Republic of Iraq

Ministry of Higher Education and Scientific Research

Al-Furat Al-Awsat Technical University

Karbala Technical Institute

Department of Community Health

General Human Physiology

Theoretical Lectures

Class: 1st Year (Second semester)

Time: 2 hours

Preparation by;

Assist. Pro. **Lecturer.**

Dr. Zainab Abdmohsen Al-Habobi **Dr. Shukrya H. Alwan**

2022 – 2023

**** وصف البرنامج الاكاديمي:-**

يوفر برنامج الوصف الاكاديمي هذا ايجازاً مقتضياً لاهم خصائص البرنامج ومخرجات التعليم المتوقعة من الطالب تحقيقها مبرهناً عما اذا كان قد حقق الاستفادة القصوى من الفرص المتاحة. ويصاحبه وصف لكل مقرر ضمن البرنامج.

1. المؤسسة التعليمية	**جامعة الفرات الأوسط التقنية**
2. القسم العلمي/ المركز	**المعهد التقني كربلاء**
3. اسم البرنامج الاكاديمي او المهني	**وظائف الأعضاء**
4. اسم الشهادة النهائية	**دبلوم تقني**
5. النظام الدراسي: سنوي/مقررات/اخرى	**فصلي**
6. برنامج الاعتماد المعتمد	**القسم العلمي في طور الاعتراف الرسمي من قبل الاعتماد الاكاديمي للتخصصات الطبية لمنظمة الصحة العالمية**
7. المؤثرات الخارجية الأخرى	**هناك علاقة وثيقة بسوق العمل الذي يستقبل خريجينا**
8. تاريخ اعداد الوصف	**2022/12/11**

9. اهداف البرنامج الاكاديمي

1- المعرفة التقنية سيكون الطالب قادرا على أن يتمكن من أجراء بعض الفحوصات والتحليلات الخاصة بوظائف الأعضاء والأجهزة المختلفة للجسم.

2- مؤهلات الخريج /

- **معرفة تركيب وظيفة كل عضو في الجسم -**
- **ب 2 معرفة الفحوصات السريرية وعلاقتها بوظيفته الاعضاء -**
- **ب 3 معرفة الامراض المعدية وطرق الوقاية -**
- **ب 4 معرفة الصحة المدرسية والريفية والمهنية**

3- التحضير للمهنة /يكون التحضير من خلال العمل على أجراء التحليل التي لها علاقة مع وظائف الجسم .

4- المهارات العامة والتأهيلية المنقولة (المهارات الاخرى المتعلقة بقابلية التوظيف والتطور الشخصي)

1. **خريج المعهد الطبي -**
2. **قدرتة العالية على التعاون وتصحيح الاخطاء -**
3. **مهارته في اداء العمل المطلوب -**
4. **قابلية على تطوير اي مهارة يتطلبها العمل الموجود فيه**

طرائق التعليم والتعلم

1. **المحاضرة واستخدام الوسائل العلمية الحديثة في عرض المحاضرات - (data show).**
2. **المختبرات .**
3. **اسئلة مباشرة .**
4. **نقل واقع المحاضرة من الجانب النظري الى العملي .**
5. **توزيع الطلبة بشكل مجاميع لمناقشة مواضيع معينة.**

طرائق التقييم

1- **الإمتحانات اليومية.**
2- **الامتحانات الفصلية**
3- **الامتحانات النهائية.**
4- **المشاريع العملية.**
5- **التقارير المختبرية .**

10. بنية البرنامج

المرحلة الدراسية	رمز المقرر او المساق	اسم المقرر او المساق	الساعات المعتمدة	
			نظري	عملي
المرحلة الاولى	T.C.H	وظائف الأعضاء	(15) فصل 1	(15) فصل 1
			(15)فصل 2	(15) فصل 2

11. التخطيط للتطور الشخصي

1- **التعليم التطبيقي في المؤسسات الصحية .**
2- **العمل في المختبرات واجراء التجارب التي لها علاقة بقياس وظائف الجسم .**

12. معيار القبول (وضع الانظمة المتعلقة بالالتحاق بالكلية أو المعهد)

1- المعدل لخريجي الدراسة الإعدادية /الفرع العلمي الاحيائي .
13. أهم مصادر المعلومات عن البرنامج
1. Lecture Notes. Dr. Zainab A. Alhabobi& Dr. Shukrya H. Alwan, 2022. **2. Hall, J. E. 1. (2006). Guyton and Hall textbook of medical physiology (11th edition.). Philadelphia, PA: Elsevier.** **3. Bipin Kumar. 2001.Human Physiology. Campus Books International, New Delhi.**
14 . الاهداف الوجدانية والقيمية
1- مهارات البحث. **2- أجراء التجارب الخاصة بوظائف الأعضاءوكفية العمل على الاجهزة الأجهزة .** **3- مهارات على تحديد الوظائف الحيوية للجسم المتعلقة بوظائف الجسم .**

بنية المنهج الفصل الثاني

Week	Topics details
1	Digestive system – part of it
2	Stage of digestion (oral, stomach, intestine) and digestives enzymes.
3	Intestinal functions and absorption
4	Digestion system glands (salivary glands , pancreas – liver) structures and functions
5	Gallbladder – structure and functions
6	Stool formation
7&8	Nervous system –structure – functions Central nervous system –peripheral nervous system
9	The brain and spinal cord
10 &11	Different area in brain which responsible for sense, movement, hearing, smell, taste, sight.
12	Endocrine glands (types & functions)

&13	
14 &15	Reproductive system (male and female) structure and functions

الاسبوع الاول والثاني

Physiology of Nervous System

The nervous system is a major communicating and control system within the body. It works with the endocrine system to control many body functions. The nervous system provides a rapid and short acting response and the endocrine system provides a slower but often more sustained response. The two systems work together to maintain homeostasis. **Neuron (nerve cell)** which is the functional unit of the nervous system. Neurons consist of an axon, dendrites and a cell body. Their function is to transmit nerve impulses **(Figure 4.1).**

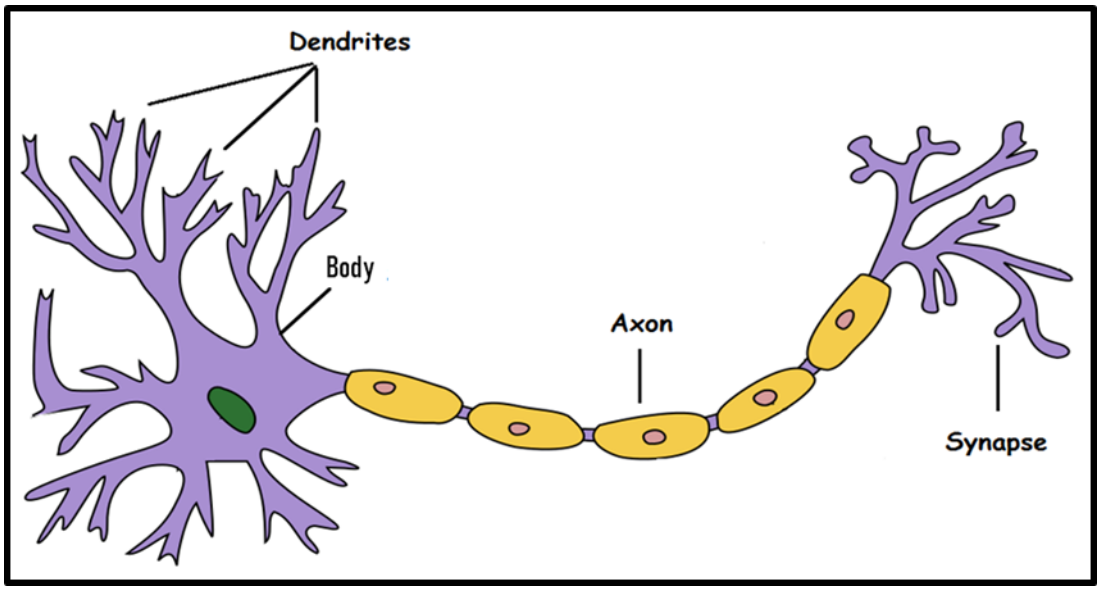


Figure (4.1): Neuron

Functions of the Nervous System:

1. Integration of body processes

2. Control of voluntary effectors (skeletal muscles).

3. Control of involuntary effectors (smooth muscle, cardiac muscle, glands).

4. Response to stimuli

5.Responsible for conscious thought and perception, emotions, personality, the mind.

Neural synapses: its small gap or space between the axon of one neuron and the dendrite of another. which uses neurotransmitters (**Figure 4.2)** to start the impulse in the second neuron or an effector (muscle or gland)

Neurotransmitters: Chemicals in the junction which allow impulses to be started in the second neuron. It also Propagated action potentials carry information through axons over long distances. Examples of neurotransmitters are **Acetylcholine, Norepinephrine, Epinephrine, Dopamine, Glutamate, Gamma-Aminobutyric Acid, Serotonin, Glycine, Histamine and Nitric Oxide.**

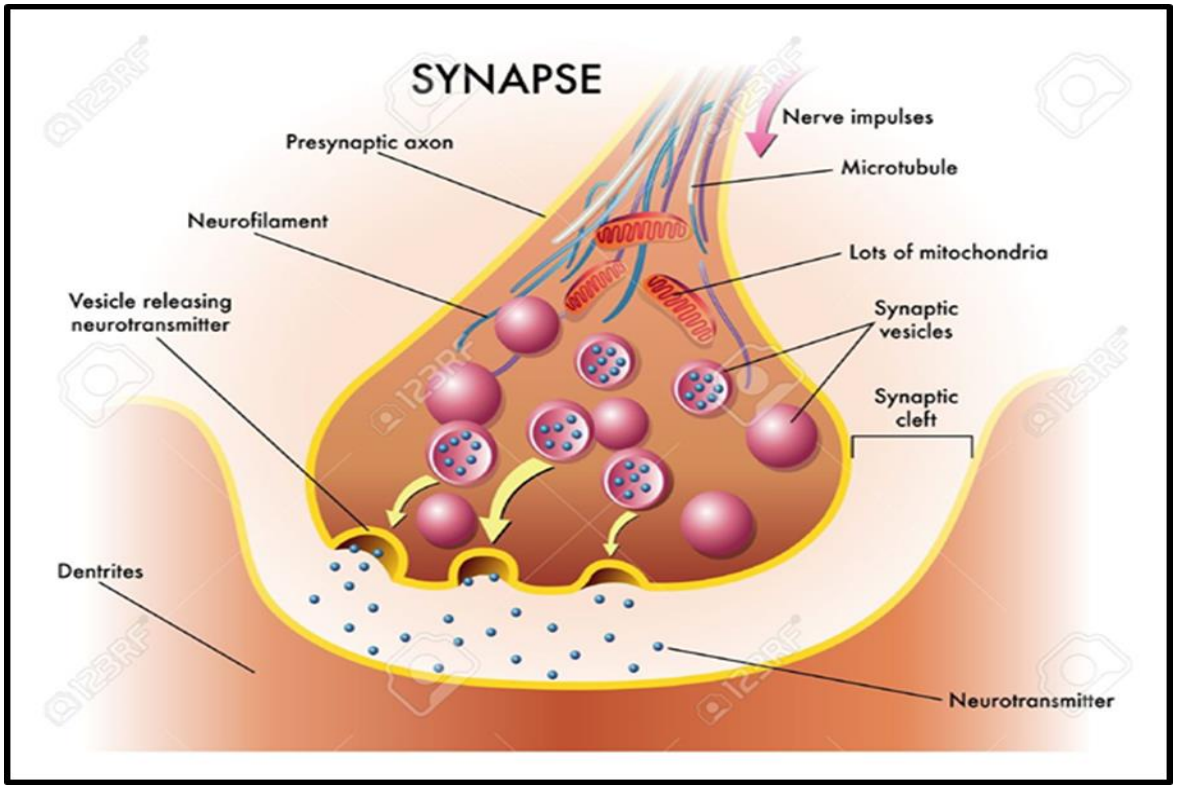


Figure (4.2): Synapse and Neurotransmitters

Nervous System Divisions:

The nervous system has two divisions **(Figure 4.3)**. The **central nervous system** (**CNS**) consists of the **brain and spinal cord**. The **peripheral nervous system** (**PNS**) consists of the autonomic nervous system (sympathetic and parasympathetic) and somatic nerves (motor and sensory).

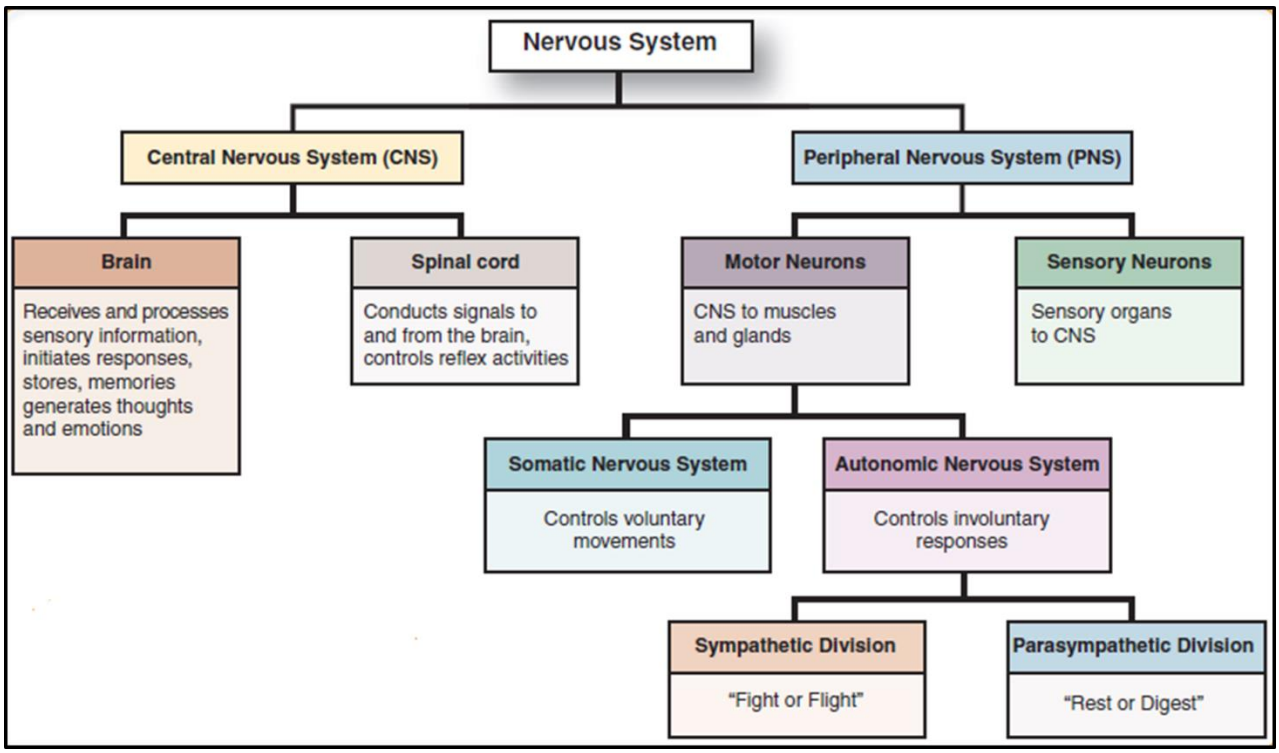


Figure (4.3): Nervous System

Central nervous system:

A. Brain

The brain consists of many parts that function as an integrated whole. The major parts are the medulla oblongata, pons, and midbrain, the cerebellum, the hypothalamus, the thalamus, and the cerebrum. The brain is a well - protected control and integration center which receives information from the peripheral sensory nervous system and sends motor information to the peripheral nervous system through a network of pathways via the spinal cord.

B. Spinal cord

The spinal cord transmits impulses to and from the brain and is the integrating center for the spinal cord reflexes. spinal cord is enclosed within the vertebral canal which forms a protective ring of bone around the cord. Other protective coverings include the spinal meninges, which are three layers of connective tissue coverings which extend around the spinal cord. The spinal meninges consist of:

- **Pia mater** – the innermost layer
- **Arachnoid mater** – the middle layer
- **Dura mater** – the outermost layer.

-The spinal cord consists of a central canal and grey and white matter. The central canal and the spinal meninges contain cerebrospinal fluid.

Reflex Action

-A reflex action is an involuntary response to a stimulus for example painful stimulus applied to the hand leads to reflex withdrawal of the arm (the withdrawal reflex).

-The basic structural unit of the nervous system which is capable of conducting a reflex action is the **reflex arc**. **A reflex arc consists of 5 components (Figure 4.4):**

1. Receptors: detect a change (the stimulus) and generate impulses.

2. Sensory neurons: transmit impulses from receptors to the CNS.

3. Central nervous system: contains one or more synapses (interneurons may be part of the pathway).

4. Motor neurons: transmit impulses from the CNS to the effector.

5. Effector: performs its characteristic action.

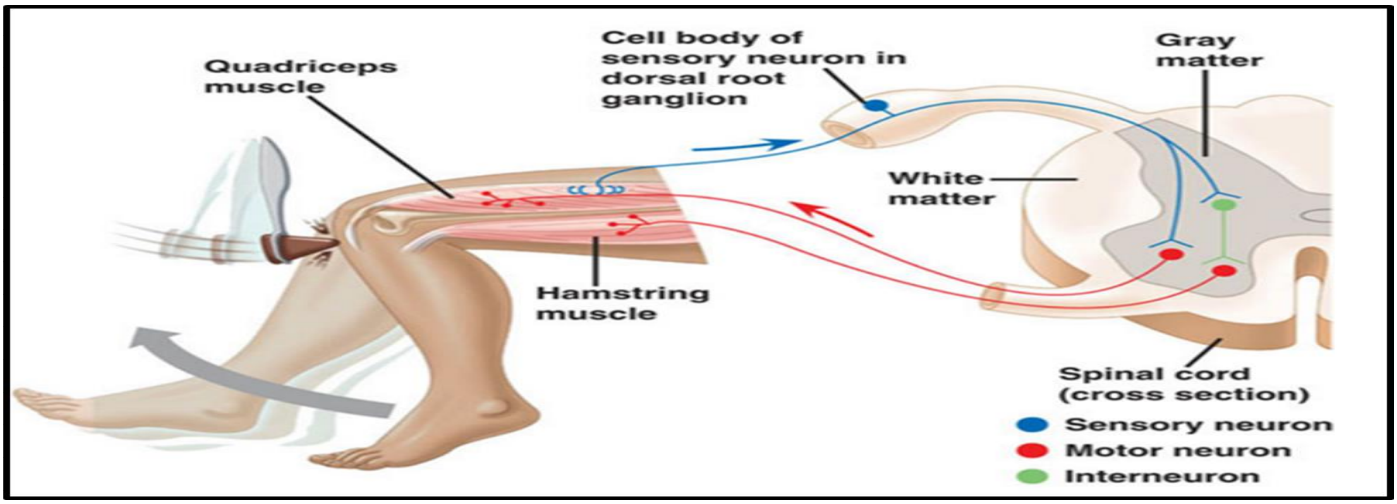


Figure (4.4): Reflex action

The peripheral nervous system

-The PNS is subdivided into the efferent or motor system and the afferent or sensory system.

A. Sensory neurons: The somatic sensory system serves the skeletal muscles, joints, tendons and the skin and includes the senses of vision, hearing, smell and taste. The internal organs of the body are supplied by **the visceral sensory system**. Both the somatic and visceral sensory systems take information from peripheral sensory receptors towards the CNS.

B. Motor neurons: the CNS to the skeletal muscles are carried by the somatic motor system. The autonomic motor system predominantly regulates the activity of smooth and cardiac muscles and glands.

- The peripheral nervous system includes **cranial and spinal nerves** that connect **the brain and spinal cord**, respectively, to peripheral structures such as the skin surface and the skeletal muscles.

Cranial Nerves

-Cranial nerves are nerves that are attached to the brain. There are 12 pairs of cranial nerves **(Figure 4.5).**

Number	Name	Components	Location/Function
	Olfactory	Sensory	Olfactory receptors for sense of smell
	Optic	Sensory	Retina (sight)
I	Oculomotor	Motor	Eye muscles (including eyelids and lens, pupil)
V	Trochlear	Motor	Eye muscles
	Trigeminal	Sensory and motor	Teeth, eyes, skin, tongue for sensation of touch, pain and temperature
VI	Abducens	Motor	Jaw muscles (chewing) Eye muscles
VII	Facial	Sensory and motor	Taste buds Facial muscles, tear and salivary glands
VIII	Vestibulocochlear	Sensory	Inner ear (hearing and balance)
X	Glossopharyngeal	Sensory and motor	Pharyngeal muscles (swallowing)
	Vagus	Sensory and motor	Internal organs
XI	Spinal accessory	Motor	Neck and back muscles
XII	Hypoglossal	Motor	Tongue muscles

Figure (4.5): Carinal nerve

Spinal nerves

-Spinal nerves are nerves that are attached to the spinal cord **(Figure 4.6).**

Spinal Nerves

lame	Spinal Nerves Involved*	Function
lusculocutaneous nerves	C_5–T_1	Supply muscles of the arms on the anterior sides, and skin of the forearms
adial nerves	C_5–T_1	Supply muscles of the arms on the posterior sides, and skin of the forearms and hands
ledian nerves	C_5–T_1	Supply muscles of the forearms, and muscles and skin of the hands
lnar nerves	C_5–T_1	Supply muscles of the forearms and hands, and skin of the hands
hrenic nerves	C_3–C_5	Supply the diaphragm
ntercostal nerves	T_2–T_{12}	Supply intercostal muscles, abdominal muscles, and skin of the trunk
emoral nerves	L_2–L_4	Supply muscles and skin of the thighs and legs
ciatic nerves	L_4–S_3	Supply muscles and skin of the thighs, legs, and feet

Figure (4.6): Spinal nerves

-The autonomic nervous system

-The autonomic nervous system (ANS) plays a major role in the maintenance of homeostasis by regulating the body’ s automatic, involuntary functions.

-The autonomic nervous system is divided into: sympathetic division (Norepinephrine) and the parasympathetic division (Acetylcholine) **(Figure 4.7)**.

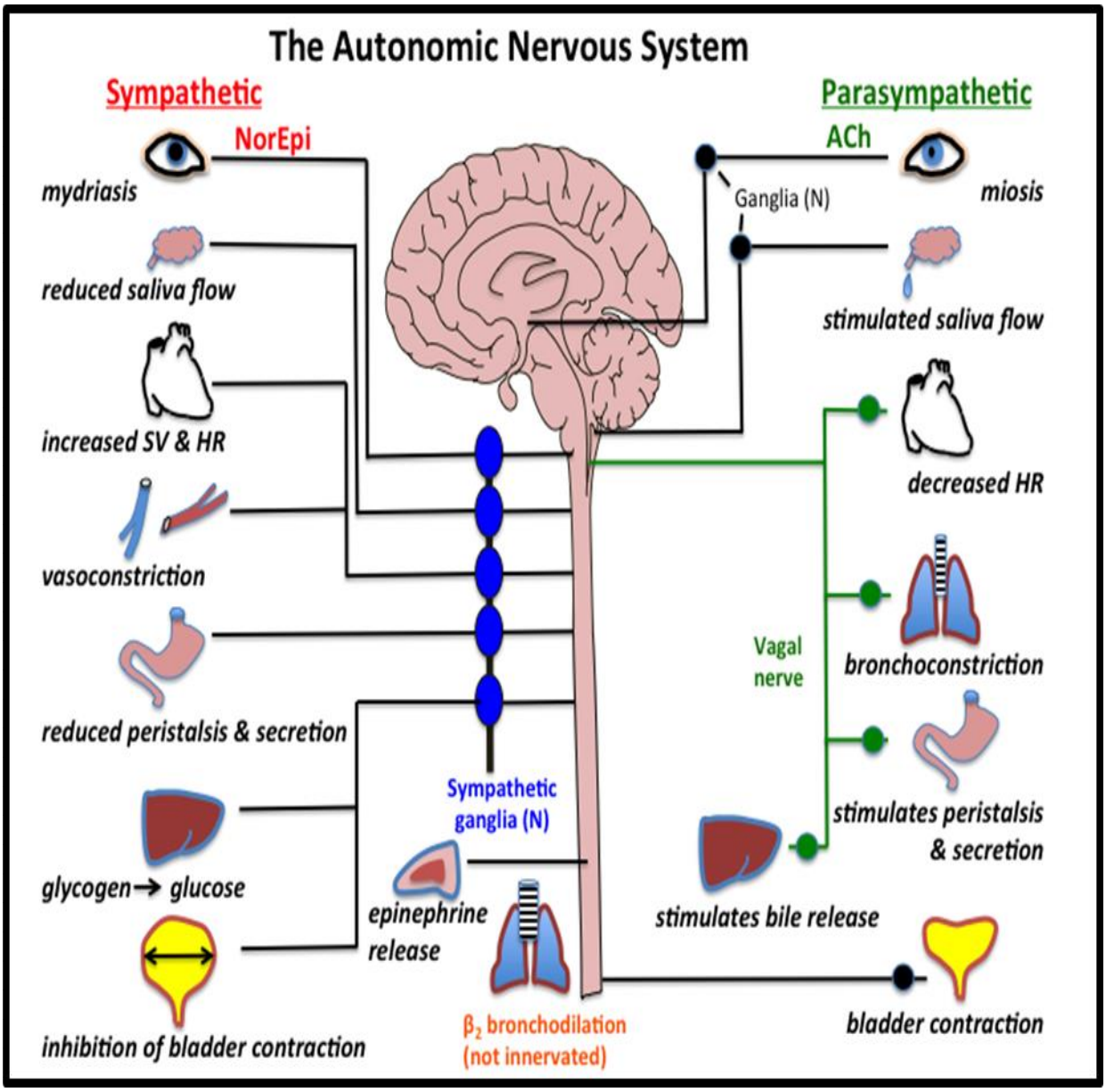


Figure (4.7): Autonomic Nervous System

الاسبوع الثالث والرابع

قسم تقنيات صحة المجتمع

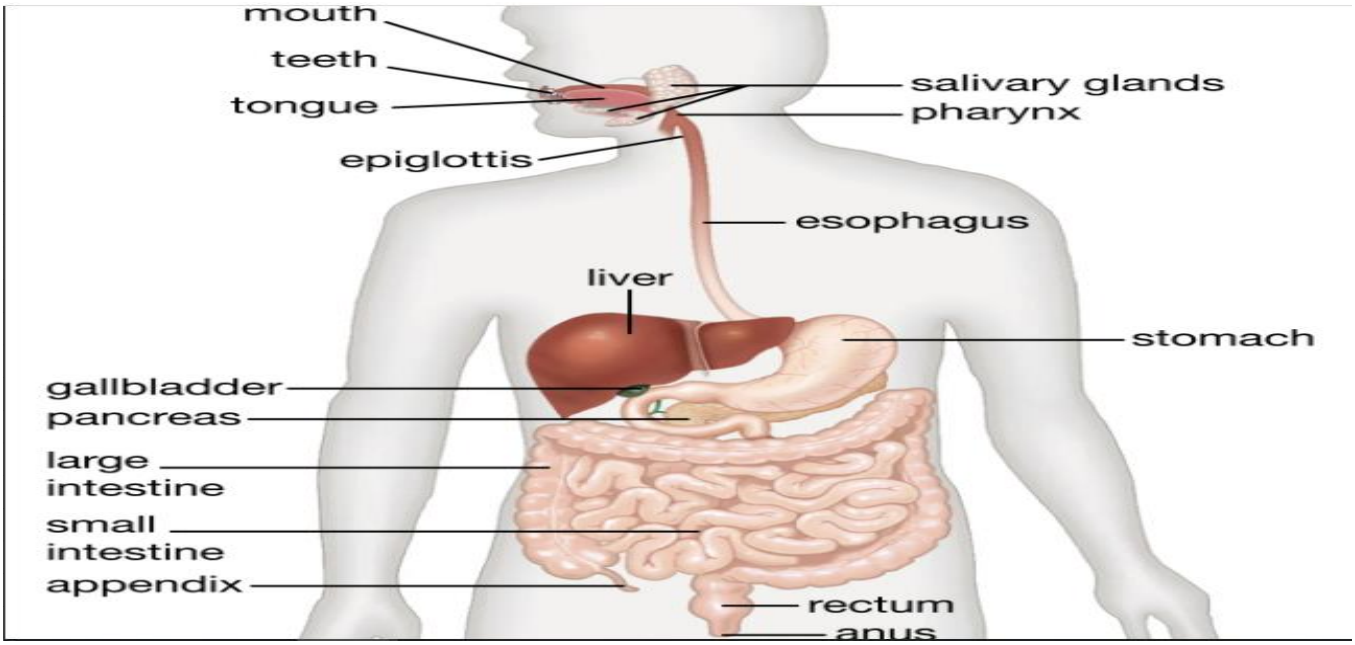
علم وظائف الأعضاء

General Human Physiology

المرحلة الاولى

Physiology of Digestive System

The digestive system consists of the digestive tract, is a tube extending from the mouth to the anus, and its associated accessory organs, primarily glands, which secrete fluids into the digestive tract. The digestive tract begins at the lips and ends at the anus. **gastrointestinal tract**, also called **digestive tract** or **alimentary canal**, pathway by which food enters the body and solid wastes are expelled. The gastrointestinal tract includes It consists of the mouth, or oral cavity, with its teeth, for grinding the food, and its tongue, which serves to knead food and mix it with saliva; the throat, or pharynx; the esophagus; the stomach; the small intestine, consisting of the duodenum, the jejunum, and the ileum; and the large intestine, consisting of the cecum, a closed-end sac connecting with the ileum, the ascending colon, the transverse colon, the descending colon, and the sigmoid colon, which terminates in the rectum.



Digestive tract or **Alimentary canal**

-The primary function of the digestive (gastrointestinal or GI) system (*gastro* means “stomach”) is to transfer nutrients, water, and electrolytes from the food we eat into the body’s internal environment.

1. **Mechanical**

   mastication (chewing), swallowing (deglutition) and movements of the GIT (motor functions)

2. **Chemical** Saliva, gastric juice, pancreatic juice, intestinal juice and bile

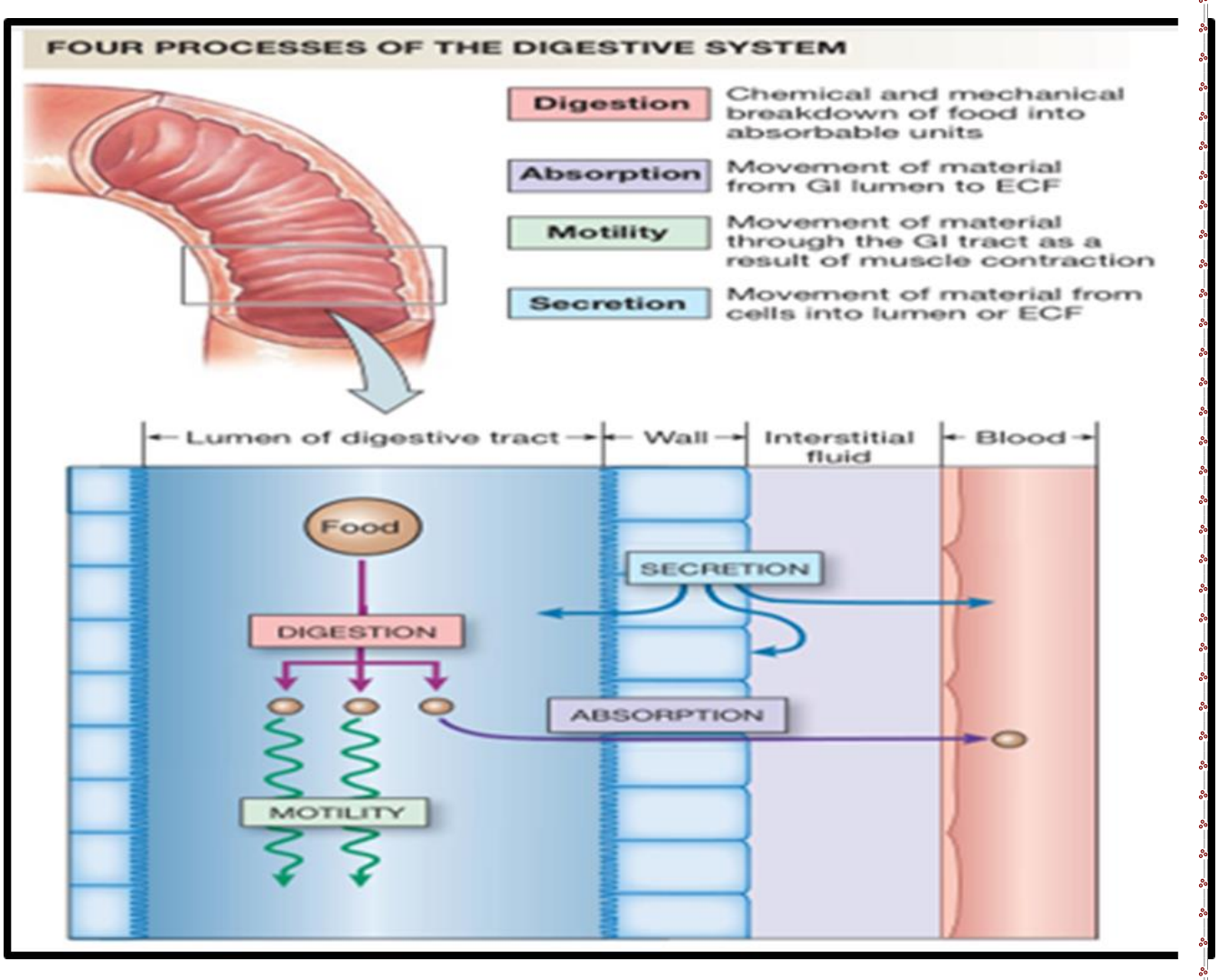


Figure (6.1): The processes of digestive system

The main parts of the digestive tract and functions (Figure 6.2):

1. **Oral cavity**

A. *Ingestion*. Solid food and fluids are taken into the digestive tract through the oral cavity.

B. *Taste*.

C. *Mastication*. Movement of the mandible cause the teeth to break food down into smaller pieces.

D. *Digestion*. Amylase in saliva begins carbohydrate (starch) digestion.

E. *Swallowing*. The tongue forms food into a bolus and pushes the bolus into the pharynx.

2. **Pharynx**

A. *Swallowing*. Materials are prevented from entering the nasal cavity by the soft palate and from entering the lower respiratory tract by the epiglottis and vestibular folds.

B. *Breathing*. Air passes from the nasal or oral cavity through the pharynx to the lower respiratory tract.

C. *Protection*. Mucus provides lubrication.

3. **Esophagus**

A. *Propulsion*. Peristaltic contractions move the bolus from the pharynx to the stomach. The lower esophageal sphincter limits reflux of the stomach contents into the esophagus.

B. *Protection*. Glands produce mucus that provides lubrication and protects the inferior esophagus from stomach acid.

4. **Stomach**
   - **A.** *Storage*. Rugae allow the stomach to expand and hold food until it can be digested.
   - **B.** *Digestion*. Protein digestion begins as a result of the actions of hydrochloric acid and pepsin.
   - **C.** *Absorption*. Except for a few substances (e.g., water, alcohol, aspirin) little absorption takes place in the stomach.
   - **D.** *Protection*. Mucus provides lubrication and prevents digestion of the stomach wall. Stomach acid kills most microorganisms.
5. **Small intestine**
   - **A.** *Neutralization*. Bicarbonate ions from the pancreas and bile from the liver neutralize stomach acid to form a pH environment suitable for pancreatic and intestinal enzymes.
   - **B.** *Digestion*.
   - **C.** *Absorption*. The circular folds, villi, and microvilli increase surface area. Most nutrients are actively or passively absorbed.
   - **D.** *Excretion*. Bile from the liver contains bilirubin, cholestrol, fats, and fat-soluble hormones.
   - **E.** *Protection*. Mucus provides lubrication, prevents the digestion of the intestinal wall, and protects the small intestine from stomach acid. Peyer's patches protect against microorganisms.
6. **Large intestine**
   - **A.** *Absorption*. The proximal half of the colon absorbs salts (e.g., sodium chloride), water, and vitamins (e.g., K) produced by bacteria.
   - **B.** *Storage*. The distal half of the colon holds feces until it is eliminated.

Muscular movement of the GI tract

1. **Peristalsis** – wavelike movement that occurs from the oropharynx to the rectum , allowing GI tract to push food particles toward the anus.
2. **Mixing**—mixing motion in the oral cavity and stomach that allows break down food into smaller particles.
3. **Segmentation** – regions of the small intestine contracting and relaxing independently , allowing the small intestine to digestive and absorb more efficiently

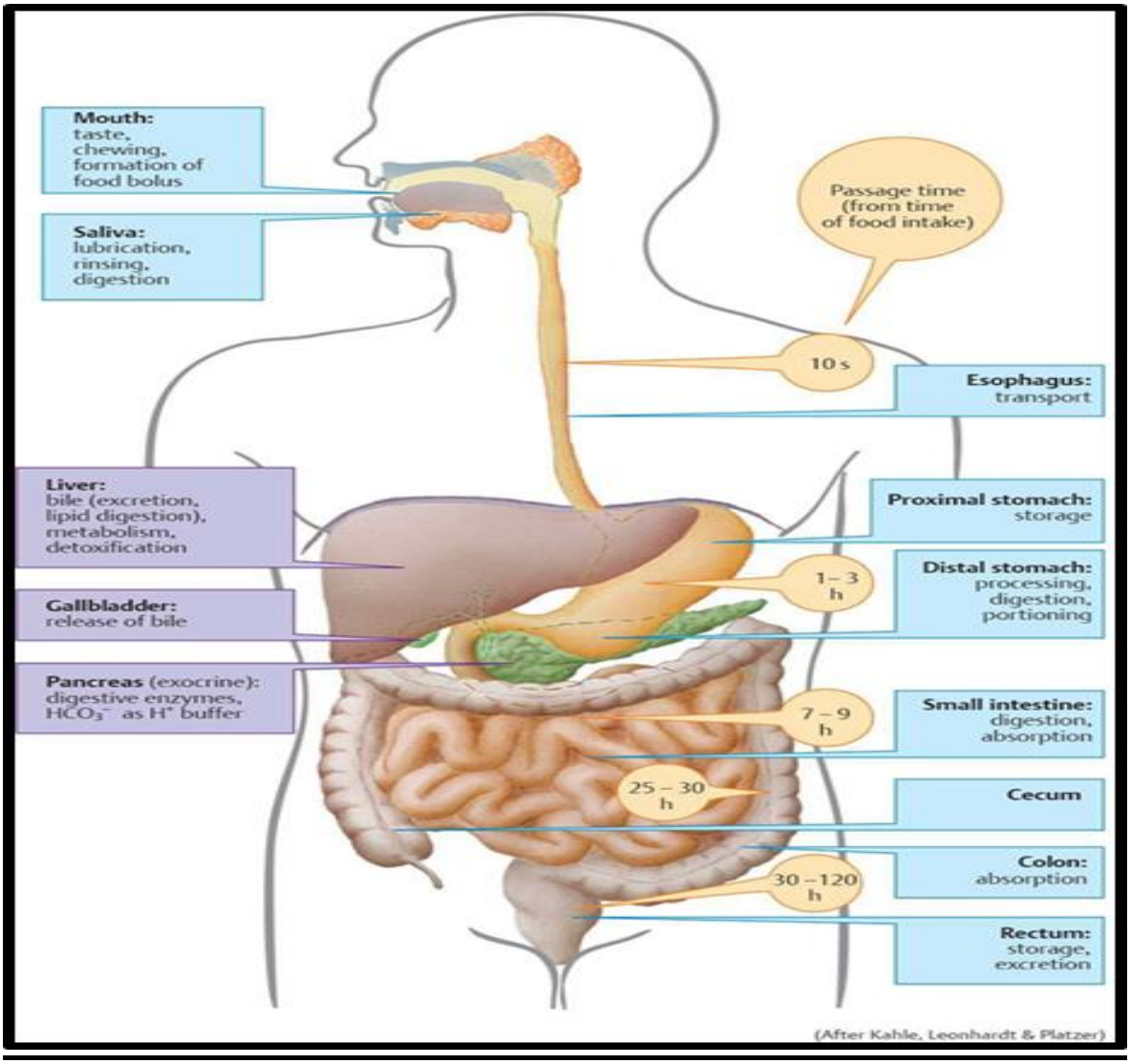


Figure (6.2): Digestive system

Stomach

The stomach is an enlarged segment of the digestive tract in the left superior part of the abdomen. Its shape and size vary from person to person **(figure 6.3)**.

gastric pits contain four major secretory cells:

1. **chief cells**

   i- secretes **pepsinogen**

   -activation of pepsinogen by low pH to form **pepsin**

   - pepsin is a protease for protein digestion

2. **parietal cells**

   i - secretes HCl

   ii -Intrinsic factor : binds to and allows B_{12} absorption in intestines

3. **G-cell**

   i - secretes **gastrin hormone**

   - gastrin activates gastric juice secretion and gastric smooth muscle "churning"

4. **mucus cell**

   i. protective role of mucus against acids and digestive enzymes

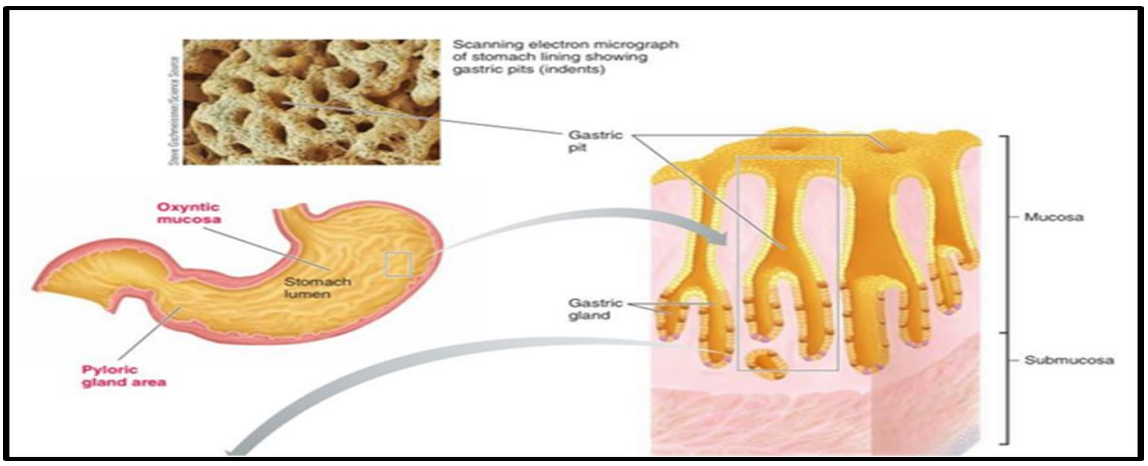


Figure (6.3): Stomach

Chemical digestion & absorption in the stomach:

1. Carbohydrate digestion is continued with gastric amylase, resulting in disaccharides.
2. Protein digestion begins with pepsin, resulting in peptides (small chains of protein).
3. Lipid digestion begins with gastric lipases which can only break down certain lipids.
4. Absorption in the stomach is limited, where only small and fat-soluble substances can be absorbed—water , alcohol, aspirin , and certain drugs .
5. The result of all these mixing , chemical digestion , secretion, and absorption is a yellowish paste called **chyme** , which will be passed on to the small intestine .

Three major mechanisms of gastric regulation

1. **Cephalic phase:** is activated by the smell and taste of food and swallowing.
2. **Gastric phase:** is activated by the chemical effects of food and the distension of the stomach.
3. **Intestinal phase:** blocks the effect of the cephalic and gastric phases.

Small Intestine

1. The small intestine is the site at which the greatest amount of digestion and absorption occur..

2. Approximately 21 ft. long/ 1inch diameter.

3. It divided into three major segments

A. duodenum ~12 inches

B. jejunum ~8 ft

C. ileum ~ 12 ft

Secretions of the Small Intestine

- The mucosa of the small intestine has glands for secretion of intestinal juice that primarily contain mucus, electrolytes, and water.
- Intestinal secretions lubricate and protect the intestinal wall from the acidic chyme and the action of digestive enzymes.
- mucosa also has circular folds, villi & microvilli for increased surface area
- "brush border" has many enzymes embedded in plasma membranes as peptidases, nucleosidases and enterokinase

Hormones secreted from SI (small intestine) mucosa

A. gastric inhibitory peptide (GIP)

i. fatty acids in chyme induce GIP secretion

ii. GIP inhibits gastric secretion

iii. GIP inhibits gastric "churning"

iv. GIP activates insulin secretion

B. secretin

i. inhibits gastric secretion

C. cholecystokinin (CCK)

i. CCK fatty acids in chyme induce CCK secretion

ii. CCK slows gastric emptying

The Pancreas

- Is a complex organ composed of both endocrine and exocrine tissues **(Figure 6.4)**.
- **The endocrine part** of the pancreas consists of pancreatic islets (islets of Langerhans). The islet cells produce insulin and glucagon, which are very important in controlling blood levels of glucose.
- **The exocrine part** of the pancreas is a compound acinar gland produce digestive enzymes.
- Approximately 1.5L/day pancreatic secretions produced.
- Secretions enter duodenum via two pancreatic ducts
- Many different components in these secretions
    - $NaHCO_3$ – buffers pH of chyme
    - pancreatic amylase
    - trypsinogen, chymotrypsinogen, trypsin acts on other proteases to activate them
    - lipases

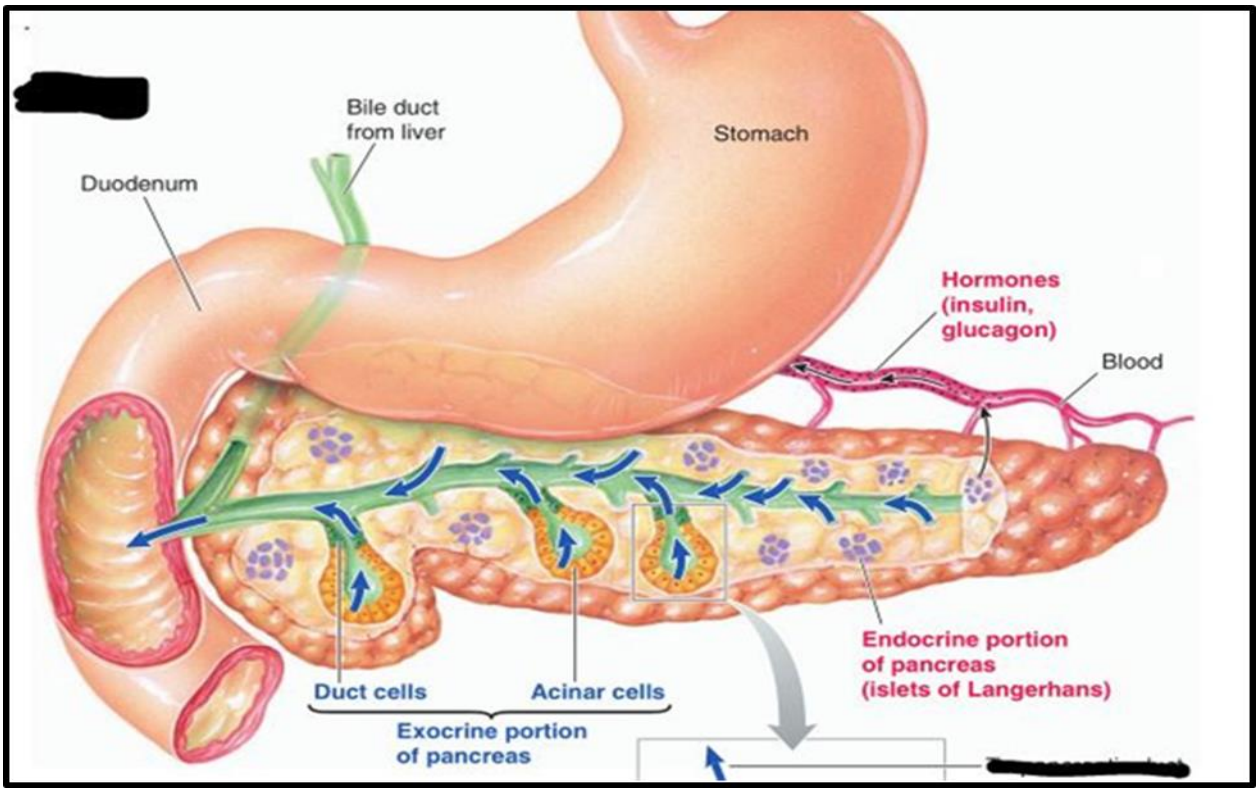


Figure (6.4): Pancreas

The Liver

- Liver is largest internal organ in body **(Figure 6.5)**.
- Receives nutrient-rich blood from SI via the hepatic portal vein.
- Many functions to liver besides aiding in digestion

1. **Bile synthesis** (approximately 1L/day):
    - Bile contains no digestive enzymes, but it plays a role in digestion because it neutralizes and dilutes stomach acid and emulsifies fats.
    - Bile salts (cholesterol derivatives) function to emulsify fats to aid enzymatic digestion
    - Bile salts are recycled (are not excreted) from colon back into liver for reuse
    - Main bile pigment is bilirubin – derived from RBC heme
    -
    - Bile is synthesized in liver, stored in gall bladder
    - "gallstones" are concentrated precipitates of cholesterol (gallstones form when bile is too rich in cholesterol or lacking bile salts)
2. **Storage:** hepatocytes can remove sugar from the blood and store it in the form of glycogen.
3. **Nutrient Interconversion:** Ingested nutrients are not always in the proportion needed by the tissues. If this is the case, the liver can convert some nutrients into others. If, for example, a person is on a diet that is excessively high in protein, and an undersupply of lipids and carbohydrates, the hepatocytes break down the amino acids and cycle many of them through metabolic pathways so they can be used to produce adenosine triphosphate, lipids, and glucose.
4. **Detoxification:** It detoxifies many substances by altering their structure to make them less toxic or make their elimination easier.
5. **Synthesis:** produces many blood proteins, such as albumins, fibrinogen, globulins, heparin, and clotting factors.

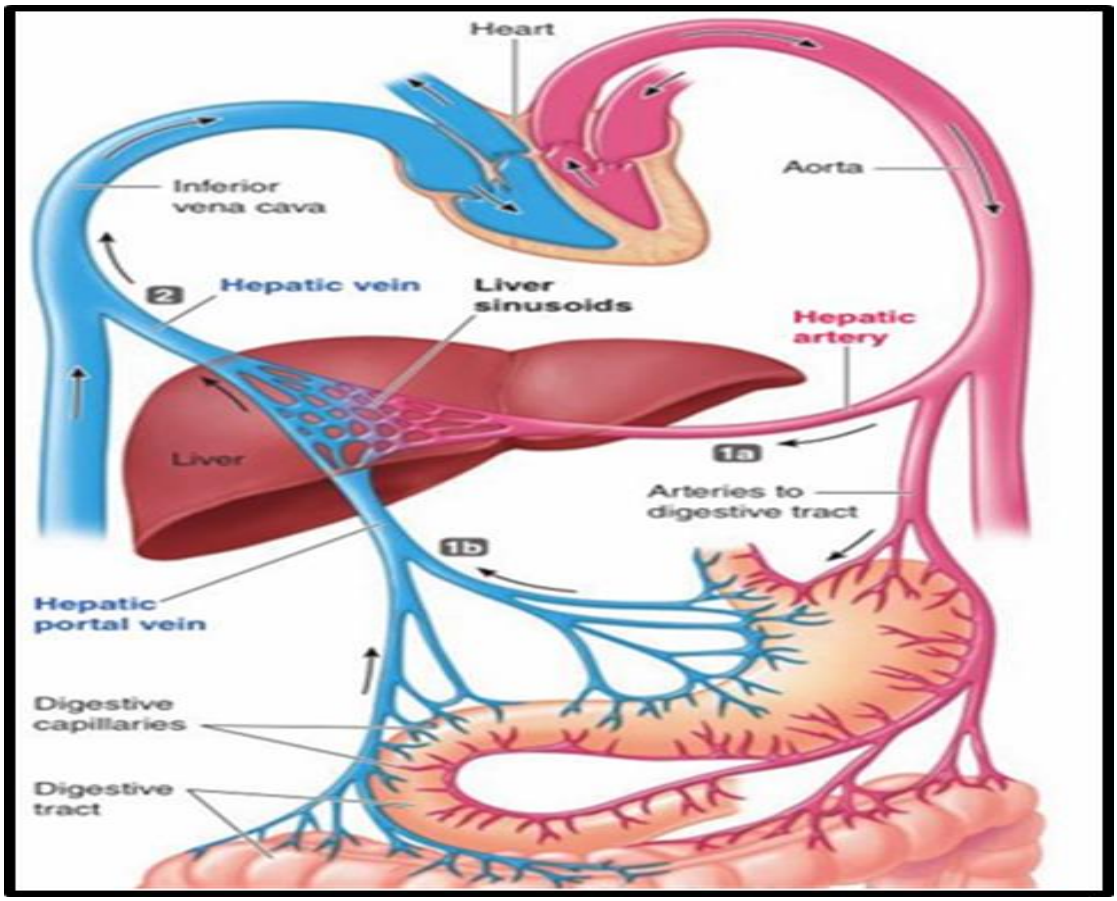


Figure (6.5): Liver

Large Intestine

- Major function to absorb water, electrolytes and some vitamins .and eliminate indigestable matter
- The major structures of the LI

a) cecum with vermiform appendix

b) ascending, transverse, descending colon

c) sigmoid colon, rectum

- Haustra are pouches in wall of large intestine, its churning is sequential movement of contents from one haustra to the next
- Normal bacterial flora colonize colon where they break down certain indigestible substances and synthesize certain vitamins . (vitamin K synthesis by *E. coli* bacterium).

Physiology of the Reproductive System

Reproduction describes processes that maintain the species rather than the individual. These processes help to assure that a viable egg meets a viable sperm. The physiology of reproduction is largely about endocrine control.

-Normal functioning of the reproductive system is not aimed at homeostasis and is not necessary for survival of an individual, but it is essential for survival of the species.

Puberty

-**Puberty** is the stage of life when the reproductive system matures and becomes functional.

-Up until age 9, gonadotropin-releasing hormone (GnRH) from the hypothalamus and follicle stimulating hormone (FSH) and luteinizing hormone (LH) from the anterior pituitary are secreted at low levels in both males and females.

-At puberty, there is a shift to pulsatile GnRH release during various stages of sleep. GnRH causes upregulation of GnRH receptors in the anterior pituitary and a pulsatile release of LH and FSH (LH > FSH). Increased secretion of LH stimulates the production of the male sex hormones testosterone and dihydrotestosterone (DHT) and the female sex hormone estrogen that are responsible for the secondary changes in males and females at puberty.

Physiology of the male reproductive system

The male reproductive system has several functions:

1. To produce, maintain and transport the sperm (the male reproductive cells) and the fluid semen

2. To discharge sperm from the penis.

3. To produce and secrete the male sex hormones.

The major structures of the male reproductive system include:

-The testes, the external genitalia, incorporating the penis, scrotum, reproductive tract and a number of ducts responsible for the transportation of the sperm from the testes to the penis and outside the body; there are also **two seminal vesicles**, **bulbourethral glands** and the **prostate gland**.

The functions of the testes are to:

a. Produce sperm (spermatozoa)
b. Produce the male sex hormones; testosterone is one of these hormones.

Spermatogenesis

-Sperm production occurs in the seminiferous tubules of the testes and is termed **spermatogenesis** which is a complex activity**.** A young healthy man will produce many hundred million sperm daily.

-Spermatogenesis begins with **the spermatogonia**. The spermatogonia divide continually as a result of mitotic division to produce cells that are called **primary spermatocytes**.

Primary spermatocytes are produced, then meiosis occurs with the emergence of **secondary spermatocytes**. **Spermatids** are produced with the next stage of cell division; these then become **spermatozoa or sperm cells**; this is the final stage of spermatogenesis **(Figure 8.1)**.

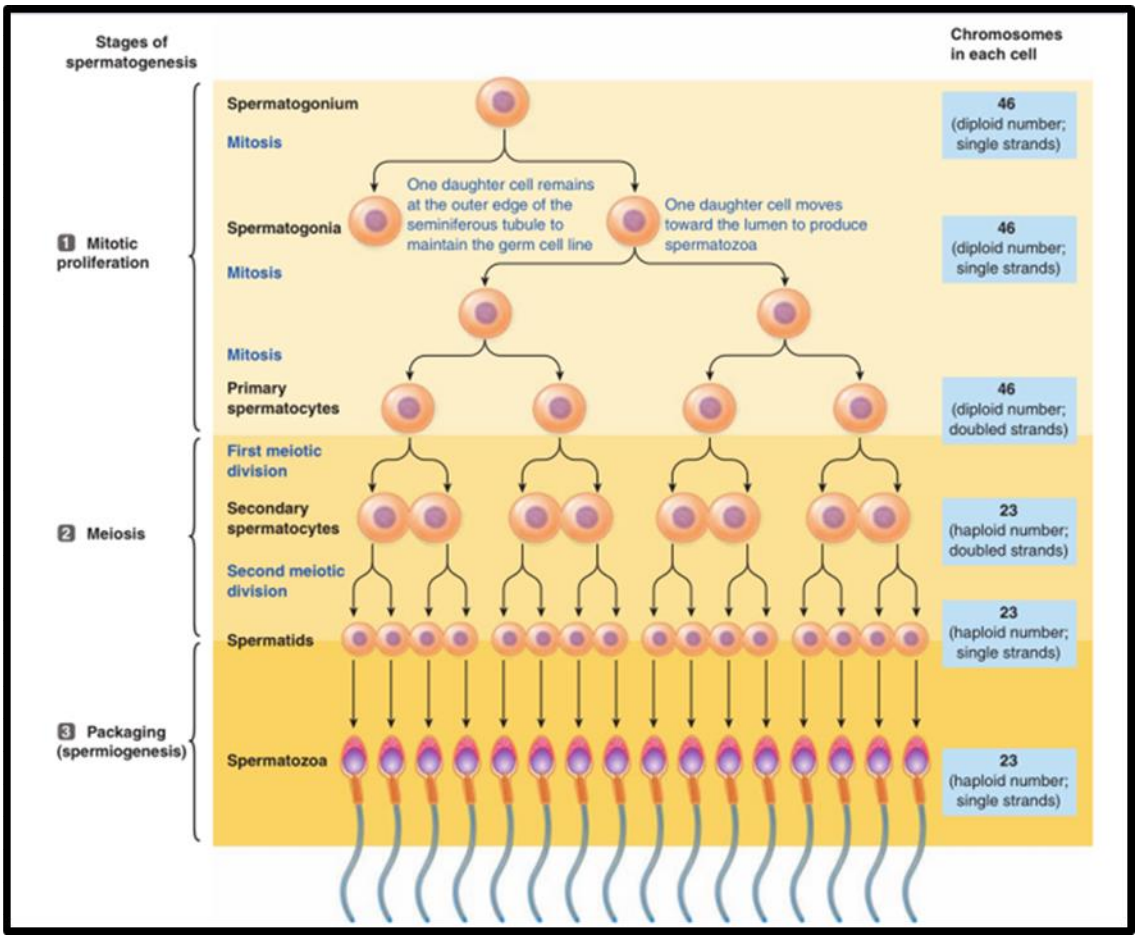


Figure (8.1): spermatogenesis

LH and FSH from the anterior pituitary control testosterone secretion and spermatogenesis (Figure 8.2):

-The testes are controlled by the two gonadotropic hormones secreted by the anterior pituitary, luteinizing hormone (LH) and FSH, both of which are produced by the same cell type, the gonadotropin. Both hormones in both sexes act on the gonads by activating cAMP.

-LH and FSH, which are named for their functions in females, act on separate components of the testes.

-LH acts on Leydig cells to regulate testosterone secretion.

-FSH acts on Sertoli cells to enhance spermatogenesis.

-Secretion of both LH and FSH from the anterior pituitary is stimulated in turn by a single hypothalamic hormone, gonadotropin-releasing hormone (GnRH).

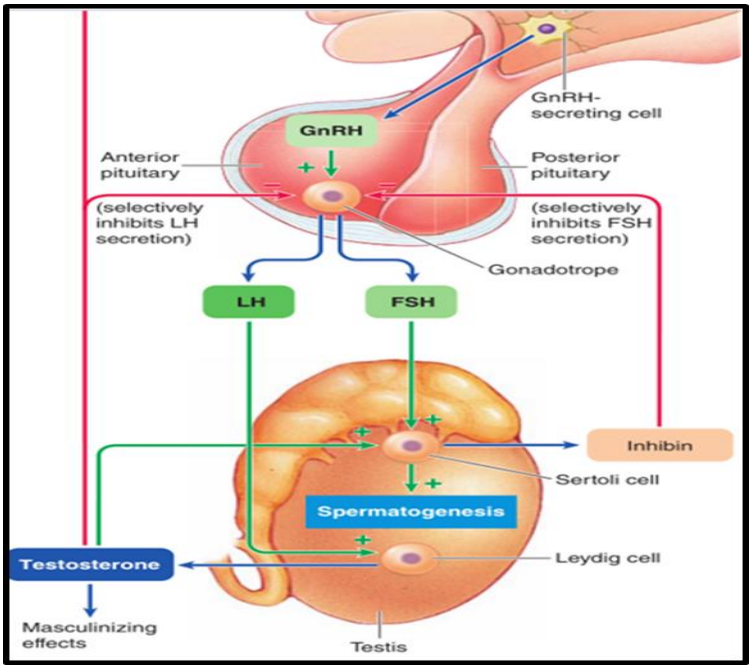


Figure (8.2): Hormonal effect in male

Physiology of The female reproductive system

The major structures of the female reproductive system include (Figure 8.3):

-The female reproductive system consists of the paired ovaries and fallopian tubes, the single uterus and vagina, and the external genital structures. Egg cells (ova) are produced in the ovaries and travel through the fallopian tubes to the uterus. The uterus is the site for the growth of the embryo-fetus.

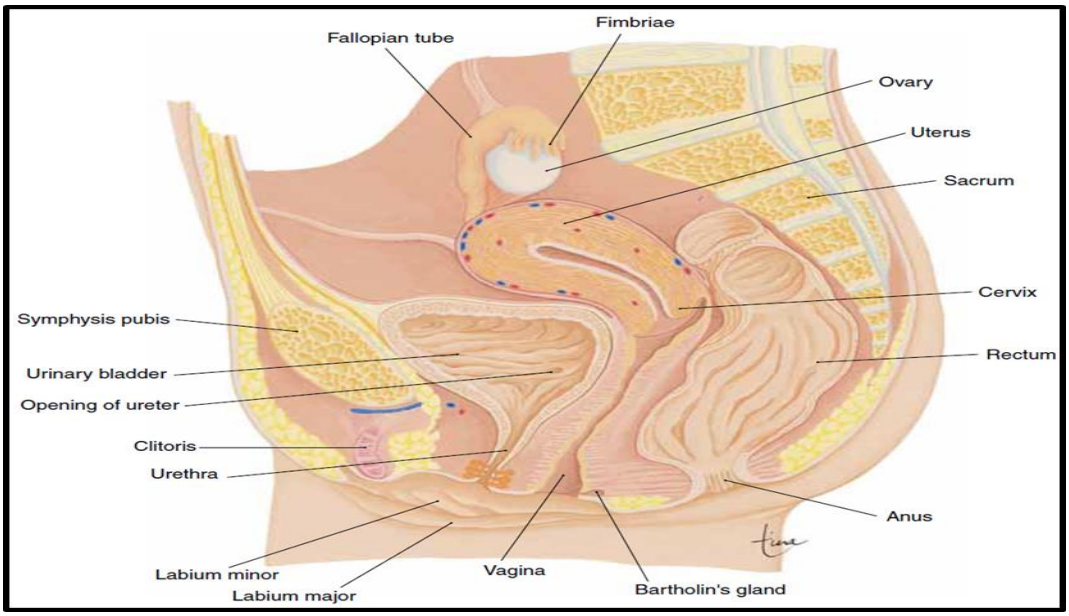


Figure (8.3): Female reproductive system

The ovaries

The ovaries are flat, almond - shaped glands situated on each side of the uterus beneath the ends of the fallopian tubes **(Figure 8.4).** The ovaries provide a space of storage for the female germ cells and produce the female hormones **Oestrogen and progesterone**. The ovary contains a number of small structures, called **ovarian follicles**. Each follicle contains an immature ovum, called an **oocyte**. Monthly, follicles are stimulated by two **hormones the follicle - stimulating hormone (FSH) and luteinising hormone (LH)**; these hormones stimulate the follicles to mature. The tissues influenced by these sex hormones also undergo cyclic changes, the most obvious of which is the monthly **menstrual cycle**. The developing follicles are enclosed in layers of follicle cells; the mature follicles are called **graafian follicles.**

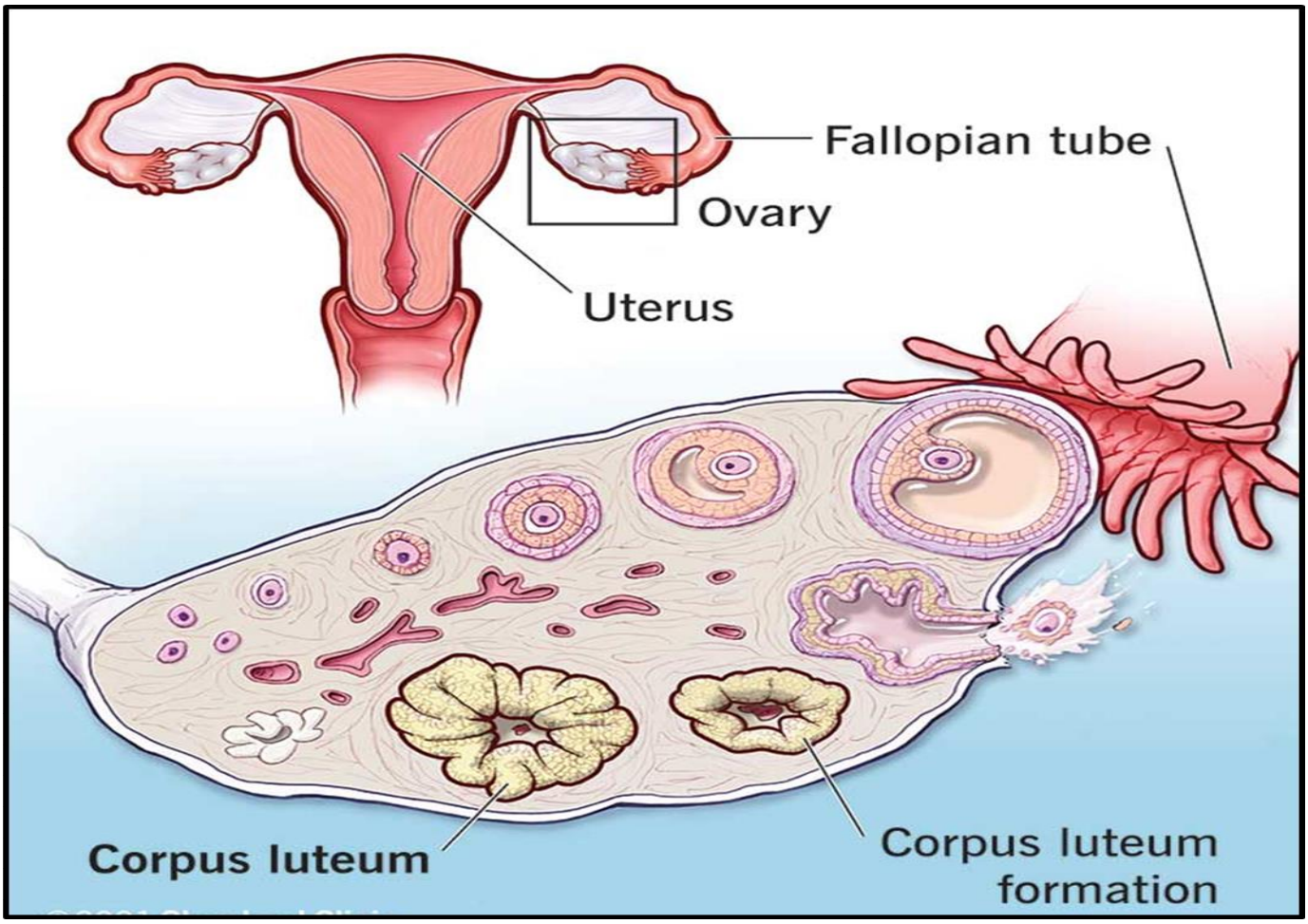


Figure (8.4): Female reproductive system

- **Oogenesis;** Oogenesis is the production of mature oocytes from oogonia. Oogonia within follicles in the ovary enter the prophase of meiosis and become primary oocytes approximately between 8 weeks' gestation and 6 months after birth. They then remain quiescent until they complete the first meiotic division following recruitment into the menstrual cycle and ovulation many years later **(Figure 8.5)**.

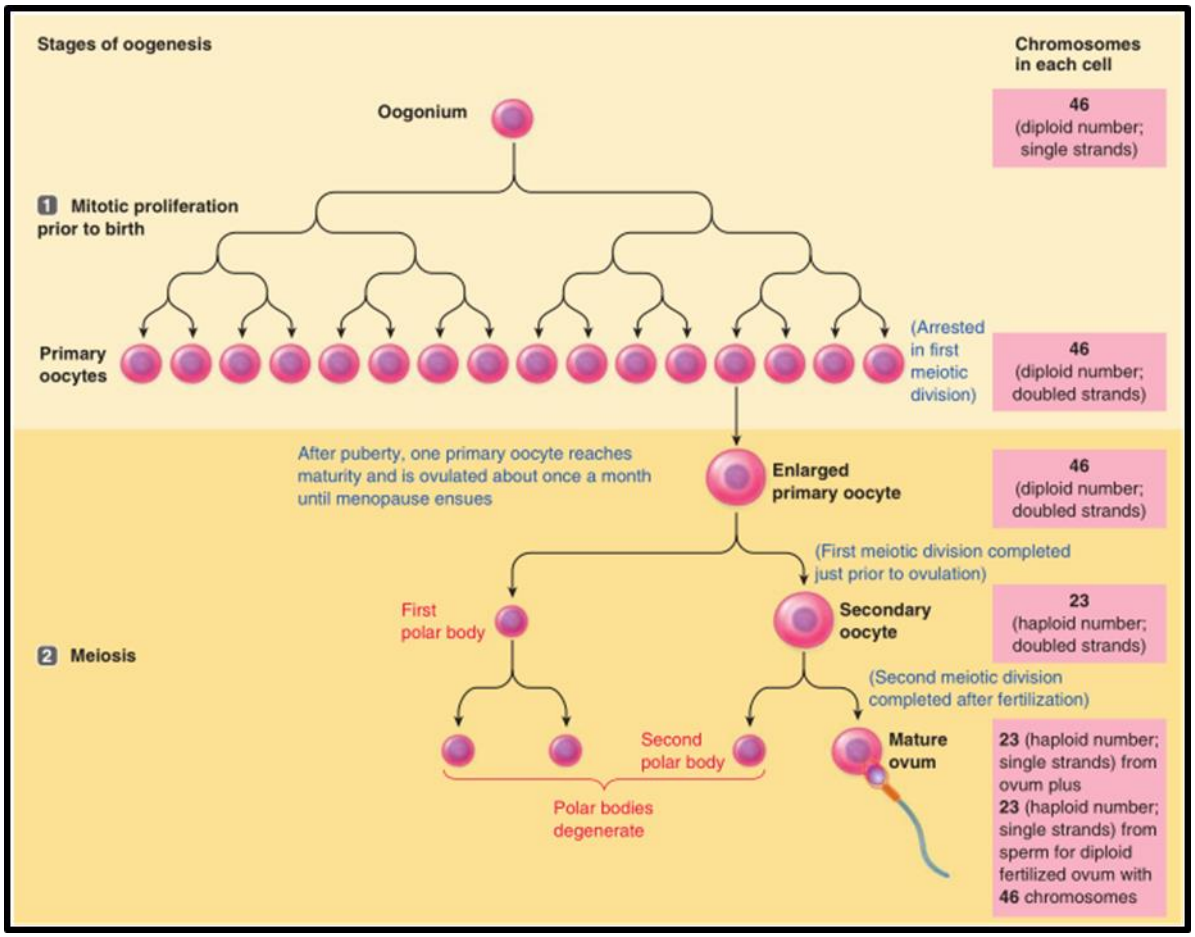


Figure (8.5): Oogenesis

Female Sex Hormones: Estrogens and Progesterone (Figure 8.6)

-The ovaries secrete estrogens (estrone [E1], estradiol [E2], and estriol [E3]), and progesterone.

-Hypothalamic–anterior pituitary control: GnRH release from the hypothalamus is pulsatile.

-In females, GnRH pulses vary in accordance with the stage of the menstrual cycle, and the ovarian production of estrogen and progesterone.

-GnRH stimulates the anterior pituitary to produce FSH and LH in a corresponding pulsatile manner.

-FSH and LH act on the ovaries to cause the following:

- FSH stimulates estradiol synthesis and the development of multiple follicles.
- LH stimulates the synthesis of pregnenolone, and the LH surge causes ovulation.

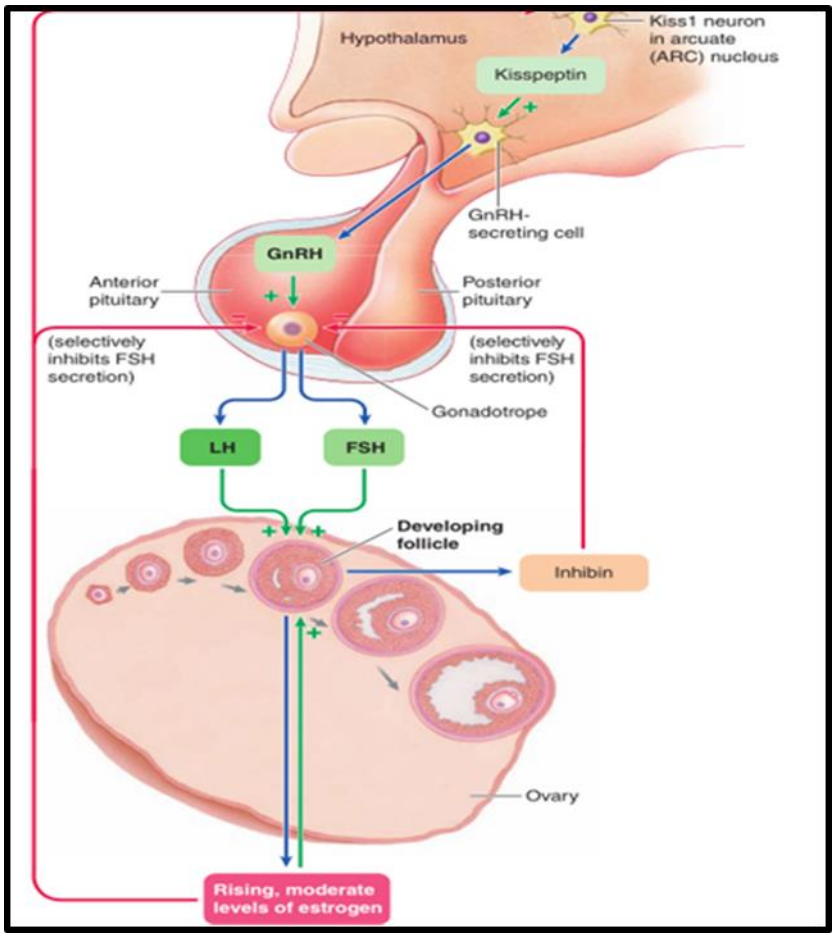


Figure (8.6): Hormonal effect in Female