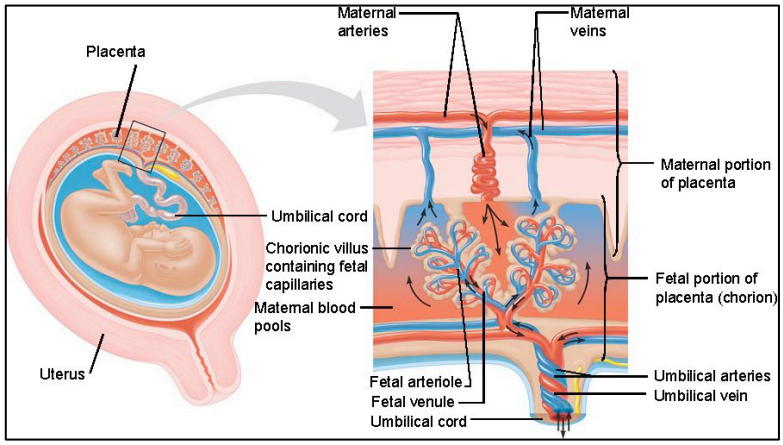
Maternal – Fetal Drug Transfer

Anesthetic Pearls: Anesthetic Implications and Management of Maternal – Fetal Drug Transfer

I. Maternal Drug Concentration

a. Site of administration – highest in areas of high vascularity (IV > Paracervical > Caudal > Epidural > IM > Spinal)
b. Total dose: obviously greater drug => greater drug transfer
c. Protein binding – only unbound fraction of drug crosses placenta (therefore lower protein binding facilitates greater drug transfer across the placenta)
d. Maternal metabolism – clears drug from circulation (therefore drug becomes unavailable)
e. Maternal pH – only **unionized** forms of drugs cross placenta (therefore a low maternal pH will ionize the drug and prevent placental transfer)



II. Placenta Transfer

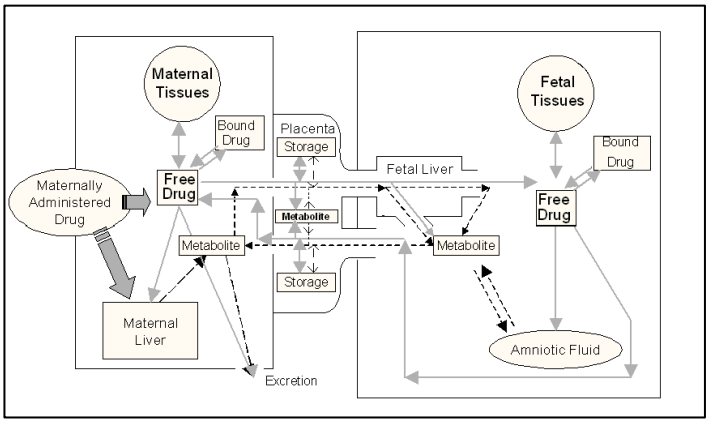
There is a diffusion coefficient that is constant for each drug.
Factors that <u>INCREASE the DIFFUSION CONSTANT</u>:

1. High lipid solubility
2. Low molecular weight
3. Low protein binding
4. Low degree of ionization

III. Fetal Drug Concentration

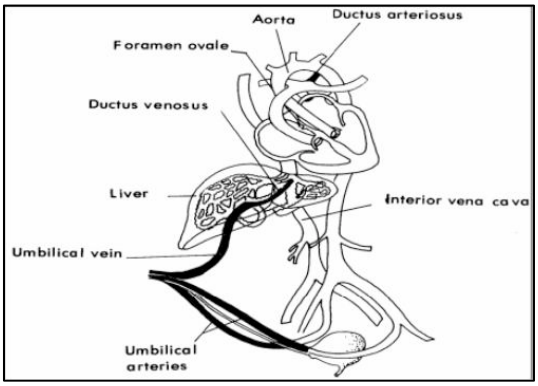
a. Fetal circulation – very little drug entering the fetus is seen by the fetal brain and heart because of first pass metabolism through the fetal liver and progressive dilution by blood returning to the heart from other parts of the fetal circulation
b. Fetal pH – fetal pH is less than maternal pH (fetus more acidic)
   - local anesthetics can get "trapped" in fetus causing levels that can exceed maternal levels (baby is slightly acidotic; therefore when B^- crosses and binds to H^+, it consequently becomes trapped "BH")
   - 2-Chloroprocaine is recommended during fetal distress secondary to shortest half life

c. Protein binding – low protein binding leads to high levels of "free" drug that can cross the placenta
d. Fetal metabolism – immature metabolism contributes to elevated active drug levels



IV. Specific Drugs

1. Atropine - crosses placenta and can mask fetal distress
2. Thiopental - crosses placenta rapidly but does <u>not</u> affect fetus due to redistribution and first pass effect
3. Propofol – rapidly crosses the placenta in a dose dependent manner but has lesser affect on fetal BP than maternal BP
4. Inhalation agents - rapidly cross placenta and equilibrate after ~15 min
5. Opioids - cross placenta rapidly (Fentanyl lowest proportion)



- Drugs that do **<u>NOT</u>** cross the placenta ("<u>H</u>e <u>I</u>s <u>G</u>oing <u>N</u>owhere <u>S</u>oon")

1. Heparin - negative charge does **<u>NOT</u>** cross
2. Insulin - does **<u>NOT</u>** cross to significant degree
3. Glycopyrrolate - quarternary compound does **<u>NOT</u>** cross
4. Non-Depolarizing Muscle Relaxants - highly ionized with low lipid solubility (very minimal transfer)
5. Succinylcholine - does **<u>NOT</u>** cross placenta to significant degree