
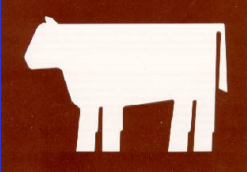


## Ecology of Disease

Weekly theme: Production  
Lecture: Enzoootic stability


Prof Peter O'Donoghue

1

## FOOD

**Wild harvest (hunter/gatherer)**

- native plants (fruits, vegetables, cereals)
- wild game (mammals, birds, fish, crustacea)



**Cultured food (farmer)**

- plants (cereals, fruit, vegetables)
- terrestrial animals (mammals, birds)
- aquatic animals (fish, crustacea)




2

## Agriculture (cultivation of soil)

**Free-range animals**

- domestic ruminants
- herdsmen (pastoralists)




**Penned animals**

- intensive production
- farmer (husbandry)

**Cultivated plants**

- cereals, fruit, vegetables
- gardeners (horticulture)

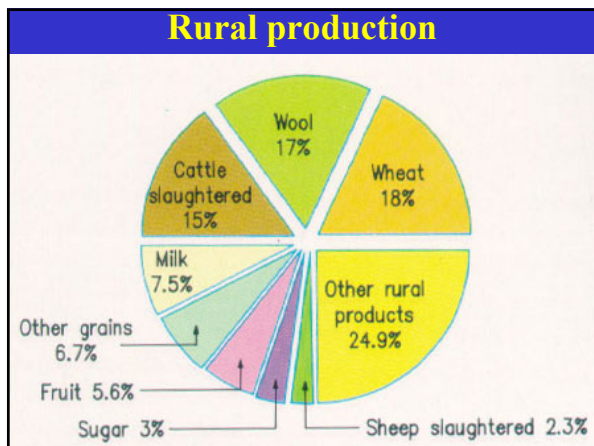


3

## Agriculture in Australia

- 64% of Australia used for agriculture but only 6.3% used for crops and sown pasture (48m ha)
- major limiting factor is availability of water
- wool industry founded on fine wool Merino sheep and demand of Industrial Revolution
- wheat industry expanded using new implements, techniques and breeds of grain
- refrigerated shipping led to meat export market
- centrifugal cream separator led to dairy industry
- while production increased, farm mechanization and share-farming led to rural decline in employment

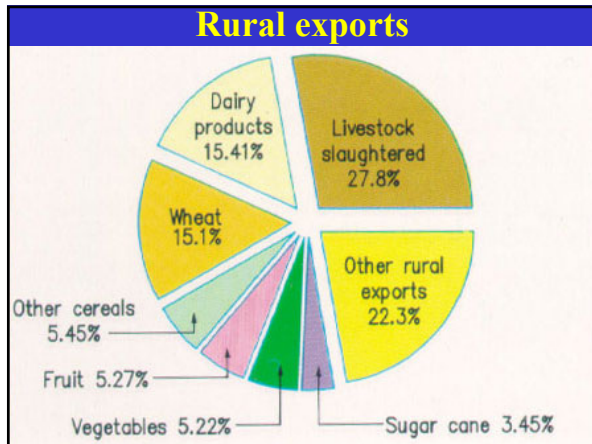
4



5



6



7



8

### Animal utilization

Cattle domesticated since about 5,000 BC  
Milking depicted in art dated to 2,900 BC

Domestic animals used to provide:

- meat (musculature, offal, smallgoods)
- milk (and cream, butter, cheese, yoghurt)
- leather (tanned hides - clothes, footwear, tents)
- fibre (wool, mohair, cashmere)
- fertilizer (dung for horticulture)
- fuel (dried dung for fires)
- power (beasts of burden)

9

### Main domestic animal species

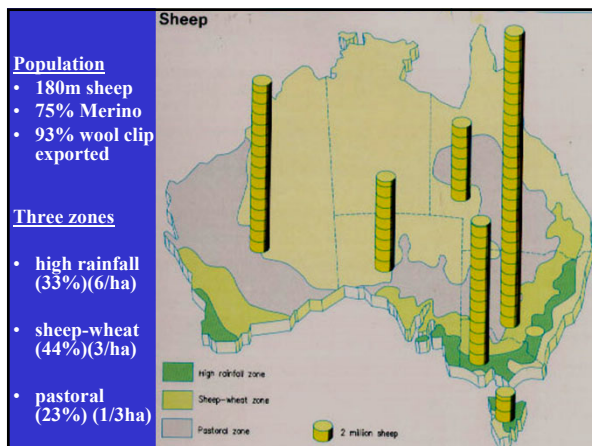
Artiodactyls (even-toed, cloven-hoofed)

- Ruminants (foregut fermenters)
  - cattle *Bos taurus*
  - sheep *Ovis aries*
  - goats *Capra hircus*
- Suidae (monogastrics)
  - pigs *Sus scrofa*

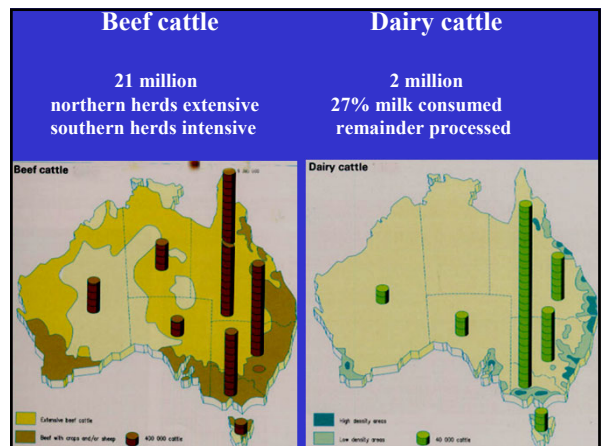
Perissodactyls (odd-toed)

- Equidae (hindgut fermenters)
  - horses *Equus caballus*

10



11



12

## Main production-limiting diseases

- worms (gastro-intestinal nematodes)
- clostridial diseases (black disease, blackleg, malignant oedema, pulpy kidney, tetanus)
- infertility (condition at joining, inf. diseases)
- flystrike (*Lucilia cuprina* & friends)
- footrot (*Bacteroides nodosus*)
- lice (chewing *Bovicola*, sucking *Linognathus*)
- brucellosis (*Brucella ovis*)
- weaner illthrift (multiple aetiology)

13

## Co-evolution

Despite the number of pathogens, many do not cause overt clinical disease in their hosts because they have evolved together to live in a stable relationship where the existence of neither is threatened.

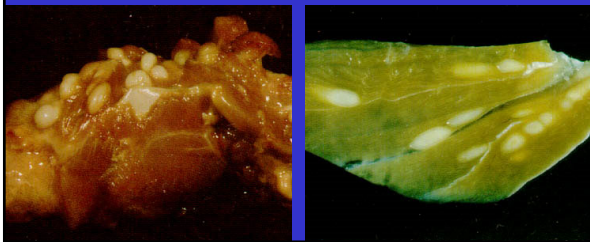
This balance is called ENZOOTIC stability

- the pathogen does not kill the host
- the host does not kill the pathogen

14

## Protozoan exemplar - *Sarcocystis*

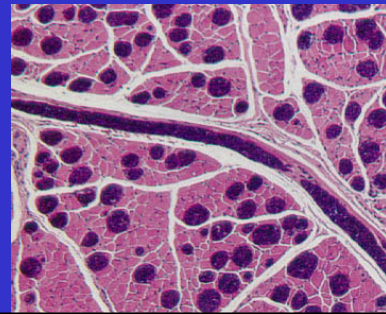
- Tissue cyst-forming coccidian (esp. muscles)
- Macrocysts lead to rejection of carcass from export or condemnation from human consumption
- Prevalence around 5% but low intensity



15

## *Sarcocystis*

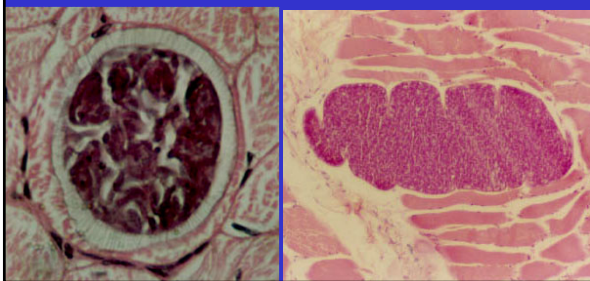
- Microcysts not considered at meat inspection
- Prevalence around 95% and intensity high



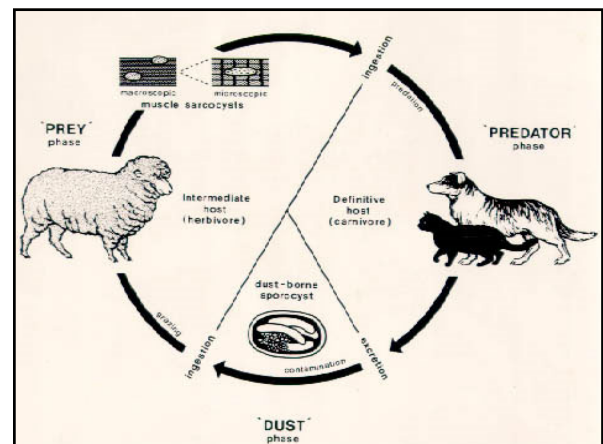
16

## *Sarcocystis*

- Sarcocysts contain millions of cystozoites awaiting uptake by definitive host (predator)
- Two cycles discovered for sheep (dog & cat cycles)



17



18

### Acute sarcocystosis

- asexual proliferation in vascular endothelial cells
- schizonts in arterioles then capillaries

19

### Acute sarcocystosis

- schizogony linked with acute disease
- characterized by petechial haemorrhages
- possible cause of weaner illthrift/mortality

20

### Acute sarcocystosis

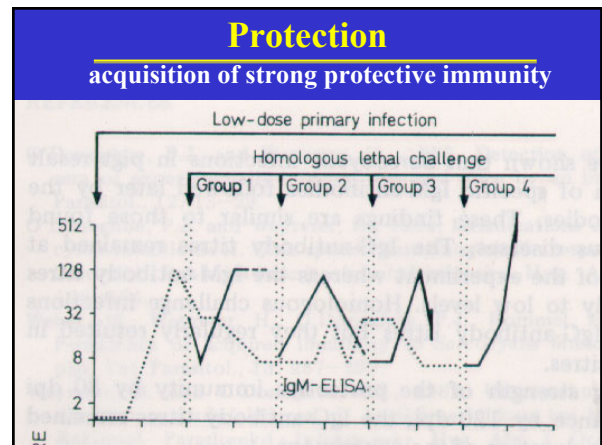
Disease associated with:

- mortality
- morbidity
- reduced weight gain
- reduced wool growth
- reproductive failure (abortion/stillbirth)

- **BUT ONLY IN EXPERIMENTAL LABORATORY ANIMALS GIVEN HIGH DOSES**
- **CONDITION NOT SEEN IN FIELD ANIMALS**

WHY?

21



22

### Enzootic stability

Absence of clinical disease due to:

- low-dose primary infections (trickle/sporadic) being asymptomatic/subclinical
- solid protective immunity (concomitant not sterile) able to resist super-infection and disease

23



24