



7, HORMONAL REGULATION OF SEX DETERMINATION.

Prof. Sherif W. Mansour
Physiology dpt., Mutah School of medicine
2020-2021

Puberty

- Definition :

It is a period of life during which the endocrine and gametogenic functions of the primary sex organs have first developed , adult sexual life is reached and reproduction is possible .

(reproductive system has ability to produce gametes) .

- Age of puberty :

In male between 9-14 years .

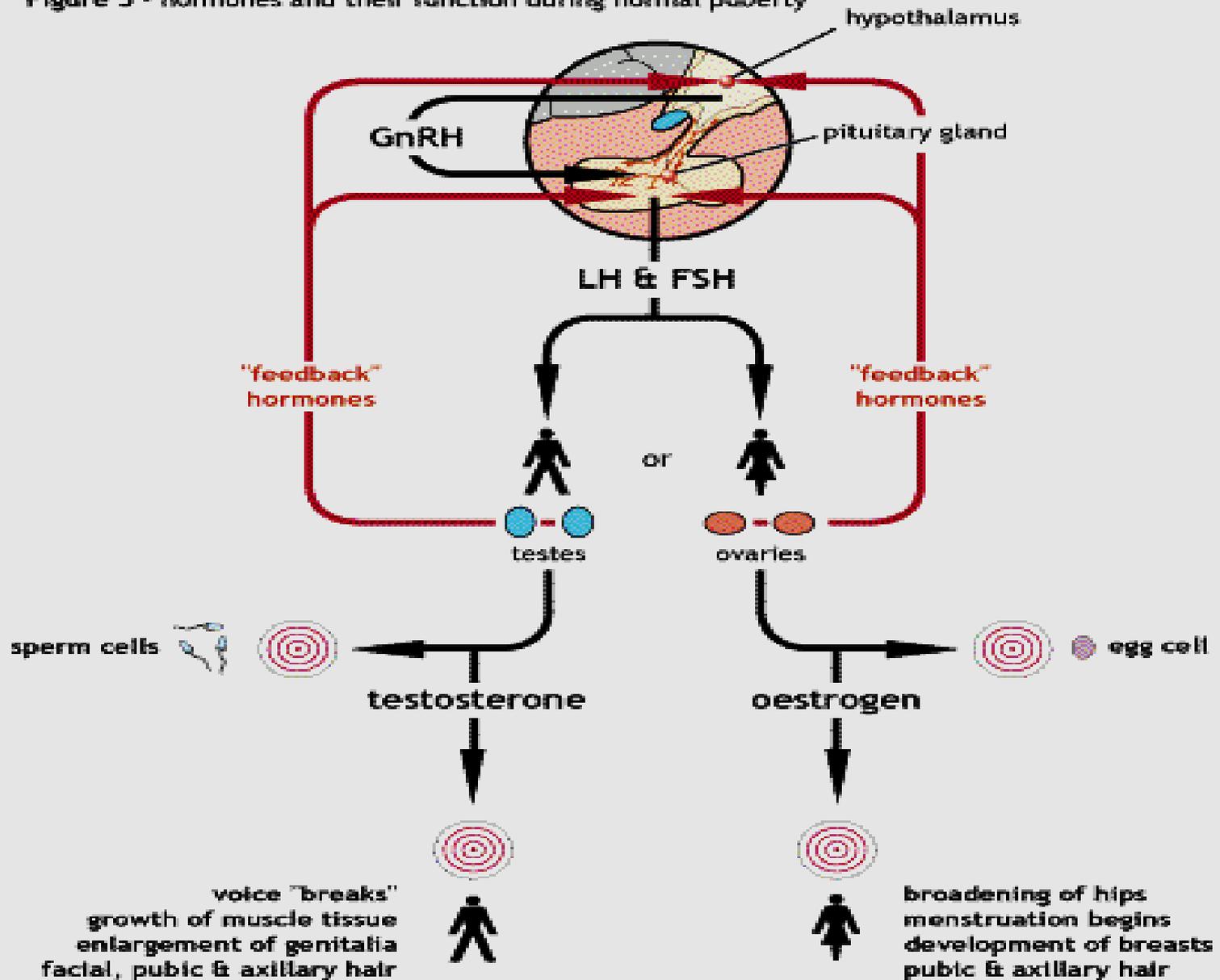
In female between 8-13 years .

- Control of puberty :

There is no single accepted hypothesis to account for the various endocrine changes which lead to puberty .

Puberty is initiated by a maturation of the CNS and hypothalamus involving the gradual establishment of the pulsatile GnRH release from the hypothalamic neurons.

Figure 5 - hormones and their function during normal puberty



- Theories of puberty may include :

1- Change in the feedback sensitivity of anterior pituitary and / or hypothalamus to circulating gonadal and / or adrenal steroids with gradual increase in the "set point" at which the gonadal steroids exert their negative feedback on GnRH and GntTH (gradual decrease in the sensitivity of negative feedback) the negative feedback sensitivity is very high in children , reach highest sensitivity at age of 4 years. ie very low levels of estrogen → inhibits GnRH , after that , as the sensitivity decreases FSH start to increase → follicular development estrogen → secondary sexual development .

At puberty normal level of feedback sensitivity is reached , so estrogen is increased to level able to cause LH surge.

2- Role of the pineal gland : removal of the inhibitory effect of the pineal hormones on the anterior pituitary and gonads after its atrophy and calcification .

3- Release of neurotransmitters at hypothalamus Dopamine and noreadrenaline are involved in the release of GnRH , enzymes needed for formation of these neurotransmitters increase and reach adult levels at puberty.

4- Role of opioid peptides : beta endorphin and enkephalin increase the levels of circulating gonadotrophin . these peptides reach highest level at puberty.

5- Increase the secretion of adrenal androgen : at age 8-10 years , adrenal androgen is increased due to :

- a) Change in the enzyme system so that more pregnenolone is diverted to androgen pathway .
- b) Increase secretion of an adrenal androgen stimulating hormone from anterior pituitary.

- Changes at puberty :

1- Growth promotion :

The acceleration of growth is mainly due to sex steroids from gonads acting with growth hormone from anterior pituitary and other growth promoting hormones e.g insulin and thyroxin .

The end of the growth occurs when the epiphyses of the long bones have fused to the bone shafts .

2- Maturation of the secondary sex characters e.g hair , voice shoulder , hip , fat distribution.

3- In female :

Puberty starts by :

a- Thelarche : development of breast under the effect of sex hormones .

b- Puberche : development of axillary and pubic hair under the effect of androgen and gonadal androgen.

c- Menarche first menstrual periods usually unovulatory for about 1-1.5 years .

d- Size of hip is more in female than in male lastly true reproductive capability

4- In male :

The most obvious manifestations are growth and development of external genitalia , hair distribution in face and body , deepening of voice and spermatogenesis .

- Abnormal puberty :

(1) Early puberty (precocious puberty)

a) Precocious pseudopuberty : early development of secondary sex organs and characteristics without gametogenesis due to exposure of immature male to androgen or exposure of immature of female to estrogen .

The cause may be adrenal or gonadal in origin (interstitial cell or granulosa cells tumors) .

b) Precocious true puberty : early normal puberty due to early secretion of GnRH due to abnormality of hypothalamus or pineal gland .

(2) delayed puberty :

In female if delayed to 17 years .

In male if delayed to 20 years.

(3) Absent puberty : failure of sexual maturation.

In male → Eunuchoidism .

In female → primary amenorrhea.

The cause may abnormalities in pituitary , thyroid e.g panhypopituitarism .

Thank You