




PUBERTY

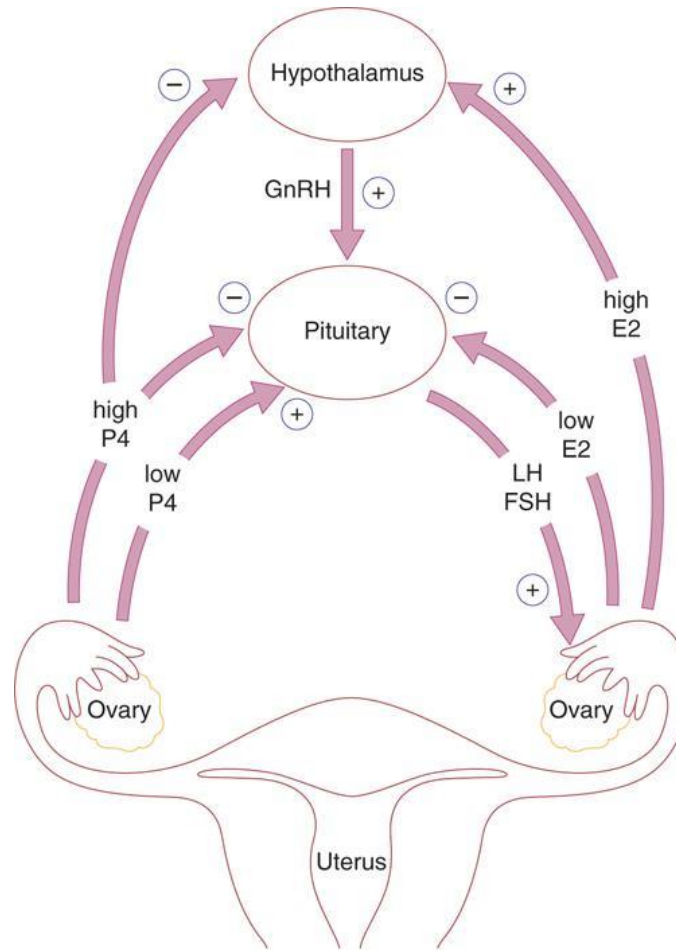
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Definition



The process of reproductive and sexual development and maturation that changes a child into an adult

HPO axis



HPO axis

The development of the anterior pituitary in the human starts between the fourth and fifth weeks of fetal life, and by the 12th week of gestation the vascular connection between the hypothalamus and the pituitary is functional

HPO axis

- GnRH is detectable in the hypothalamus by 10 weeks of gestation
- By 10–13 weeks FSH and LH are produced in the pituitary.
- The peak pituitary concentrations of FSH and LH occur at about 20–23 weeks of intrauterine life, and peak circulating levels occur at 28 weeks.

HPO axis

- Beginning at midgestation, there is an increasing sensitivity to inhibition by steroids and a resultant decrease in gonadotropin secretion
- The rise in gonadotropins after birth reflects loss of the high levels of placental steroids

HPO axis

- The childhood period is characterized by low levels of gonadotropins in the pituitary and in the blood, little response of the pituitary to GnRH, and maximal hypothalamic suppression
- In girls, the first steroids to rise in the blood are dehydroepiandrosterone (DHEA) and its sulfate (DHEAS) beginning at 6–8 years of age, shortly before FSH begins to increase

HPO axis

- Pulsatile secretion of gonadotrophins commences at 8-9 years of age
- Ovarian oestrogen initiates the physical changes of puberty

Physical changes of puberty

- Breast development (thelarche)
- Pubic and axillary hair growth (adrenarche)
- Growth spurt
- Onset of menstruation (menarche)

Onset of puberty

- Race
- Heredity
- Body weight
- Exercise



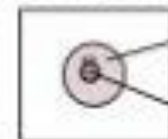
Stage 1



Preadolescent



Stage 2



Areola

Papilla

Breast budding
Mean age 11.2
(9–13.4)



Stage 3



Continued
enlargement
Mean age 12.2
(10–14.3)



Stage 4



Areola and
papilla form
secondary mound
Mean age 13.1
(10.8–15.4)



Stage 5



Mature female
breasts
Mean age 15.3
(11.9–18.8)

FIGURE 3



Female pubic hair development by Tanner stage.

Stage 1: No pubic hair.

Stage 2: Straight hair is extending along labia.

Stage 3: Pubic hair has increased in quantity, is darker, and is present in typical female triangle, but in smaller quantity than in later stages.

Stage 4: Pubic hair is more dense, curled, and adult in distribution, but less abundant than in adults.

Stage 5: Abundant, adult-type pattern; hair may extend onto the medial aspect of the thighs.

Tanner Staging: Stage I

Prepubertal

- Height increases at basal rate: 5-6 cm/year
- Breast: Papilla elevation only
- Pubic Hair:
 - Villus hair only
 - No coarse, pigmented hair

Tanner Staging: Stage 2

- Height increases at accelerated rate: 7-8 cm/year
- Breast:
 - Breast buds palpable and areolae enlarge
- Pubic Hair:
 - Minimal coarse, pigmented hair mainly on labia
- Modifications based on increasingly earlier puberty
 - White: Stage 2 changes may appear one year earlier
 - Black: Stage 2 changes may appear two years earlier

Tanner Staging: Stage 3

- Height increases at peak rate: 8 cm/year (age 12.5)
- Breast:
 - Elevation of Breast contour; areolae enlarge
- Pubic Hair:
 - Dark, coarse, curly hair spreads over mons pubis
- Other changes
 - Axillary hair develops
 - Acne Vulgaris develops

Tanner Staging: Stage 4

- Height increases at 7 cm/year
- Breast:
 - Areolae forms secondary mound on the Breast
- Pubic Hair:
 - Hair of adult quality
 - No spread to junction of medial thigh with perineum

Tanner Staging: Stage 5

- No further height increases after age 16 years
- Breast:
 - Adult Breast contour
 - Areola recesses to general contour of Breast
- Pubic hair
 - Adult distribution of hair
 - Pubic hair spreads to medial thigh
 - Pubic hair does not extend up linea alba

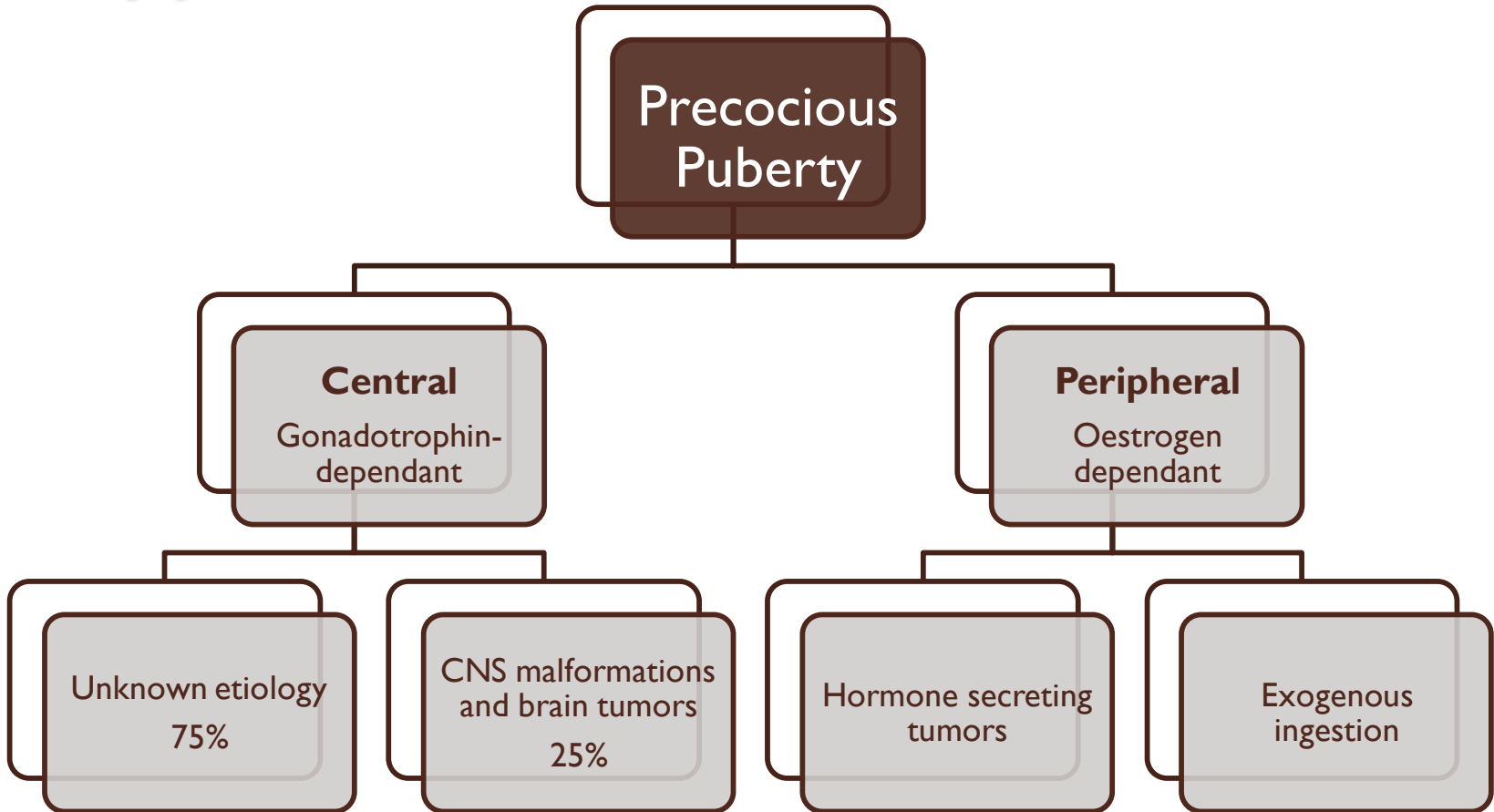
Menarche

- Mean age 12.8 years
- Initially cycles may be anovulatory, irregular and unpredictable

Precocious Puberty

- Onset of puberty at an age less than 8y in a girl or 9y in a boy

Types



Investigations

- Hormone profile
- Hand and wrist x-ray
- Brain imaging
- Pelvic US
- Tumor markers

Treatment

- GnRH analogue therapy
- Treat the underlying cause

Delayed puberty

- No signs of secondary sexual characteristics by age 14y

Types

Delayed puberty

Hypogonadotrophic hypogonadism

- Constitutional
- Anorexia nervosa
- Excessive exercise
- Chronic illness
- Pituitary tumors
- Kallman syndrome

Hypergonadotrophic hypogonadism

- Idiopathic premature ovarian failure
- Autoimmune ovarian failure
- Chemo/radiotherapy
- Turner syndrome
- XX gonadal dysgenesis

Delayed Puberty

Investigation:

- FSH, LH
- Karyotyping
- Pelvic US
- X-ray to determine bone age

Treatment

- Target the underlying cause
- Watchful waiting
- Gonadal hormone replacement
- Growth hormone therapy



THE END