Use of information to reduce the risk of OPP infection

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Two primary routes of OPPV exposure

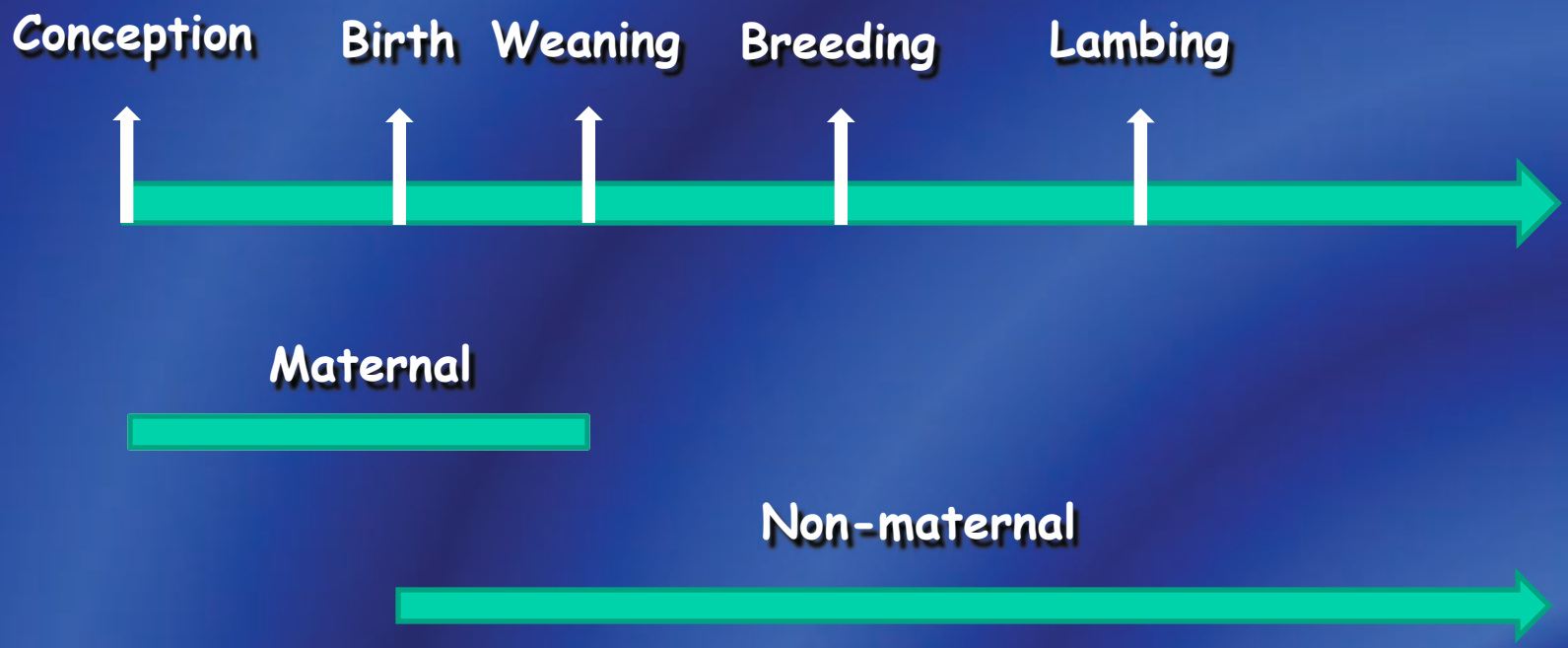
Maternal (vertical, dam-offspring)

- Virus in colostrum and milk of dam

Non-maternal (horizontal, lateral)

- Virus in lung secretions of flock mates

Biological model of OPPV exposure for breeding ewes



Importance of maternal vs. non-maternal exposure

Non-maternal exposure is more important than maternal exposure in the long run.

Maternal exposure won't increase eventual risk of infection if production conditions support non-maternal exposure.

Ultimately, must prevent non-maternal exposure.

Factors that may affect infection rate

- Viral load/challenge
  - Prevalence of infected sheep in flock
  - Adverse environmental conditions
- Maternal antibodies
- Physiological status
- Genetic components – new information
  - Sheep genetics
  - Viral genetics
- Other?

Prospective experiments

Need well-designed studies that account for risk factors to advance understanding of transmission and to develop more effective methods of reducing the prevalence of OPP infection.

Experimental objectives

Test additive and dominance effects of haplotypes 1 and 3.

Study relative importance of maternal and non-maternal exposure.

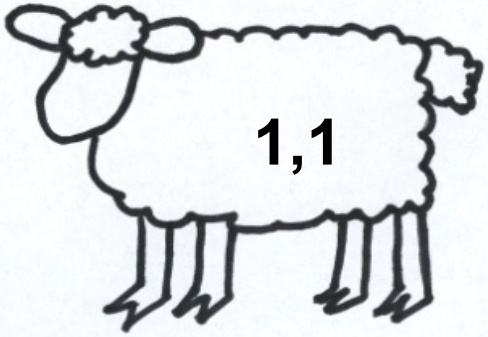
Experimental procedures

20 sentinel lambs were naturally reared by uninfected dams and 185 lambs were naturally reared by infected dams. All dams and lambs were comingled.

All lambs were bled 1 week after weaning and every 5 weeks thereafter until 10 months of age.

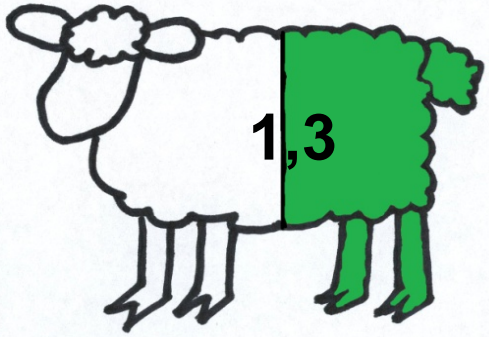
OPPV serological status was monitored by running cELISA assays in duplicate at USMARC.

Uninfected ewes

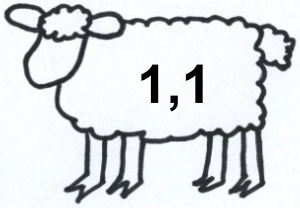


X

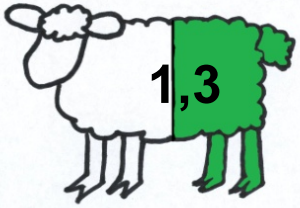
11 rams



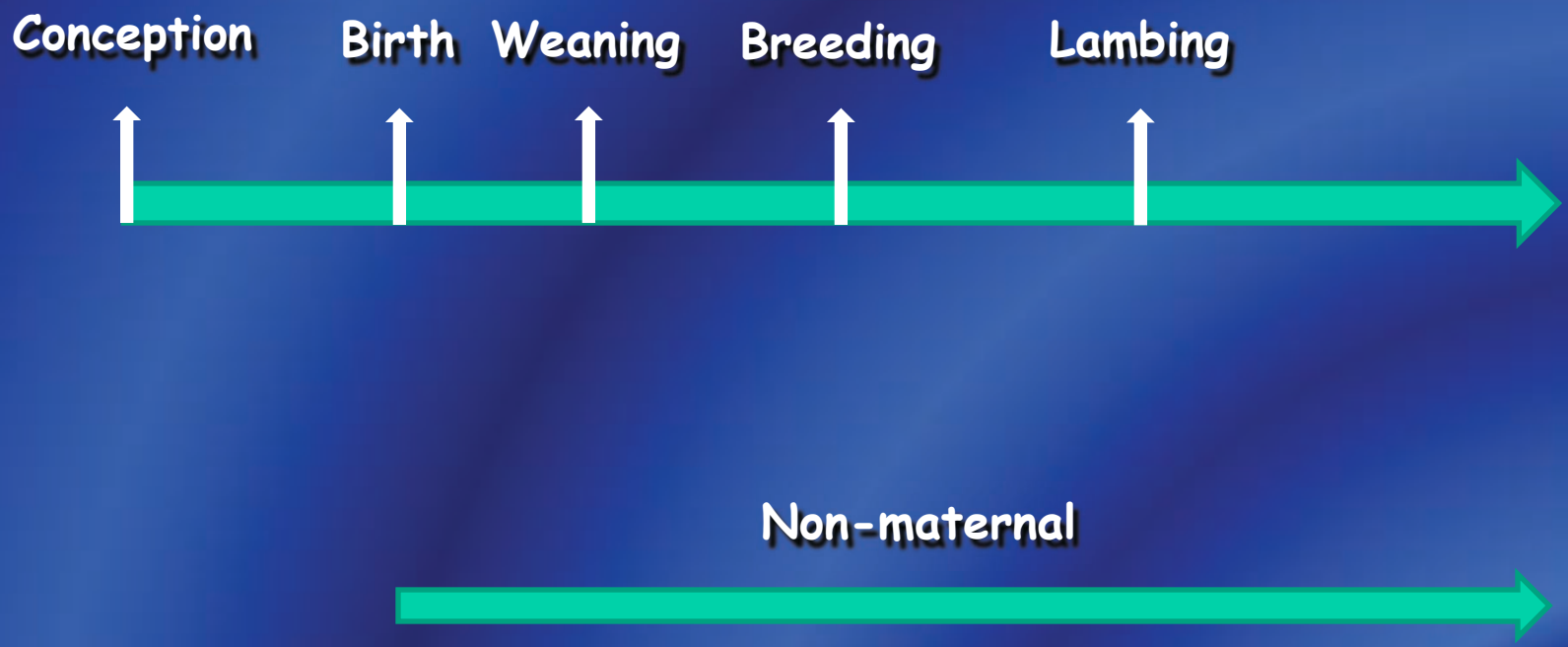
10 lambs



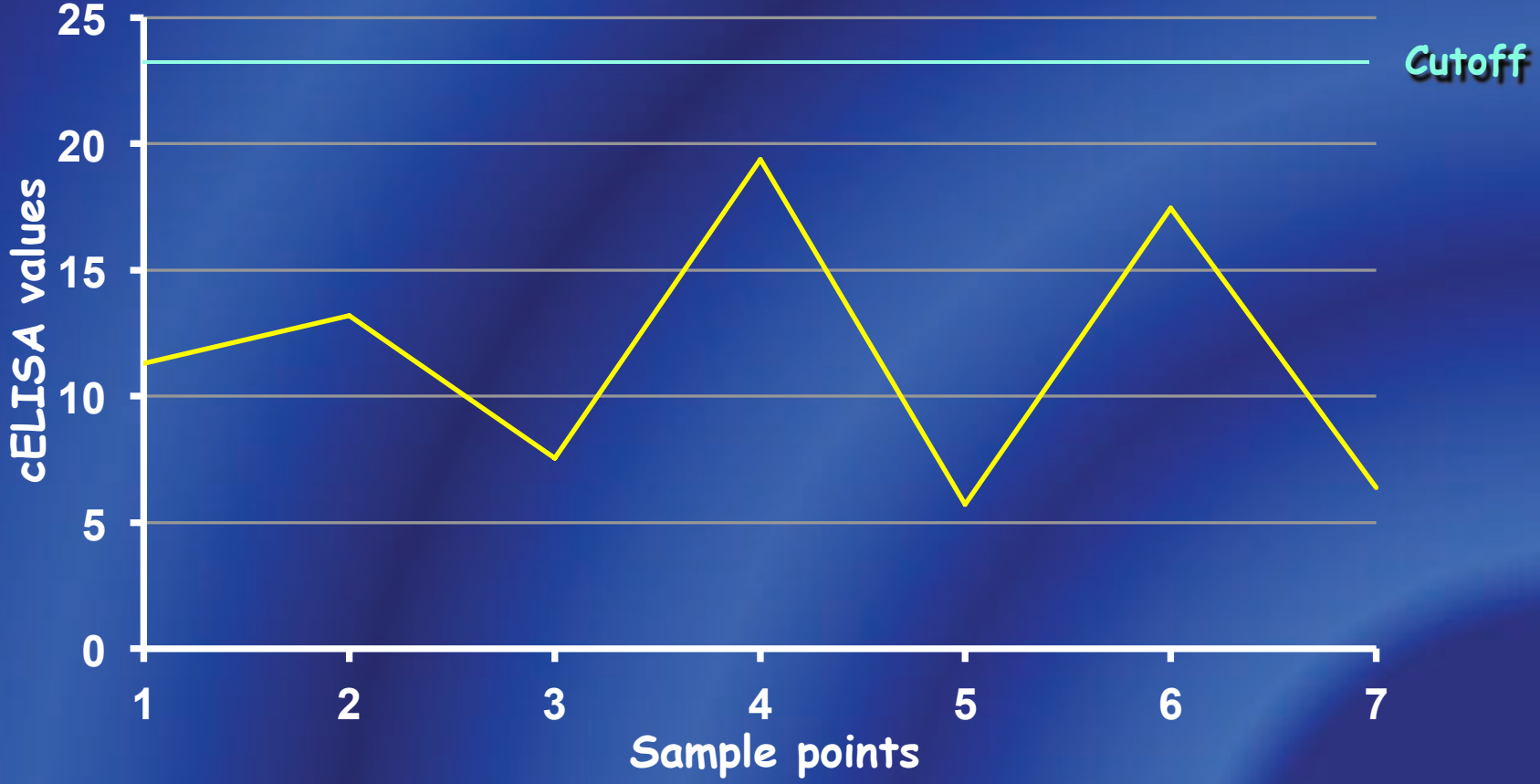
10 lambs



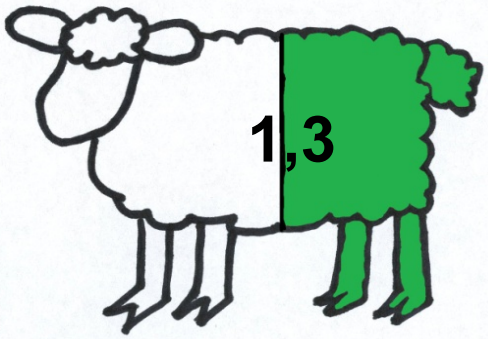
Biological model of OPPV exposure for sentinel lambs born to uninfected dams



cELISA values for a typical sentinel lamb.

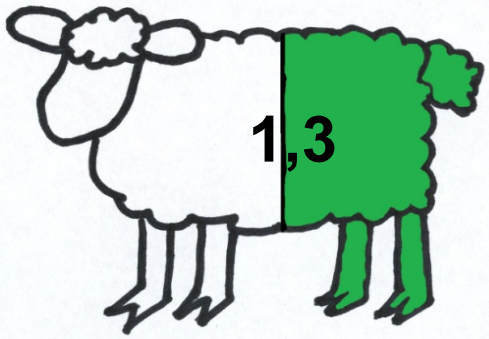


140 infected ewes

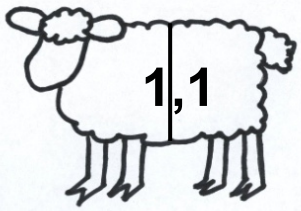


X

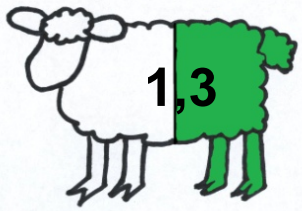
11 rams



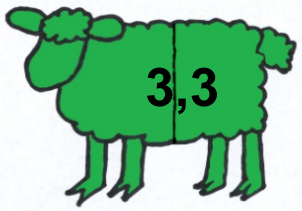
56 lambs



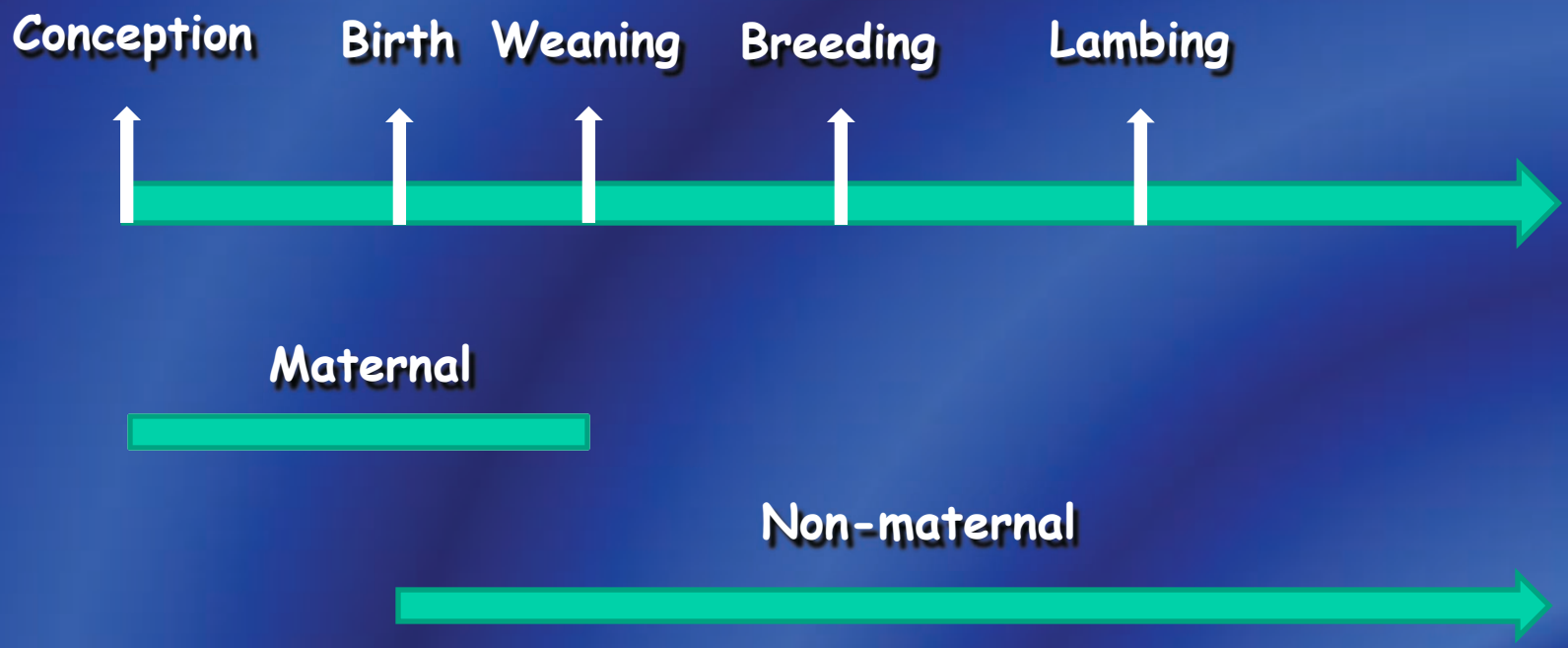
70 lambs



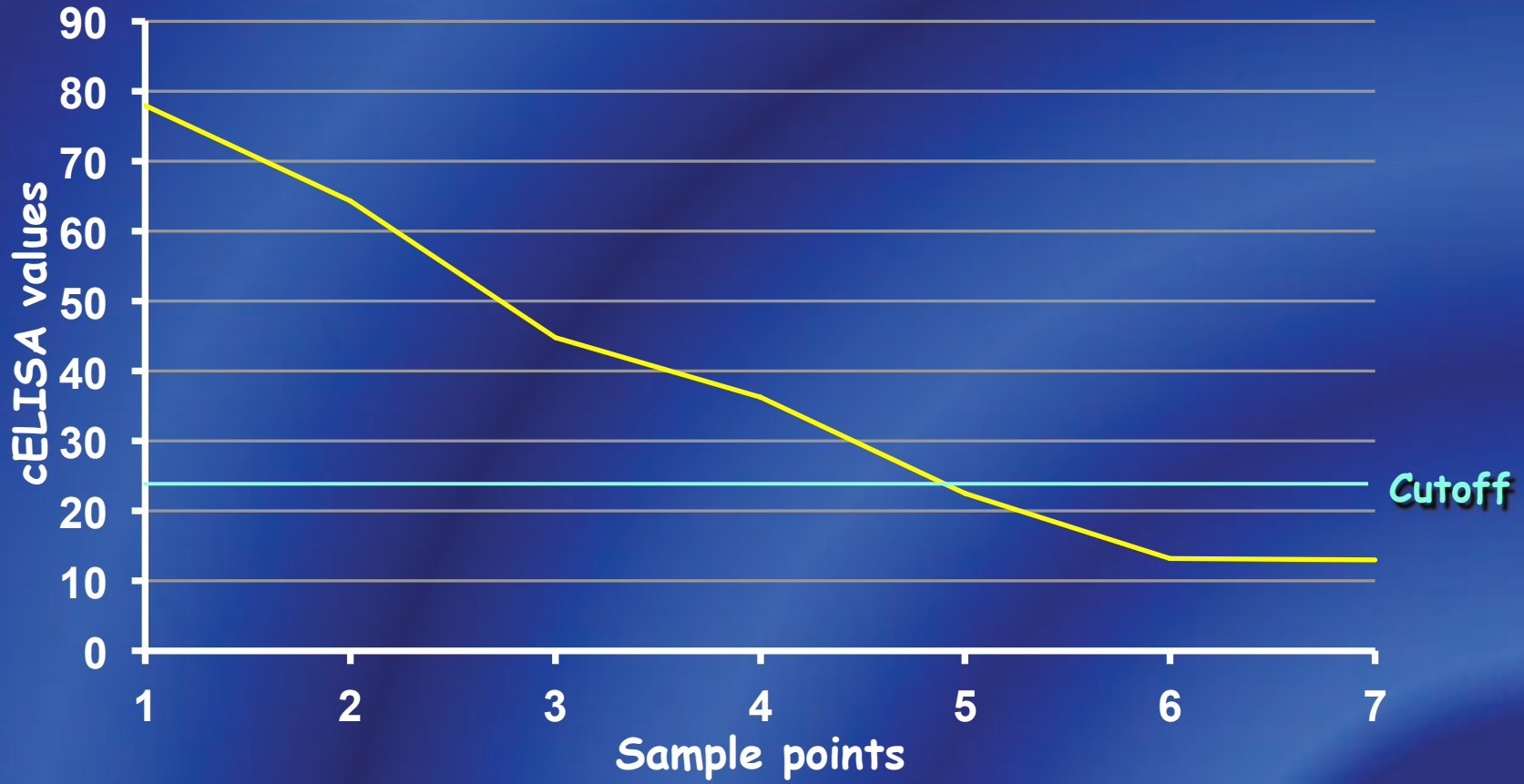
59 lambs



Biological model of OPPV exposure for lambs born to infected dams

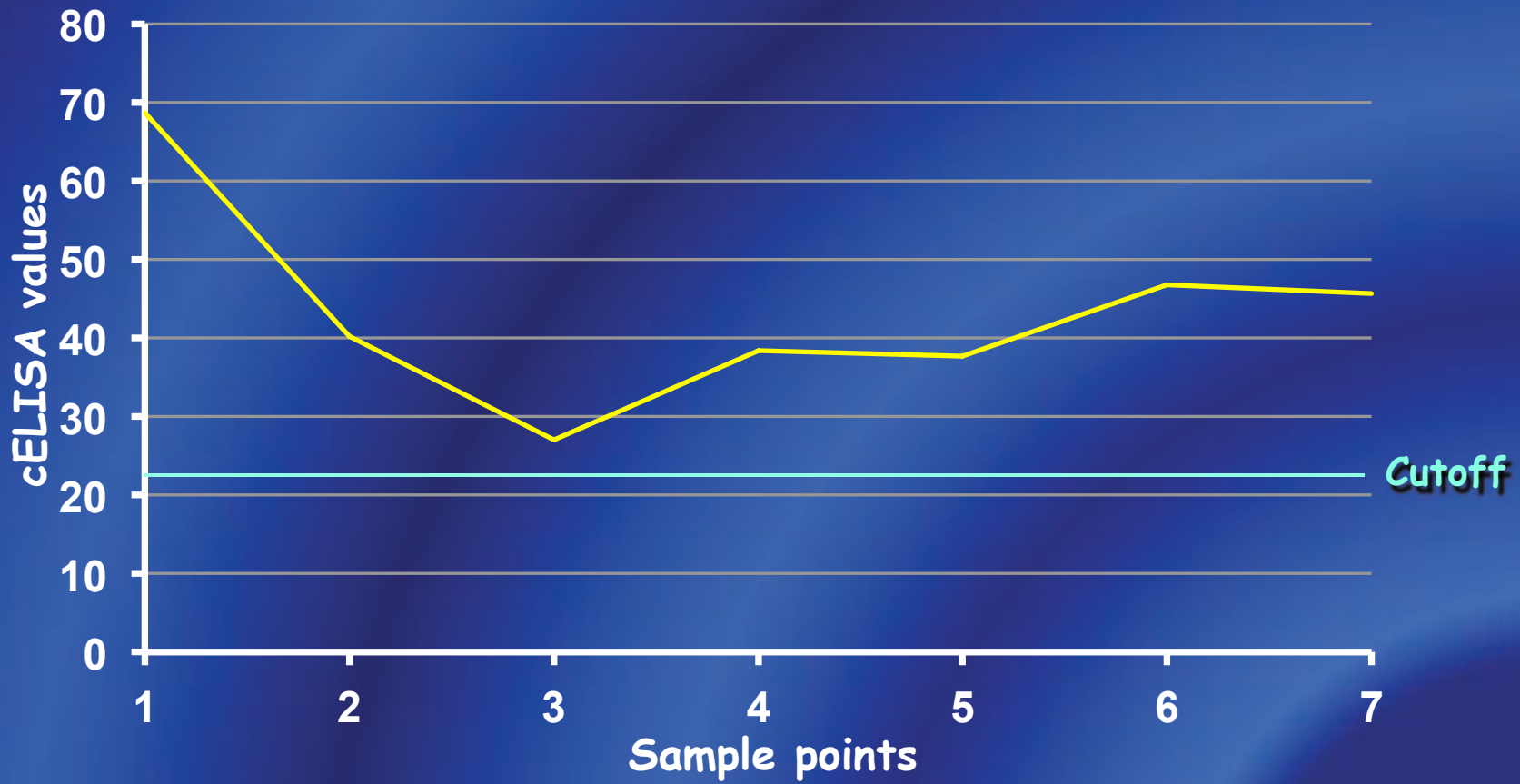


cELISA values for a typical seronegative lamb.

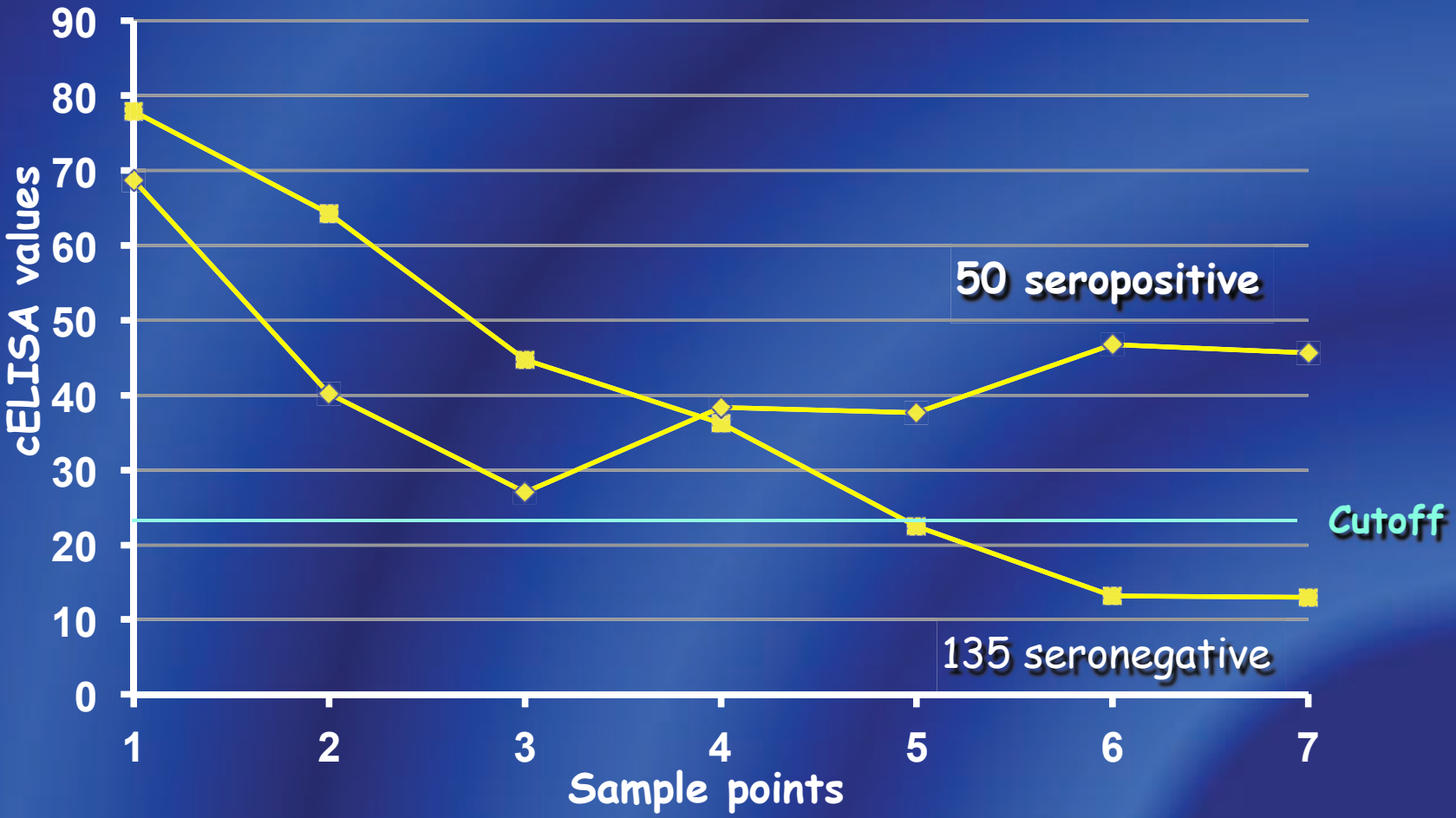


Trend shows the loss of maternal antibody, with implications for age at testing.

cELISA values for a typical seropositive lamb.



cELISA values for lambs born to infected dams.



OPPV serological status of naturally-exposed lambs at 10 months of age by diplotype.

	Diplotype		
Serological status	1,1	1,3	3,3
Negative	50	47	38
Positive	6	23	21
Percent infected	10.7	32.9	35.6

11% of 1,1's and 34% of 1,3's and 3,3's were infected.

The infection rate of lambs with 1 or 2 copies of haplotype 3 was 3.2 times greater than lambs with 2 copies of haplotype 1.

The less-susceptible haplotype 1 is recessive to haplotype 3.

Important results from this experiment.

Confirmed association of TMEM154 haplotypes with susceptibility.

Established that haplotype 1 is recessive to haplotype 3.

Non-maternal exposure caused little, if any, OPPV infection to 10 months of age.

Maternal exposure during the preweaning period infected, at most, 11% of genetically less-susceptible lambs and 34% of genetically more-susceptible lambs.

Therefore, the primary cause of infection in the long run must be due to non-maternal exposure that occurs after young ewes join the infected breeding flock.

The key management strategy is isolation of young ewes.

Conventional procedures to establish OPP-free flocks.

1. Periodically test all sheep and selectively cull seropositive.
   Replace with offspring from seronegative ewes.
   Preferably old ewes to exploit genetics.

2. Artificially rear lambs and isolate from infected sheep.

3. Depopulate and repopulate with sheep from OPP-free flocks.

OPP-free flocks established through these approaches remain genetically susceptible to OPPV and will become infected if subsequently exposed to infected sheep.

Advice to manage impacts of OPPV infection

Use information to supplement, not replace, your current selection and culling procedures.

Determine serological status of flock, particularly older ewes.

Don't discard good genetics because of seropositive test results.

Don't automatically cull lambs born to infected ewes.

Know the TMEM154 diplotype of breeding rams.

Reducing prevalence in highly-infected flocks

Might breed all ewes, infected and uninfected.

- Serologically test sound daughters at 7 months of age or older.
- Retain seronegative ewe lambs.
- Isolate ewe lambs from infected flock.
- Mate ewe lambs to rams with 1 or 2 copies of haplotype 1.