

# Mammal breeding

Only the **female** reproductive system is considered at any time!

This is controlled by 4 hormones:

- Two from the pituitary
  - Follicle Stimulating Hormone (F.S.H.)
  - Luteinising Hormone (L.H.)
- Two from the ovaries
  - Oestrogen (produced in the first half of the cycle)
  - Progesterone (produced in the second half and in pregnancy)



How they interact with each other is the basis of most exam questions!

## Menstrual Cycle

The menstrual cycle is the repeating series of changes in the uterine lining of a fertile woman if fertilisation and implantation does not happen. This cycle lasts exactly 28 days (for AS!).

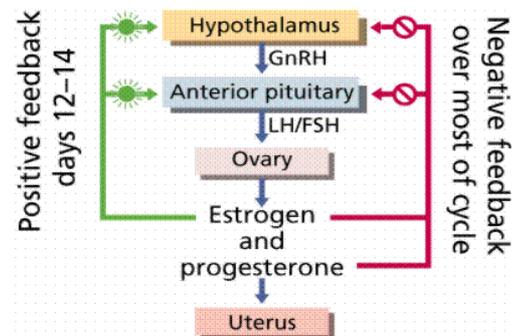
### Events of the Female Reproductive Cycle

#### Day 1 to day 5

- Day 1 is the first day of menstruation – the breakdown and discharge of the **endometrium**.
- The **corpus luteum** disintegrated,
  - so **progesterone levels are low**,
  - thus triggering menstruation.
- The levels of oestrogen and progesterone are low too.
  - This permits the secretion of FSH by the pituitary gland.

#### Day 6 to day 13

- FSH stimulated the formation and maturation of a Graafian follicle.
  - This **secretes oestrogen**.
- The rising oestrogen levels **inhibit FSH secretion**
  - Thus preventing other follicles maturing.
- Oestrogen also **stimulates growth of the endometrium** (uterine lining).
- Eventually, high oestrogen levels (peak – day 12) bring about a surge of LH



#### Day 14

- The **surge of LH stimulates ovulation**
- This is the release of an ovum from the mature Graafian follicle at the ovary's surface.
- The egg cell is drawn into the Fallopian tube.

#### Day 15 to day 26

- A corpus luteum develops from the 'empty' Graafian follicle.
- **The corpus luteum secretes progesterone.**
- This causes the uterine lining to become filled with blood vessels.
- **High levels of progesterone also inhibits FSH and LH secretion from the pituitary.**
- If implantation does not take place by day 26 the corpus luteum disintegrates

#### Day 26 to day 28

- The degeneration of the corpus luteum causes the level of progesterone to fall rapidly.
- This fall triggers menstruation
- The degenerated corpus luteum becomes a small scar in the ovary.

## Pregnancy

The usual first sign that pregnancy has occurred is that menstruation does not happen.

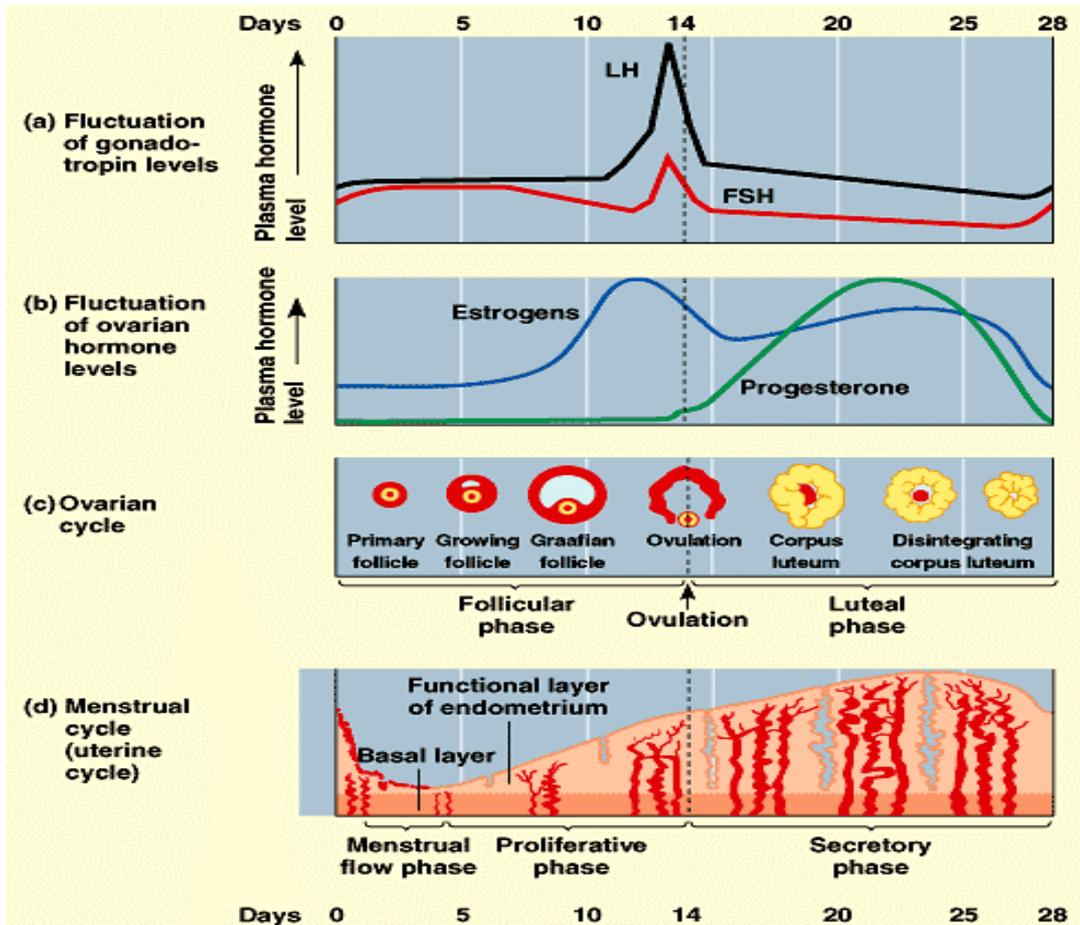
- **Implantation** is the embedding of the **blastocyst** (ball of cells) into the endometrium.
- This occurs about six days after fertilisation (= day 20).
- The developing embryo releases a hormone (HCG) into the mother's blood.
- This hormone maintains the corpus luteum – and is the basis of pregnancy testing kits.
- The surviving corpus luteum continues to secrete progesterone.
  - so the endometrium does not break down and pregnancy continues.

**Conception** is fertilisation followed by successful implantation.

## Hormones and negative feedback

These 4 hormones interact with each other to ensure that only one egg is released with each cycle and that pregnancy prevents further ovulation. These feedback loops are as follows:

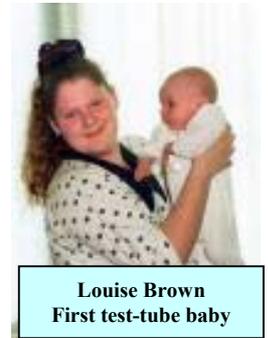
Hormone	Origin	Stimulates	Inhibits
FSH	Pituitary	Oestrogen	-
LH	Pituitary	Progesterone	-
Oestrogen	Ovary (Graafian follicle)	LH	FSH
Progesterone	Ovary (corpus luteum)	-	FSH, LH



# Human fertility treatment

## Fertility drugs

- The commonest of these is **chlomiphene** which mimics oestrogen
  - This causes a surge in LH and so triggers ovulation.
  - Another hormone (**HCG**) may also be used to trigger ovulation
- For **IVF treatment** many ova are '**harvested**' at once, (a painful procedure)
  - so she is **given synthetic FSH first**.
- Only about 20% of IVF treatments work per cycle – normally 2 embryos are implanted
- 'Spare' embryos can be frozen for months, even years
  - this is particularly useful when used for cattle breeding (*see below*)



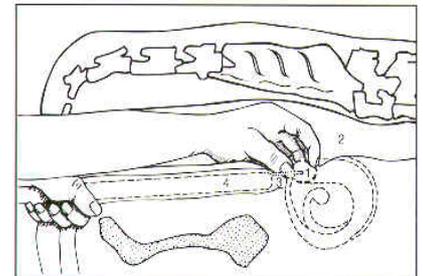
## Domestic animals –control of breeding

It is more profitable to control **oestrus** (= breeding season) in farm animals because:

- Births occur **at a known (planned) time**,
- Spreading the season away from the normal time (thus ↑ profits - NB additional cost)
- Ensuring that all ewes can birth in a lambing shed that is too small for his whole flock
- Allowing feeding to be geared to the stage of pregnancy for a whole group of animals
- Allowing continuity of production throughout the year (pigs)
- Vets can AI a number of cattle on one visit (thus cheaper per cow)
- Milk production is evened out with 3-4 calving seasons per year

Most farm animals have their **breeding cycles controlled** by the farmer.

- Most animals have a breeding 'season',
  - to ensure young are born when food is most abundant
- The normal control 'trigger' is day-length, measured by the **pineal gland** in the head
- A contraceptive 'coil' is fitted to the females, which releases progesterone
  - suppressing ovulation
- The coil is then removed from a batch of females at the same time
- They all come into **oestrus** at the same time (about a week later)
- The farmer can then plan to have mating take place at that time
- Artificial insemination (AI) is usually used for cows, needing a vets' visit (£) each time
- Pigs and sheep have natural mating
  - often the male is brought in to 'service' a batch of females
- The ram **also** needs to be in season
  - using hormone injections or a controlled light regime



## Detection of oestrus:

The farmer knows when to use AI, or introduce the male

He knows when the animal is **not** pregnant, so a second breeding cycle can start at once.

**Cattle** – restless; mount other cows ('bulling'); vagina secretes mucus; vulva swells

**Swine** - 'stands' for the boar, when weight applied to the sow's hips

**Sheep** - the ram detects **pheromones** released by the ewe – he 'flares' when she is receptive

## Other hormones:

**BST** is given to (non-EU) cattle to increase milk production, at the cost of increased mastitis (£)

**Oestrogen** is given to many chickens to promote faster growth

**Castration** of most male animals removes the source of testosterone, thus 'feminising' them.