vessels.

Svar spørsmål 3

Bone is a dynamic organ composed of cells, matrix, and minerals. A healthy bone is made of osteoblasts, osteoclasts, osteocytes, and matrix. In humans, normal bone repair begins when the osteoclasts resorb old bone in order to create space for the new one. Meanwhile, the osteoblasts lay down a new bone in that area. The simultaneous occurrence of these processes allows the bone to maintain its strength. With age, however, bone modeling may be disrupted. Dissolved bone can be diverted to the serum, as a result of which bone loss exceeds bone replacement. The new bone created this way is prone to fracture. Osteoporosis results from reduced bone mass (osteopenia) while the bone matrix remains normally mineralized. Optimal serum levels of calcium are crucial to maintaining a healthy bone. Under-absorption 15D of calcium by the gastrointestinal tract (GI) leads to reduced bone mass. Low levels of serum calcium 15C activate a biofeedback system involving calcium, vitamin D, and parathyroid hormone. The activated system causes bone destruction in order to release calcium into the blood stream. Hyperparathyroidism, renal failure, and vitamin D deficiency also affect bones negatively. Drugs implicated in the development of 15B osteoporosis include corticosteroids, which reduce bone mass, and phenytoin, which alters the vitamin D +E metabolism in the liver. Another factor that affects bone turnover is Paget's disease. In pagetic bone, the processes of resorption and formation are accelerated and result in dense and chaotic structure. Pagetic 17 bone bears little structural resemblance to the honey-comb appearance of a healthy one. Moreover, osteoclasts contain fifty to one hundred nuclei per cell, while in a healthy bone there are four to ten. These osteoclasts are also bigger and more numerus than in a healthy bone.

15. Which of the following statements is true:
    A. Because of Paget's disease, bones are more prone to fracture.
    B. Corticosteroids are used in the treatment of osteoporosis. / Causes osteoporosis
    C. Thyroid function does not affect bone formation. / PTH
    D. The functioning of the digestive tract has no impact on bone structure. / Vit D i tarm (bl.a)
    E. Phenytoin reduces the vitamin D metabolism in the liver. / Alters

Svar spørsmål 4

Bone is a dynamic organ composed of cells, matrix, and minerals. A healthy bone is made of osteoblasts, osteoclasts, osteocytes, and matrix. In humans, normal bone repair begins when the osteoclasts resorb old bone in order to create space for the new one. Meanwhile, the osteoblasts lay down a new bone in that area. The simultaneous occurrence of these processes allows the bone to maintain its strength. With age, however, bone modeling may be disrupted. Dissolved bone can be diverted to the serum, as a result of which bone loss exceeds bone replacement. The new bone created this way is prone to fracture. Osteoporosis results from reduced bone mass (osteopenia) while the bone matrix remains normally mineralized. Optimal serum levels of calcium are crucial to maintaining a healthy bone. Under-absorption 15D of calcium by the gastrointestinal tract (GI) leads to reduced bone mass. Low levels of serum calcium 15C activate a biofeedback system involving calcium, vitamin D, and parathyroid hormone. The activated system causes bone destruction in order to release calcium into the blood stream. Hyperparathyroidism, renal failure, and vitamin D deficiency also affect bones negatively. Drugs implicated in the development of 15B osteoporosis include corticosteroids, which reduce bone mass, and phenytoin, which alters the vitamin D +E metabolism in the liver. Another factor that affects bone turnover is Paget's disease. In pagetic bone, the processes of resorption and formation are accelerated and result in dense and chaotic structure. Pagetic 17 bone bears little structural resemblance to the honey-comb appearance of a healthy one. Moreover, osteoclasts contain fifty to one hundred nuclei per cell, while in a healthy bone there are four to ten. These osteoclasts are also bigger and more numerus than in a healthy bone.

16. What kind of pharmaceutical would you administer to a patient with osteoporosis? The one that:
    A. Inhibits the effects of osteoblasts. = ↓Bone formation
    B. Increases the production of osteoclasts. = ↑ Bone resorption
    C. Decreases both bone resorption and bone formation. = ↔ No change
    D. Decreases bone resorption without affecting bone formation. = ↓ bone res.
    E. Decreases the mineralization of bone matrix. = ↓Bone formation

Svar spørsmål 5

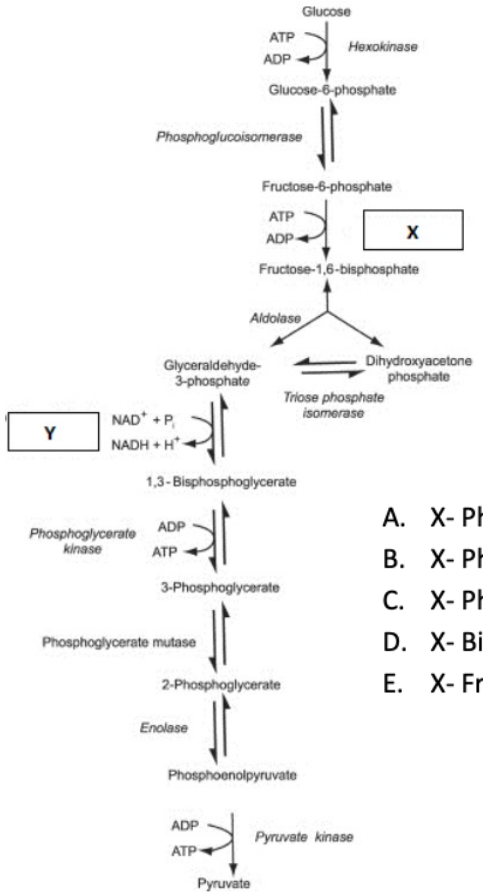
Bone is a dynamic organ composed of cells, matrix, and minerals. A healthy bone is made of osteoblasts, osteoclasts, osteocytes, and matrix. In humans, normal bone repair begins when the osteoclasts resorb old bone in order to create space for the new one. Meanwhile, the osteoblasts lay down a new bone in that area. The simultaneous occurrence of these processes allows the bone to maintain its strength. With age, however, bone modeling may be disrupted. Dissolved bone can be diverted to the serum, as a result of which bone loss exceeds bone replacement. The new bone created this way is prone to fracture. Osteoporosis results from reduced bone mass (osteopenia) while the bone matrix remains normally mineralized. Optimal serum levels of calcium are crucial to maintaining a healthy bone. Under-absorption 15D of calcium by the gastrointestinal tract (GI) leads to reduced bone mass. Low levels of serum calcium 15C activate a biofeedback system involving calcium, vitamin D, and parathyroid hormone. The activated system causes bone destruction in order to release calcium into the blood stream. Hyperparathyroidism, renal failure, and vitamin D deficiency also affect bones negatively. Drugs implicated in the development of 15B osteoporosis include corticosteroids, which reduce bone mass, and phenytoin, which alters the vitamin D +E metabolism in the liver. Another factor that affects bone turnover is Paget's disease. In pagetic bone, the processes of resorption and formation are accelerated and result in dense and chaotic structure. Pagetic 17 bone bears little structural resemblance to the honey-comb appearance of a healthy one. Moreover, osteoclasts contain fifty to one hundred nuclei per cell, while in a healthy bone there are four to ten. These osteoclasts are also bigger and more numerus than in a healthy bone.

17. In Paget's disease, increased vascularization is observed in the affected bone. Indicate which of the possible effects on the body listed below is NOT likely to occur as a result of that:
    A. Pagetic bone can pose a risk of serious bleeding if fractured. ✓ (vascular)
    B. Pagetic bone can exert an extra strain on cardiac tissue. ✓ (vascular)
    C. Increased warmth can be detected directly over the site of pagetic bone. ✓ (vascular)
    D. Decreased hemoglobin concentrations can occur in areas of non-pagetic bone.
    E. Abnormal bone formation is associated with recruitment of abnormal blood vessels. ✓

Spørsmål 6

18. The name of an enzyme is often derived from the name of its substrate or the chemical reaction which it catalyzes, with an *–ase* at the end. Different types of enzymes catalyze different reactions, for example:
    - Oxidoreductases: catalyze oxidation/reduction reactions (also commonly named as *"donor"*-dehydrogenase or *"acceptor"*-reductase)
    - Transferases: transfer a functional group (e.g. a methyl or phosphate group)
        - Kinases: catalyze the transfer of phosphate groups from high-energy, phosphate-donating molecules to specific substrates
    - Hydrolases: catalyze the hydrolysis of various bonds
    - Isomerases: catalyze isomerization changes within a single molecule

What are the correct names of the missing enzymes (X and Y) in the presented pathway?



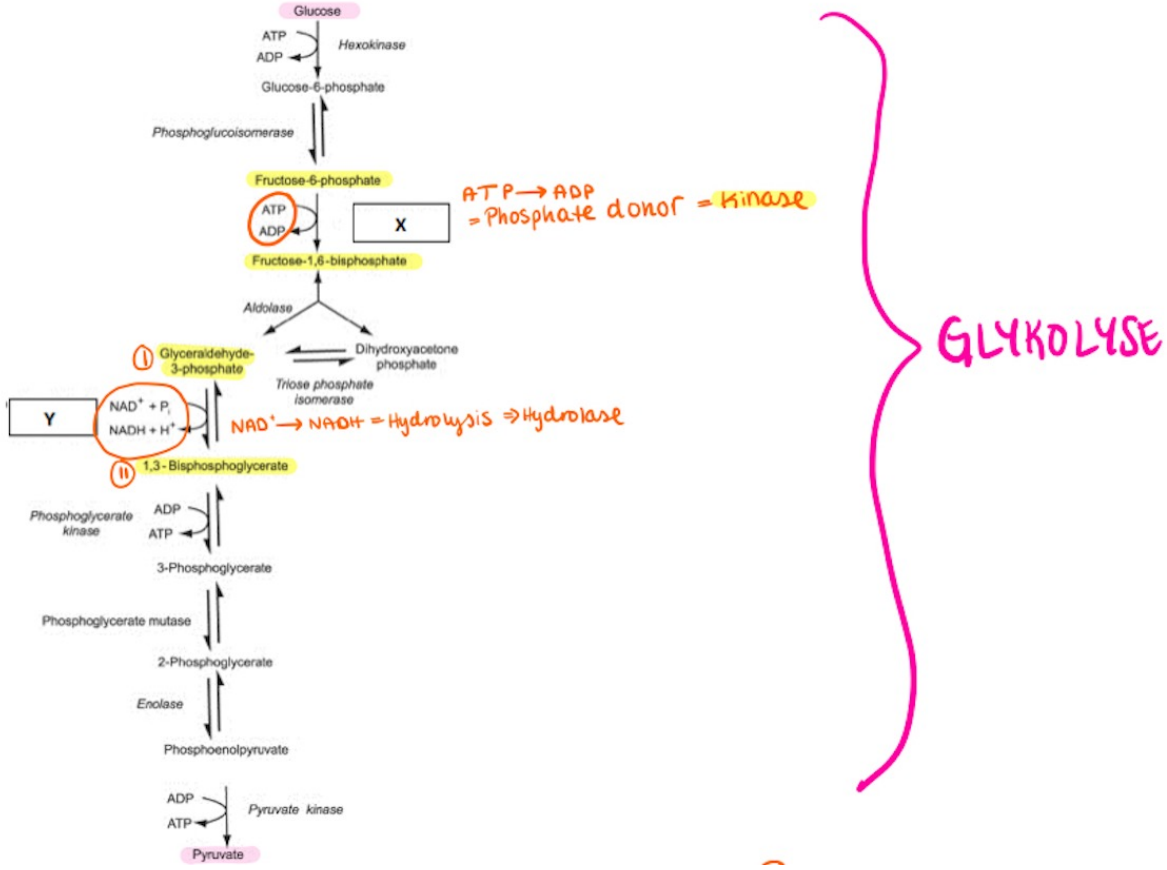
A. X- Phosphofructokinase, Y- 1,3- Bisphosphoglycerate dehydrogenase
B. X- Phosphofructo isomerase, Y- Glyceraldehyde-3-phosphate reductase
C. X- Phosphofructokinase, Y- Glyceraldehyde-3-phosphate dehydrogenase
D. X- Bisphosphofructokinase, Y- Glyceraldehyde-3-phosphate isomerase
E. X- Fructose-6-phosphate reductase, Y- 1,3- Bisphosphoglycerate dehydrogenase

Svar spørsmål 6

18. The name of an enzyme is often derived from the name of its substrate or the chemical reaction which it catalyzes, with an *–ase* at the end. Different types of enzymes catalyze different reactions, for example:
    - Oxidoreductases: catalyze oxidation/reduction reactions (also commonly named as *"donor"*-dehydrogenase or *"acceptor"*-reductase)
    - Transferases: transfer a functional group (e.g. a methyl or phosphate group)
        - Kinases: catalyze the transfer of phosphate groups from high-energy, phosphate-donating molecules to specific substrates
    - Hydrolases: catalyze the hydrolysis of various bonds
    - Isomerases: catalyze isomerization changes within a single molecule

    A. X- Phosphofructokinase, Y- 1,3- Bisphosphoglycerate dehydrogenase (II)
    B. X- Phosphofructo isomerase, Y- Glyceraldehyde-3-phosphate reductase
    C. X- Phosphofructokinase, Y- Glyceraldehyde-3-phosphate dehydrogenase (I)
    D. X- Bisphosphofructokinase, Y- Glyceraldehyde-3-phosphate isomerase
    E. X- Fructose-6-phosphate reductase, Y- 1,3- Bisphosphoglycerate dehydrogenase

What are the correct names of the missing enzymes (X and Y) in the presented pathway?



Spørsmål 7

23. Ultrasound is a sound of a frequency higher than 20 kHz (which is above the human hearing range). It is commonly used in medicine for sonography. In sonography, ultrasonic waves are sent through the body, and the reflected waves that bounce off from different tissues are measured and translated by a computer into a visual image. Various tissues have characteristic attenuation coefficients (**Table 1**) which illustrate how quickly the beam is attenuated as it passes through them. The lower the coefficient, the more transparent this particular medium is to the beam.

Table 1. Attenuation coefficients of sound in various bodily tissues

Substance	Attenuation coefficient [dB / (MHz x cm)]
Air	1.64
Blood	0.2
Cortical Bone	6.9
Brain	0.6
Cardiac	0.52
Enamel	120

(Source: Culjat, Martin O.; Goldenberg, David; Tewari, Priyamvada; Singh, Rahul S. (2010). A Review of Tissue Substitutes for Ultrasound Imaging. *Ultrasound in Medicine & Biology* 36 (6): 861–873.)

If a sonography machine emits a sound wave of 2 MHz into a soft tissue, what would be the size of the wavelength, given that the speed of sound in a soft tissue is 1540 m/s? (Wave equation → $v = \lambda f$; where v-speed, λ-wavelength, f-frequency)

A. 0.0077 m
B. 7.7×10^{-5} m
C. 0.77 m
D. 77 mm
E. 0.77 mm

Svar spørsmål 7

If a sonography machine emits a sound wave of 2 MHz into a soft tissue, what would be the size of the wavelength, given that the speed of sound in a soft tissue is 1540 m/s? (Wave equation → v =λf; where v-speed, λ-wavelength, f-frequency)

A. 0.0077 m
B. 7.7×10^{-5} m
C. 0.77 m
D. 77 mm
E. 0.77 mm

$v = \lambda f$ — frequency; speed; wavelength

$$v = \lambda f$$

$$\lambda = \frac{v}{f} = \frac{1540\ m/s}{2\ MHz} = \frac{1540\ m/s}{2 \cdot 10^6\ Hz} = 0{,}00077\ m = \underline{0{,}77\ mm}$$

Spørsmål 8

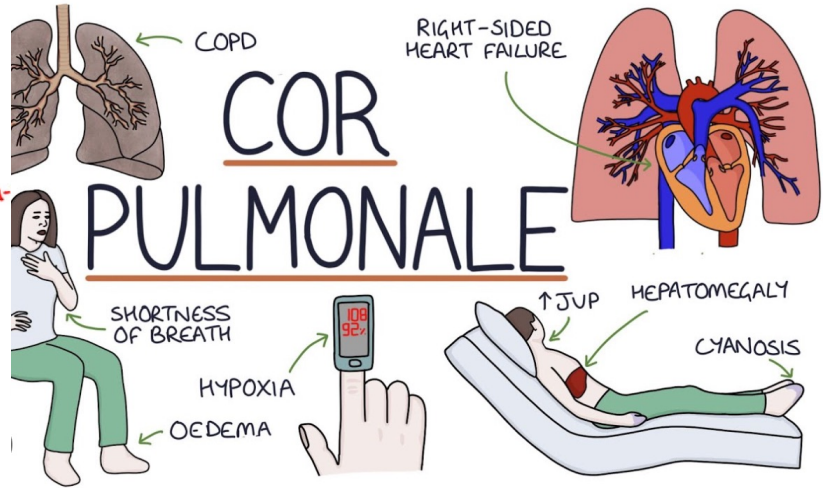
29. Advanced form of chronic obstructive pulmonary disease (COPD) leads to a high pressure on the lung arteries, which strains the right ventricle of the heart. This condition, referred to as cor pulmonale, presents with symptoms such as leg swelling and bulging neck veins.
    X- COPD may be instigated by the high pressure on the lung arteries.
    Y- The strain on the right ventricle of the heart causes leg swelling and bulging of neck arteries.

Based on the given information, it can be concluded that:

A. X is true but Y is false.
B. X is false but Y is true.
C. Both X and Y are true.
D. Both X and Y are true, and X leads to Y.
E. Both X and Y are false.

Svar spørsmål 8

29. Advanced form of chronic obstructive pulmonary disease (COPD) leads to a high pressure on the lung arteries, which strains the right ventricle of the heart. This condition, referred to as cor pulmonale, presents with symptoms such as leg swelling and bulging neck veins.
X- COPD may be instigated by the high pressure on the lung arteries. / NO: Emphysema + chronic bronchitis → inflammation
Y- The strain on the right ventricle of the heart causes leg swelling and bulging of neck arteries. ✓
↳ Right sided heart failure (RHF)



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B. X is false but Y is true.
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D. Both X and Y are true, and X leads to Y.
E. Both X and Y are false.

Lung disease → High pulmonary pressure → RHF → Leg swelling + JVD

Spøsrsmål 9

39. *Milli-* (symbol m) is a unit prefix in the metric system denoting a factor of one thousandth (10^{-3}). A mole is X grams of a substance, where X is its relative molecular mass (molecular weight). Molar solutions have a concentration of 1 mole of the substance in 1 litre of solution. 1 mole of glucose weights 180 grams (g). The 3 millimolar solution (3 mM) of glucose contains?

    A. 180 milligrams of glucose per litre
    B. 0.54 g of glucose per litre
    C. 180 milligrams of glucose per 100 ml
    D. 540 milligrams per 100 ml
    E. None of the above is true

Svar spørsmål 9

39. *Milli-* (symbol m) is a unit prefix in the metric system denoting a factor of one thousandth (10^{-3}). A mole is X grams of a substance, where X is its relative molecular mass (molecular weight). Molar solutions have a concentration of 1 mole of the substance in 1 litre of solution. 1 mole of glucose weights 180 grams (g). The 3 millimolar solution (3 mM) of glucose contains?

1-1

A. 180 milligrams of glucose per litre
B. 0.54 g of glucose per litre
C. 180 milligrams of glucose per 100 ml
D. 540 milligrams per 100 ml
E. None of the above is true

3mM contains:

- $180\,g \cdot (3 \cdot 10^{-3}\,M) = 0{,}54\,g$
- $180\,g \cdot 0{,}003\,M = 0{,}54\,g$

Spørsmål 10

40. A kilocalorie (kcal) is the amount of energy needed to raise the temperature of one litre of water by one degree Celsius (centigrade). Basal metabolic rate (BMR) is the total number of calories that your body needs to perform the basic, life-sustaining functions. BMR of a 20-year-old, moderately active man (80 kg weight, 180 cm height) is c.a. 2300 kcal. This energy increases the temperature of 1 cubic meter of water by?
    A. 46 degrees Celsius
    B. 23 degrees Celsius
    C. 0.23 degrees Celsius
    D. 2.3 degrees Celsius
    E. 4.6 degrees Celsius

Svar spørsmål 10

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A. 46 degrees Celsius
B. 23 degrees Celsius
C. 0.23 degrees Celsius
D. 2.3 degrees Celsius
E. 4.6 degrees Celsius

$1\,kcal/L$

$1\,m^3 = 1000\,L$

$°C = \frac{2300\,kcal}{1000} = 2{,}3°C$

Spørsmål 11 og 12

The following information refers to questions no. 46-47.

The half-maximal inhibitory concentration **(IC_{50})** is a measure of the potency of a substance in inhibiting a specific biological or biochemical function. IC_{50} is a quantitative measure that indicates how much of a particular inhibitory substance (e.g. drug) is needed to inhibit a given biological process or biological component by 50%. Inhibition of dihydrofolate reductase (DHFR) represents an important mechanism of action of potential antimicrobial drugs. The inhibitory activity against DHFR of three compounds: X, Y, and Z is presented (as IC_{50} of each compound in microM/L) in the table.

Inhibitor	Human DHFR	Protozoan DHFR	Bacterial DHFR
X	260	0,07	0,005
Y	0,7	0,0005	2,5
Z	0,001	0,1	Not active

46. Which of the statements is correct?

A. X is the strongest drug to kill protozoa.
B. Y is the strongest drug to kill bacteria.
C. The use of Z may pose the highest risk of adverse effects.
D. Y seems to be safer than X.
E. None of above answers is correct

47. Which of the statements is NOT correct?

A. X could be a good candidate for treating bacterial urinary tract infection.
B. Y could be a good candidate for treating malaria.
C. Z could be a good candidate in the treatment of human neoplasm.
D. One could expect more adverse effects from using X as compared to Y.
E. Z is not useful in the treatment of bacterial lung inflammation.

Svar spørsmål 11

The following information refers to questions no. 46-47.

The half-maximal inhibitory concentration **(IC_{50})** is a measure of the potency of a substance in inhibiting a specific biological or biochemical function. IC_{50} is a quantitative measure that indicates how much of a particular inhibitory substance (e.g. drug) is needed to inhibit a given biological process or biological component by 50%. Inhibition of dihydrofolate reductase (DHFR) represents an important mechanism of action of potential antimicrobial drugs. The inhibitory activity against DHFR of three compounds: X, Y, and Z is presented (as IC_{50} of each compound in microM/L) in the table.

Inhibitor	Human DHFR	Protozoan DHFR	Bacterial DHFR
X	260	0,07	0,005 ↑
Y	0,7	0,0005 ↑	2,5
Z	0,001 ↑	0,1	Not active

Most potent = ↓IC_{50}

46. Which of the statements is correct?

A. X is the strongest drug to kill protozoa. /
B. Y is the strongest drug to kill bacteria.
C. The use of Z may pose the highest risk of adverse effects. Ex: Bredspektret antibiotika
D. Y seems to be safer than X. /
E. None of above answers is correct

Svar spørsmål 12

The following information refers to questions no. 46-47.

The half-maximal inhibitory concentration **(IC_{50})** is a measure of the potency of a substance in inhibiting a specific biological or biochemical function. IC_{50} is a quantitative measure that indicates how much of a particular inhibitory substance (e.g. drug) is needed to inhibit a given biological process or biological component by 50%. Inhibition of dihydrofolate reductase (DHFR) represents an important mechanism of action of potential antimicrobial drugs. The inhibitory activity against DHFR of three compounds: X, Y, and Z is presented (as IC_{50} of each compound in microM/L) in the table.

Inhibitor	Human DHFR	Protozoan DHFR	Bacterial DHFR
X	260	0,07	0,005 ↑
Y	0,7	0,0005 ↑	2,5
Z	0,001 ↑	0,1	Not active

Most potent = ↓IC50

47. Which of the statements is NOT correct?

A. X could be a good candidate for treating bacterial urinary tract infection. ✓
B. Y could be a good candidate for treating malaria. ✓ (Protozo)
C. Z could be a good candidate in the treatment of human neoplasm. ✓
D. One could expect more adverse effects from using X as compared to Y. ✗
E. Z is not useful in the treatment of bacterial lung inflammation. ✓

Spørsmål 13 og 14

The following information refers to questions no. 9 and 10.

DNA molecules are very long chains, so in order to fit within the nucleus they are wrapped around "packaging" proteins called histones. In the interphase, histones with wrapped DNA are visible in the electron microscope as distinct units called nucleosomes

9. Histones allow for:
   A. Mixing of genetic information between and among gene segments.
   B. Enzyme synthesis within the nucleus.
   C. Packaging of DNA in the nucleus.
   D. "Packaging" protein synthesis in the nucleosomes.
   E. Efficient packaging of the nucleolus.
10. Nucleosomes refer to:
   A. Structural units of the nucleotide bases.
   B. Structural units of DNA/histone complex.
   C. Functional subunits of histones.
   D. Functional units of the nucleolus.
   E. Structural units of the nuclear envelope.

Svar spørsmål 13

The following information refers to questions no. 9 and 10.

DNA molecules are very long chains, so in order to fit within the nucleus they are wrapped around "packaging" proteins called histones. In the interphase, histones with wrapped DNA are visible in the electron microscope as distinct units called nucleosomes

9 10

9. Histones allow for:
   A. Mixing of genetic information between and among gene segments.
   B. Enzyme synthesis within the nucleus.
   C. Packaging of DNA in the nucleus.
   D. "Packaging" protein synthesis in the nucleosomes.
   E. Efficient packaging of the nucleolus.

Svar spørsmål 14

The following information refers to questions no. 9 and 10.

DNA molecules are very long chains, so in order to fit within the nucleus they are wrapped around 9
"packaging" proteins called histones. In the interphase, histones with wrapped DNA are visible in the 10
electron microscope as distinct units called nucleosomes

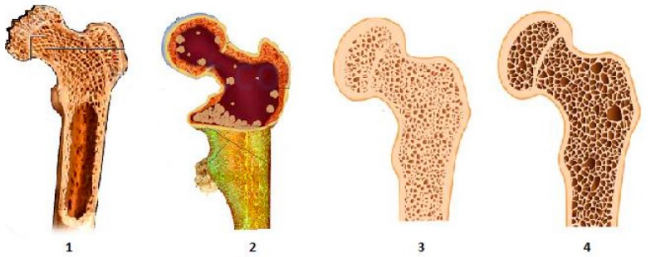
10. Nucleosomes refer to:
    A. Structural units of the nucleotide bases.
    B. Structural units of DNA/histone complex.
    C. Functional subunits of histones.
    D. Functional units of the nucleolus.
    E. Structural units of the nuclear envelope.

Spørsmål 15, 16 og 17

The following information refers to questions no. 15 to 17.

Bone is a dynamic organ composed of cells, matrix, and minerals. A healthy bone is made of osteoblasts, osteoclasts, osteocytes, and matrix. In humans, normal bone repair begins when the osteoclasts resorb old bone to create space for the new one. Meanwhile, the osteoblasts lay down a new bone in that area. The simultaneous occurrence of these processes allows the bone to maintain its strength. With age, however, bone modelling may be disrupted. Dissolved bone can be diverted to the serum, as a result of which bone loss exceeds bone replacement. The new bone created this way is prone to fracture. Osteoporosis results from reduced bone mass (osteopenia) while the bone matrix remains normally mineralized. Optimal serum levels of calcium are crucial to maintaining a healthy bone. Under-absorption of calcium by the gastrointestinal tract (GI) leads to reduced bone mass. Low levels of serum calcium activate a biofeedback system involving calcium, vitamin D, and parathyroid hormone. The activated system causes bone destruction in order to release calcium into the bloodstream. Hyperparathyroidism, renal failure, and vitamin D deficiency also affect bones negatively. Drugs implicated in the development of osteoporosis include corticosteroids, which reduce bone mass, and phenytoin, which alters the vitamin D metabolism in the liver. Another factor that affects bone turnover is Paget's disease. In pagetic bone, the processes of resorption and formation are accelerated and result in dense and chaotic structure. Pagetic bone bears little structural resemblance to the honey-comb appearance of a healthy one. However, the image is different from osteonecrosis where a whole section of the bone is clearly destroyed and missing. Moreover, in pagetic bone, osteoclasts contain fifty to one hundred nuclei per cell, while in a healthy bone there are four to ten. These osteoclasts are also bigger and more numerous than in a healthy bone.

15. Which of the following statements (I to III) is/are true about the osteoclasts?
    I. They are multinucleated cells.
    II. They are a type of bone cell.
    III. They deposit new bone during bone remodeling.
    A. II only
    B. I and II
    C. I, II and III
    D. II and III
    E. I and III
16. Which of the following is a pathophysiological process associated with osteopenia?
    A. Decreased rate of bone resorption.
    B. Decreased gastrointestinal absorption of calcium.
    C. Increased production of osteoblasts.
    D. Increased rate of bone formation.
    E. Increased gastrointestinal absorption of calcium.
17. Look at the pictures below. Which descriptions properly match the bones?



    A. 1- bone cancer, 2- osteoporosis, 3- healthy bone, 4- osteonecrosis
    B. 1- pagetic bone, 2- osteonecrosis, 3- osteoporosis, 4- healthy bone
    C. 1- osteonecrosis, 2-pagetic bone, 3 – healthy bone, 4- bone cancer
    D. 1- osteonecrosis, 2- bone cancer, 3- healthy bone, 4- osteoporosis
    E. 1- osteonecrosis, 2- healthy bone, 3-pagetic bone, 4-bone cancer

Svar spørsmål 15

The following information refers to questions no. 15 to 17.

Bone is a dynamic organ composed of cells, matrix, and minerals. A healthy bone is made of osteoblasts, osteoclasts, osteocytes, and matrix. In humans, normal bone repair begins when the osteoclasts resorb old bone to create space for the new one. Meanwhile, the osteoblasts lay down a new bone in that area. The simultaneous occurrence of these processes allows the bone to maintain its strength. With age, however, bone modelling may be disrupted. Dissolved bone can be diverted to the serum, as a result of which bone loss exceeds bone replacement. The new bone created this way is prone to fracture. Osteoporosis results from reduced bone mass (osteopenia) while the bone matrix remains normally mineralized. Optimal serum levels of calcium are crucial to maintaining a healthy bone. Under-absorption of calcium by the gastrointestinal tract (GI) leads to reduced bone mass. Low levels of serum calcium activate a biofeedback system involving calcium, vitamin D, and parathyroid hormone. The activated system causes bone destruction in order to release calcium into the bloodstream. Hyperparathyroidism, renal failure, and vitamin D deficiency also affect bones negatively. Drugs implicated in the development of osteoporosis include corticosteroids, which reduce bone mass, and phenytoin, which alters the vitamin D metabolism in the liver. Another factor that affects bone turnover is Paget's disease. In pagetic bone, the processes of resorption and formation are accelerated and result in dense and chaotic structure. Pagetic bone bears little structural resemblance to the honey-comb appearance of a healthy one. However, the image is different from osteonecrosis where a whole section of the bone is clearly destroyed and missing. Moreover, in pagetic bone, osteoclasts contain fifty to one hundred nuclei per cell, while in a healthy bone there are four to ten. These osteoclasts are also bigger and more numerous than in a healthy bone.

15. Which of the following statements (I to III) is/are true about the osteoclasts?

I. They are multinucleated cells. ✓

II. They are a type of bone cell. ✓

III. They deposit new bone during bone remodeling. osteoblasts

A. II only

B. I and II

C. I, II and III

D. II and III

E. I and III

Svar spørsmål 16

The following information refers to questions no. 15 to 17.

Bone is a dynamic organ composed of cells, matrix, and minerals. A healthy bone is made of osteoblasts, osteoclasts, osteocytes, and matrix. In humans, normal bone repair begins when the osteoclasts resorb old bone to create space for the new one. Meanwhile, the osteoblasts lay down a new bone in that area. The simultaneous occurrence of these processes allows the bone to maintain its strength. With age, however, bone modelling may be disrupted. Dissolved bone can be diverted to the serum, as a result of which bone loss exceeds bone replacement. The new bone created this way is prone to fracture. Osteoporosis results from reduced bone mass (osteopenia) while the bone matrix remains normally mineralized. Optimal serum levels of calcium are crucial to maintaining a healthy bone. Under-absorption of calcium by the gastrointestinal tract (GI) leads to reduced bone mass. Low levels of serum calcium activate a biofeedback system involving calcium, vitamin D, and parathyroid hormone. The activated system causes bone destruction in order to release calcium into the bloodstream. Hyperparathyroidism, renal failure, and vitamin D deficiency also affect bones negatively. Drugs implicated in the development of osteoporosis include corticosteroids, which reduce bone mass, and phenytoin, which alters the vitamin D metabolism in the liver. Another factor that affects bone turnover is Paget's disease. In pagetic bone, the processes of resorption and formation are accelerated and result in dense and chaotic structure. Pagetic bone bears little structural resemblance to the honey-comb appearance of a healthy one. However, the image is different from osteonecrosis where a whole section of the bone is clearly destroyed and missing. Moreover, in pagetic bone, osteoclasts contain fifty to one hundred nuclei per cell, while in a healthy bone there are four to ten. These osteoclasts are also bigger and more numerous than in a healthy bone.

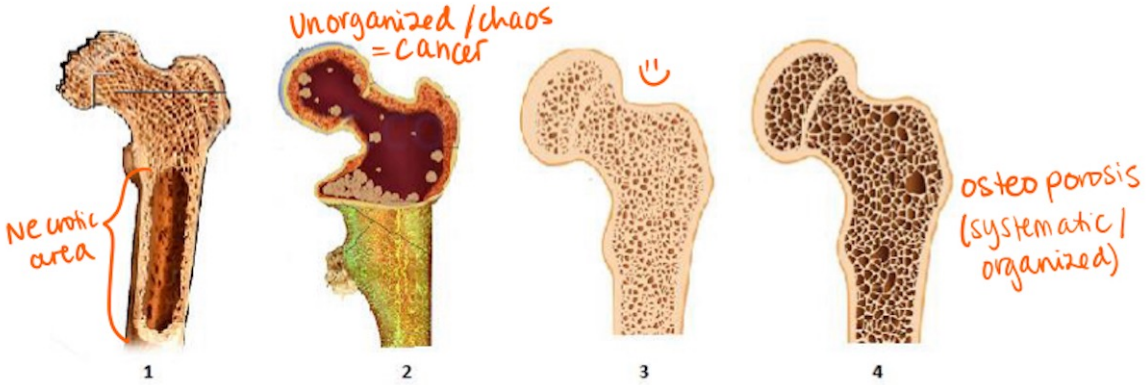
16. Which of the following is a pathophysiological process associated with osteopenia?
    A. Decreased rate of bone resorption. – ↑Bone mass
    B. Decreased gastrointestinal absorption of calcium. – ↓Bone mass
    C. Increased production of osteoblasts. } ↑Bone mass
    D. Increased rate of bone formation.
    E. Increased gastrointestinal absorption of calcium.

Svar spørsmål 17

The following information refers to questions no. 15 to 17.

Bone is a dynamic organ composed of cells, matrix, and minerals. A healthy bone is made of osteoblasts, osteoclasts, osteocytes, and matrix. In humans, normal bone repair begins when the osteoclasts resorb old bone to create space for the new one. Meanwhile, the osteoblasts lay down a new bone in that area. The simultaneous occurrence of these processes allows the bone to maintain its strength. With age, however, bone modelling may be disrupted. Dissolved bone can be diverted to the serum, as a result of which bone loss exceeds bone replacement. The new bone created this way is prone to fracture. Osteoporosis results from reduced bone mass (osteopenia) while the bone matrix remains normally mineralized. Optimal serum levels of calcium are crucial to maintaining a healthy bone. Under-absorption of calcium by the gastrointestinal tract (GI) leads to reduced bone mass. Low levels of serum calcium activate a biofeedback system involving calcium, vitamin D, and parathyroid hormone. The activated system causes bone destruction in order to release calcium into the bloodstream. Hyperparathyroidism, renal failure, and vitamin D deficiency also affect bones negatively. Drugs implicated in the development of osteoporosis include corticosteroids, which reduce bone mass, and phenytoin, which alters the vitamin D metabolism in the liver. Another factor that affects bone turnover is Paget's disease. In pagetic bone, the processes of resorption and formation are accelerated and result in dense and chaotic structure. Pagetic bone bears little structural resemblance to the honey-comb appearance of a healthy one. However, the image is different from osteonecrosis where a whole section of the bone is clearly destroyed and missing. Moreover, in pagetic bone, osteoclasts contain fifty to one hundred nuclei per cell, while in a healthy bone there are four to ten. These osteoclasts are also bigger and more numerous than in a healthy bone.

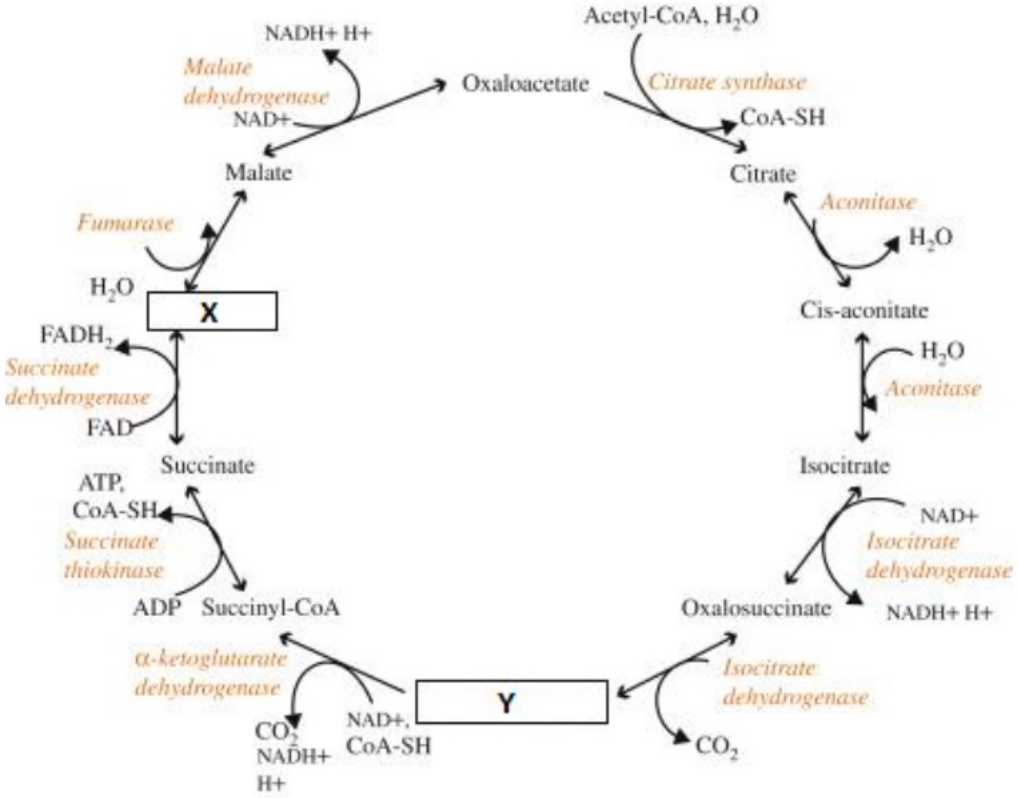
17. Look at the pictures below. Which descriptions properly match the bones?



A. 1- bone cancer, 2- osteoporosis, 3- healthy bone, 4- osteonecrosis
B. 1- pagetic bone, 2- osteonecrosis, 3- osteoporosis, 4- healthy bone
C. 1- osteonecrosis, 2-pagetic bone, 3 – healthy bone, 4- bone cancer
D. 1- osteonecrosis, 2- bone cancer, 3- healthy bone, 4- osteoporosis
E. 1- osteonecrosis, 2- healthy bone, 3-pagetic bone, 4-bone cancer

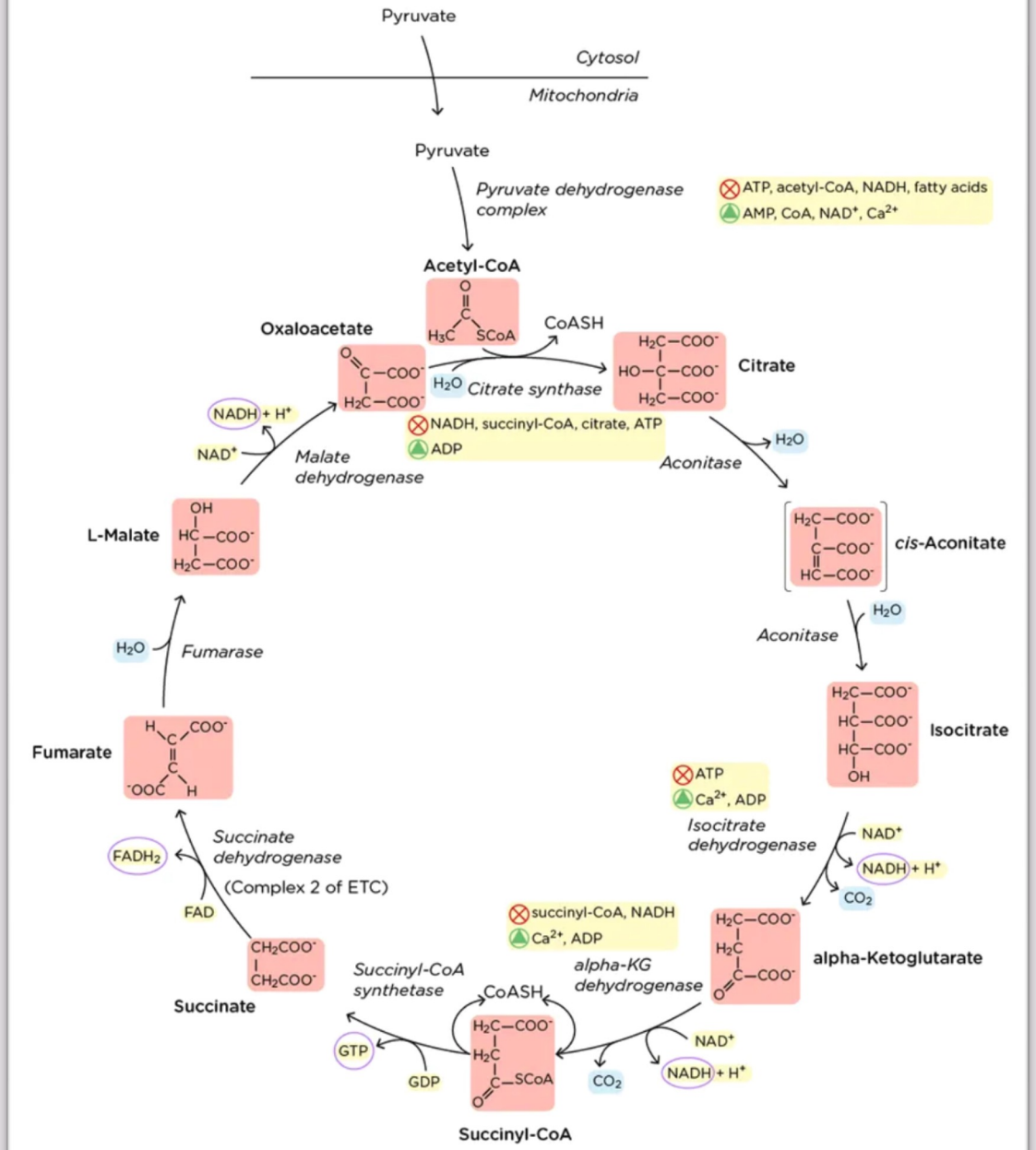
Spørsmål 18

What are the names of the missing substrates (X and Y)?



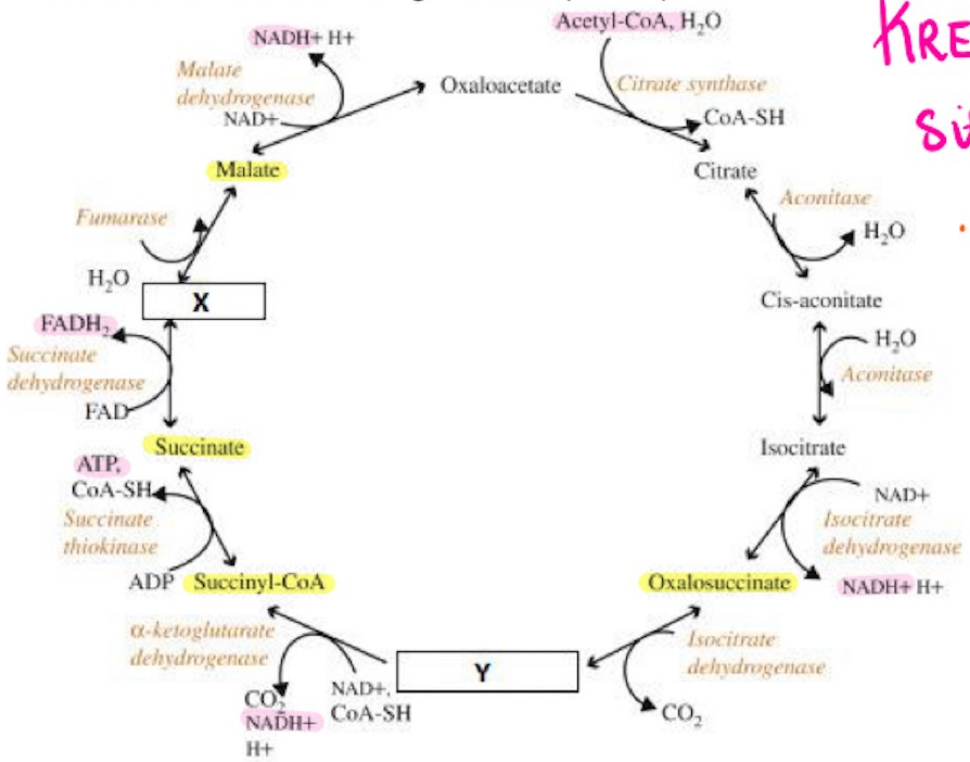
A. X- Fumarate, Y- Alpha- ketoglutarate
B. X- Phosphofumarate, Y- Isocitrate
C. X- Fumarate, Y- Ketoglutarase
D. X- Phosphofumarate, Y- Alpha- ketoglutarate
E. X- Fumaryl, Y- Isocitrate

Tricarboxylic Acid Cycle



Svar spørsmål 18

What are the names of the missing substrates (X and Y)?



KREBS / TCA / sitronsyresyklus

- Acetyl CoA (FA ox++)
- to generate energy:
  - NADH
  - $FADH_2$
  - ATP

A. X- Fumarate, Y- Alpha- ketoglutarate
B. X- Phosphofumarate, Y- Isocitrate
C. X- Fumarate, Y- Ketoglutarase
D. X- Phosphofumarate, Y- Alpha- ketoglutarate
E. X- Fumaryl, Y- Isocitrate

Eks på vanskelige spørsmål/verdt å øve på?

The following information refers to questions no. 88-92
Five roommates: Rose, Sonia, Tatiana, Uma, and Veronica each do one housekeeping task: mopping, sweeping, laundry, vacuuming, or dusting one day a week; Monday through Friday.

* Veronica does not vacuum and does not do her task on Tuesday.
* Sonia does the dusting, and does not do it on Monday nor Friday.
* Mopping is done on Thursday.
* Tatiana does her task, which is not vacuuming, on Wednesday.
* The laundry is done on Friday, and not by Uma.
* Rose does her task on Monday.

88. **What task does Tatiana do on Wednesday?**
   A. vacuuming
   B. dusting
   C. mopping
   D. sweeping
   E. laundry

89. **Who is responsible for mopping?**
   A. Rose,
   B. Sonia,
   C. Tatiana,
   D. Uma,
   E. Veronica

90. **When does Sonia do the dusting?**
   A. Monday
   B. Tuesday
   C. Wednesday
   D. Thursday
   E. Friday

91. **What day does Veronica do her task?**
   A. Monday
   B. Tuesday
   C. Wednesday
   D. Thursday
   E. Friday

92. **On what day is the vacuuming done?**
   A. Monday
   B. Tuesday
   C. Wednesday
   D. Thursday
   E. Friday

Oppsummering/ tips&triks

Oppsummering

- **Selve opptaksprøven:**
  - Les undertekster og forstå hva du ser (grafer) før du gyver løs på oppgavene (men ikke bruk for lang tid ;))
  - Hvis to påstander motsier hverandre må en av de være det riktige alternativet
  - Lange tekstoppgaver: Les spørsmålene før du leser oppgaveteksten
  - Bruk fornuften
  - Hente tid der du kan

- Øve på å prosessere mye informasjon raskt
- Gjennomfør tidligere opptaksprøver under tidspress
- Les smart → De store temaene
- Kjenn til og jobb med dine svakheter
- Stol på intuisjonen og magefølelsen (hvis du er godt forberedt)

Tusen takk for meg!

Lykke til, jeg heier på deg!

☺

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larsgulbrandsen.qa@gmail.com