

Life Support for a Developing Baby

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Part 1: What substances move from a mother's blood to her baby's blood?

When a **fetus** (developing baby) is in the mother's **uterus**, it can't eat or breathe on its own, so it needs a support system that provides it with substances essential for normal development.

While in the uterus, a developing baby's life-support system is composed of the **placenta** and the **umbilical cord**. The placenta has been described as a pancake-shaped organ that attaches to the inside of the mother's uterus and is connected to the fetus by the umbilical cord.

The mother's blood usually contains oxygen and nutrients such as glucose, amino acids, and lipids. In the placenta, oxygen and nutrients **diffuse** from the mother's blood into the baby's blood. Waste products, such as carbon dioxide and urea, diffuse from the baby's blood to the mother's blood.

If the mother takes in harmful substances such as alcohol or nicotine, her blood may also contain these harmful substances. If she is sick, there may also be pathogens, such as viruses or bacteria, present in her blood.

1. Label the diagram on the right.

- Fetus
- Placenta
- Umbilical Cord
- Mother's Uterus

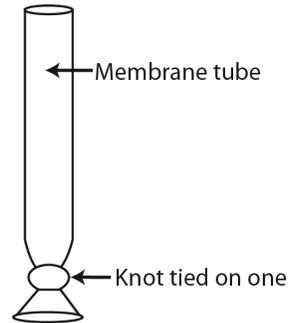


Follow the instructions below to create a model of a baby's and mother's blood vessels in the placenta. You will use this model to determine whether **alcohol** and **the viruses which cause rubella (German measles)** can move from the mother's blood into her baby's blood.

2. Fill the cup labeled "Placenta" approximately $\frac{1}{2}$ full of warm tap water.

3. Prepare two membrane tubes:

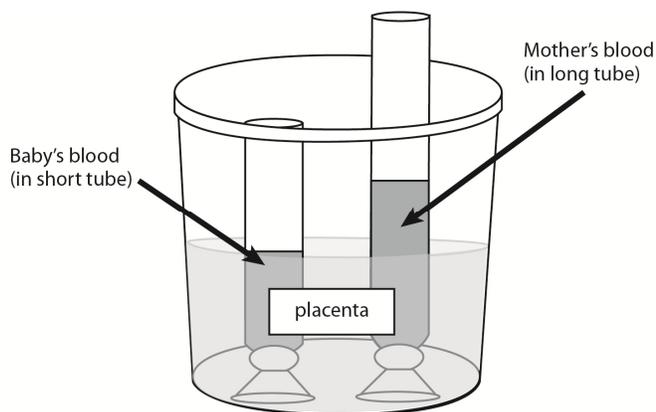
- Dip one end of each black-striped membrane tube into water to soften it.
- Tie the moistened end of each of the black-striped membrane tubes into a knot and pull it tight to close it off. The other end should remain open.



4. The shorter membrane tube represents the baby's blood vessels.

- Shake the tube of "Baby's Blood" to get the red blood cells (represented by glitter) mixed with the fluid in the tube.
- Pour the entire tube of "Baby's Blood" into the shorter tube.
- Replace the cap on the tube and return the tube to the kit bag.

5. Carefully set the membrane tube containing the "Baby's Blood" into the cup labeled "Placenta." See the diagram below.



6. The longer membrane tube represents the mother's blood vessels.
- Shake the tube of "Mother's Blood" to get the red blood cells (represented by glitter) mixed with the fluid in the tube.
 - Pour the entire tube of "Mother's Blood" into the longer tube.
 - Replace the cap on the tube and return the tube to the kit bag.

The mother's blood contains:

- Alcohol (she consumed an alcoholic beverage)
- Viruses (she has a case of the measles)

7. Carefully set the membrane tube containing the "Mother's Blood" into the cup labeled "Placenta."
8. Note the time _____

Wait for 15 minutes to allow the diffusion process to occur.

While you wait, go on to complete Parts 2 and 3 (pages 5 through 9).

Answer questions 9–12 after waiting for at least 15 minutes.

9. The glitter in your model represents red blood cells. Do the mother's blood cells diffuse into the baby's blood? Explain how you can tell.

10. Follow the instructions in your lab kit to test the baby's blood (in the shorter tube) for alcohol and the viruses that cause rubella (German measles). Record the results of the tests in the data table below.

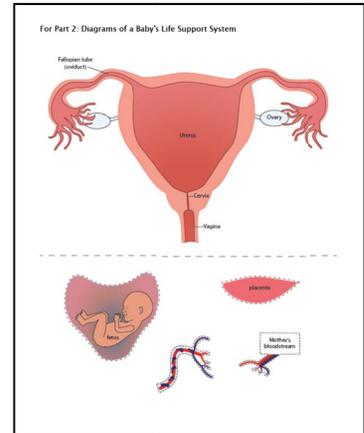
11. The data table below shows the substances that were present in the mother's blood and the baby's blood at the beginning of the experiment and the data you collected from testing the baby's blood.

Harmful Substances	Present in Mother's Blood at Beginning of Experiment (yes or no)	Present in Baby's Blood at Beginning of Experiment (yes or no)	Present in Baby's Blood at End of Experiment (yes or no)
Alcohol	yes	no	
Viruses that cause rubella	yes	no	

12. What substances moved from the mother's blood to the baby's blood? Support your answer with information from the data table above.

Part 2: A paper model of a baby's life support system

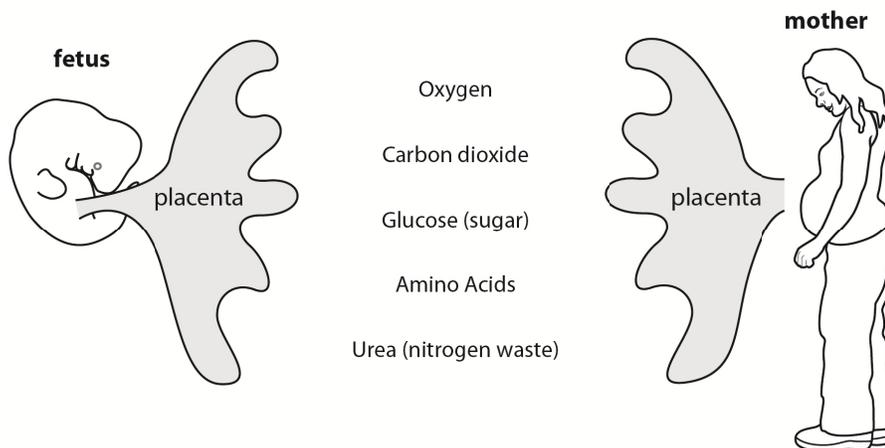
1. Your lab kit contains an information sheet (**A Baby's Life Support System**) and a sheet of diagrams (**Diagrams of a Baby's Life Support System**) that illustrate a developing baby and its support system.
2. Cut along the dotted lines on the sheet of diagrams to create a set of five pieces that show the parts of a baby's support system.
3. Use the information in the **A Baby's Life Support System** sheet to put the cut-out pieces together to make a paper model of the support system for a developing baby.



Use your paper model and the information sheet (**A Baby's Life Support System**) to answer questions 4 through 8.

4. Does the maternal (mother's) blood flow directly into the fetal (developing baby's) blood? Explain why or why not.

5. On the diagram of the placenta below, draw arrows (\rightarrow or \leftarrow) to indicate the direction that each of the substances would diffuse. *Hint: Refer to the **A Baby's Life Support System** information sheet.*



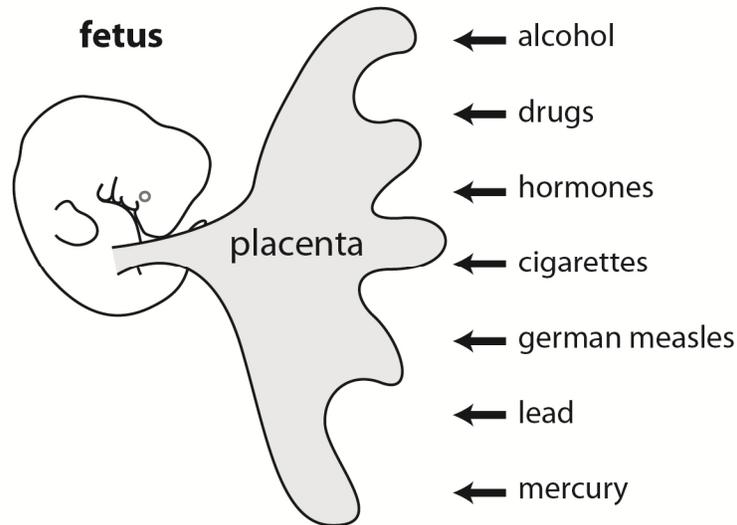
6. Explain why the placenta is essential for the normal development of a fetus.

7. The blood vessels of the mother and baby are not directly connected to each other. Explain how some substances in the maternal blood can enter the fetal blood.

8. In some rare cases, the placenta separates from the uterus before a baby is born. How might this effect the baby's development?

Part 3: Problems with Prenatal Development

Scientists know that prenatal (before birth) exposure to harmful substances and some pathogens (disease causing viruses or bacteria) may interfere with the normal development of a baby.



Your lab kit contains a chart (**Effects of Harmful Substances and Pathogens on Prenatal Development**) that illustrates when a baby’s developing organs are most likely to be affected by harmful substances or pathogens. Use the information in this chart to answer the questions below.

1. What does the term “prenatal” mean?

2. 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?

3. When is a mother’s exposure to toxins or pathogens most likely to cause the most serious harm to a developing baby—early in pregnancy or late in pregnancy?

4. Most women do not suspect they are pregnant until the third or fourth week of pregnancy. Which two structures of the developing baby are most likely to be seriously harmed by exposure to harmful substances before the mother realizes she is pregnant?
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5. Which two structures of a developing baby's body are most likely to be damaged by exposure to harmful substances during the **fetal** stage of pregnancy?
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Use the information in the two boxes below to answer questions 6 through 9.

Fetal Alcohol Syndrome

Fetal Alcohol Syndrome is a condition that results from alcohol exposure during pregnancy. Birth defects associated with fetal alcohol syndrome include physical deformities, mental retardation, learning disorders, vision difficulties and behavioral problems.

Even moderate alcohol intake, and especially periodic binge drinking, can seriously damage a developing baby. In the early months of a pregnancy, many women don't even know that they are pregnant. Therefore, it is very important for women who are thinking about becoming pregnant to adopt healthy behaviors before they get pregnant.

Mothers who drink alcohol during the first three months of pregnancy have children with the most severe problems because that is when the major organs such as the brain and the heart are developing. Even in the last six months of pregnancy, a baby's brain is still developing and may be damaged by alcohol.

Congenital Rubella Syndrome

Rubella (also called German measles) is a mild childhood illness, but it can cause serious birth defects to unborn children. About 25 percent of babies whose mothers get rubella in the first three months of pregnancy are born with one or more serious birth defects including heart problems, eye defects, hearing loss, and mental retardation.

Many women are immune to the rubella virus because they received a childhood vaccine to prevent rubella. Women who have not been vaccinated for rubella, should consider being vaccinated at least 28 days before trying to get pregnant.

Pregnant women are routinely tested for rubella immunity at an early prenatal doctor's appointment. If a pregnant woman finds out she is not immune, she should not be vaccinated during pregnancy. All she can do is try to avoid exposure to anyone with the illness.

6. Describe two symptoms of **fetal alcohol syndrome**.
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7. Describe two symptoms of **congenital rubella syndrome**.
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8. Describe two actions women should take to prevent birth defects BEFORE they know they are pregnant. *Hint: Refer to the readings in the two boxes on the previous page.*

- _____
- _____

9. Describe two actions women should take to prevent birth defects AFTER they know they are pregnant. *Hint: Refer to the readings in the two boxes on the previous page.*

- _____
- _____

Be sure to go back and complete Part 1 by answering questions 9 through 12 on pages 3 and 4.