Drugs and Development

Part A: Is John a drug baby?

Is John a Drug Baby?

John was small and weighed 1.8 kilograms (4 pounds) at birth. As a baby, John cried a lot and had difficulty eating and sleeping. His growth and development were slow. He was not as quick as other children to talk or walk or learn new words. When he played, he was not good at picking up blocks or sorting objects.

John's mother had used tobacco, alcohol, and a drug called "FLORATRYP" while she was pregnant. Following John's birth, his mother continued to use FLORATRYP. She also suffered from depression. John's mother found that raising a baby and supporting herself as a single mom was very stressful. There never seemed to be enough money for food and rent. As John was growing up, he had few toys or books. He rarely had a chance to interact with his mother, other adults or other children.

When John began kindergarten, he had trouble learning his letters and writing. He seemed "tuned out" and was easily distracted. He did not interact with his classmates. In elementary school he was diagnosed with learning disabilities. Testing, done by the school psychologist, indicated that John had slightly below normal intelligence.

Some people said that John's problems with learning and social interaction were caused by his mother's use of FLORATRYP during her pregnancy. They called him a "drug baby." But other people said that there could be many other explanations for John's problems.

1. Do you think that John's problems with learning and social interaction were caused by his mother's use of the drug FLORATRYP during her pregnancy? Explain why or why not.

   _____

   _____

2. List at least four other factors (before birth and after birth) that could have led to John's problems with learning and social interaction?

   _____

   _____

   _____

   _____

Part B: Do drugs diffuse from a mother to her developing baby?

Labels on cigarette packs warn that "Smoking by pregnant women may result in fetal injury, premature birth, and low birth weight." Labels on bottles of alcohol warn that "Women should not drink alcohol during pregnancy because of the risk of birth defects." Scientists know that nicotine and alcohol can move from a pregnant woman to her developing baby. They also know that alcohol and nicotine can harm a developing baby.

Does the drug FLORATRYP diffuse from a mother's blood into a developing baby's blood?

In this activity you will make a simple model to answer this question.

(Note: This activity is a simulation that does <u>not</u> use any real drugs.)

1. Before you make your model, use FLORATRYP Test Strips to test the mother's blood and the baby's blood for the presence of drugs.

    - Dip one FLORATRYP Test Strip into the sample of the "mother's blood". Is FLORATRYP present in the mother's blood?

      _____

    - Dip one FLORATRYP Test Strip into the sample of the "baby's blood". Is FLORATRYP present in the baby's blood?

      _____

If the FLORATRYP Test Strip turns DARK green or blue, the drug FLORATRYP is present in the blood.

2. You will now make a model to see if FLORATRYP can diffuse from the blood of a pregnant mother into the blood of her developing baby. To make your model:

   - Prepare <u>two</u> membrane tubes:
     - Dip one end of each membrane tube into water to soften it.
     - Tie one end of each of the tubes into a knot and pull it tight to close it off.

   - Pour the entire tube of "Baby's Blood" into the <u>shorter</u> tube. The membrane tubing represents the baby's blood vessels.

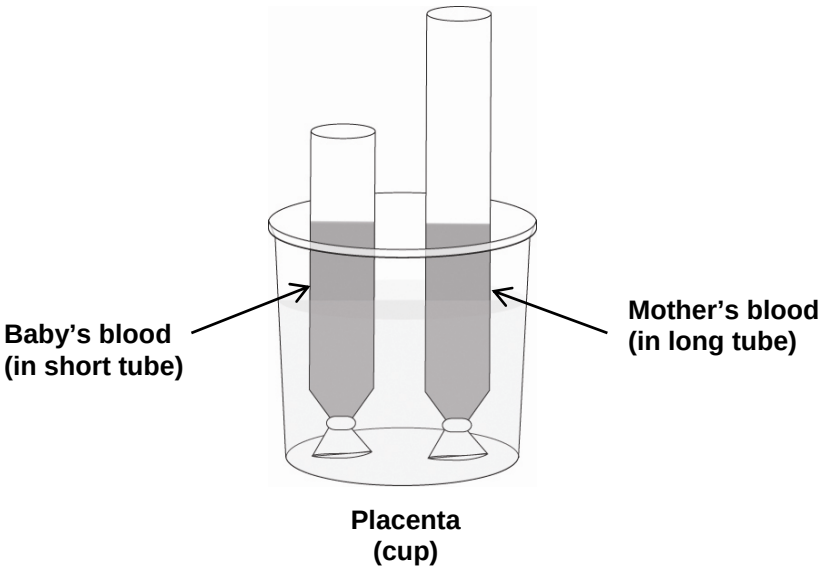
   - Pour the entire tube of "Mother's Blood" into the <u>longer</u> tube. The membrane tubing represents the mother's blood vessels.

   - Fill the cup labeled "Placenta" approximately ½ full of hot tap water.

   - Carefully set the membrane tubes containing the "Baby's Blood" and "Mother's Blood" into the cup labeled "Placenta." See the diagram below.

   - Wait for at least 30 minutes to allow the diffusion process to occur.

     Start time _____ End time _____



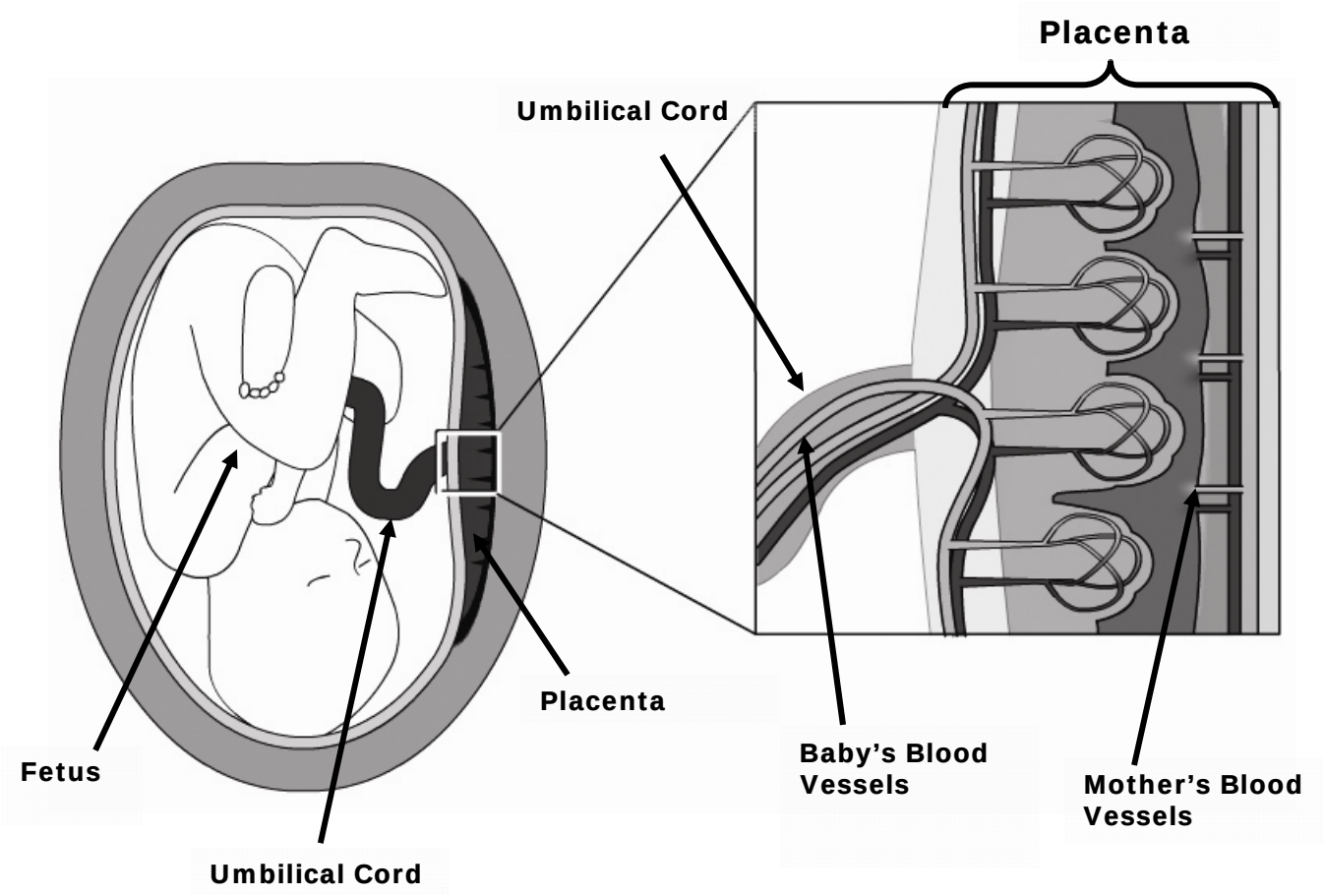
While you wait, go on to answer questions 3 through 6 in Part B. Also, go on to work on Part C.

Base your answers to questions 3 through 6 (on the next page) on the information in the reading and the diagram below, and on your knowledge of biology.

Do drugs diffuse from a mother to her developing baby?

The **placenta** is an organ that supplies a developing baby with oxygen and food, and allows the baby's wastes to be excreted into the mother's bloodstream. In the placenta, the mother's blood vessels come close to but do not connect with the baby's blood vessels. The mother's blood does NOT enter the baby. Instead, in the placenta, small molecules such as food, oxygen, wastes, or harmful substances diffuse from the mother's blood vessels to (or from) the developing baby's blood vessels. Larger substances, such as blood proteins and blood cells, cannot diffuse from the mother's blood to the baby's blood.

Many harmful substances in a mother's bloodstream, such as alcohol, cocaine, and nicotine, can easily enter a developing baby through the placenta and umbilical cord. Prenatal (before birth) exposure to harmful substances can cause the abnormal development or death of a baby.



3. What is meant by the term “prenatal drug exposure”?

_____

4. Does the mother’s blood flow directly into the developing baby? Explain why or why not.

_____

_____

5. Explain why the placenta is essential for the normal development of the baby.

_____

_____

6. The blood vessels of the mother and baby are not directly connected to each other. Explain how some harmful substances in the blood of a pregnant female can enter a developing baby.

_____

_____

7. Use the FLORATRYP Test Strips to test the mother’s blood and the baby’s blood for the presence of drugs.

   - Dip one FLORATRYP Test Strip into the “mother’s blood” in the cup. Is FLORATRYP present in the mother’s blood?

     _____

   - Dip one FLORATRYP Test Strip into the “baby’s blood” in the dialysis tubing. Is FLORATRYP present in the baby’s blood?

     _____

If the FLORATRYP Test Strip turns DARK green or blue, the drug FLORATRYP is present in the blood.

8. In your model, did FLORATRYP diffuse through the placental membrane from the mother’s blood to the developing baby’s blood? Explain how you could tell.

_____

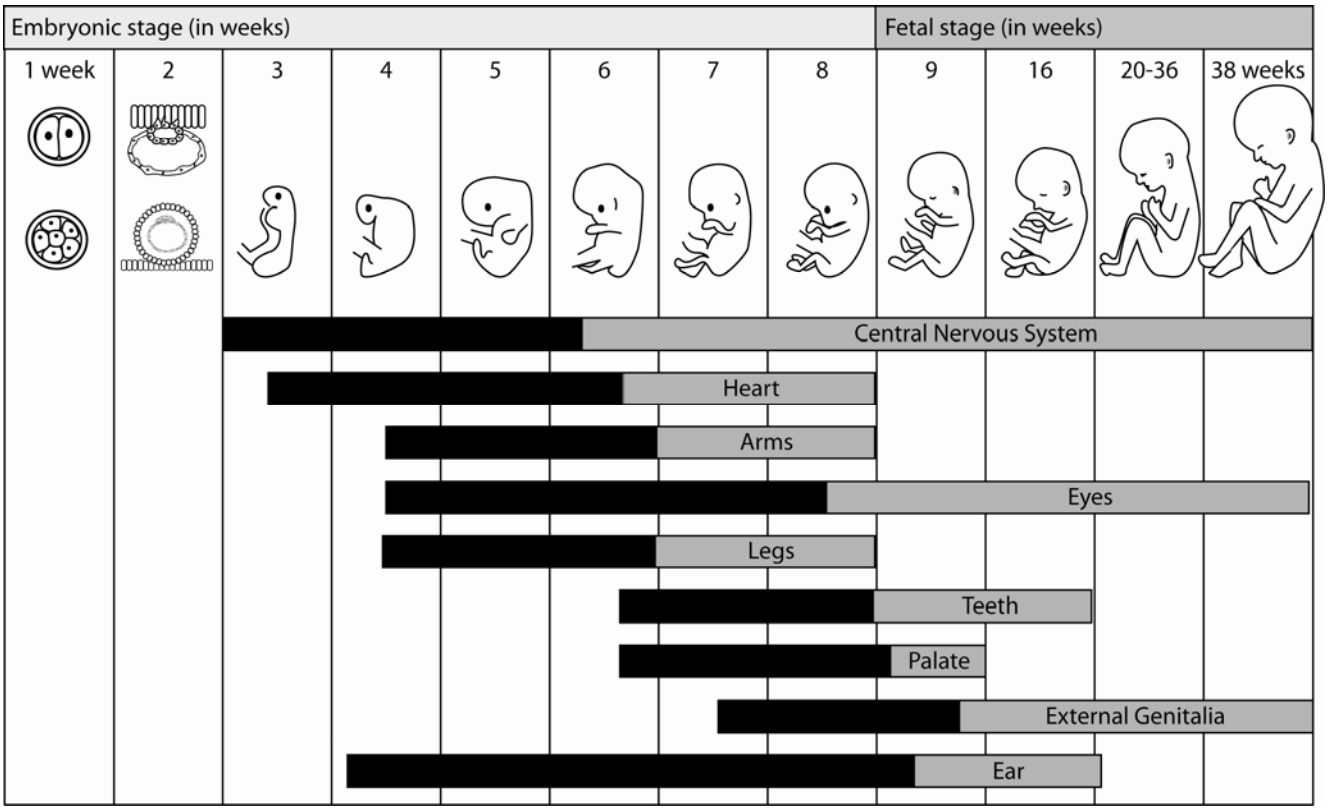
_____

Part C: When do drugs affect a developing baby?

How a drug affects development depends on the type of drug, the embryo or fetus's stage of development, the strength of the drug, and how much and how often the mother took the drug when she was pregnant. Drugs reaching an embryo or fetus may have no effect, or they may cause major (obvious at birth) defects, or minor (subtle but noticed later in life) defects.

The chart below illustrates when developing organs may be affected by harmful substances. The chart will help you think about the effects of the mother's lifestyle on embryonic and fetal development.

- Black bars represent times when harmful substances may cause major structural abnormalities.
- Gray bars represent times when harmful substances may cause physiological (functional) or minor structural abnormalities.



1. An **embryo** is an unborn offspring in whom the major body organs are still forming. Once the major organs have formed, the unborn offspring is called a **fetus.** At the beginning of what week does an embryo become a fetus?

   _____

2. At which stage (the embryo stage or the fetus stage) is exposure to harmful substances, such as alcohol or drugs, most likely to cause major birth defects?

   _____

3. During which weeks would prenatal exposure to drugs be likely to cause major birth defects that affect the CNS (brain and spinal cord)?

   _____

4. During which weeks might prenatal exposure to drugs be most likely to cause minor structural or physiological (functional) defects that affect the CNS (brain and spinal cord)?

   _____

5. How does prenatal exposure to drugs such as nicotine, alcohol, and cocaine affect developing babies? Do an Internet search using the search terms (shown in parentheses) found below. For each type of drug (tobacco and alcohol) list at least three negative effects that the drug may have on children whose mothers used the drug during pregnancy.

   - "prenatal tobacco exposure" and/or "prenatal nicotine exposure"

     _____

     _____

     _____

   - "prenatal alcohol exposure"

     _____

     _____

     _____

   - "prenatal cocaine exposure"

     _____

     _____

     _____

6. Which drug (alcohol, nicotine, or cocaine) has the greatest effect on children born to mothers who used the drug during pregnancy?

   _____

7. When is a mother's use of drugs most likely to harm a developing baby—early in pregnancy or late in pregnancy?

   _____

8. Some people have suggested there should be a law that makes the use of drugs such as alcohol, tobacco, or illegal drugs during pregnancy a criminal offense.

   - Explain one advantage this kind of law.

     _____

     _____

     _____

   - Explain one disadvantage to this kind of law.

     _____

     _____

     _____

   - Would you support this kind of law? Explain why or why not.

     _____

     _____

     _____

     _____

     _____

     _____