

23 STUDY OF REPRODUCTIVE AND ENDOCRINE ORGANS IN RAT/MOUSE

23.1 INTRODUCTION

The purpose of this exercise is to enable you to locate and identify the male and female reproductive organs of a rat by dissection procedures. You will also learn to locate the major endocrine glands in the animal and to recognize different types of endocrine tissues using prepared slides.

Objectives

After completing this exercise you will be able to:

- identify the structures of the male and female rat/reproductive organs,
- identify stages in oogenesis and spermatogenesis by examining the sections of testis and ovary in prepared slides.
- state the location of each endocrine gland in the body,
- identify the sections of pituitary, thyroid, parathyroid, pancreas and adrenal glands under a microscope.

23.2 MATERIAL REQUIRED

dissecting microscope

compound microscope

dissecting instruments

prepared slides of ovary, testis, pituitary, thyroid, parathyroid, pancreas and adrenal.

23.3 REPRODUCTIVE ORGANS

Dissect out a freshly chloroformed rat (male or female) for general viscera. Remove the alimentary canal, liver, heart and lungs.

A. Female Reproductive Organs

Look for female reproductive organs in the pelvic region (Fig. 23.1). On the torso, you should be able to locate a small reddish brown, irregular shaped ovary lying just medial and inferior to each kidney. You may observe that each ovary is connected to a short coiled oviduct (fallopian tube) that conveys ova, or eggs, to the uterus. Observe that the vagina lies posterior to the urethra and extends to the outside, opening at the vaginal orifice, anterior to the anus. Identify ovaries, vagina and the uterus.

B. Male Reproductive Organ

In male rats immediately inferior to the pelvic region, locate the scrotum, which is a sac covered with skin. It contains a pair of testes (Fig. 23.2). Also observe the epididymis, a large coiled duct on the anterior lateral surface of each testes. Extending from the epididymis is an ascending tube, the spermatic cord, which consists of the vas deferens (ductus deferens), blood vessels, and a nerve. Trace the spermatic cord and notice that it enters the body cavity through an opening, the inguinal canal. When the spermatic cord reaches the level of the urinary bladder, you will observe that the vas deferens leaves the spermatic cord and makes a sharp bend medially and inferiorly over the ureter and continues inferiorly until it penetrates the urethra at the level of prostate gland. Trace the urethra inferiorly until it enters the penis, an external structure. The opening at the

interior end of the penis where urine and semen are released is the urinogenital opening. Identify scrotum, testes epididymis, spermatic cord, vas deferens, urethra, prostate gland and penis.

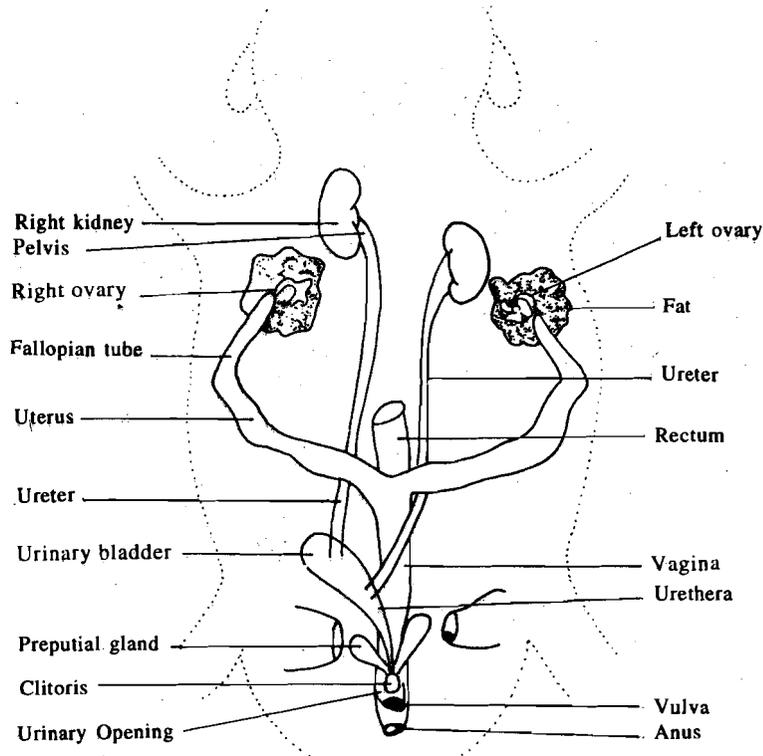


Fig. 23.1 : Urinogenital system of a female rat.

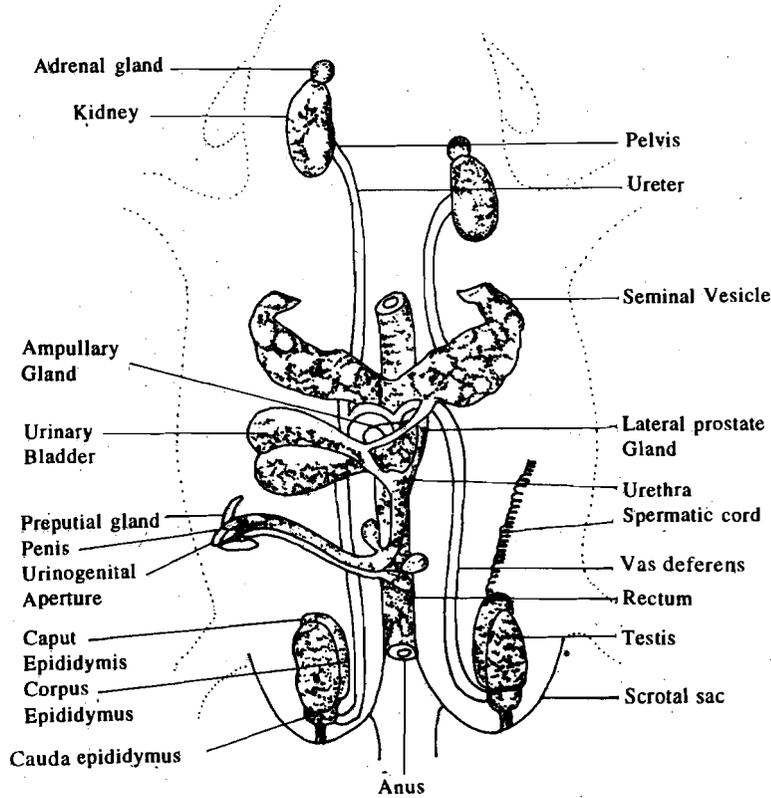


Fig. 23.2 : Urinogenital system of a male rat.

23.4 STUDY OF PREPARED SLIDES

C. Cross Section of A Mammalian Ovary (RAT)

You will observe in a slide of a sectioned ovary Graafian follicles (Fig. 23.3 and 23.4). Notice the cuboidal epithelium around the periphery of the section. Medial to the cuboidal epithelium you may see **primary follicles**. After puberty, under hormonal influence, several follicles begin to grow prior to ovulation and become **primary oocytes**, **secondary oocytes**, and later, **Graafian follicles**. You will observe that the **Graafian follicles** (Fig. 23.4), which occur only in mammals, are hollow sacs containing an ovum surrounded by **follicular fluid** (or **liquor folliculi**). The cavity containing the follicular fluid is the **antrum**. Immediately underlying the ovum, within the Graafian follicle is a mound of cells known as the **cumulus oophorus**. Make a sketch of the structures you have observed and label them.

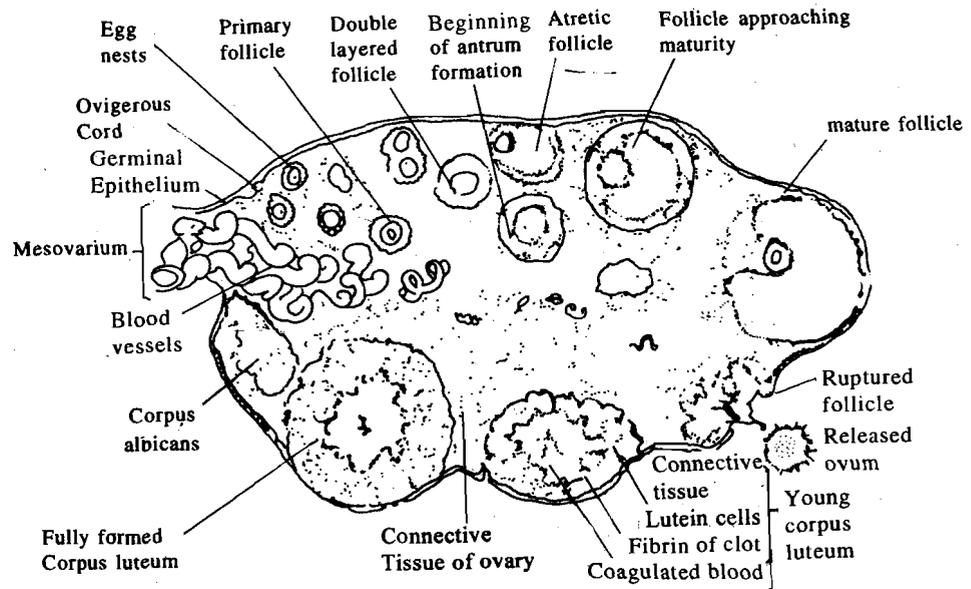


Fig. 23.3 : Generalized structure of ovary.

1. Theca externa
2. Theca interna
3. Lutein Corpus luteum
4. Antrum containing follicular fluid and cells
5. Coronaradiata
6. Ovum
7. Nucleus of ovum
8. Zona pellucida
9. Cumulus Oophorus

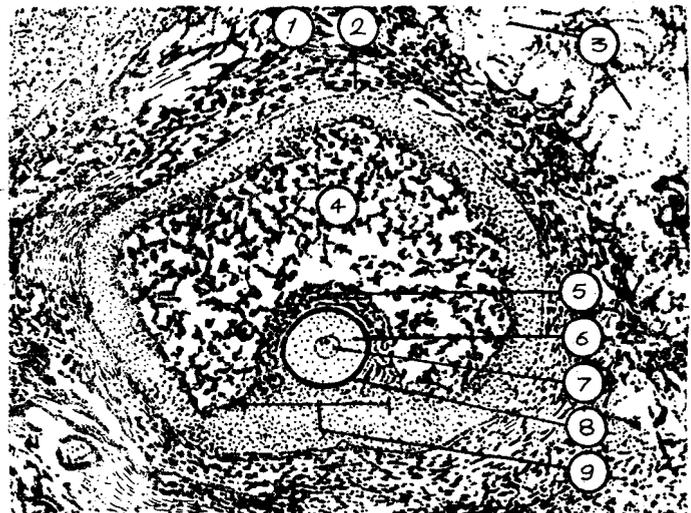


Fig. 23.4 : Graafian follicle.

D. Cross Section of Testis

Observe a slide containing a section of testes. Within the testes, you will find numerous seminiferous tubules (Fig. 23.5). Under high power, focus on a cross section near the

periphery of a seminiferous tubules. Starting from the periphery move towards the centre, you should be able to see different stages of development of sperm. Towards the periphery you can observe relatively small but numerous *spermatogonial cells*. Then follows the large *primary spermatocytes*. You will then observe *secondary spermatocytes* which arise out of post-meiotic division. Then follows deeply staining spermatids. Between the seminiferous tubules are the interstitial cells of Leydig, which produce and secrete the male hormone *testosterone*. Draw and neatly label the various structures that you have observed in the cross section of the testes.

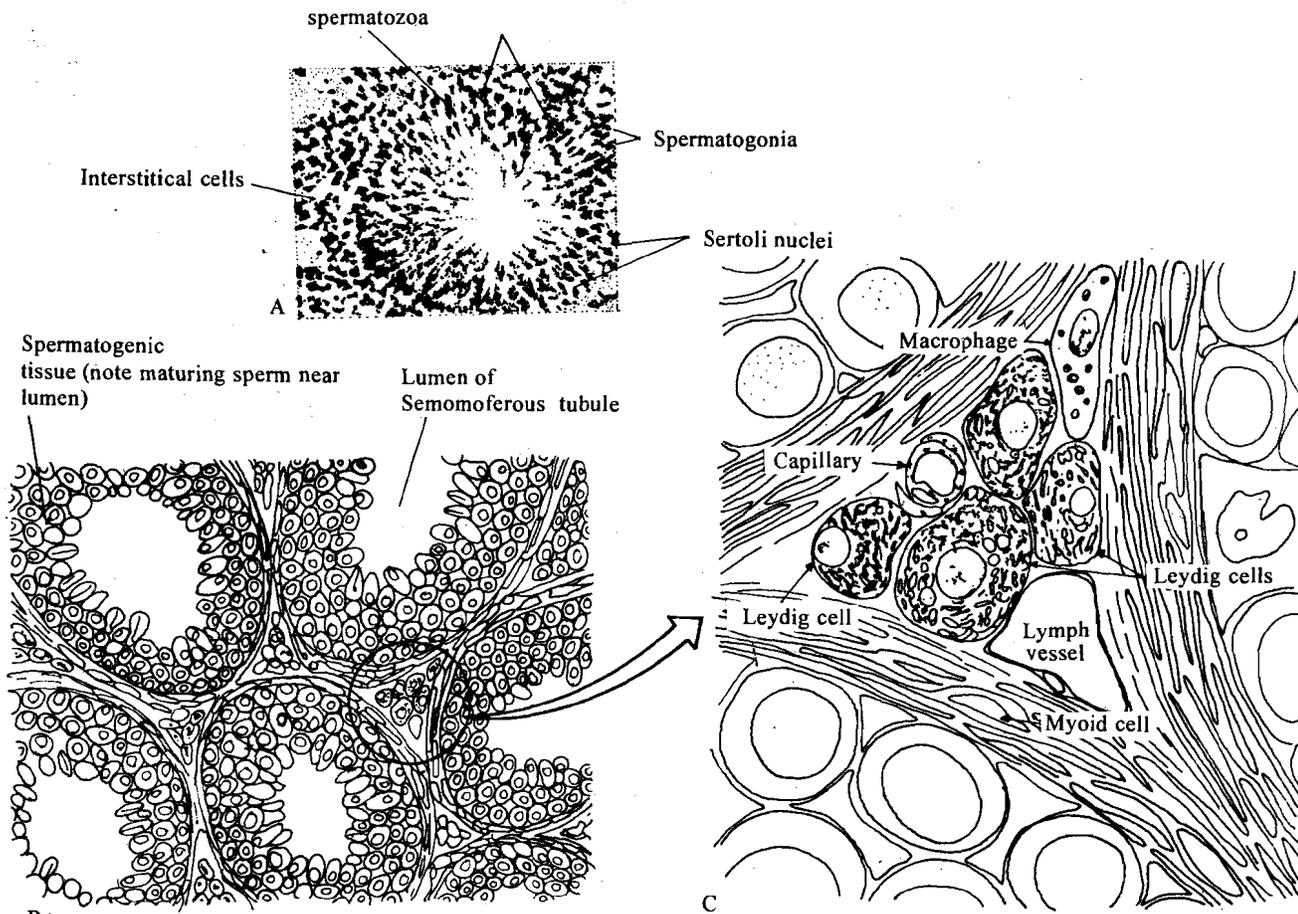


Fig. 23.5 : (A) Photomicrograph of Transverse section of rat testis showing a seminiferous tubules in full spermatogenic activity. (B) Diagram of section of rat testis showing seminiferous tubules and interstitial cells (C) Section showing Leydig cells at higher magnification.

E. Cross Section of Uterus

You will observe in a cross section of uterus the smooth muscle area and endometrical lining. The endometrium is composed of two layers: the underlying *stratum basale* which contains blood vessels, and the more superficial *stratum functionale*, which is composed of secretory glands and columnar epithelium. The *stratum functionale* is sloughed off during estrus phase (Recall the experiment on Vaginal Smears) (Fig. 23.6). Sketch and label the different structures.

23.4 LOCATION OF ENDOCRINE GLANDS

Endocrine glands are ductless glands which secrete chemical agents known as hormones. Hormones from each endocrine gland are transported in the blood stream to another part of the body where they evoke systematic responses or adjustments by acting on target tissues or organs. The endocrine glands together with the nervous system integrate functions of organs and organ systems in the body (Fig. 7.8). Before carrying out the dissection of a rat to locate various endocrine glands, you may go through Unit 10 of Block 2 LSE-05 Course to recall to your memory the various endocrine glands and their functions.

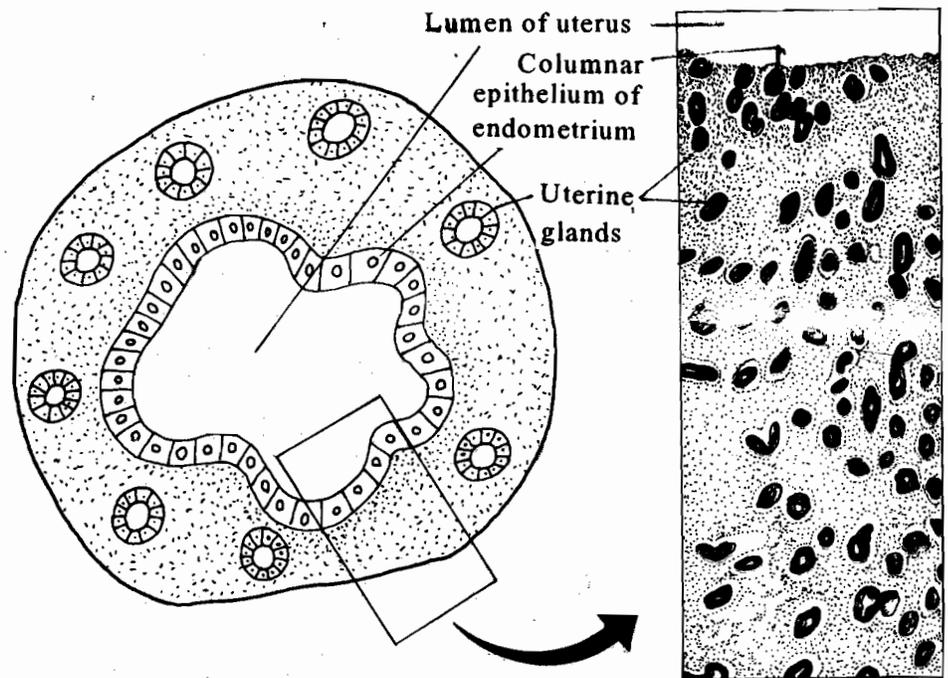


Fig. 23.6 : Cross section of rat uterus.

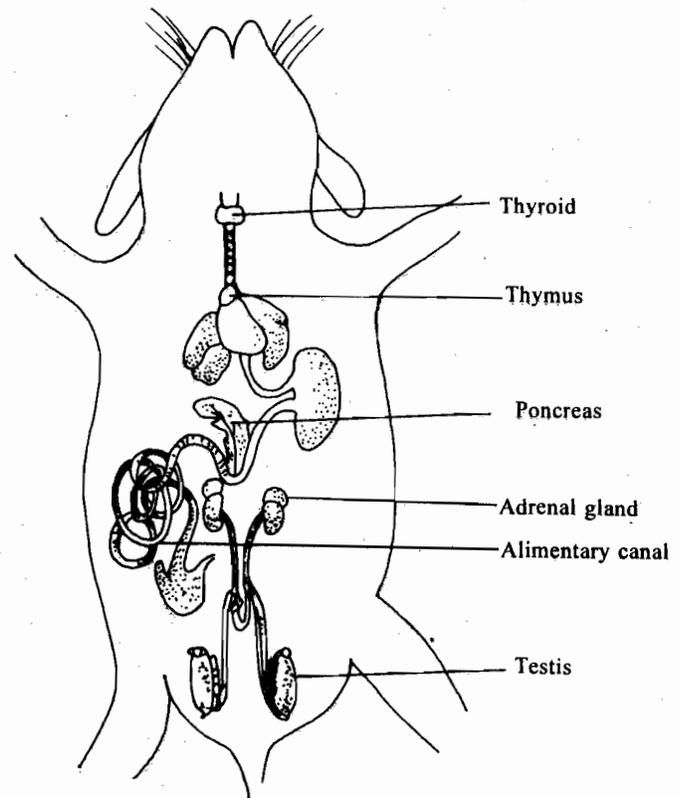


Fig. 23.7 : Endocrine system of rat.

A. Dissection of Endocrine Glands

1. Dissect out a freshly anaesthetized rat to expose body cavity.
2. Expose the trachea and look for thyroid gland at the beginning of trachea, on the ventral side of the pharynx. (Fig. 23.7) It is reddish brown in colour.

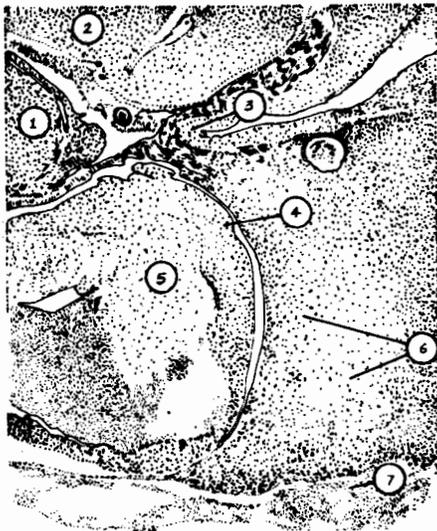
3. Look for the Thymus gland just above the heart, near the auricles. It is bilobed and white in colour.
4. Expose the duodenum and between the arms of the duodenum, observe highly branched pancreas pink-grey in colour. Do not uncoil the loop.
5. Remove mesenteries to separate the alimentary canal from rest of the organs to show other endocrine glands. Push and pin the alimentary canal to one side and expose the kidneys.
6. Observe the pale yellow cap-shaped adrenal gland on the top of each kidney.
7. Trace the ovaries and testes as described in reproductive organs, as certain cells of these organs secrete hormones.

Draw a well labelled diagram of your dissection.

In the next part of the exercise you will observe sections of prepared slides of various endocrine glands.

E. Pituitary Gland (Hypophysis)

Examine a section of pituitary gland. Draw the section and label the following: infundibular stalk, pars distalis, chromophil cells, pars nervosa, and pars intermedia (Fig. 23.8). First observe this section under a dissecting microscope to see it in its entity.



1. Sella turcica
2. Hypothalamus
3. Infundibular stalk
4. Pars intermedia
5. Pars nervosa
6. Pars distalis containing chromophil cells
7. Dura mater

Fig. 23.8 : T.S of pituitary of rat.

F. Thyroid Gland

In this section you will see several thyroid follicles each lined with cuboidal epithelium and containing a colloidal substance that stains pink in colour. This substance is the thyroglobulin, the precursor and storage form of thyroxine and triiodothyronine (Fig. 23.9). Draw and label the colloid and cuboidal epithelium.

G. Pancreas

Observe the scattered islets of Langerhans among the acinar tissue (Fig. 23.10), which secrete digestive enzymes. The islets produce three hormones: glucagon from alpha cells, insulin from beta cells, and somatostatin from delta cells. Draw a section of pancreas and label the acinar and islet portions.

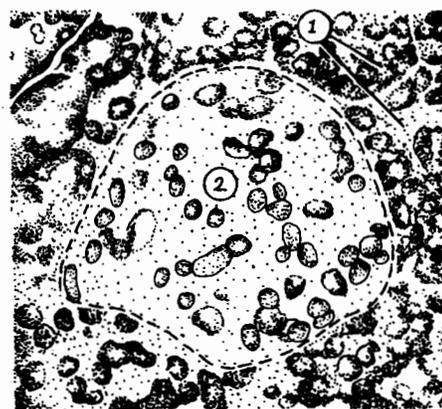
H. Adrenal Glands

Each adrenal gland has an outer cortex surrounding the medulla. The cortex consists of three zones: the outer **zona glomerulosa** which secretes aldosterone; the middle **zone fasciculata**; and the inner **zona reticularis**, Adrenal Cortex secretes corticosteroid hormones the glucocorticoids and mineralocorticoids and the medulla secretes epinephrine and norepinephrine.

- f Thyroid follicle
- p Parathyroid tissue



Fig. 23.9 : Section of thyroid and parathyroid glands in mouse.



- 1. Pancreatic acini
- 2. Islet of Langerhans

Fig. 23.10 : T.S. of pancreas showing islet of Langerhans.



- 1. Capsule
- 2. Zona glomerulosa
- 3. Zona fasciculata
- 4. Zona reticularis
- 5. Medulla
- 6. Veins in medulla

Fig. 23.11 : T.S. of adrenal gland showing cortex and medulla.

23.6 SELF ASSESSMENT QUESTIONS

1. Which of these is the correct sequence for oogenesis?
 - a) oogonium, primary oocyte, ovum, secondary oocyte, ootid
 - b) primary oocyte, secondary oocyte, oogonium, ootid, ovum
 - c) oogonium, primary oocyte, secondary oocyte, ootid, ovum
 - d) ovum, primary oocyte, oogonium, secondary oocyte, ootid.
2. How many spermatozoa are normally produced from primary spermatocyte?
 - a) one
 - b) one plus three polar bodies
 - c) two
 - d) four.
3. Match I with II.
 - I.
 - a) pituitary
 - b) parathyroid
 - c) thyroid
 - d) pancreas
 - e) adrenal
 - II.
 - i) This gland is both an endocrine and an exocrine gland.
 - ii) This gland contains the following structure: pars distalis, pars nervosa, and pars intermedia.
 - iii) There are usually four of these gland.
 - iv) This gland produces tropic hormones.
 - v) There is evidence that this gland produces androgens in both sexes.
 - vi) This gland produces thyroid stimulating hormone (TSH).