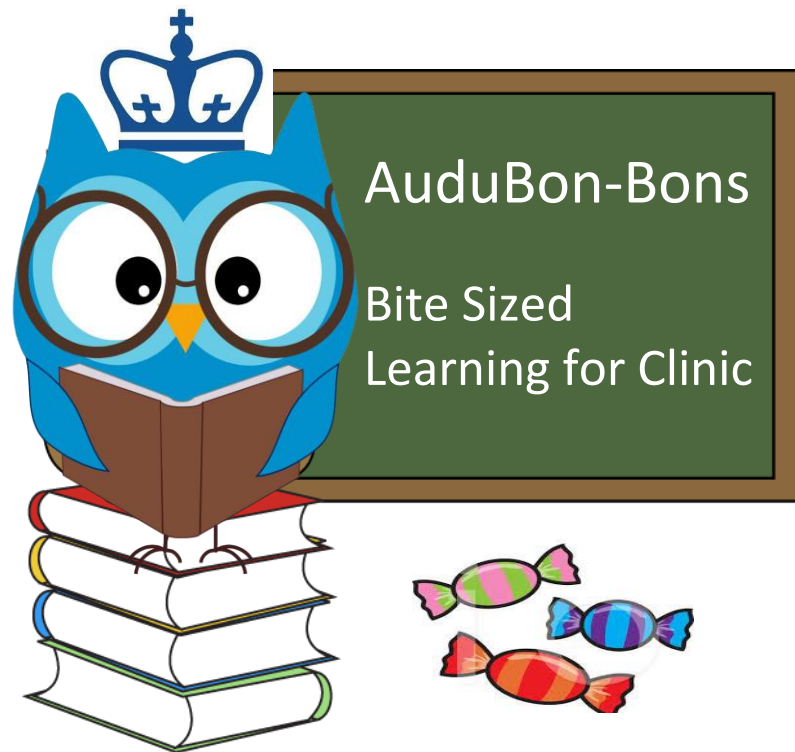


# NORMAL PUBERTAL DEVELOPMENT

Week 75



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Reading Assignment:

- Emmanuel M, Bokor BR. Tanner Stages. *StatPearls*. May 2019.  
Accessed <https://www.ncbi.nlm.nih.gov/books/NBK470280/>

# LEARNING OBJECTIVES

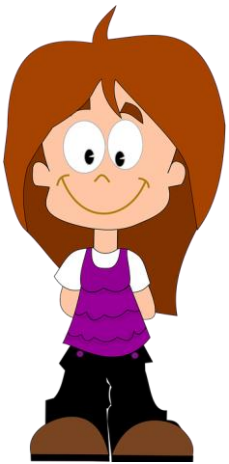


- Review common terminology regarding puberty
- Discuss normal sequence of pubertal events
- Review physical exam changes during puberty



# CASE VIGNETTE

- A well established patient brings in her daughter for a GYN visit as she is concerned her daughter is undergoing “puberty too quickly”.
- The daughter is an 11 y.o. patient with no significant medical history. She has not yet had a period and doesn't understand why her mom made her come in. She is in 6<sup>th</sup> grade and is doing well in school.



# FOCUSED HISTORY

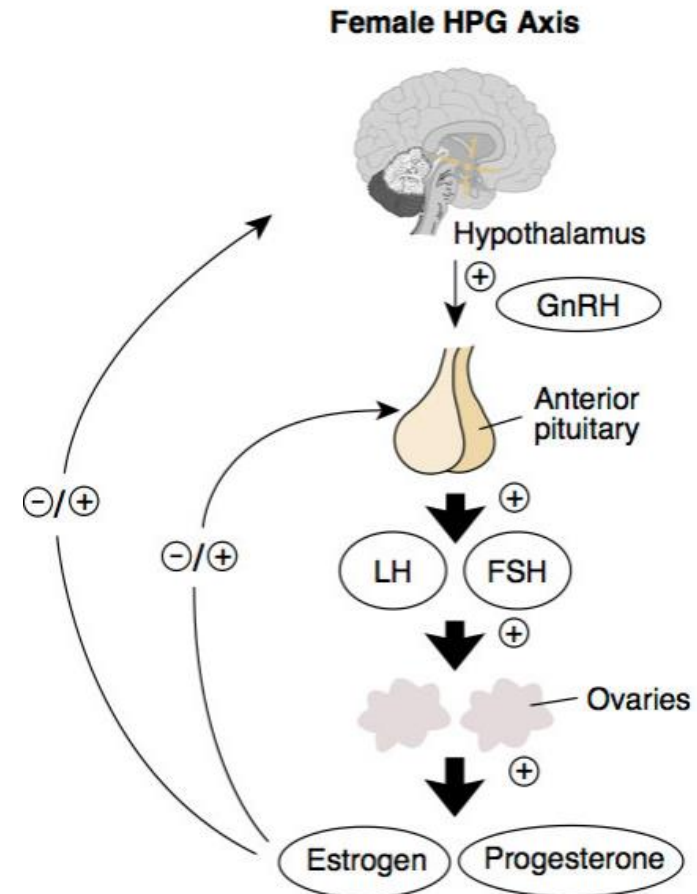
- PMH: None
- PSH: Tonsil and adenoids at age 8
- OB/GynHx: None
- FH: Maternal grandmother with DM, HTN
- SH: 6<sup>th</sup> grade, B+ averages, no behavioral issues, plays soccer and girls scouts. Denies tobacco/EtOH/ drug use
- Meds: None
- All: NKDA



# LET'S REVIEW THE BASICS....

- **Puberty definition:**

- Transition from sexual immaturity to sexual maturity with two main physiologic changes
- **Gonadarche:** activation of the gonads by pulsatile release of **GnRH** from the **hypothalamus** causing release of **FSH/LH** from the anterior **pituitary**
- **Adrenarche:** increase in production of androgens by the adrenal cortex
- **\*Gonadarche and Adrenarche are physiologically distinct events**



[https://embryology.med.unsw.edu.au/embryology/index.php?title=File:HPG\\_female\\_axis.jpg](https://embryology.med.unsw.edu.au/embryology/index.php?title=File:HPG_female_axis.jpg)



# PUBERTY continued...

- Specific components of puberty:
  - **Thelarche:** appearance of breast tissue under areola (Tanner Stage II)
    - Primarily due to estradiol release from ovaries
    - Can be asymmetrical
  - **Pubarche:** appearance of pubic/axillary hair
    - Caused by androgens from the adrenal gland
  - **Menarche:** first menstrual bleed
    - Typically caused by effects of estradiol on endometrial lining. Not necessarily related to ovulation



# PUBERTY TIMING

- Onset and sequence depend on race, ethnicity, and environmental factors
- On average in US, puberty begins with thelarche around 10 years for girls (range 8-13)
  - **Thelarche:** Average age 10 for caucasian, and 8.9 years for African-Americans
- ↓
- **Pubarche:** typically between 1-1.5 years after thelarche
- ↓
- **Growth spurt** (peak height velocity between Tanner stage 2-3)
- ↓
- **Menarche:** 2.5 years later, on average at age 12 regardless of race



# ABNORMAL DEVELOPMENT

- **Precocious puberty:**

- Pubertal onset 2-3 SD below mean onset of puberty
- US: breast development (Tanner Stage II) before age 7-8

- **Delayed puberty:**

- Absence of signs of puberty 2-3 SD above mean onset of puberty
- US: absence of breast development (Tanner Stage 2) by 12-13 years

- **Primary Amenorrhea:**

- Failure to start menses within 3 years of thelarche, or by 15 years of age





# PERTINENT PHYSICAL EXAM FINDINGS

- VS: Wt 42 kg, Ht 150 cm, BP 90/62, P 82, T 37.0
  - Gen: NAD
  - HEENT: WNL
  - Chest: CTAB
  - CVS: RRR
  - Breast: **Bilateral breast tissue enlargement. No contours and no secondary areola mound.**
  - Abd: Soft, non-tender
  - Ext Pelvic: **Scant dark, coarse pubic hair on the mons; no extension lateral**
  - Ext: WWP



# What system can we use to stage her development?

- **Tanner Staging or Sexual Maturity Rating (SMR)**

- An “objective” classification system to track the development of **secondary sex characteristics**
- Developed by Marshall and Tanner during the 1940-1960s based on observational data
- Used to counsel patients on timing of anticipated body changes during puberty
- Should be used instead of chronological age to assess pubertal development



# What system can we use to stage her development?







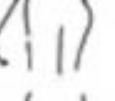



- **Tanner Staging or Sexual Maturity Rating (SMR)**

## Pubic Hair Scale (both males and females)

- Stage 1: No hair
- Stage 2: Downy hair
- Stage 3: Scant terminal hair
- Stage 4: Terminal hair that fills the entire triangle overlying the pubic region
- Stage 5: Terminal hair that extends beyond the inguinal crease onto the thigh

## Female Breast Development Scale

- Stage 1: No glandular breast tissue palpable
- Stage 2: Breast bud palpable under areola (1st pubertal sign in females)
- Stage 3: Breast tissue palpable outside areola; no areolar development
- Stage 4: Areola elevated above contour of the breast, forming “double scoop” appearance
- Stage 5: Areolar mound recedes back into single breast contour with areolar hyperpigmentation, papillae development and nipple protrusion

PREPUBERTAL		1		PREPUBERTAL
BREAST BUD		2		PRESEXUAL HAIR
BREAST ELEVATION		3		SEXUAL HAIR
AREOLAR MOUND		4		MID-ESCUTCHEON
ADULT CONTOUR		5		FEMALE ESCUTCHEON

<https://www.ncbi.nlm.nih.gov/books/NBK470280/>

<https://pedsinreview.aappublications.org/content/pedsinreview/32/7/281.full.pdf>



# BACK TO THE PATIENT... WHAT IS HER TANNER STAGE?

- VS: Wt 42 kg, Ht 150 cm, BP 90/62, P 82, T 37.0

- Gen: NAD

- HEENT: WNL

- Chest: CTAB

- CVS: RRR

- Breast: Bilateral breast tissue enlargement. No contours and no secondary areola mound.

- Abd: Soft, non-tender

- Ext Pelvic: Scant dark, coarse pubic hair on the mons; no extension laterally

- Ext: WWP

**TANNER STAGE 3**  
breast and pubic hair



# SOCIAL DETERMINANTS OF HEALTH

## Disparities in pubertal development

Black young women enter pubertal development before Caucasian and Hispanic young women, independent of BMI.

With the 3x rise in mean BMI in the past 40 years, higher BMI is associated with earlier onset menarche in all races, though Black young women have experienced a steeper decrease in age of onset.

Family-related adversity exposures (exposures to marital conflict, father absence, negative parenting practices, and socioeconomic disadvantage) are associated with earlier pubertal timing.

Earlier pubertal timing may be a key risk factor for poorer cardio-metabolic health in adolescence and adulthood

There is a clear need for more data that is representative of the racial/ethnic diversity of the US population to better understand these disparities and their effects.



# EPIC .PHRASE

## **BBONNormalPubertalDev**

Description: Normal pubertal development counseling

We reviewed the normal sequence of puberty, including thelarche, pubarche, and menarche. We discussed that the puberty experience varies for each adolescent, but that in the US puberty typically begins with thelarche (between age 8-13). We reviewed red flags requiring further evaluation including precocious puberty, delayed puberty and primary amenorrhea.



# CODING AND BILLING

- Z00.3, Encounter for examination for adolescent developmental state
- E30.9, Disorder of puberty, unspecified
- N92.2, Excessive menstruation at puberty
- E30.0, Delayed puberty
- E30.1, Precocious puberty



# EVIDENCE

- Bordini B, Rosenfield RL. Normal pubertal development: Part II: Clinical aspects of puberty. *Peds in Review*. 2011 (32):7;281-291.
- ACOG Committee Opinion 651. Menstruation in girls and adolescents: using the menstrual cycle as a vital sign. *Obstet Gynecol* 2015;126:e143-6.
- Biro FM, Chan YM. Normal Puberty. *UpToDate*. Apr 2020. Accessed [https://www.uptodate.com/contents/normal-puberty?search=normal%20puberty&source=search\\_result&selectedTitle=1~150&usage\\_type=default&display\\_rank=1](https://www.uptodate.com/contents/normal-puberty?search=normal%20puberty&source=search_result&selectedTitle=1~150&usage_type=default&display_rank=1) on May 23, 2020.
- Emmanuel M, Bokor BR. Tanner Stages. *StatPearls*. May 2019. Accessed <https://www.ncbi.nlm.nih.gov/books/NBK470280/> on May 24, 2020.
- Bleil ME, Booth-LaForce C, Benner AD. Race disparities in pubertal timing: Implications for cardiovascular disease risk among African American women. *Popul Res Policy Rev*. 2017;36(5):717-738. doi:10.1007/s11113-017-9441-5
- Ramnitz MS, Lodish MB. Racial disparities in pubertal development. *Semin Reprod Med*. 2013 Sep;31(5):333-9. doi: 10.1055/s-0033-1348891. Epub 2013 Aug 9. PMID: 23934693.
- Deardorff J, Hoyt LT, Carter R, Shirtcliff EA. Next Steps in Puberty Research: Broadening the Lens Toward Understudied Populations. *J Res Adolesc*. 2019;29(1):133-154. doi:10.1111/jora.12402

