HORMONAL CONTROL OF EXTRACELLULAR CALCIUM
QUIZ #4

1. Which of the following statements about the parathyroid glands is false?
   a. They are four glands embedded in the thyroid.
   b. They secrete only one hormone, parathyroid hormone (PTH).
   c. If removed upon thyroidectomy, there is no alteration in regulation of plasma Ca levels.
   d. PTH is secreted in response to a decrease in plasma calcium concentrations.

2. Due to the displacement of calcium ions by hydrogen ions,
   a. acidosis increases plasma ionized calcium
   b. acidosis decreases plasma ionized calcium
   c. alkalosis increases plasma ionized calcium

3. Parathyroid hormone increases plasma calcium levels directly by
   a. Increasing intestinal absorption of calcium
   b. Increasing osteocytic osteolysis
   c. Increasing renal reabsorption of phosphate
   d. All of the above

4. In an individual with normal calcium intake, the major action of PTH in maintaining calcium homeostasis is to increase:
   a. bone resorption
   b. gut absorption of calcium
   c. renal Ca reabsorption
   d. synthesis of calbindin

5. Calcitonin is clinically important for
   a. testing for gastrin release
   b. inhibiting ostcoblast function
   c. inhibiting osteoclast function
   d. treatment of hypocalcemia

6. Hypercalcemia is characterized by
   a. osteomalacia
   b. elevated plasma PTH levels in all cases regardless of the cause
   c. a predisposition to kidney stones
   d. hyperactive reflexes

7. Hypocalcemia might result from
   a. vitamin D excess
   b. heptectomy
   c. thyroidectomy
   d. increased renal phosphate excretion
8. In pseudohypoparathyroidism, plasma levels of PTH, calcium and phosphate would be:
   a. high PTH, high Ca, low phosphate
   b. high PTH, low Ca, high phosphate
   c. low PTH, low Ca, low phosphate
   d. low PTH, low Ca, high phosphate

9. Which of the following would you expect to find in a patient whose diet has been low in calcium for 2 months?
   a. increased formation of 24, 25-dihydroxy vitamin D
   b. decreased amounts of calcium binding protein in intestinal epithelial cells
   c. increased parathyroid hormone Secretion
   d. a high plasma calcitonin concentration
   e. increased plasma phosphate levels

10. Vitamin D toxicity would be associated with the following plasma profile:
    a. high PTH, high Ca, low phosphate
    b. high PTH, low Ca, low phosphate
    c. low PTH, low Ca, high phosphate
    d. low PTH, high Ca, high phosphate
Select the BEST answer.

1. Which of the following is true?
   a) Calcium concentrations in plasma are similar to intracellular calcium concentrations
   b) Normal plasma calcium levels are regulated so tightly that they fluctuate within a range of 10%
   c) In acidosis, free plasma calcium levels would tend to be lower than normal
   d) Most of the calcium in plasma is in the form of unionized calcium-phosphate and calcium-citrate complexes

2. In the GI track:
   a) Calcium absorption only occurs by means of an active transport mechanism
   b) About one-third of ingested calcium is absorbed
   c) The amount of calcium ingested is equal to the amount excreted
   d) The major determinant of net calcium uptake is the amount of calcium ingested

3. In bone,
   a) Calcium can only be mobilized by the process of resorption
   b) Remodeling only occurs in adults
   c) Formation is earned out by the osteoblasts
   d) Receptors for PTH and vitamin D are located on the osteoclasts

4. PTH:
   a) Is synthesized and secreted by the parafollicular cells of the thyroid gland
   b) Acts directly on all three of its target organs, bone, kidney and the GI tract
   c) Is released whenever plasma calcium exceeds 10 mg %
   d) Is essential for life

5. The action of PTH
   a) In bone, is completely mediated by vitamin D
   b) Results in an increase in plasma phosphate levels
   c) Is mediated by an increase in cAMP
   d) In the kidneys, does not play a major role in control of calcium homeostasis under conditions of normal calcium balance
6. Vitamin D metabolism
   a) Yields the active compound, 24, 25-(OH)2D3
   b) Depends on the hormonal regulation of the renal 25-hydroxylase enzyme
   c) Begins in the skin and ends in the liver
   d) To produce the biologically active form, can be stimulated by low plasma phosphate levels

7. Calcitonin
   a) Release is inhibited by gastrin
   b) Can be used to prevent excessive bone resorption in certain diseases
   c) Increases osteoclast activity
   d) Is an important physiologic regulator of plasma calcium concentrations

8. Hypocalcemia would cause symptoms of
   a) constipation
   b) kidney stones
   c) rickets
   d) decreased neuromuscular excitability

9. A plasma profile of high PTH, low calcium and high phosphate levels would be observed in patients with:
   a) Primary hypoparathyroidism
   b) Pseudohypoparathyroidism
   c) Vitamin D deficiency
   d) An ectopic tumor secreting PTH

10. Which of the following is true?
    a) The tetany caused by hypocalcemia can cause death
    b) An excess of either glucocorticoid, or thyroid hormone, or estradiol could cause osteoporosis
    c) Some malignancies cause hypocalcemia by secreting PTH-Related Peptides (PTH-RP's)
    d) Calcitonin acts on its receptors located on the osteocytes.
Select the BEST answer.

1. A patient with parathyroid deficiency 10 days after inadvertent damage to the parathyroid glands during thyroid surgery would probably have:
   a) Low plasma phosphate and low plasma calcium levels and tetany
   b) Low plasma calcium and increased muscular excitability
   c) High plasma phosphate and high plasma calcium levels and bone demineralization
   d) Increased muscular excitability, a high plasma calcium level and bone demineralization

A high plasma calcium level causes:
   a) Bone demineralization
   b) Increased formation of 1,25-dihydroxy vitamin D₃
   c) Decreased secretion of calcitonin
   d) Decreased blood coagulability
   e) Increased formation of 24,25-dihydroxy vitamin D₃

3. Which of the following is NOT involved in regulating plasma calcium levels?
   a) Kidneys
   b) Skin
   c) Liver
   d) Lungs
   e) Intestine

4. Which of the following would you expect to find in a patient whose diet has been low in calcium for 2 months?
   a) Increased formation of 24,25-dihydroxy vitamin D₃
   b) Decreased amounts of calcium-binding protein in intestinal epithelial cells
   c) Increased parathyroid hormone secretion
   d) A high plasma calcitonin concentration
   e) Increased plasma phosphates

5. Which of the following conversions is increased in the presence of high levels of vitamin D₃?
   a) 7-dehydrocholesterol to vitamin D₃
   b) 25-hydroxy D₃ to 24,25-dihydroxy D₃
   c) 25-hydroxy D₃ to 1,25-dihydroxy D₃
   d) vitamin D₃ to 25-hydroxy D₃
6. Which of the following would tend to increase the plasma free calcium level?
   a) High plasma pH
   b) Severe renal disease
   c) Some types of cancer
   d) Elevated plasma protein

QUESTIONS 7-10. Match the diseases below with the following plasma levels:

   a) high PTH, low calcium
   b) high PTH, high calcium
   c) low PTH, low calcium
   d) low PTH, high calcium

7. Primary hyperparathyroidism
8. Pseudohypoparathyroidism
9. Vitamin D deficiency
10. Vitamin D toxicity
Select the BEST answer.

1. Which of the following is true: **(TOSSED OUT)**
   a) Calcium concentrations in plasma are similar to intracellular calcium concentrations
   b) The smallest pool of calcium in the body is plasma calcium
   c) In acidosis, free plasma calcium levels would tend to be lower than normal
   d) Most of the calcium in plasma is in the form of unionized calcium-phosphate and calcium-citrate complexes

2. In the GI tract:
   a) Calcium absorption only occurs by means of an active transport mechanism
   b) About one-third of ingested calcium is absorbed
   c) The amount of calcium ingested is equal to the amount excreted
   d) The major determinant of net calcium uptake is the amount of calcium ingested

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   a) Calcium can only be mobilized by the process of resorption
   b) Remodeling only occurs in adults
   c) Formation is carried out by the osteoblasts
   d) Receptors for PTH and vitamin D are located on the osteoclasts

4. PTH:
   a) Is synthesized and secreted by the parafollicular cells of the thyroid gland
   b) Acts directly on all three of its target organs, bone, kidney and the GI tract
   c) Is released whenever plasma calcium exceeds 10 mg
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5. The action of PTH:
   a) In bone, is completely mediated by vitamin D
   b) Results in an increase in plasma phosphate levels
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   d) In the kidneys, does not play a major role in control of calcium homeostasis under conditions of normal calcium balance
6. Vitamin D metabolism
   a) Yields the active compound, 24,25-(OH)$_2$ vitamin D
   b) Depends on the hormonal regulation of the renal 25-hydroxylase enzyme
   c) Begins in the skin and ends in the liver
   d) To the biologically active compound, is stimulated by low plasma phosphate levels

7. Calcitonin
   a) Release is stimulated by gastrin
   b) Can be used to prevent excessive bone resorption in certain diseases
   c) Increases osteoclast activity
   d) Is an important physiologic regulator of plasma calcium concentrations

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   a) Primary hypoparathyroidism
   b) Pseudohypoparathyroidism
   c) Vitamin D deficiency
   d) An ectopic tumor secreting PTH

10. Which of the following is true?
    a) The tetany caused by hypocalcemia can cause death
    b) An excess of either glucocorticoid, or thyroid hormone, or estradiol would cause osteoporosis
    c) some malignancies cause hypocalcemia by secreting PTH-Related Peptides (PTHRP's)
    d) some tumors cause hypocalcemia by secreting calcitonin-gene-related peptide (CGRP)
Endocrine Control of Calcium Homeostasis  
Class Quiz #4 (1998)

1. Which of the following statements about the parathyroid glands is true?  
   a) They are four glands embedded in the thymus.  
   b) They secrete only one hormone, parathyroid hormone (PTH).  
   c) If totally removed, there is no alteration in regulation of plasma Ca levels.  
   d) They are important in decreasing plasma calcium levels.

2. Plasma ionized calcium levels are increased by  
   a) an increase in calcitonin release  
   b) a decrease in PTH secretion  
   c) decreased synthesis of 1,25 dihydroxy vitamin D  
   d) an increase in hydrogen ion concentration (acidosis)

3. Calcium circulates in plasma  
   a) 100% ionized  
   b) 40% bound to plasma protein  
   c) 50% complexed to anions such as phosphate and citrate  
   d) 10% free

4. Which of the following is true?  
   a) plasma constitutes the largest compartment of body calcium  
   b) passive diffusion of calcium across the small intestine is regulated by active vitamin D  
   c) the GI tract is not very efficient at absorbing ingested calcium  
   d) to maintain normal calcium balance, in a given day, the kidneys should excrete an amount of calcium equivalent to that which is ingested

5. Parathyroid hormone increases plasma calcium levels directly by  
   a) increasing intestinal absorption of calcium  
   b) increasing osteocytic osteolysis  
   c) increasing renal reabsorption of phosphate  
   d) all of the above

6. Which of the following would activate the renal 1-hydroxylase enzyme?  
   a) decreased plasma phosphate levels  
   b) decreased PTH  
   c) increased 1,25 dihydroxy vitamin D  
   d) increased plasma Ca

7. In pseudohypoparathyroidism, plasma levels of PTH, calcium and phosphate would be:  
   a) high PTH, high Ca, low phosphate  
   b) high PTH low Ca, high phosphate  
   c) low PTH, low Ca, low phosphate  
   d) low PTH, low Ca, high phosphate
8. Calcitonin is clinically important for
   a) testing for gastrin release
   b) inhibiting osteoblast function
   c) inhibiting osteoclast function
   d) treatment of hypocalcemia

9. Hypercalcemia is characterized by
   a) stronger than normal bones
   b) elevated plasma PTH levels in all cases regardless of the cause
   c) a predisposition to kidney stones in some patients
   d) hyperactive reflexes

10. Hypocalcemia might result from (TOSSED OUT)
    a) vitamin D excess
    b) increased renal phosphate excretion
    c) a C cell tumor
    d) a lung tumor producing PTHRP
HORMONAL CONTROL OF PLASMA CALCIUM
Class Quiz (1997)

Select the BEST answer.

1. Which of the following is true?
   a) The largest fraction of total body calcium is found in the plasma
   b) Approximately 50% of plasma calcium is in the free, or ionized form
   c) Free plasma calcium would be decreased by severe acidosis
   d) Bone remodeling ceases in adulthood

2. PTH
   a) is released when plasma calcium increases
   b) acts directly on bone and in the GI tract
   c) stimulates 25-hydroxylase activity in the kidney
   d) in the kidneys, decreases phosphate reabsorption in the proximal tubules

3. Which of the following would increase plasma calcium the most?
   a) high PTH and high calcitonin
   b) high PTH and low calcitonin
   c) low PTH and high calcitonin
   d) low PTH and low calcitonin

4. Synthesis of the biologically active form of Vitamin D
   a) requires hydroxylation in the 1 and 24 positions
   b) is not hormonally regulated
   c) is increased in response to decreased plasma phosphate concentrations
   d) takes place in skin, intestine and kidney

5. The active form of Vitamin D
   a) is permissive to the action of PTH on renal calcium reabsorption
   b) causes an increase in synthesis of calcitonin
   c) is increased in response to a rise in plasma calcium above about 9 mg per cent
   d) acts directly in the gut to increase synthesis of a calcium binding protein

6. Calcitonin
   a) decreases plasma phosphate
   b) is synthesized and secreted by the parathyroid gland
   c) release is suppressed in response to an increase in gastrin
   d) must be replaced after thyroidectomy to maintain normal calcium balance
7. An individual who has had several episodes of kidney stones might have all of the following EXCEPT
   a) increased neuromuscular excitability
   b) constipation
   c) bone pain
   d) ulcers

8. In Vitamin D toxicity, which of the following would be observed?
   a) low calcium, high PTH, and low phosphate
   b) high calcium, high PTH, and high phosphate
   c) high calcium, low PTH, and high phosphate
   d) low calcium, low PTH, and high phosphate

9. The most rapid physiological response to an increase in PTH secretion would be an increase in
   a) synthesis of active Vitamin D
   b) osteocytic osteolysis
   c) bone remodeling
   d) intestinal calcium absorption

10. Which of the following would you expect to find in a patient whose diet has been low in calcium for two months?
    a) decreased amounts of calcium binding protein in the gut
    b) increased plasma phosphate levels
    c) increased formation of active Vitamin D
    d) low plasma PTH levels
    e) high plasma calcitonin concentrations