

Carbon is released from fossil fuels into the atmosphere during combustion, ie. burning of the fossil fuels. The four key stages allowing the carbon cycle to continue are" photosynthesis, respiration, decomposition and combustion.

The last biological cycle takes place in the body, specifically in female humans and primates. It is referred to as the oestrous cycle because it is a series of changes in the level of hormones which repeat every 28 days. Its aim is to prepare the body for pregnancy and it is repeated if fertilisation does not occur. The oestrous cycle has three stages.

Follicular stage. It starts with menstruation and a rise in FSH level in blood, which causes the follicle in the ovary to develop. The follicle releases oestrogen, which stimulates the uterus lining to thicken (so that a fertilised egg can implant) and inhibits FSH.

Ovulatory stage. When oestrogen level is high enough, it boosts the secretion of LH and FSH from the pituitary gland and ovulation occurs (around day 14). The follicle ruptures and an egg is released.

Luteal stage. LH stimulates the empty follicle to develop into corpus luteum, which releases progesterone into blood. Progesterone maintains the thick lining of the uterus; it also inhibits FSH and LH. If the egg is not fertilised, corpus luteum breaks down and stops secreting progesterone, allowing the FSH level to rise back to its level at the start of the follicular stage. The drop in the level of progesterone means the uterus lining is no longer maintained, breaks down and leaves the body via the vagina. This is called menstruation and is therefore the start of the next oestrous cycle. The cycle starts again, to give the body another 'chance' to become impregnated and reproduce.

Summary & Notes

1 **Calvin cycle.** Photosynthesis (light-independent). Stroma of the chloroplast. $6xCO_2$ enters the cycle. Rubisco. Combines with $6xC_5$ RuBP. ATP is used and NADP is regenerated. Produces $12xC_3$ TP. $2xC_3$ TP are used to produce organic substances e.g. glucose. $10xC_3$ TP $\rightarrow$ $6xC_5$ RuBP $\rightarrow$ regenerate $6xC_5$ RuBP using ATP. RuBP combines with CO_2 and the cycle continues.

2 **Cyclic photophosphorylation.** Photosynthesis (light-dependent). Thylakoid membrane (PS1/P700). Light energy is absorbed by PS1, electrons are excited. Not transferred to NADP $\rightarrow$ passed back to PS1 via electron carrier system. Small amounts of ATP (no reduced NADP or O_2). Repeated flow through PS1 = electrons are recycled.

3 **Krebs cycle.** Respiration. Matrix of the mitochondria. $2xC_2$ acetyl coA combines with $4C$ oxaloacetate, releasing coA and forming $6C$ citrate. Decarboxylation and dehydrogenation. $5C$. Decarboxylation and dehydrogenation, produces reduced FAD, reduced NAD and more CO_2 . $4C$ oxaloacetate, combines with acetyl coA and the cycle continues.

4 **Nitrogen cycle.** Nitrogen has to be recycled $\rightarrow$ needed for growth (essential component of amino acids and DNA). Nitrogen gas from the atmosphere, Rhizobium, ammonia $\rightarrow$ plants. Dead organisms, nitrogen compounds $\rightarrow$ ammonification by decomposers $\rightarrow$ ammonium compounds. Nitrification: nitrites $\rightarrow$ nitrates. Nitrates used by plants. Nitrates used in anaerobic respiration by denitrifying bacteria.

5 **Carbon cycle.** Carbon is used to make essential compounds, e.g. plants use CO_2 to make glucose. Carbon dioxide from air and water absorbed by plants $\rightarrow$ carbon compounds, plant tissues. Eaten by primary consumers, secondary, tertiary. Dead organisms $\rightarrow$ saprobionts, decomposition. Respiration returns carbon dioxide to the air and water. Dead organic matter $\rightarrow$ no decomposers $\rightarrow$ fossil fuels $\rightarrow$ carbon released to the atmosphere by combustion.

6 **Oestrous cycle.** Repeats every 28 days. Hormone levels fluctuate and the lining of the uterus prepares for pregnancy. Follicular stage $\rightarrow$ (menstruation) Follicle development - FSH, oestrogen. Thickening of uterus lining - oestrogen. Ovulatory stage $\rightarrow$ Ovulation - LH (day 14). Luteal stage $\rightarrow$ Follicle develops into corpus luteum - LH. Progesterone maintains thick uterus lining and inhibits FSH and LH. No fertilisation $\rightarrow$ breakdown of corpus luteum, progesterone falls, FSH rises. Menstruation. Back to day 1.