Chapter 7

Placental Function

Functions of the placenta
Transport and metabolism
  Different types of placentas
  Transport of respiratory gases (oxygen transfer)
  Transport and metabolism of carbohydrates (glucose transfer)
  Transport and metabolism of amino acids and lipids
  Transport of water, inorganic ions, minerals and vitamins
    Sodium, other ions, water transfer
Endocrine functions of the placenta
  Hypophyseal hormones
    Human chorionic gonadotropin (hCG)
    Human chorionic somatomammotropin (hCS)
    Prolactin (PRL)
    Other pituitary-like peptides
    ß-endorphine
  Steroidogenesis in the maternal-fetal-placental unit
    Progesterone, estrogens, growth hormone
  Placental peptides similar to hypothalamic factors
    Human chorionic gonadotropin releasing factor (GnRH)
    Chorionic thyrotropin releasing hormone (chorionic TRH)
    Chorionic somatostatin (CS)
    Chorionic corticotropin releasing hormone (chorionic CRH)
    Oxytocin
  Other chorionic cytokines, growth factors, and peptides
    Leptin, relaxin, inhibin, activin, vasoactive peptides, eicosanoids, prostanoids
Protective functions of the placenta
Objectives

The purpose of this Chapter is to review:

1) Different types of placentation.
2) The main functions of the placenta such as:
3) Transport and metabolism function.
4) Endocrine function.
5) Protection function.

Functions of the placenta

The placenta acts to provide oxygen, water, carbohydrates, amino acids, lipids, vitamins, minerals, and other nutrients to the fetus, while removing carbon dioxide and other waste products. It metabolizes a number of substances and can release metabolic products into maternal and/or fetal circulations. It can help to protect the fetus against foreign molecules, infectious agents and maternal diseases. It also releases hormones into both the maternal and fetal circulations to affect pregnancy, metabolism, fetal growth, parturition and other functions.

Transport and metabolism

DIFFERENT TYPES OF PLACENTAS

The circulation of the mammalian fetus is separated from that of the mother by intervening placental tissue. There are several structurally different placentas in the mammals. These differ in the numbers and types of cell layers between the maternal and embryonic/fetal blood.

In epitheliochorial placentas, chorion is located on the uterine epithelium. Pig placenta is a typical example of this type (Fig. 7-1). In some hooved mammals such as deer and cattle, varying amounts of uterine epithelium may be absent, thus bringing the chorion into contact with the connective tissue of the uterus. This type of placenta is called syndesmochorial (Fig. 7-2). This is sometimes considered a variant of the epitheliochorial placenta.

When no maternal connective tissue is present between the endothelium of the maternal vessels and chorionic epithelium, the placenta is called endotheliochorial (Fig. 7-3). The placenta of cats and dogs is of endotheliochorial type.
In primates, including humans, maternal blood is directly in contact with the chorion (trophoblast layer). This arrangement is designated as *hemochorial placentation* (Fig. 7-4). Rabbits and many common rodents possess placentas in which the endothelium of the fetal vessels appears to be in direct contact with the maternal blood. These are called *hemoendothelial placentas* and they represent an extreme variation of the hemochorial type.

Functionally, transfer of the substances varies widely in different types of placentas. Hemochorial placentas are more permeable to lipid-insoluble molecules for which there are no specific transport systems. Diffusion is thought to occur by leaking through special pores.

Placental structures of the *vasculosyncytial membrane* are illustrated in Fig. 7-5. Common transfer mechanisms in a hemochorial placenta are illustrated in Fig. 7-6.

This Chapter reviews examples of transplacental transfer. Although most of the information is derived from term placentas, preterm placentas differ in certain transporter proteins, oxygen tension, and blood flow.
**FIGURE 7-1.** Epitheliochorial placenta (pig).
1) Chorionic connective tissue. 2) Chorionic blood vessels. 3) Chorionic epithelium. 4) Uterine epithelium. 5) Uterine connective tissue. 6) Uterine blood vessels. *(MODIFIED FROM CARLSON, ET AL., 1981)*

**FIGURE 7-2.** Syndesmochorial placenta (deer and cattle).
1) Chorionic connective tissue. 2) Chorionic blood vessels. 3) CTB. 4) STB. 5) Uterine connective tissue. 6) Uterine blood vessels. *(MODIFIED FROM CARLSON, ET AL., 1981)*
**FIGURE 7-3.** Endotheliochorial placenta (cat and dog).
1) Chorionic blood vessel. 2) Chorionic connective tissue. 3) CTB. 4) STB. 5) Uterine blood vessels. 6) Uterine connective tissue. *(MODIFIED FROM CARLSON, ET AL., 1981)*

**FIGURE 7-4.** Hemochorial placenta (human).
1) Floating villus. 2) Lacuna where maternal blood circulates. 3) Anchoring villus. 4) Villous and extravillous CTB. 5) STB. 6) Uterine blood vessels. 6) Uterine connective tissue. *(MODIFIED FROM CARLSON, ET AL., 1981)*
FIGURE 7-5. Structures that comprise the placental barrier (vasculosyncytial membrane).