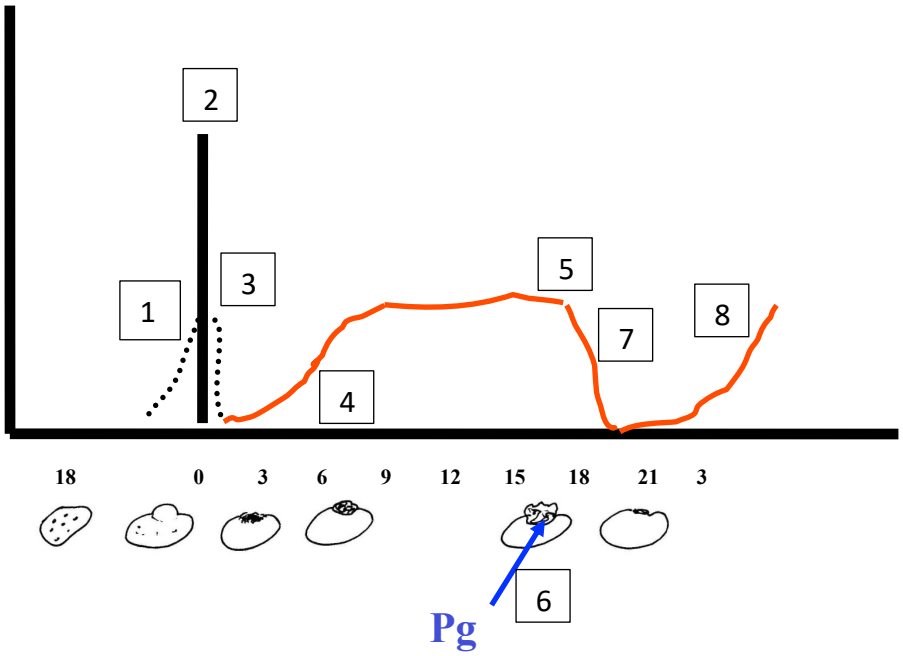
Effectiveness evaluation of the Ridgeway P4 Rapid, pen-side estrus detection test:

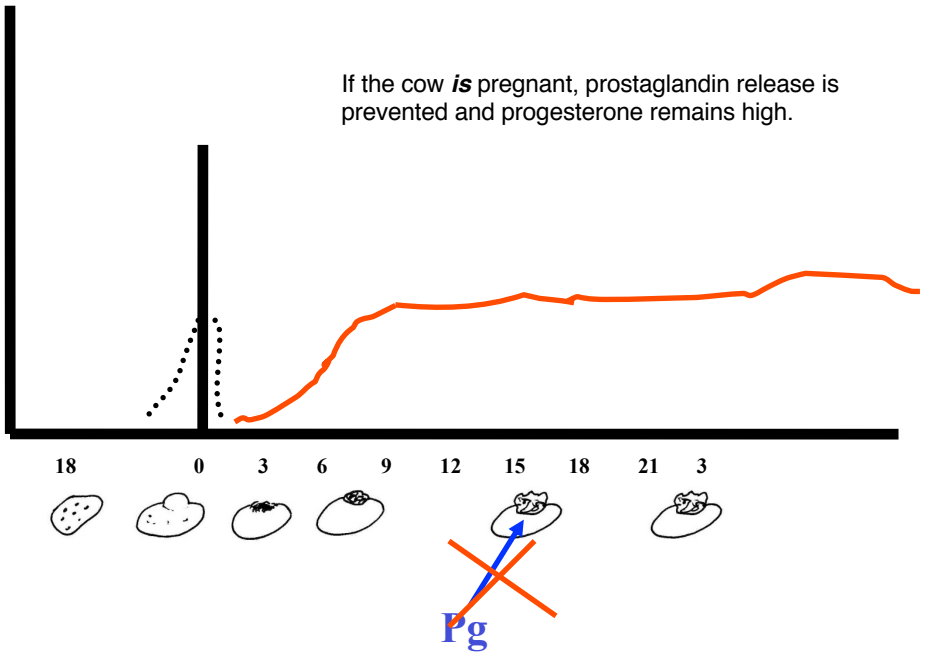
Training Session, Nairobi, 27-29th August 2019. Peter Ball and Mike Christian

1. Physiology of the reproductive cycle with an emphasis on P4 changes.

Physiological changes during the oestrus cycle.



1. Follicle produces oestrogen: cow comes in heat; reproductive tract prepared for insemination.
2. Short peak of LH causes ovulation
3. Oestrogen levels fall; CL starts to form and to produce progesterone
4. Progesterone levels start to rise
5. Progesterone stays high for about 17 days
6. If the cow is not pregnant, prostaglandin is released
7. Prostaglandin shuts down the CL; Progesterone levels fall
8. This allows another ovulation and a new cycle begins

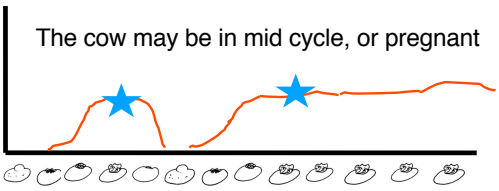


If an embryo or fetus is lost, progesterone levels are likely to fall and the cow may show oestrus at an unexpected time.

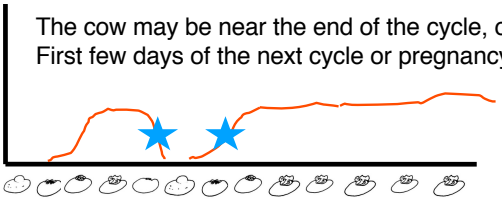
Other reproductive problems may cause unexpected P4 results. It is quite common for cows' ovaries to be inactive, particularly as a result of poor nutrition. This will lead to constant low P4 levels.

Single P4 measurements:

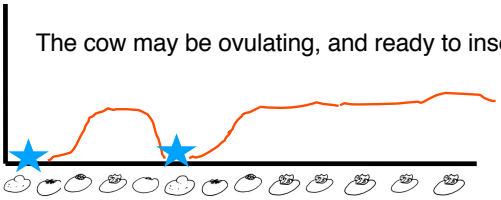
High



Medium



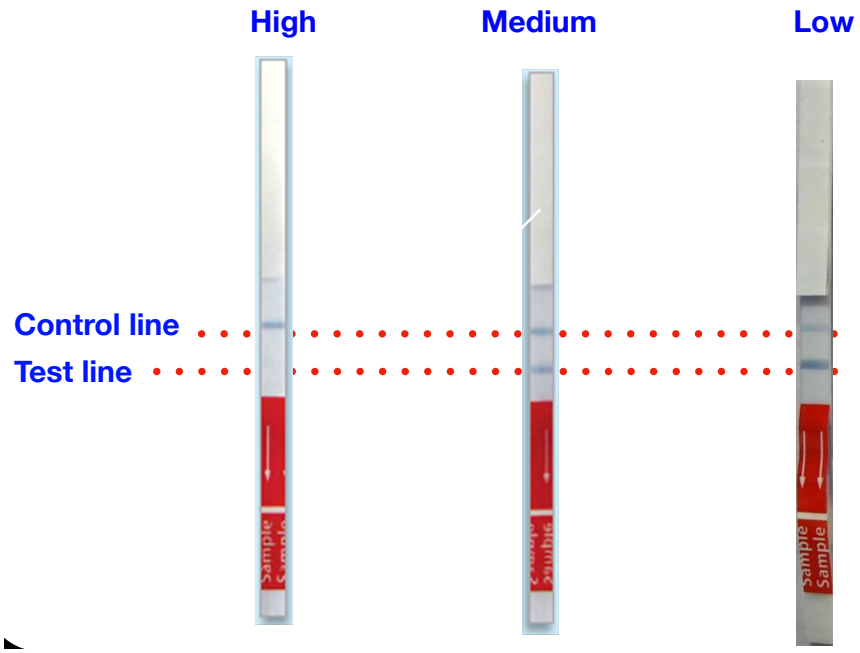
Low



2. The P4 Rapid test

The test is carried out according to the instructions which are contained in each box.

Make sure to add only one pipette dose of milk. The milk level should not reach the red label on the stick.

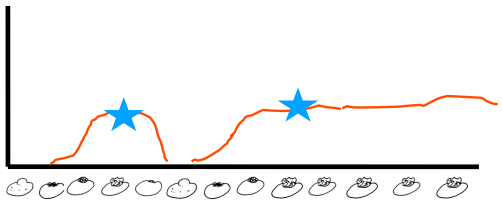


- If P4 is high, the test line will be faint or invisible. **Do not inseminate.**
- If P4 is medium, the test line will be slightly fainter, or equal to the control line. **Re-test next day.**
- If P4 is low, the test line will be darker than the control line. **Okay to inseminate.**

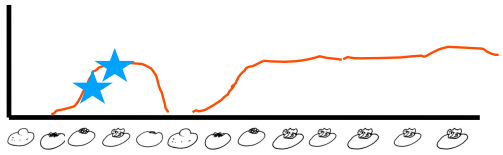
3. **P4 Rapid in the study.**

First heat reported for a cow in the study:

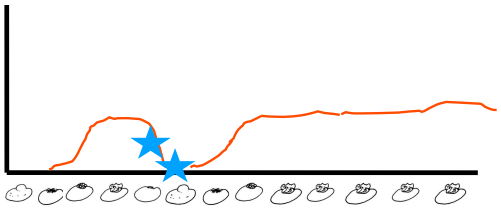
- P4 is high: She may be mid cycle, won't conceive and has a high risk of infection. Do not inseminate.
  She may be pregnant. Insemination may abort her. Do not inseminate



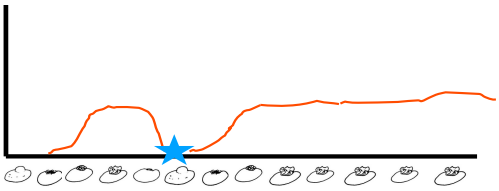
- P4 is medium: she may be starting to cycle. Test next day and do not inseminate if high



she may be near the end of cycle. Test next day and inseminate if low

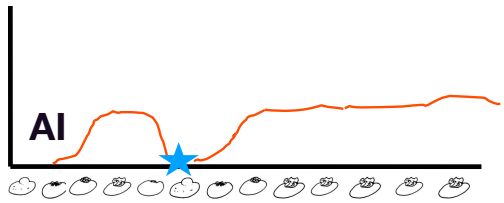


- P4 is low: okay to inseminate

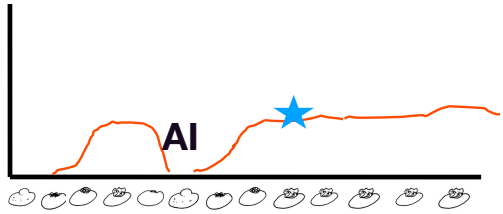


21 days after insemination:

- P4 is low: she has not conceived. Okay to inseminate if seen in heat or not



- P4 is high: she is probably pregnant. Do not AI again, even if she is reported in heat



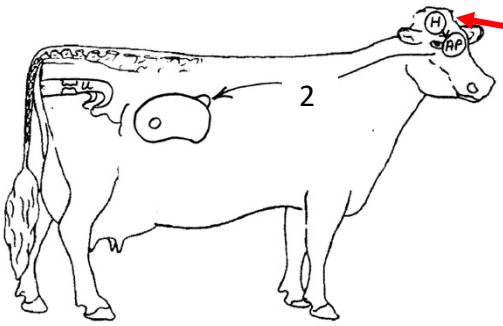
- P4 is medium: she may not be pregnant. Re-test next day. If test line is darker, inseminate.

4. **P4 Rapid practical**

Situation	Sample	Result	Action
Farmer reports cow in heat for the first time	A		
	B		
	C		
A medium result was obtained the day before	A		
	B		
	C		
Cow has been served, but is reported in heat again*	A		
	B		
	C		
21 days since insemination	A		
	B		
	C		

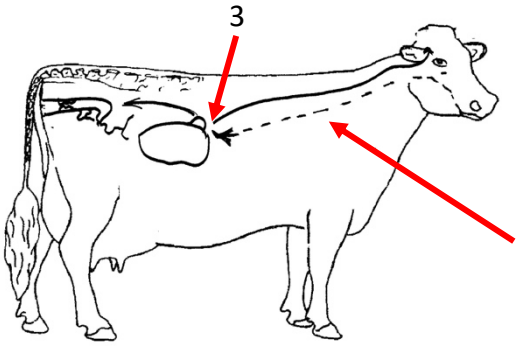
*usually about three or six weeks after previous AI

Appendix: The cycle and pregnancy



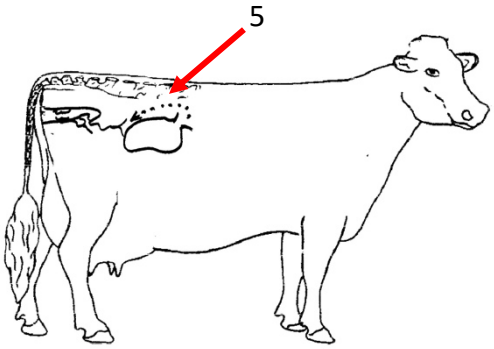
1. The Hypothalamus sends GnRH to the anterior pituitary, releasing FSH.

2. The FSH causes a follicle to mature and the egg within it to develop.

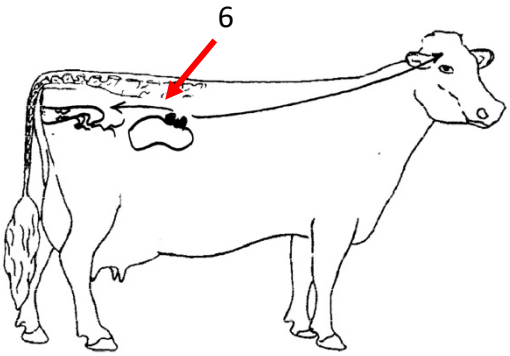


3. The developing follicle produces oestrogen which causes heat signs, prepares the reproductive tract* and feeds back to the hypothalamus causing.....

4. Further GnRH release to the pituitary, releasing LH.

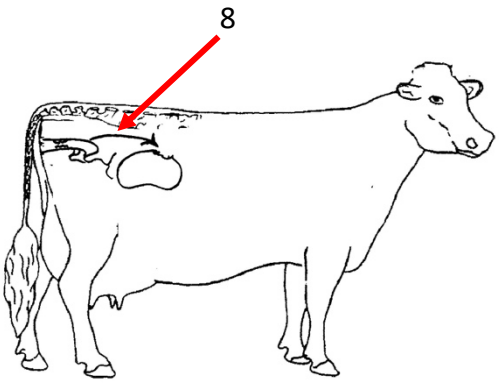


5. The LH causes ovulation - the release of the egg into the oviduct (fallopian tube).



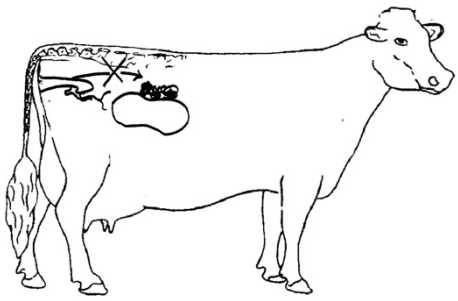
6. The site of the follicle becomes the corpus luteum, which secretes progesterone, preparing the tract for implantation.

7. The progesterone feeds back to the hypothalamus, preventing further ovulations.



8. After about 17 days, if there is no pregnancy, the uterus produces PgF2α

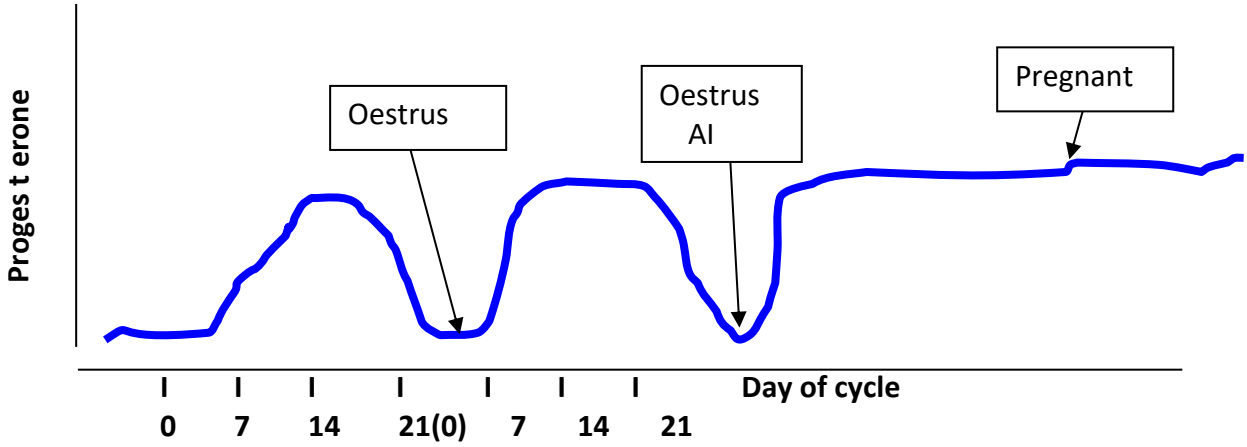
9. This destroys the corpus luteum and another cycle is able to begin



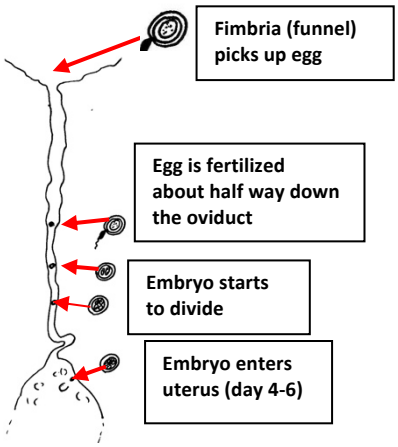
10. If the animal becomes pregnant, the Pg release is prevented, and progesterone levels remain high, supporting pregnancy.

***Oestrogen protects the uterus from infection *only* while the cow is in heat. Insemination at any other time could easily cause infection.**

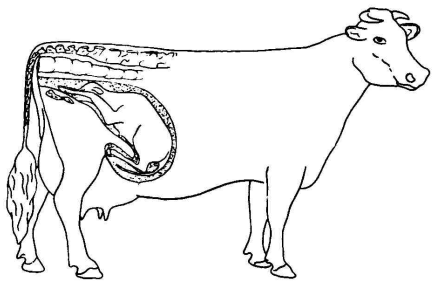
The oestrous cycle can be followed by studying the cow's progesterone profile.



If insemination is successful, the egg is fertilised about half way down the oviduct, fusing with one of the spermatozoa that are hopefully making their way up from the uterus. Rapid cell division then begins. The early embryo leaves the oviduct and enters the uterus around day 4. It grows rapidly so that by day 16 the rudimentary placenta can already be seen although it is not attached to the uterus. At this time it sends out its signal to ensure that the corpus luteum is maintained. By day 25 a small embryo and its sacs can usually be seen by real-time ultrasound and by day 42 the embryo has developed to such a degree that it has all the rudimentary organs and can now be called a foetus. The placenta has now formed and is attached to the wall of the uterus.



The embryo/fetus is very vulnerable throughout this stage and until about two months of pregnancy, after which it is relatively secure. Poor nutrition, stress, disease and specific infections – some of them possibly introduced at insemination – can all cause loss of the calf, especially at this early stage. The longer the embryo/foetus survives in the uterus the less likely it is to be lost - so called 'embryonic loss' and 'abortion'. Early pregnancy diagnosis (e.g. using the milk progesterone level at about day 21) is very useful to detect non-pregnancy, but the likelihood of a subsequent loss must be born in mind. Foetal growth is amazingly rapid and the placenta, which carries nutrients to the fetus and waste products from the fetus to the dam's bloodstream, soon fills the entire gravid horn (the horn of the uterus in which the fetus is developing).



Through the final few weeks of pregnancy the placenta, influenced by the foetus, produces more oestrogen. This sensitises the uterus so that, in the last few days of pregnancy, it starts to contract as the result of a drop in progesterone, which is in turn caused by prostaglandin release triggered by the fetus. Gradually these contractions build up alongside other changes in the dam, such as relaxation of the pelvic canal and the foetus assuming the normal delivery position. Once all is in place the foetus and its fluid filled membranes move into the pelvis and parturition (so-called Stage II) begins in earnest. This generally only takes about ½ to 4 hours depending on circumstances. Aiding the birth too soon is not recommended as this can interfere with the third stage, namely the detachment of the placental membranes from their caruncles and the expulsion of the afterbirth. This is helped by the surge of another important hormone, oxytocin, which is associated with first milk let-down.

After parturition, the uterus, ovaries and reproductive hormone system take some time to re-establish themselves. In particular the uterus must involute and heal the lining, which was damaged and in some cases infected when the placenta was expelled. Often cyclicity is resumed by 20 to 30 days but full involution may not be complete until 7 or 8 weeks; hence the advice to delay re-breeding for at least 6 weeks after parturition. In fact, as has been said elsewhere, most present-day cows need at least two months before it is wise to breed them.