Hormone Interactions:

Synergism and Antagonism:
- multiple synergistic stimuli are more than additive
- insulin opposes glucagon

Is insulin a competitive inhibitor of glucagon?

Permissiveness:
- need 2nd hormone to get full expression
- e.g. reproductive development

Interaction of Hormones at Target Cells

Three types of hormone interaction

1) Permissiveness –
   one hormone cannot exert its effects without another hormone being present

2) Synergism –
   more than one hormone produces the same effects on a target cell

3) Antagonism –
   one or more hormones opposes the action of another hormone
Adrenal Androgens
source: zona recticularis
physiological role??
very low titers compared to gonadal production
females: contribute to pubertal changes:
adrenarche
presence of pubic hair <8 years of age
development of axillary hair & adult axillary odor
premature production↑ dehydroepiandrosterone (DHEA)
↑ growth: advancing bone age & clitoral enlargement
↑ incidence in African American females
benign condition that requires no treatment except:
abnormal growth acceleration
development secondary traits

Common inherited disorders of steroid hormone metabolism
11β-hydroxylase enzyme needed synthesis of glucocorticoids/mineralocorticoids
→ glucocorticoids → ACTH by anterior pituitary gland normal feedback mechanism
adrenal glands enlarge ↑ pregnenolone synthesis
 progesterone
 17α-hydroxyprogesterone
 androgens

pregnancy: abnormal production (tumor or steroidogenesis)
morphogenic consequences:
mammary carcinomas
cigarette smoking
↑ dehydroepiandrosterone (DHEA)
↑ antiestrogenic effect
↑ cardiovascular disease & osteoporosis
↓ breast cancer/endometrial cancer risks
postmenopausal:
substrate for extragonadal estrogen production
males: contribute to prepubertal:
adrenarche
pubic hair <9 years of age
penal enlargement
prostate carcinomas
A) Effects of high levels of androgens

1) Development of female fetus →
   masculinization of external genitalia
2) Development of male fetus
   a) sexual organs normal at birth
   b) sexual precocity apparent several months later
   c) accelerated growth & very early bone maturations—>short stature
3) 50% with 21-hydroxylase deficiency lose Na⁺ in urine
4) aldosterone (mineralocorticoid)
   ↑ loss of salts lead to dehydration and hypotension
5) Therapy
   a) administration of glucocorticoid hormone (ACTH secretion)
   b) mineralocorticoid for those who lose salts
   c) symptoms reversed therapy started within the first 2 years after birth

B) Congenital adrenal hyperplasia (inherited disease)

1) affect enzymes required for steroidogenesis
   11-hydroxylase—>virilization
   17-hydroxylase
   3-B-dehydrogenase
demolase
2) all above enzymes deficiency—>
   enlargement of adrenal gland