1) Which of the following is not a class of hormone?

* A. Carbohydrate derivatives
  B. Fatty acid derivatives
  C. Peptides
  D. Proteins
  E. Amino-acid derivatives
  F. Steroids

The various classes of hormones are
Amino acid derivatives (e.g., Epinephrine; Thyroxine; Melatonin) Peptides (e.g., Hypothalamic hormones/factors) Proteins (e.g., Growth hormone; Prolactin) Steroids = Cholesterol derivatives (e.g., Glucocorticoids; Mineralocorticoids) Fatty acid derivatives (e.g., Prostaglandins)

2) Which of the following statements about hormone synthesis and release is FALSE?

  A. Steroid hormones diffuse out of the cell after synthesis (constitutive secretion)
  B. Aminergic hormones are released in the form of secretory granules
  C. Protein hormones are initially synthesized as mRNA in the nucleus
  D. The Golgi apparatus is a key player in the synthesis of peptide hormones
* E. Steroid hormones are synthesized as prehormones in rough endoplasmic reticulum

Protein, peptide and aminergic hormones start off as mRNA in the nucleus which is processed into a prehormone by the ReR and Golgi apparatus, before being stored as secretory granules. The regulated secretory pathway is used for proteins that are stored and secreted on demand. For example, insulin is produced by the beta cells of the pancreas and stored in dense core secretory granules. When blood sugar increases to a threshold level, insulin containing secretory granules fuse with the plasma membrane, releasing insulin to the blood, as shown above. The digestive enzymes produced by the acinar cells of the pancreas are stored in dense core granules called zymogen granules and are released into the duct leading to the gut following feeding.<p>Steroid hormones, on the other hand, are <u>synthesized in SeR (smooth reticulum) and mitochondria</u> after which they diffuse out of the cell on a continuous basis (constitutive secretion).

* A. Receptors for thyroid hormones are found in the plasma membrane of target cells
  B. Cytoplasmic signalling pathways activated by hormones can lead to the activation of proteins (transcription factors) that act on the DNA of target cells and modify gene expression
  C. Receptors for steroid hormones are found in the cytoplasm of target cells
  D. Receptors for most hormones are found in the plasma membrane of target cells
  E. With respect to transmembrane receptors, the hormone binds to the extracellular domain of the receptor and activates one or more cytoplasmic signalling pathways

<img src="Hormone-receptors.jpg"><p>Receptors for thyroid hormones, located within the nucleus, are members of a large family of nuclear receptors. The hormone binds to the intracellular receptor and the hormone-receptor complex acts as a transcription factor that modifies the expression of specific genes. <p>The receptor theory for hormonal action states the following :
Hormones bind non-covalently to specific proteins (binding sites or receptors) in target cells
The receptors for most hormones are found in the plasma membrane of target cells
The receptors for steroid and thyroid hormones are inside the target cells
<p>Transmembrane receptors work as follows :
The hormone binds to the extracellular domain of the receptor and activates one or more cytoplasmic signalling pathways Many of these pathways involve phosphorylat
and enzyme activation Some of these pathways lead to the activation of proteins (transcription factors) that act on the DNA of t

4) Which of the following statements is FALSE?

  A. Growth hormone works through a cytokine receptor
  B. Adrenergic receptors are a class of G protein-coupled receptors that are targets of the catecholamines, like epinephrine
  C. Ligand-activated transcription factors include those activated by thyroid hormone and steroid hormones
* D. Insulin carries out its action through an ion-channel transmembrane receptor

Transmembrane receptor types include
Ion-channel receptors (e.g. several growth factors)
Tyrosine kinase receptors (e.g. insulin)
Cytokine receptors (e.g. Growth hormone)
G-protein-linked receptors (the most common receptor)
<p>
protein-coupled receptors (GPCRs), also known as seven transmembrane receptors, 7TM receptors, heptahelical receptors, and G protein linked receptors (GPLR), are a protein family of transmembrane receptors that transduce an extracellular signal (ligand binding) into an intracellular signal (G protein activation). The GPCRs are the largest protein family known, members of which are involved in all types of stimulus-response pathways, from intercellular communication to physiological senses.<p>G-protein linked enzymes include adenylate cyclase (beta-adrenergic, epinephrine, create cAMP) and phospholipase C (alpha1-adrene
noradrenaline on smooth muscle, triggers creation of DAG & IP3)

5) Which of the following is NOT a hypothalamic hormone?

* A. GH
  B. TRH
  C. GHRH
  D. SRIH
  E. GnRH
  F. CRH

The hypothalamus releases a number of hormone/factors :
CRH: corticotropin-releasing hormone - Regulates secretion of adrenocorticotropic hormone [ACTH]
TRH: thyrotropin-rel hormone - Regulates secretion of thyroid stimulating hormone [TSH]
GnRH: gonadotropin-re hormone - Regulates secretion of gonadotropin-releasing hormones, luteinizing [LH] and follicle stimulating hormone [FSH]
GHRH: growth hormone releasing hormone - Stimulates secretion of GH
SRIH: somatostatin - Inhibits secretion of growth hormone [GH]
S salsolinol (dopamine-related agent) - Stimulates release of prolactin [PRL] in ruminants
<li dopamine - Inhibits secretion of prolactin [PRL]
MRF: MSH releasing factor - Stimulates MSH secretion MIF: melanocyte stimulating hormone (MSH) - inhibits MSH secretion

6) All the following hormones, secreted by the Anterior pituitory (adenohypophysis), belong to the POMC family, EXCEPT

  A. ACTH
  B. MSH
* C. GH
  D. Endorphin
  E. Enkephalin

<img src="Pituitary-hormones.jpg"><p>The Anterior Pituitary secretes 3 classes of hormones (POMC) family (peptides)
Somatomammotropin family (proteins)
Glycoprotein family (glycoproteins)
The POMC family of peptides consist of
ACTH: adrenocortic hormone - Regulates adrenal cortex function
MSH: melanocyte stimulating hormone - Skin pigmentation in response to UV radiation End: Endorphin - Analgesic roles in central nervous system
Enk: enkephalin - Analgesic roles in fetus
All hormones of the POMC family arise from Proopiomelanocorticotropin (POMC), the parent molecule. Different convertases (enzymes) cleave POMC differently to give rise to different products.<p>All the POMC peptides operate through different forms of the G-protein-linked melanocortin receptors (MC-Rs).

7) All the following hormones, secreted by the Anterior pituitory (adenohypophysis), belong to the Somatommammotropin family

  A. Prolactin (PRL)
  B. GH
* C. ACTH
  D. Somatolactin (SL)

<img src="Pituitary-hormones.jpg"><p>The Anterior Pituitary secretes 3 classes of hormones (POMC) family (peptides)
Somatomammotropin family (proteins)
Glycoprotein family (glycoproteins)
The Somatomammotropin family of peptides consist of
GH (Growth hormone) - Growth and metabolic regulation
PRL (Prolactin) - Lactation [adipocyte glucose/lipid metabolism]
SL (Somatolactin) - Role unknown

8) All the following hormones, secreted by the Anterior pituitory (adenohypophysis), belong to the Glycoprotein family

* A. GH
  B. TSH
  C. FSH
  D. LH

<img src="Pituitary-hormones.jpg"><p>The Anterior Pituitary secretes 3 classes of hormones (POMC) family (peptides)
Somatomammotropin family (proteins)
Glycoprotein family (glycoproteins)
The Glycoprotein family consist of
TSH: thyroid stimulating hormone - Regulates thyroid gland activity
FSH: follicle stimulating hormone - Regulates gonadal activity
LH: luteinizing hormone - Regulates gonadal activity

9) With respect to the Pituitary's cellular composition, which of the following statements is FALSE?

  A. Basophils create gonadotropes like LH and FSH
  B. Basophils create corticotropes like ACTH
* C. Acidophils create thryotropes
  D. Acidophils are the most numerous cell type
  E. Acidophils create lactotropes like Prolactin

The adenohypophysis (anterior pituitary) consists of chromophils (95%) and chromophobes (5%) [Note : Dr Y suggests a 70:30 ratio]. The majority of cells (65%) are acidophils (chromophils that stain eosinophilic) - they secrete lactotropes (PRL) and somatotropes (GH). 35% of cells are basophils (chromophils that stain basophilic) - hormones include thyrotrophs (TSH), corticotropes (ACTH) and gonadotrophs (LH, FSH).<p>The posterior pituitary contain non-myelinated magnocellular neurons.

10) GH peaks in the bloodstream

  A. when the animal is threatened
  B. GH has no peak; its secretion is steady, changing gradually with the season
  C. about 1 hour after waking
* D. about 1 hour after onset of sleep

GH secretion occurs as several large pulses or peaks each day, 10 to 30 minutes in duration. The largest GH peak is about 1 hr after onset of sleep (diurnal pattern). During an animal's lifetime, basal levels are highest early in life - the amplitude and frequency of peaks are greatest during the pubertal growth spurt and then decline throughout adult life.<p>GH triggers the synthesis of IGF-1 (Insulin Growth Factor - 1) in the liver <u>and other tissues</u> [IGF-1 down-regulates release of GH from the adenohypophysis]. IGF-1 and GH have a number of similar effects (upregulate protein use, bone growth), although they also have opposing effects (plasma glucose, liver glucose release, lipolysis)

11) Which of the following is FALSE about the regulation of GH secretion?

  A. Glucocorticoids decrease it
* B. Sleep decreases it
  C. Ghrelin increases it
  D. Hypoglycemia increases it
  E. Hyperglycemia decreases it
  F. Exercise increases it

Sleep, exercise, hypoglycemia, a high protein diet, steroids and ghrelin tend to increase GH secretion. Hyperglycemia, glucocorticoids and endocrine disrupters tend to reduce GH secretion.<p>For example, Cushing's syndrome's increased cortisol levels down-regulate GH resulting in alopecia (thin skin, hair loss).<p>GH has a half-life of between 6 and 20 minutes.<p>Ghrelin is a hormone produced by P/D1 cells lining the fundus of the human stomach that stimulate appetite (Bowers, et al). <p>Cortisol, the most important <b>glucocortico is a corticosteroid hormone produced by the adrenal cortex that is involved in the response to stress; it increases blood pressure, blood sugar levels, may cause infertility in women, and suppresses the immune system. <a href="http://en.wikipedia.org/wiki/Cortisol">More</a

12) Many of the effects of IGF-1 oppose those of GH. Which process is thought to be up-regulated by both IGF-1 and GH?

  A. Lipolysis in adipocytes
  B. Hepatic glucose release
  C. Plasma glucose concentration
* D. Amino acid uptake and protein synthesis
  E. Sensitivity of tissue to insulin
* F. Bone growth and mineralization

GH tends to up-regulate hepatic glucose release, plasma glucose concentration and lipolysis in adipocytes while IGF-1, like insulin, down-regulates them. <p>On the other hand, tissue sensitivity to insulin is up-regulated by IGF-1 but down-regulated by GH.<p>It is possible that both GH and IGF-1 up-regulate amino acid uptake and protein synthesis by skeletal muscle. In addition, both GH and IGF-1
Contribute to the maintenance and function of pancreatic islets
Stimulate the immune system
Are anti-aging [lean-mean machine]
Stimulate the growth of internal organs (except brain)
Help in normal reproduction
Commercially, GH (Bovine growth hormone or rbST) results in a 30% increase in milk yield, faster growth and leaner meat (marbling) in cattle, although it may be linked to reproductive problems.

13) With respect to transport of GH and IGF-1 (Insulin growth factor - 1), which statement about their transport is correct?

  A. GH is always bound to transport proteins. IGF-1 may be transported as a free hormone or by transport proteins.
  B. Both GH and IGF-1 are transported as free hormones.
* C. GH may be transported as as free hormones or bound to transport proteins. IGF-1 needs transport proteins.
  D. GH and IGF-1 are almost entirely bound to transport proteins.

GH may be transported as a free hormone but much of it is transported by binding protein (GHBP). IGF-1 is almost entirely bound to transport proteins (IGF-BP’s).

14) Which of the following statements about the thyroid gland axis is FALSE?

A. TSH production is modulated by thyrotropin-releasing hormone (TRH), which is produced by the paraventricular nucleus (aggregation of neurons) in the hypothalamus
B. The thyroid and thyrotropes form a negative feedback loop: TSH production is suppressed when T4 levels are high, and vice versa.
C. Only "free" (i.e. unbound to transport proteins) circulating hormone is biologically active
* D. About 50% of the thyroid hormone circulating in the blood is bound to transport proteins.
E. If there is a deficiency of dietary iodine, the thyroid enlarges in an attempt to trap more iodine, resulting in goitre.

Over 99% of thyroid hormones in blood circulation is bound to thyroxin-binding globulin (TBG). <u>Only free fractions of thyroid hormones are biologically active</u>. [Hmmm... So what happens to the "99%"? If you know, <a href="mailto:fernandr@ovc.uoguelph.ca?subject=99% of Thyroid hormones are useless?">e-mail me</A>] <p>The primary function of the thyroid is production of the hormones thyroxine (T4), triiodothyronine (T3), and calcitonin. Up to 80% of the T4 is converted to T3 by peripheral organs such as the liver, kidney and spleen.<p>Production of thyroid hormones occurs in two broad steps :
Iodinated Thyrobulin production : This happens as follows :
Uptake of iodide by thyrocytes using an Na/I symporter
Synthesis of the protein, thyroglobulin (Tg) by thyrocytes
<
of Tg and I (independently) into the lumen of follicles
Iodination/condensation of the Tg in the lumen into TgI (catalyzed by thyroid peroxidase) - Tyrosine residues are mono and diiodinated, the

15) Which of the following statements regarding TRH release is INCORRECT?

A. Young animals tend to have higher secretions than old animals
B. In humans, release follows a circadian rhythm, peaking between 10 am and 2pm
C. TRH secretion tends to be pulsed
* D. TRH is created in the adenohypophysis of the pituitary
E. Stress and cold up-regulate the release of TRH

Thyrotropin-releasing hormone (TRH), also called thyrotropin-releasing factor (TRF), thyroliberin or protirelin, is a tripeptide hormone that stimulates the release of thyroid-stimu
hormone and prolactin by the anterior pituitary. It is produced by the hypothalamus, near the paraventricular nucleus. <p>By the way, an excess of iodide (>2 mg/day in humans) inhibits the activity of iodide pump (iodide 'trapping') ... Wolff-Chaikoff effect.

16) Which of the following statements regarding T3 and T4 is FALSE?

A. 60-75% of T3 is produced from T4 in the liver
B. In plasma, the normal ratio of T4:T3 is 20:1
C. T4 appears to primarily support the feedback mechanism (to the hypothalamus and adenohypophysis)
D. T3 is 3 to 5 times more potent than T4
E. T4 is largely similar in structure to T3, except that it has 4 iodine atoms whereas T3 has 3
* F. The T4:T3 ratio produced by the thyroid is 1:4

In fact, the T4:T3 ratio of production by the thyroid gland is 4:1. Further conversion of T3 into T4 results in a plasma ratio of 20:1. <p><img src="Thyroid-peroxidase.jpg"><p>Iodinat of Thyroglobuline requires two oxidation steps, which occur in the lumen. Both use Thyroid Peroxidase (TPO).
Firstly, TPO iodinates tyrosine residues in Thyroglobulin to form mono- and diiodinated tyrosine residues [monoiodotyrosine (MIT) & diiodotyrosine (DIT)]
TPO causes the condensation of MIT and DIT residues to form triiodothyronine (T3) and tetraiodothyronine (T4). These iodinated thyronine residues remain as part of the TgI molecule until endocytosis back into the thryocyte where proteolysis cleaves T3 and T4 from TG
<p><img src="Thyroid-hormone-release.jpg">

17) Triiodothyronine (T3) affects cells through

* A. Nuclear receptors
B. Cytoplasmic receptors
C. Transmembrane receptors
D. G-protein linked receptors

Receptors for thyroid hormones are members of a large family of nuclear receptors that include those of the steroid hormones. They function as hormone-activated transcription factors and thereby act by modulating gene expression. <p>In contrast to steroid hormone receptors, thyroid hormone receptors bind DNA in the absence of hormone, usually leading to transcriptional repression. Hormone binding is associated with a conformational change in the receptor that causes it to function as a transcriptional activator. <p>Four isoforms of the Thyroid hormone receptor are known (alpha-1 and 2, beta-1 and 2). Distribution of isoforms is tissue-specific. Thyroid hormone receptor isoforms can form dimers with one another and still activate the gene.

18) With respect to thyroid hormone excretion, which of the following statements is FALSE?

A. Acetic acid derivatives of T3 and T4 are formed in several tissues; these are excreted via urine and feces
* B. The primary mode of removal is through catabolism in tissue
C. The half life of T3 is 1 day while that of T4 is about 6-7 days
D. Deiodination of thyroid hormones occurs in liver, kidney, brain and muscle
E. Conjugation of thyroid hormones occurs in the liver. Excretion is via bile, and some via the kidney

19) With respect to the physiological action of thyroid hormones, which of the following is FALSE?

  A. They are involved in the synthesis of other hormones like GH and glucocorticoids
  B. They are needed for normal gonadal development and function
  C. They are needed for normal hematopoiesis
* D. Thyroid hormone deficiency may lead to gigantism
  E. They are needed for normal embryonic/fetal development, particularly for the development of the central nervous system

Some of the physiological actions of thyroid hormones include :
Many of the effects of THs are permissive, in collaboration with other hormones
Commonly involved in the synthesis of other hormones (e.g., GH and glucocorticoids), also enhance the effects of GH
Needed for normal hematopoiesis (red blood cell production)
En ATP production (and calorigenesis) by isolated mitochondrial preparations Needed for normal gonadal development and function Needed for normal embryonic/fetal development, particularly for the development of the central nervous system Thyroid hormone deficiency may lead to cretinism
T3 also substantially increases: Na+/K+ pump activity The number of mitochondria ATPase activity Cellular glucose uptake

20) Which of the following conditions is least likely to cause hypothyroidism?

  A. Impaired TH synthesis
  B. TSH deficit
  C. Insufficient dietary iodide
* D. Thyroid tumours
  E. Mutant thyroid hormone receptor

Hypothyroism can be primary (thyroid follicle destruction, although over 75% of both lobes must be non-functional before clinical signs show up), secondary (TSH deficiency) or tertiary (TRH deficiency). Among the causes are (* - goitre) Insufficient dietary iodide* Anti-thyroid factors (goitrogens) in diet* Mutant TSH-R or TRH-R (genetic) Mutant TH transport proteins Peripheral resistance to TH (mutant T3R?) TSH deficit Impaired TH synthesis* Thyroiditis
</ul Hyperthyroidism can be caused by : Autoimmune response to TSH-R (Grave’s disease [thyrotoxicosis]*) Thyroid tumors Inflammation of the thyroid Ectopi thyroid

21) When goitres are associated with hypothyroidism, a common mechanism is which one of the following?

  A. Low iodide intake ...Low thyroid hormone ... low TRH ... low TSH ... enlarged thyroid gland
* B. Low iodide intake ...Low thyroid hormone ... high TRH ... high TSH ... enlarged thyroid gland
  C. High iodide intake ...high thyroid hormone ... high TRH ... high TSH ... enlarged thyroid gland
  D. Low iodide intake ...high thyroid hormone ... high TRH ... high TSH ... enlarged thyroid gland

A goitre (or goiter) is a swelling in the neck (just below Adam's apple or larynx) due to an enlarged thyroid gland. The most common cause for goitre in the world is iodine deficiency. Iodine is necessary for the synthesis of the thyroid hormones triiodothyronine and thyroxine (T3 and T4). In conditions producing endemic goitre, when iodine is not available, these hormones cannot be made. In response to low thyroid hormones, the pituitary gland releases thyroid stimulating hormone (TSH). Thyroid stimulating hormone acts to increase synthesis of T3 and T4, but in excess it also causes the thyroid gland to grow in size as a type of compensation.

22) When goitres are associated with antibody-induced hyperthyroidism, common plasma measurements are as follows

  A. Low T3 & T4, low TSH, low TRH
  B. High T3 & T4, high TSH, low TRH
* C. High T3 & T4, low TSH, low TRH
  D. Low T3 & T4, high TSH, low TRH

Hyperthyroidism is often caused by an autoimmune disorder (Grave's disorder in humans), in which the body produces antibodies to the receptor for Thyroid-stimulating hormone (TSH). (Antibodies to thyroglobulin and to the thyroid hormones T3 and T4 may also be produced.) This is an example of a type II hypersensitivity. These antibodies cause hyperthyroid because they bind to the TSH receptor and <u>chronically stimulate</u> it. The TSH receptor is expressed on the follicular cells of the thyroid gland (the cells that produce thyroid hormone), and the result of chronic stimulation is an abnormally high production of T3 and T4. This in turn causes the clinical symptoms of hyperthyroidism, and the enlargement of the thyroid gland visible as goiter. In addition, high T3 & T4 down-regulate TRH and TSH.

23) Which statement regarding calcium is incorrect?

  A. Intracellular Ca++ is largely associated with membranes in mitochondria, endoplasmic reticulum and plasma membrane
* B. Within soft tissue, the major of Ca++ is stored in extra-cellular space
  C. The majority of calcium within the body is in the bones
  D. A human weighing 70kg will, on average, have about 1.2kg of Ca++
  E. Of extracellular Ca++, some is 'free', some is protein-bound and a little is complexed with phosphate and citrate
  F. Calcium is stored in bones in the form of hydroxyapatite

99% of calcium in the body is within bones as Hydroxyapatite (Ca10 (PO4)6 (OH)2)
< soft tissue, intracellular Ca++ is ten times that of extracellular (about 11 gms to 1 gm in a 70kg human).
Extracellular Ca2+ is very tightly regulated
Ionized calcium ('free'; 50%)
Protein-bound calcium (40%)
Calcium complexed with phosphate and citrate (10%)
Cellular Ca2+ is also highly regulated. It is largely associated with membranes in mitochondria, endoplasmic reticulum and plasma membrane

24) Homeostasis of calcium and phosphate primarily involve

  A. Bone, Kidney, Liver, Blood plasma, muscle cells
* B. Bone, Kidney, Gut, Blood plasma, muscle cells
  C. Bone, Spleen, Liver, Blood plasma, muscle cells
  D. Bone, Liver, Gut, Blood plasma, muscle cells

The major sites for regulation of Ca2+ homeostasis are :
Bones : exchange of up to 20 g/day
Gut : Of the average daily intake of 1000 mg, 700 mg is absorbed. However, 600 mg is excreted into the gut, giving a net intake of just 10% (100 mg)
The kidneys filter about 10 gms per day, reabsorbing 99% of it (9.9 gms).
Hormones (calcitonin, PTH) control the balance of Ca++ in blood plasma, cellular spaces and interstitium.

25) With regard to hormones controlling Ca++ homeostasis, which of these statements is incorrect?

  A. Parathyroid hormone (PTH) is a peptide produced by the parathyroid gland
  B. Calcitonin is secreted in response to hypercalcaemia
  C. PTH is secreted continuously; under hypocalcaemic conditions, secretion increases and vice-versa
* D. Calcitonin lowers serum Ca2+ mainly by promoting osteoblast activity
  E. PTH increases serum Ca2+ mainly by promoting osteoclast activity
  F. Calcitonin is a peptide produced by thyroid 'C' cells

Parathyroid hormone (PTH) Peptide produced by the parathyroid gland Increases serum Ca2+ mainly by promoting osteoclast activity Secretion of PTH largely determined by serum Ca2+ concentration Parathyroids seen in terrestrial amphibians onwards 2 pairs in the neck, one often within the thyroid gland 2 cell types: chief cells (produce PTH) and oxyphils (function unknown)
Vitamin D3 and hypercalcaemia down-regulate PTH secretion while hypocalcaemia up-regulates it <p>(Thy Peptide produced by thyroid 'C' cells Secreted in response to hypercalcaemia, short acting Lowers serum Ca2+ by <u>inhibiting osteoclast activity</u> Also reduces Ca2+ & PO4- reabsorption by the nephron (distal tubules)

26) With regards to calciferols, which of the following statements is FALSE?

* A. Estrogens/androgens enhance PTH actions by slowing turnover of bone
  B. It enhances absorbance of Ca2+ and PO4- by the gut and reabsorption of these ions by the nephron tubule cells
  C. PTH increases while calcitonin decreases vitamin D3 synthesis
  D. Glucocorticoids oppose calciferol actions in the GI tract
  E. In dogs and cats vitamin D3 is an essential vitamin

Vitamin D is a group of fat-soluble prohormones, the two major forms of which are vitamin D2 (or ergocalciferol) and vitamin D3 (or cholecalciferol). The term vitamin D also refers to metabolites and other analogues of these substances. Vitamin D3 is produced in skin exposed to sunlight, specifically ultraviolet B radiation. <p>Vitamin D plays an important role in the maintenance of several organ systems. Vitamin D regulates the calcium and phosphorus levels in the blood by promoting their absorption from food in the intestines, and by promoting re-absorption of calcium in the kidneys. It promotes bone formation and mineralization and is essential in the development of an intact and strong skeleton. It inhibits parathyroid hormone secretion from the parathyroid gland. Vitamin D affects the immune system by promoting immunosuppression, phagocytosis, and anti-tumor activity.
<p>Wikipedia article

27) With regards to Hyper- and hypoparathyroidism, which of the following statements is FALSE?

  A. Hyperparathyroidism causes increased thirst and urination because the increased plasma Ca2+ blocks ADH effects
* B. Hypoparathyroidism causes increased bone resorption increasing the possibility of fractures
  C. Hyperparathyroidism could cause mineralization of soft tissue
  D. Hypercalcitonism has similar effects as hypoparathyroidism
  E. Hypoparathyroidism can cause muscular weakness, ataxia and cardiac arrhythmias

Hyperparathyroidism is overactivity of the parathyroid glands resulting in excess production of parathyroid hormone (PTH). Primary hyperparathyroidism increased PTH, consequently leads to increased serum calcium (hypercalcemia) due to: increased bone resorption, allowing flow of calcium from bone to blood
reduced renal clearance of calcium
i intestinal calcium absorption
<p>Hypocalcemia is the only real result of parathyroid dysfunction and low PTH levels. This presents with tremor, tetany and, eventually, convulsions. In contrast to hyperparathyroidism (hyperfunction of the parathyroids), hypoparathyroidism does not have consequences for bone.

28) The adrenal cortex axis is controlled by all the following hormones, EXCEPT

  A. Glucocorticoids
  B. ADH
* C. Prolactin
  D. CRH
  E. ACTH

CRH is created in the paraventricular nucleus of the hypothalamus. It controls the POMC region (MSH, ACTH, endorphins, enkephalin) of the adenohypophysis. ACTH, in turn regulates the release of hormones from the adrenal cortex (glucocorticoids, mineralocort and sex hormones). Finally, glucocorticoids (cortisol) provide negative feedback to the adenohypophysis (short loop) and the hypothalamus (long loop).<p>ADH also increases ACTH synthesis and release from the adenohypophysis.

29) Cholestrol delivery into the mitochondria is the rate-limiting step in steroidogenesis. As it enters the inner chamber, it is converted to the steroid, pregnenolone (P5), by the action of the enzyme P450 side chain cleavage (P450scc). How does ACTH regulate steroidogene

A. ACTH increases the convolutions of cristae within the mitochondria increasing the surface area, thus increasing steroidogenesis
B. ACTH increases the potency of the P450 enzyme
C. ACTH inhibits peripheral-type benzodiazepine receptor (PBR), which is resident in the membrane, thus increases the flow of cholestrol
* D. ACTH stimulates the insertion of StAR protein into the mitochondrial membrane

Here are some of the facts regarding steroidogenesis :
Cholesterol delivery into the mitochondria is the rate-limiting step in steroidogenesis
As it enters the inner chamber, it is converted to the steroid, pregnenolone (a steroid <b>prohormone< involved in the steroidogenesis of progesterone, mineralocorticoids, glucocorticoids, androgens, and estrogens), by the action of the enzyme P450 side chain cleavage (P450scc)
<l cholesterol is very hydrophobic and cannot move through the hydrophilic compartment between the inner and outer mitochondrial membranes Insertion of StAR protein into the membrane allows cholesterol movement (and hence, increased P5 synthesis) ACTH (cAMP) stimulates the insertion of StAR protein into the membrane
Two proteins are probably involved:
Peripheral-type benzodiazepine receptor (PBR), which is resident in the membrane
Steroid acute regulatory (StAR) protein which can be inserted into the membrane
<

30) Which of the following statements regarding Adrenocorticosteroidogenesis is FALSE?

A. Cortisol, the main glucocorticoid, provides negative feedback to the adenohypophysis (short loop) and the hypothalamus (long loop)
B. The zona fasciculata is the middle layer of the adrenal cortex. It produces glucocorticoids (like cortisol).
* C. The adrenal cortex synthesizes three main categories of steroid hormones: Glucocorticoids, Mineralocorticoids and Androgens. All are regulated by ACTH.
D. Pregnenolone is a steroid prohormone (derived from cholesterol) involved in the steroidogenesis of progesterone, mineralocorticoids, glucocorticoids, androgens, and estrogens.
E. The zona reticularis is the innermost layer of the adrenal cortex. It produces sex steroids (like testosterone and estrogen).
F. The zona glomerulosa is the outermost layer of the adrenal cortex. It produces mineralocort (like aldosterone).

Which the synthesis and release of glucocorticoids and sex hormones is regulated by ACTH, mineralocorticoids are primarily regulated by the renin-angiotensin-aldosterone system (RAAS), which is a hormone system that helps regulate long-term blood pressure and extracellular volume in the body.<p>Catecholamines (epinephrine, norepinephrine) are synthesized in the adrenal medulla.

31) Which of the following statements regarding excretion of adrenocorticosteroids is FALSE?

  A. Potent steroids are converted into steroids that have low biological activity, and are more water soluble
* B. Like most other hormones, the primary means of excretion is catabolism
  C. The liver conjugates (joins) steroids to create steroid sulphates and steroid glucuronides making them more soluble
  D. Excretion is via urine, and some via bile

32) With respect to steroid hormone delivery to tissue, which of the following statements is FALSE?

  A. Steroid hormones, like thyroid hormone, target DNA in the nucleus, acting as transcription factors
  B. Within cells, chaperone proteins as well as receptor proteins play a part in delivery of the hormone
* C. All steroid hormones use transporter proteins to traverse the circulatory system
  D. Hormones must be released from the transporter protein to go intracellular

  Mineralocorticoids are not attached to transport proteins. <p><img src="Steroid-Hormone-Delive

  A. Stimulation of fat breakdown (lipolysis) in adipose tissue
  B. Developmental effects (e.g., formation of lung surfactant in the fetus)
  C. Glucocorticoids are involved in glucose metabolism.
  D. Glucocorticoids have potent anti-inflammatory and immunosuppressive properties.
* E. Stimulate glucose uptake into muscle tissue

  The name glucocorticoid derives from early observations that these hormones were involved in glucose metabolism. In the fasted state, cortisol stimulates :
Stimulation of gluconeogenesis, particularly in the liver Mobilization of amino acids from extrahepatic tissues: These serve as substrates for gluconeogenesis. Inhibition of glucose uptake in muscle and adipose tissue: A mechanism to conserve glucose. Stimu of fat breakdown in adipose tissue
In addition, glucocorticoids
have many permissive effects (10-20% of all expressed genes require cortisol involvement) have potent anti-inflammatory and immunosuppressive properties (inhibits chemo-attracti decrease cytokine production, reduces production of immune response cells)
have multiple effects on fetal development
Act on the nervous system (cortisol deficiency - Anorexia/fatigue + increased sense of taste, hearing and smell; excess - alternating bouts of euphoria and depress

34) Which of the following statements regarding aldosterone and ADH is FALSE?

A. ADH enhances water recovery from glomerular filtrate in the kidney
* B. Aldosterone acts by increasing the number of aquaporins on the surface of the collecting tubule
C. ADH is secreted from parvocellular neurons of the paraventricular nucleus in the hypothalamus and is stored in the neurohypophysis (posterior pituitary)
D. Aldosterone is a mineralcorticoid produced in the Zona glomerulosa of the adrenal cortex
E. Aldosterone is regulated by the renin-angiotensin-aldosterone system (RAAS) system

Both aldosterone and ADH are hormones that conserve water when up-regulated. Aldosterone recruits ATPases for active Na+ (and K+) transport, and Na+ and K+ channels, pulling in water along with Na+. ADH acts by increasing the number of aquaporins on the surface of the collecting tubule, thus allowing increased water reabsorption as the collecting duct passes through the hypertonic medullary region.

A. The juxtaglomerular apparatus is a microscopic structure in the kidney, which regulates the function of each nephron.
B. Secretory cells in the macula densa, stimulated by sensory cells, stimulate the secretion of the enzyme renin (from JG cells) into the afferent/efferent glomerular blood vessels.
* C. Angiotensin I causes vasoconstriction of peripheral blood vessels and acts to increase blood pressure
D. The JG apparatus comprises sensory cells (macula densa) in the wall of the distal tubule of the nephron which continuously monitor the Na+ concentration in the glomerular filtrate in the distal tubule, and the blood pressure in the kidney
E. Renin acts on Angiotensinogen (ATG), a constituent blood protein, and catalyzes the formation of the decapeptide, Angiotensin I

RAAS regulation is as follows :
The sensory cells (macula densa) continuously monitor the Na+ concentration in the glomerular filtrate in the distal tubule, and the blood pressure in the kidney If Na+ levels or blood pressure falls, the macula densa stimulate the release of the enzyme, renin, from secretory cells into the blood
Re
acts on Angiotensinogen (ATG), a constituent blood protein, and catalyzes the formation of the decapeptide, Angiotensin I (Ang I)
Ang I is converted into the octapeptide, Angiotensin II (Ang II), by an angiotensin converting enzyme (ACE) in capillary endothelial cells in the lungs
Angiotensin II causes vasoconstriction of peripheral blood vessels and acts to increase blood pressure Ang II also directly stimulates the secretion of aldosterone by the zona glomerulosa cells of the adrenal cortex Aldost
acts to retain Na+
Na+ retention causes water retention, which increases blood pressure</

36) Which of the following statements is FALSE?

A. ADH, also called vasopressin, differs slightly in structure in different species of animals. However, its function remains the same.
B. Oxytocin and ADH are stored in the neurohypophysis (posterior pituitary)
C. Diabetes insipidus can be "central" (reduced ADH secretion) or nephrogenic (renal tubule insensitivity to ADH)
D. Atrial natuiuretic peptide (ANP), produced by the right atrium, is inhibitory to RAAS
* E. ADH is part of RAAS

RAAS - Renin Angiotensin Aldosterone System. ADH is not part of the system, although it may work alongside in conserving water. <p>Atrial natriuretic factor (ANF), atrial natriuretic peptide (ANP) or atriopeptin, is a polypeptide hormone involved in the homeostatic control of body water,sodium, and adiposity. It is released by atrial myocytes, cells in the atria of the heart, in response to signals of raised blood pressure and acts to reduce the water, sodium and adipose loads on the circulatory system, thereby returning blood pressure to more normal levels. ANP
Inhibits renin secretion from JGA Inhi
aldosterone directly Decreases salt appetite

A. Insulin, which has a half-life of about 3-5 minutes, stimulates the uptake of glucose into cells
B. Beta cells, about 70-80 % of the cells of the Islets of Langerhans, secrete insulin
* C. GLUT2 is an insulin-regulated glucose transporter
D. Delta cells, about 3-5 % of the cells of the Islets of Langerhans, secrete somatostatin
E. Alpha cells, about 10 % of the cells of the Islets of Langerhans, secrete glucagon

GLUT4 (along with GLUT1 and 3) is the insulin-regulated glucose transporter found in adipose tissues and striated muscle (skeletal and cardiac) that is responsible for insulin-regulated glucose disposal. In the absence of insulin, GLUT4 is sequestered in the interior of muscle and fat cells. [Memory tool - 4 is "heavier" than 2, so it sinks into the cytoplasm]<p>GLUT2 is a transmembrane carrier protein and gene which is involved in passive transport of glucose over cellular membranes of the liver, pancreatic beta cells, hypothalamus, basolateral membrane small intestine. It is not insulin-dependant.<p>Insulin has a number of effects, including :
affects membrane glucose transporters (GLUT) in target cells stimulates glycogen production by skeletal muscle cells and hepatocytes stimulates amino acid uptake by skeletal muscles and other cells stimulates the rate of amino acid incorporation into proteins inhibits glycogen breakdown and glucose release by

38) Which of the following are "hyperglycemic" hormones (increase blood sugar levels)?

A. Insulin
B. IGF-1
* C. Epinephrine
* D. Glucocorticoids
* E. Glucagon
* F. GH

Glucagon's half life is as little as 6 minutes, while insulin's is 3-5 minutes. Insulin-like growth factor 1 (IGF-1) is a polypeptide protein hormone similar in molecular structure to insulin. Almost every cell in the human body is affected by IGF-1, especially cells in muscle, cartilage, bone, liver, kidney, nerves, skin, and lungs. In addition to the insulin-like effects, IGF-1 can also regulate cell growth and development, especially in nerve cells, as well as cellular DNA synthesis.

39) Which of the following hormones have inhibitory controlling hormones?

A. Insulin
* B. Prolactin
C. TSH
* D. GH
* E. Melanocyte stimulating hormone (MSH)
F. ACTH

Only the hypothalamus creates "inhibiting" hormones. These include :
SRIH (somatostatin - inhibits secretion of GH
DOPA (dopamine) - inhibits Prolactin MIF (MSH inhibiting factor) - inhibits secretion of MSH
It isn't clear why such inhibitory hormones are required.