The adrenal gland is made up of two, simultaneously present but independent glands.
Adrenal Medulla

- Gland at inner core of adrenal
- May or may not be an actual endocrine gland
- Derives in the embryo from neural tissue
- Produces epinephrine/adrenaline and norepinephrine/noradrenaline in response to stress
Adrenal Cortex

- Outer gland of adrenal
- Glandular tissue
- produces and releases hormones in response to stimulation from the *tropic hormone, ACTH*, which, in turn is controlled by the *releasing hormone, CRH*
- CRH ↔ ACTH ↔ adrenal cortical hormones
Adrenal Cortex

- Produces and releases three classes of hormones:
  1) **glucocorticoids**: control glucose metabolism and food intake (cortisol)
  2) **mineralocorticoids**: regulate levels of minerals and electrolytes such as sodium or potassium (aldosterone)
Adrenal Cortex

- Produces and releases:
  3) sex steroids - estrogen, progesterone and androgen

- Estrogen and progesterone produced by the adrenal cortex of women is insignificant compared to that coming from ovary

- ADRENAL CORTEX IS THE MAJOR SOURCE OF ANDROGEN FOR WOMEN
Androgens

• **Testosterone**
  • best known androgen
  • very strong or potent androgen
  • most prevalent androgen found in men
Androgens

- Androstenedione
  - much less well known than testosterone
  - weaker or less potent androgen than testosterone
  - most prevalent androgen found in women
Androgens

- Androstenedione
  - converted to testosterone by specific target tissue
  - allows for localized powerful androgen actions without total masculinization of the female body
Actions of Androgens

1. Stimulates the growth of pubic and underarm hair
2. acne
3. control of sex drive
Two Main Types of Hormones

• Peptide hormones
  • Water soluble hormones
  • Large molecules made up of long chains of amino acids
  • Cannot cross the blood-brain barrier
  • ADH, oxytocin, most releasing hormones and the tropic hormones fall into this category
Two Main Types of Hormones

• Steroid Hormones
  • Fat soluble hormones
  • Smaller molecular structures than peptide hormones
  • Typically can cross the blood-brain barrier
  • Include estrogens, androgens, progesterone, glucocorticoids, mineralocorticoids
Production of Sex Steroids

• Cholesterol is the precursor from which progesterone, androgen and estrogen are produced.
• All of these hormones are chemically very similar to each other such that receptors can be confused and respond to the wrong hormone.
Sex Steroid Production

Cholesterol

Progesterone → Androstenedione

Estrial → Estrone

Testosterone → Estradiol
Progesterone Production

Cholesterol → Progesterone → Androstenedione → Estrial, Estrone, Testosterone, Estradiol
Androstenedione Production

Cholesterol → Progesterone → Androstenedione

Androstenedione → Estrial, Estrone, Testosterone, Estradiol
Estrial Production
(mostly pregnancy)

Cholesterol

Progesterone → Androstenedione

Estrial

Estrone

Testosterone

Estradiol
Estrone Production
(mostly post menopause)

- Cholesterol
- Progesterone
- Androstenedione
  - Estrial
  - Estrone
  - Testosterone
  - Estradiol
Testosterone Production

Cholesterol

Progesterone → Androstenedione

Estrial

Estrone

Testosterone → Estradiol
Estradiol Production

Cholesterol → Progesterone → Androstenedione

- Estrial
- Estrone
- Testosterone
- Estradiol