BIOCHEMISTRY OF PREGNANCY

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CHOLESTEROL IS THE PRECURSOR OF STEROID HORMONES
**Cholesterol**

- **Pregnenolone**
  - **Progesterone**
  - **Cortisol** (glucocorticoid)

  - **Corticosterone** (mineralocorticoid)
    - **Testosterone**
    - **Aldosterone** (mineralocorticoid)
      - **Estradiol**

  - **Regulate reabsorption of Na⁺, Cl⁻, HCO₃⁻ in the kidney.**

- **Affects protein and carbohydrate metabolism; suppresses immune response, inflammation, and allergic responses.**

**Male and female sex hormones. Influence secondary sexual characteristics; regulate female reproductive cycle.**
کلسترول \[\xrightarrow{1} \] پرگنولون

\[\xrightarrow{2} \] پروئسترون

\[\xrightarrow{3} \] استرون دراکسی کورتیکوسترون

\[\xrightarrow{4} \] دهیدروپپرگنولون

\[\xrightarrow{5} \] دهیدروپپرگنولون

\[\xrightarrow{6} \] تستوسترون

\[\xrightarrow{7} \] آندروستنول

\[\xrightarrow{8} \] آندروستنیدیون

\[\xrightarrow{9} \] استرادیول

\[\xrightarrow{10} \] استرون

\[\xrightarrow{11} \] دهیدروکسی استرئود دهیدروژنаз، آیزومراز

\[\xrightarrow{12} \] کورتیزول

\[\xrightarrow{13} \] کورتیزول

\[\xrightarrow{14} \] آرماتاز

\[\xrightarrow{15} \] آندروسترون

\[\xrightarrow{16} \] آندروستنول

\[\xrightarrow{17} \] آندروستنیدیون

\[\xrightarrow{18} \] آندروستنول

\[\xrightarrow{19} \] آندروستنیدیون

\[\xrightarrow{20} \] آندروستنول

\[\xrightarrow{21} \] آندروستنول

\[\xrightarrow{22} \] آندروستنول

\[\xrightarrow{23} \] آندروستنول
CONCEPTION

- Normal human pregnancy lasts about 40 weeks.
- It is measured from the first day of the last normal menstrual period (LMP or LNMP).
- Term is Interval from 37 to 42 weeks.
- Pregnancy is divided into three time intervals called trimesters.
Ovary

Growth of Follicle And Ovulation

Ovum

Fertilization

Zygote

Cell Divisions

Morula

Formation of primitive yolk sac

Blastocyst

Formation of amnion

Embryo

Formation of Placenta

Implantation into uterine

Fetus

Organogenesis and Developing most major structures
PLACENTA

- Placenta is created from trophoblasts of blastocyst
- Links fetus and mother
- Has Different Functions
  - Keeps the maternal and fetal circulation systems separate
  - Nourishes the fetus
  - Eliminates fetal wastes
  - Produces hormones vital to pregnancy
PLACENTA HORMONES

**Protein Hormones**
- Chorionic Gonadotropin (CG)
- Placental Lactogoe (PL)

**Steroid Hormones**
- Progesterone
- Esteradiol
- Estriol
- Estrone
Human Chorionic Gonadotropin (hCG)

- Is synthesized by trophoblasts cells
- As LH, FSH, and TSH, is a glycoprotein composed of alpha and beta subunits
- Beta subunit of hCG is very similar to beta subunit of LH, but is longer
- It binds to LH receptor
- Has Different Functions
  - Stimulation of corpus luteum to make progesterone during first weeks of pregnancy
  - Stimulation of steroid hormone synthesis by placenta-fetus unit
  - Promotes gonads development in fetus
Human Chorionic Gonadotropin (hCG)

- 6-12 days after ovulation, serum hCG exceeds 5 IU/mL
- Synthesis of beta subunit peaks at about 8 to 10 weeks, but production of alpha subunit continues to increase
- There are many forms of hCG in maternal serum

*Unmodified* **hcG dimer** which peaks at about 10th week and is predominant all times during pregnancy

*Free subunits*: Beta subunit during first trimester and alpha subunit during second and third trimesters

*Nicked hCG*
CLINICAL APPLICATIONS OF hCG MEASURING

- Diagnosis of Pregnancy
- Screening Tests
- Abortion
- Ectopic Pregnancy
- Trophoblastic Tumors
Human Placental Lactogen (hPL)

- Is synthesized by trophoblasts cells
- Is a single polypeptide with 191 amino acids
- Is very similar to GH and to a lesser extent to PRL
- Increases during pregnancy and its secretion near term is 1 to 2 g/day
- Is lactogenic, metabolic, somatotropic, leuteotropic, erythropoietic
- Its Determination has no clinical application
STEROID HORMONES

- Estrogens and progesteron are needed for appropriate development of endometrium, uterine growth, adequate blood supply and preparation of uterus for labor.

- Synthesis of steroid hormones increases during pregnancy.

- Esteriol is made from 16-OH DHEA-S produced by fetus liver.
OTHER PROTEINS

- Alpha Protein (AFP)
- Pregnancy-associated plasma protein-A (PAPP-A)
- Inhibin A
ALPHA PROTEIN (AFP)

- Is a glycoprotein with 591 amino acid
- Is the most abundant protein in fetus serum
- Is produce initially by yolk sac and then fetus liver
- Peaks at 12-14th week (3 mg/mL), then decreases to 20 ug/mL at term, and reaches to 1 ng/mL after 1 year
- Its activity is like Albumin
- Is Determined for Screening and also tumor marker
PREGNANCY-ASSOCIATED PLASMA PROTEIN-A (PAPP-A)

- Is a zinc binding protein
- Is found in a large amount in mother serum
- Is used for screening
- May be associated with Atherosclerosis
At least, there are two types of inhibin

**Inhibin A** is secreted by placenta and may be inhibit hCG synthesis

**Inhibin A** is used in screening

**Inhibin B** is produced by gonads and inhibits FSH production
MATERNAL ADAPTATION TO PREGNANCY

- Endocrine Changes
- Chemical Changes
ENDCRINE CHANGES

- Increase of estrogens and progesterone
- Increase of PTH and Calcitriol
- Increase of cortisol and aldosterone
- Increase of PRL, but Decrease of LH and FSH
- Increase of T4 and T3
CHEMICAL CHANGES

- Increase of plasma transport proteins (TBG, CBG, SHBG)
- Increase of TG and Cholesterol
- Decrease of Alb
- Decrease of urea, creatinine, and uric acid
- Glucosuria and proteinuria