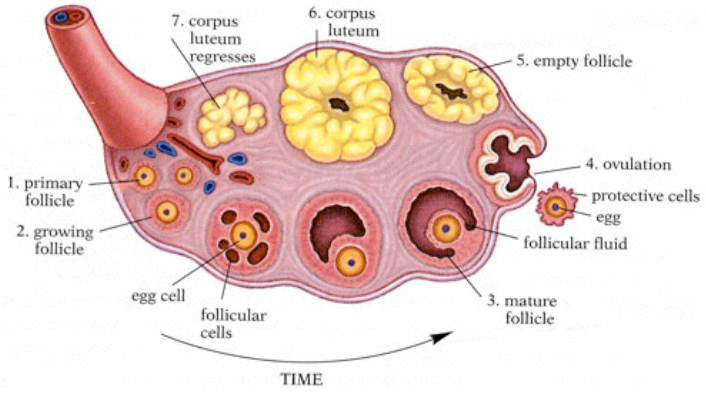
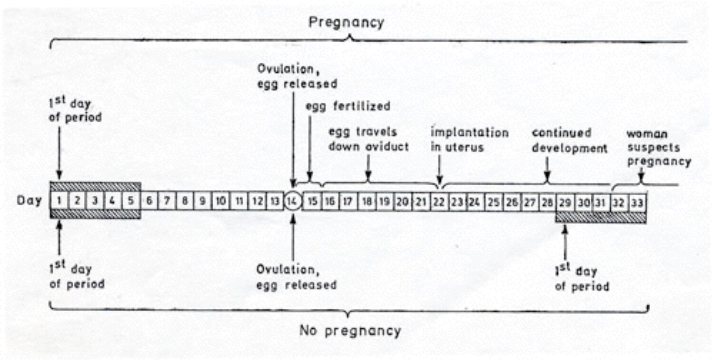
the Ovary and Placenta

SCHEMATIC DIAGRAM OF A HUMAN OVARY SHOWING VARIOUS STAGES OF EGG DEVELOPMENT.



Each oocyte is enclosed within a cluster of cells that forms a follicle (1). The oocyte fills most of the space in the small, immature follicle. As the follicle matures, it grows bigger relative to the oocyte and develops a large fluid-filled cavity (2,3). The oocyte, with its follicular cells, protrudes into the cavity. The outer wall ruptures and both the liquid and the detached oocyte with its surrounding cells are expelled during ovulation (4). The empty follicle is converted into a corpus luteum, which regresses at the end of the cycle (5-7).



THE PLACENTA

The particular mechanism by which a substance moves across the placenta is usually determined by comparing the concentrations in maternal and fetal blood. If a substance is present in a higher concentration in fetal blood, it can be postulated that it is transferred by active transport, even if the specific carrier has not been identified. On the other hand, if a substance is present in fetal blood in the same, or slightly lower, concentration as compared to maternal blood, diffusion is probably involved. Glucose is the preferred energy source for the fetus and moves more rapidly into fetal blood than fatty acids as a result of facilitated diffusion. Since most proteins cannot cross the placental membrane (IgG, an immunoglobin, can by pinocytosis), the fetus must synthesize its own proteins from maternal amino acids. Given the high rate of protein synthesis occurring in the fetus, the active transport mechanism for amino acids is probably adaptive. Similarly, the high fetal rate of calcium and phosphate deposition into bone and the utilization of iron for erythropoiesis seems to indicate an advantage in having these minerals actively transported. Although viruses are small enough to cross the placenta, bacteria and other cells are not. The placental membrane is also impermeable to some high molecular weight drugs and toxins.

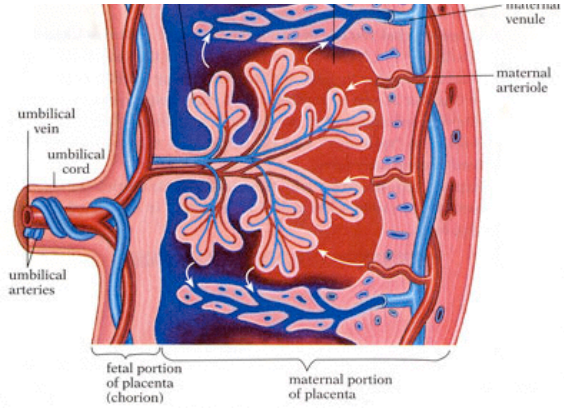


Diagram of placental circulation. Since the fetal lungs are breathing fluid rather than air, gas, nutrient, and waste exchanges between the mother and the fetus take place in the placenta, where fetal blood passes through capillaries alongside those containing maternal blood. The transfer takes place in thousands of blood pools, some of which are shown above. The umbilical artery brings part of the fetal blood supply to the fetal capillaries in the placenta where carbon dioxide and other wastes diffuse into the maternal capillaries, and oxygen and nutrients move into the fetal blood. The blood then returns to the fetus through the umbilical veins.

Transport Mechanism	Substance Transported
Passive diffusion	Oxygen, carbon dioxide, fatty acids, steroids, nucleosides, electrolytes, fat-soluble vitamins
Facilitated diffusion	Sugars
Active transport	Amino acids, some cations (calcium, iron, iodine, phosphate), water-soluble vitamins*
Solvent drag	Electrolytes

*At very high concentrations vitamin C has been shown to cross the placenta via diffusion.

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