

# Respiratory Disease in Domestic Sheep

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- **Overview of respiratory disease of domestic sheep**
- **Focus on pneumonic pasteurellosis**
- **Options for control**
- **Future research**



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## DIFFERENT AGENTS AND COMBINATIONS:

- viruses [PI3, adenovirus, RSV, retrovirus]
- bacteria [*Mannheimia haemolytica*, *Pasteurella multocida*, *Bordetella parapertussis*]
- Mycoplasma [*M. ovipneumoniae*]

## DIFFERENT PRESENTATIONS AND PATHOLOGIES:

- acute [pasteurellosis, virus infections]
- sub acute - chronic [atypical pneumonia, jaagsiekte, maedi]





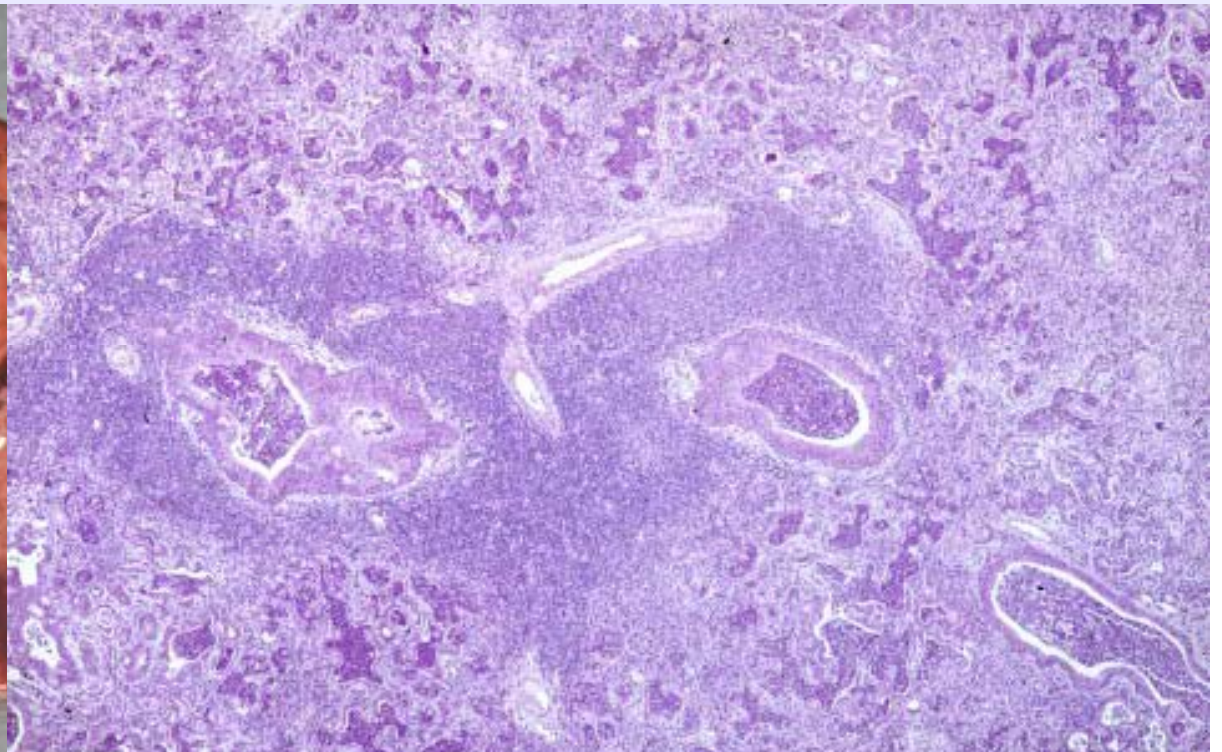
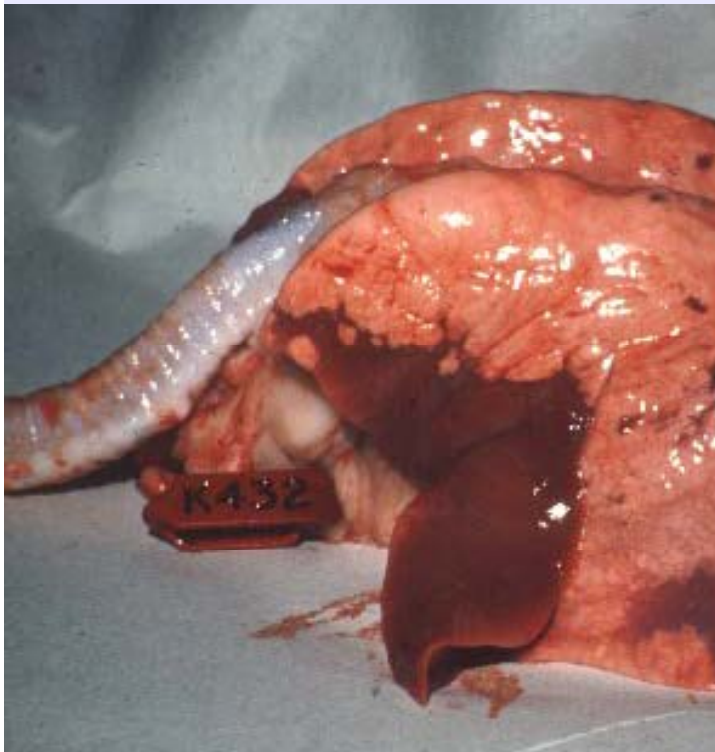
## ATYPICAL PNEUMONIA

2-12 months age [abattoir]

Subclinical to mild signs,

Endemic [home bred] and epidemic [mixed]

*M.ovipneumoniae* + *M.haemolytica*





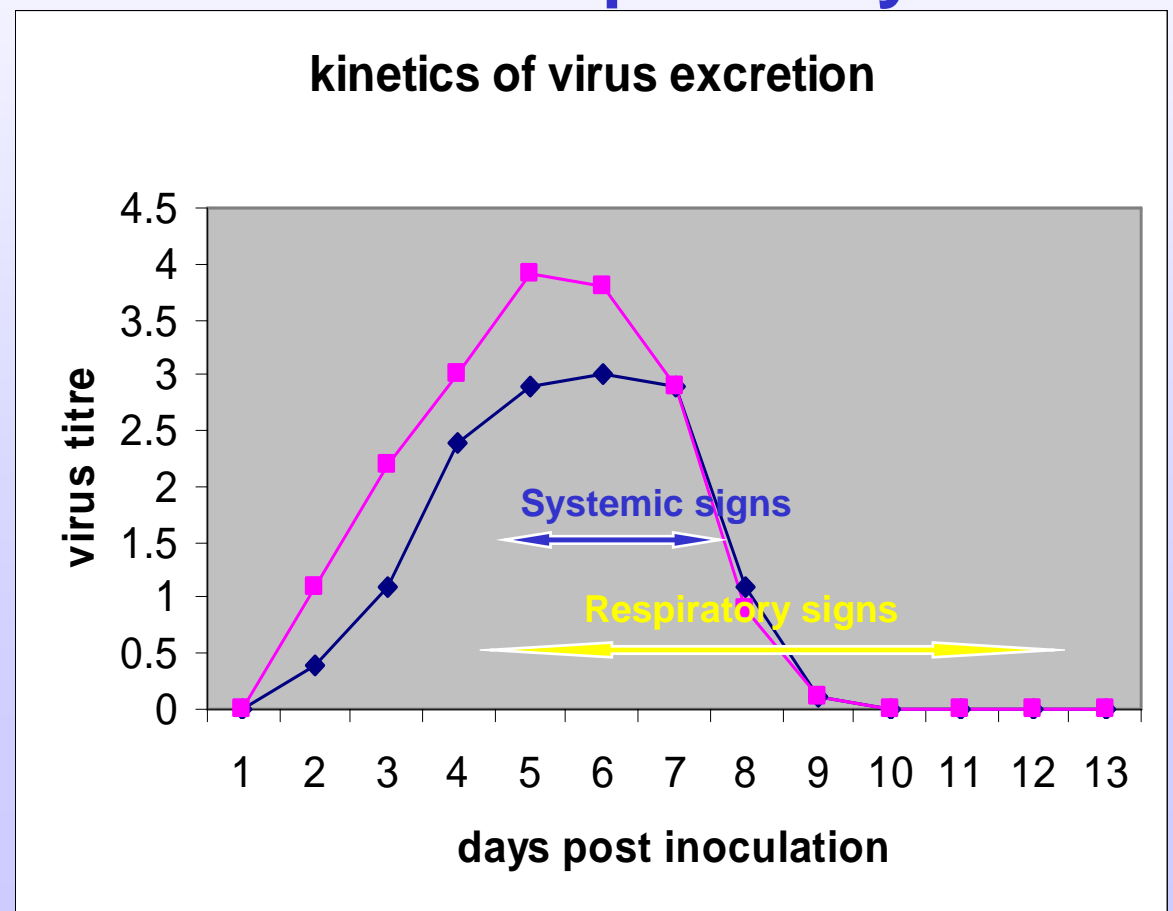
## **PERSISTENT VIRAL INFECTIONS**

- **Jaagsiekte Sheep Retrovirus: contagious lung tumour, rare in USA, outbreak in Moufflon**
- **Maedi visna virus: progressive interstitial pneumonia, common in USA**



## ACUTE VIRAL INFECTIONS

- uncomplicated disease rarely reported
- infections common but most are probably subclinical





## **DIFFERENT AGENTS AND COMBINATIONS:**

**viruses [PI3, adenovirus, RSV, retrovirus], bacteria [Mannheimia haemolytica, Pasteurella multocida, Bordatella parapertussis], Mycoplasma [M. ovipneumoniae]**

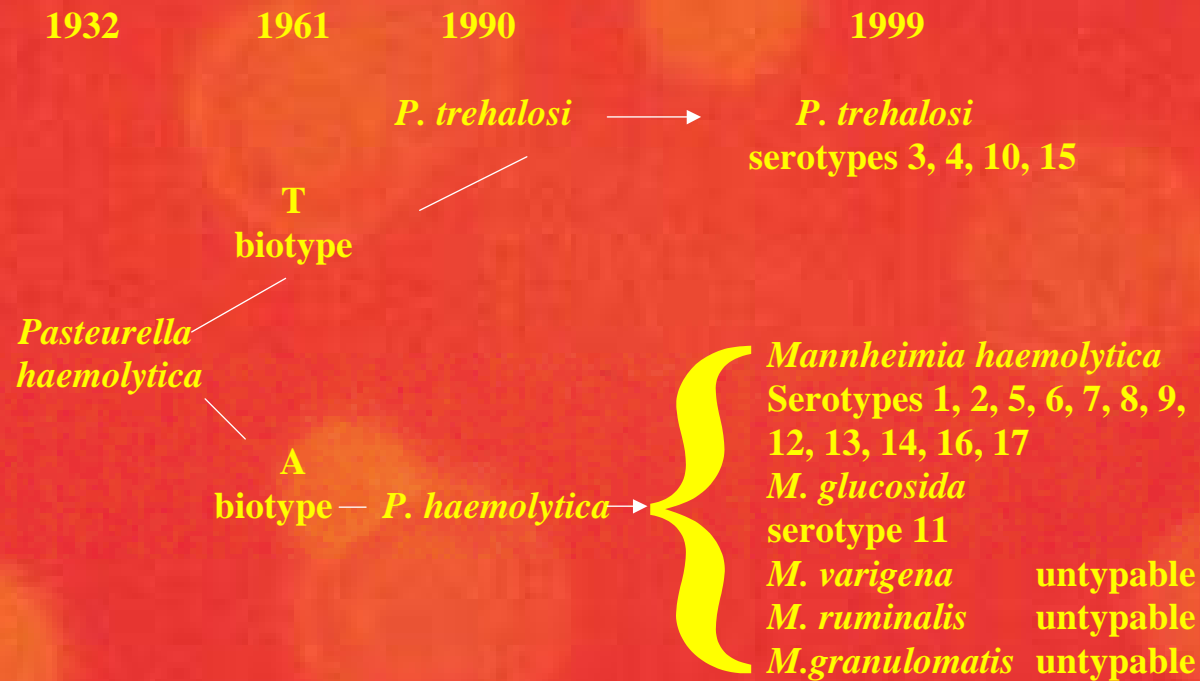
## **DIFFERENT PRESENTATIONS AND PATHOLOGIES:**

**PASTEURELLOSIS [acute –subacute]**

**sub acute - chronic [atypical pneumonia, jaagsiekte, maedi]**

# PASTEURELLOSIS

## *Mannheimia haemolytica*



1932 - Newsom & Cross, JAMVA, 80

1961 - Smith, J. Path. Bact, 80

1991 - Sneath & Stevens, Int. J. Systematic, Bacteriology, 40

1999 - Angen et al, Int. J. Systematic Bacteriology, 49





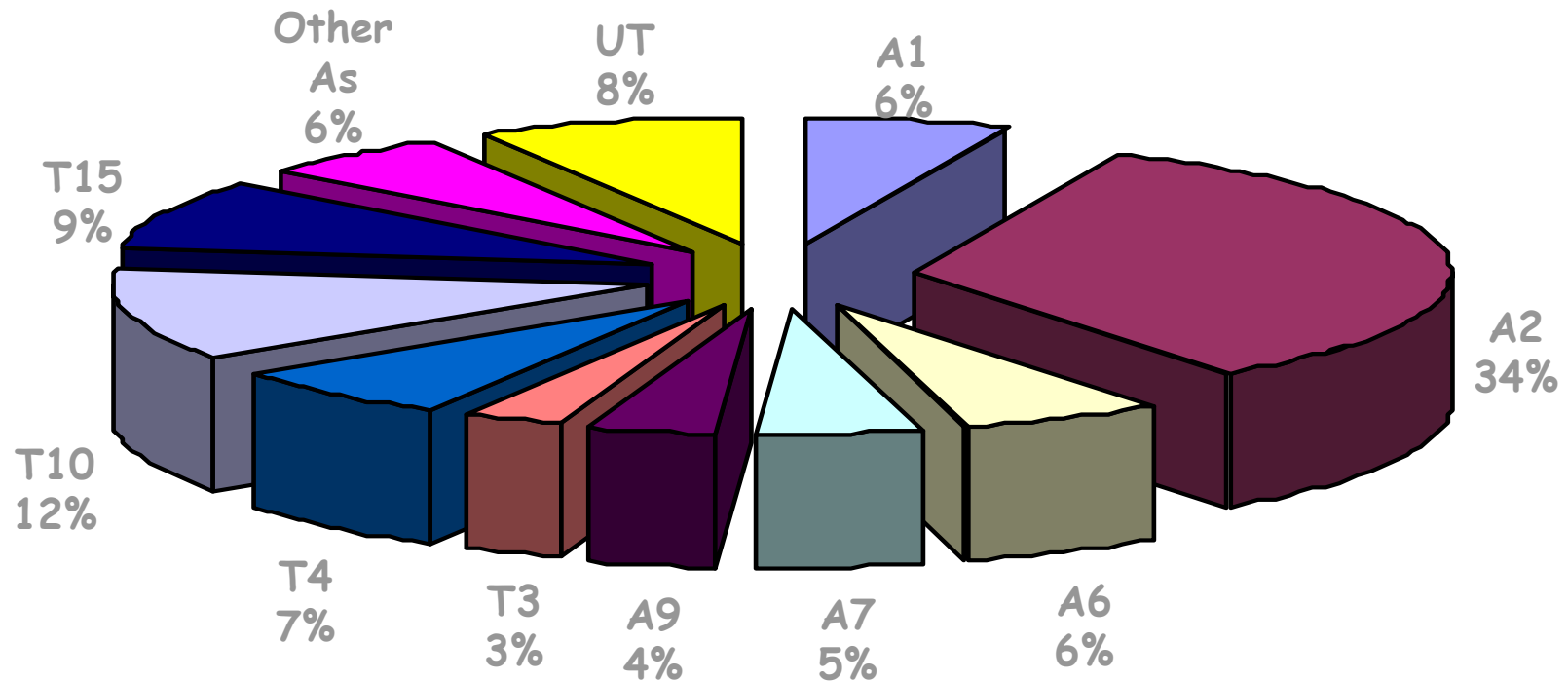
## CARRIAGE of *M. haemolytica* and *P.trehalosi* in HEALTHY SHEEP

	<i>M. haemolytica</i>	<i>P. trehalosi</i>	Total
Nasopharynx	60	4	64
Tonsils	33	62	95

100 sheep sampled



# Prevalence of *M.haemolytica* and *P.trehalosi* serotypes in the UK 1984-1999





# PASTEURELLOSIS

- caused by *M.haemolytica*
- different presentations
  - Septicaemia of young lambs
  - Pleurisy and pericarditis of older lambs
  - Acute or subacute pneumonia in all ages of older sheep





# PASTEURELLOSIS

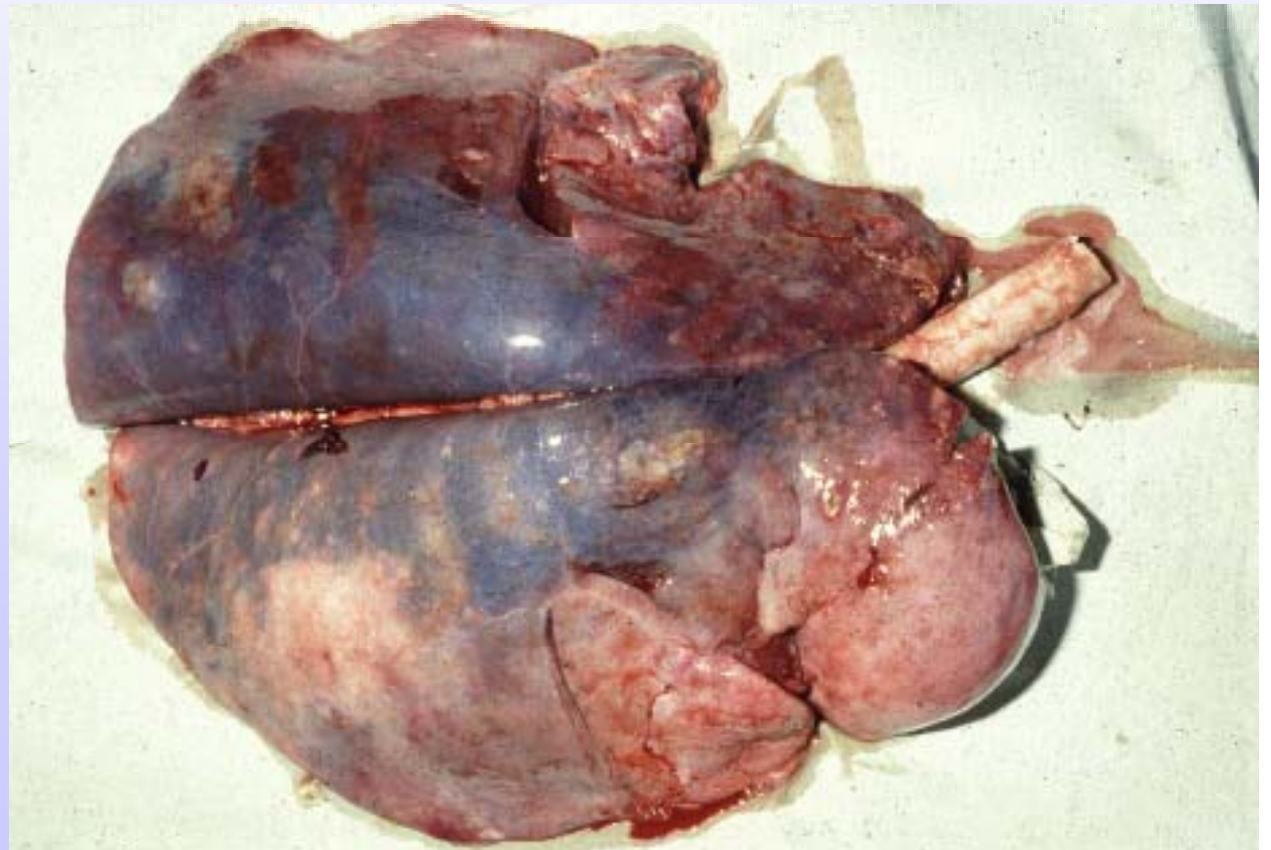
## PREDISPOSING FACTORS:

- environmental stressors [management, climate]  
– no structured epidemiological data
  
- infectious agents, Parainfluenza virus type 3, JSRV [acute pneumonia], *M.ovipneumoniae* [subacute pneumonia]



## **Pneumonic pasteurellosis is a sporadic disease**

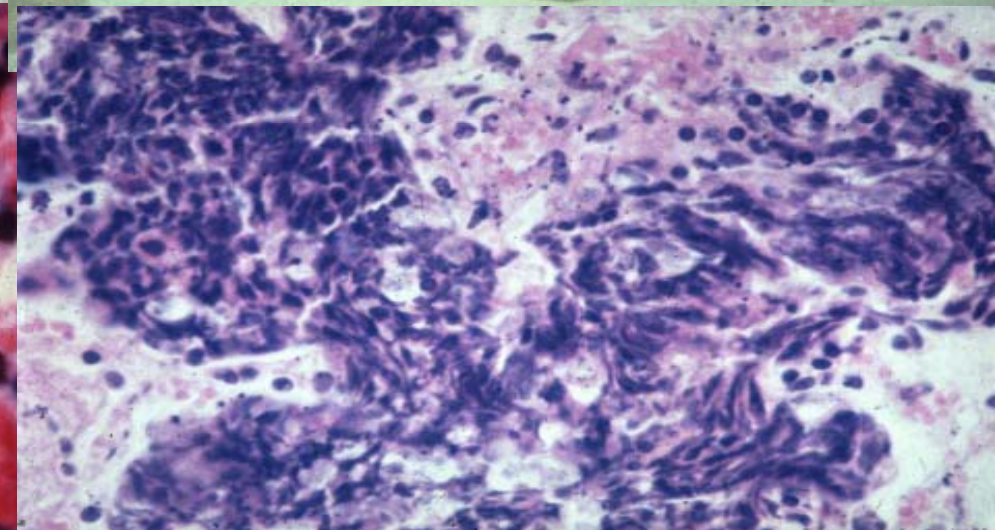
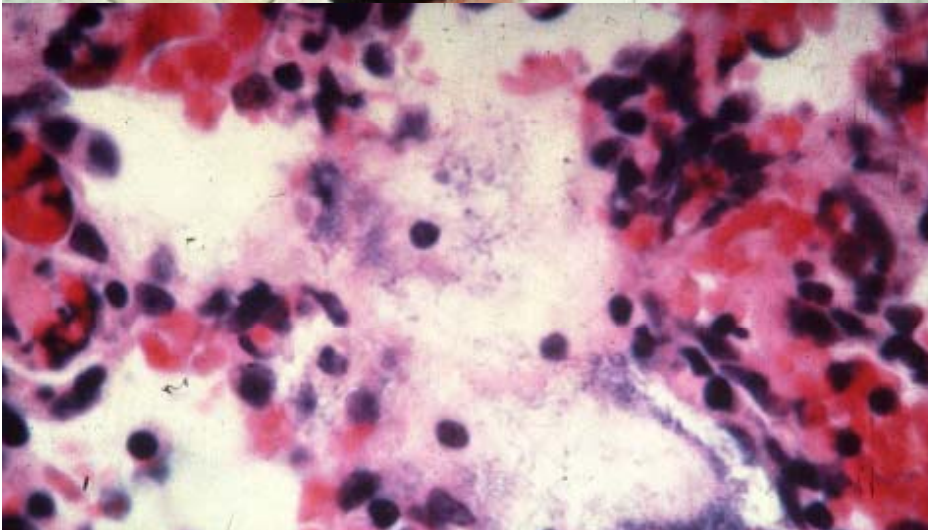
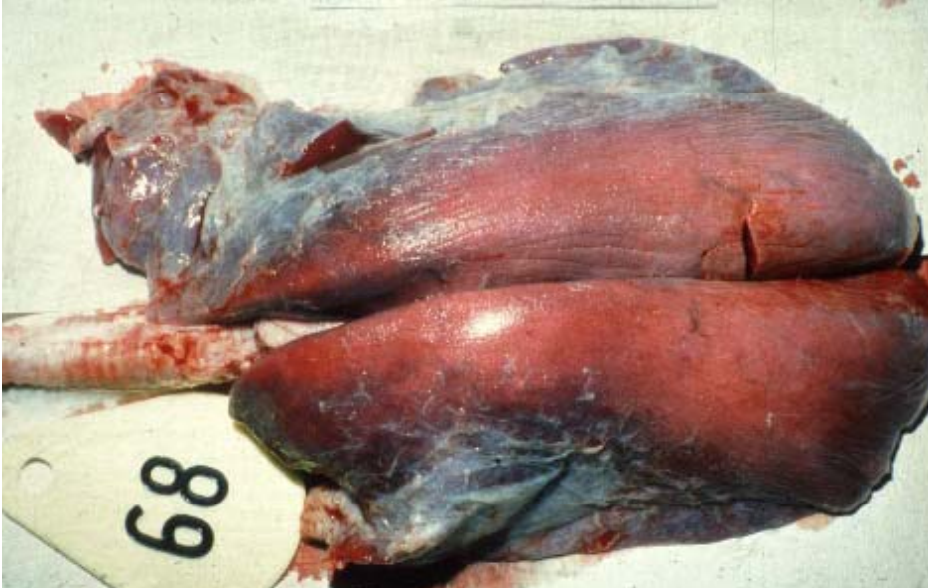
**recurring  
problem  
suggests  
underlying  
factor**







- PI3 predisposes sheep to *M. haemolytica*
- reliable experimental model







## **OPTIONS TO CONTROL PASTEURELLOSIS: ANTIBIOTIC TREATMENT**

**A wide range of antibiotics are effective against *M. haemolytica*:**

**Penicillins, Tetracyclines, Flouroquinolones**

**Associated issues include:-**

- **Treatment protocol for the affected group**
- **Duration of treatment**
- **Treatment of relapsed cases**
- **Role of anti-inflammatory agents**
- **Antibiotic resistance**



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# OPTIONS TO CONTROL PASTEURELLOSIS: VACCINATION

## AVAILABLE COMMERCIALLY

### IRON REGULATED PROTEINS

- *In vivo* is iron deficient environment
- Produced in iron deficient environment
- Produced by all serotypes
- Proteins are highly immunogenic
- Proteins are protective and cross protective



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## SUMMARY

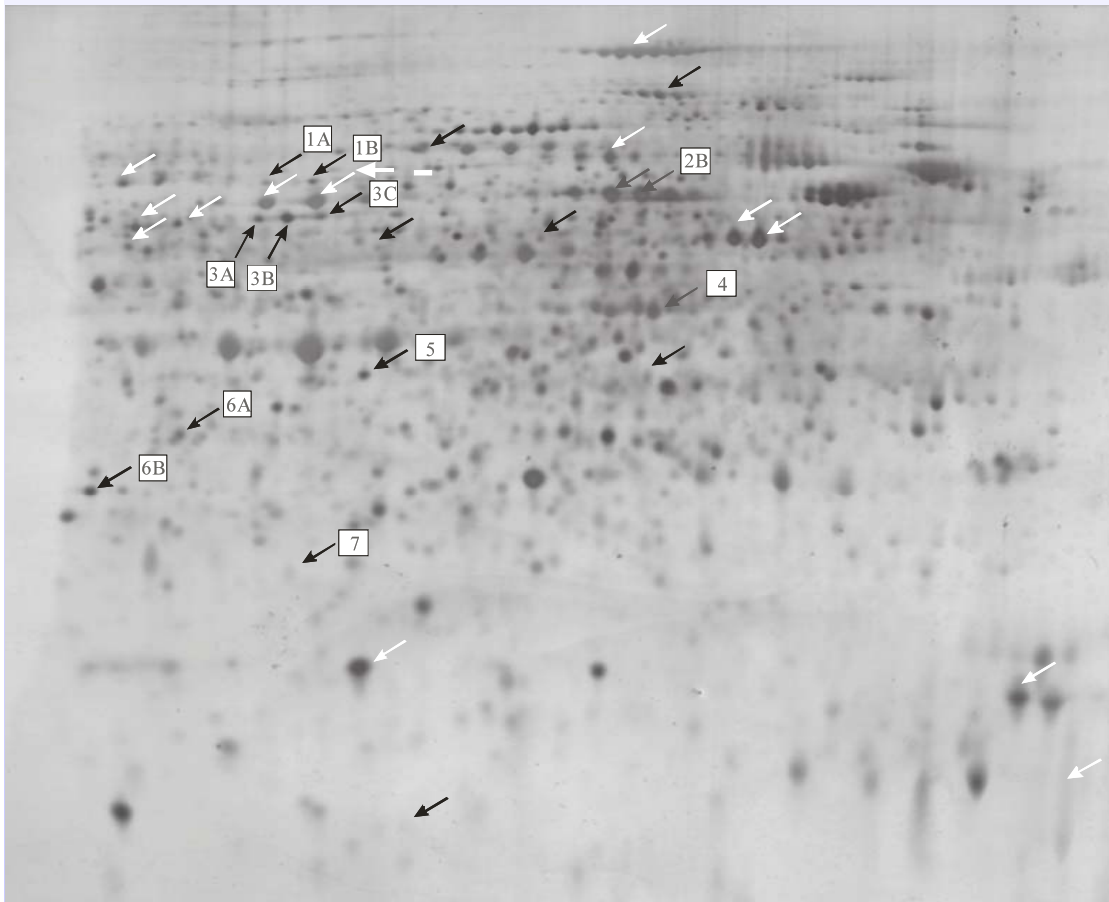
- *Mannheimia/ Pasteurella* infections are the most important respiratory pathogens in sheep
- Environment, management and and other Infections are major stressors leading to pasteurellosis
- Diagnosis is straightforward if bacteriology performed well

**VACCINATION OFFERS THE BEST MEANS OF PROTECTION**



## FUTURE DIRECTIONS

- *In vivo* phenotype is very different to *in vitro* phenotype
- Differences between hosts



Identify further molecules that are expressed in sheep



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## ***M.haemolytica* GENOMIC SEQUENCE AVAILABLE**

- **Genomic approach: targeted vs global**
- **Targeted: probing based on existing knowledge, miss novel molecules and pathways**
- **Global: scan whole genome, reveals unexpected molecules and pathways**



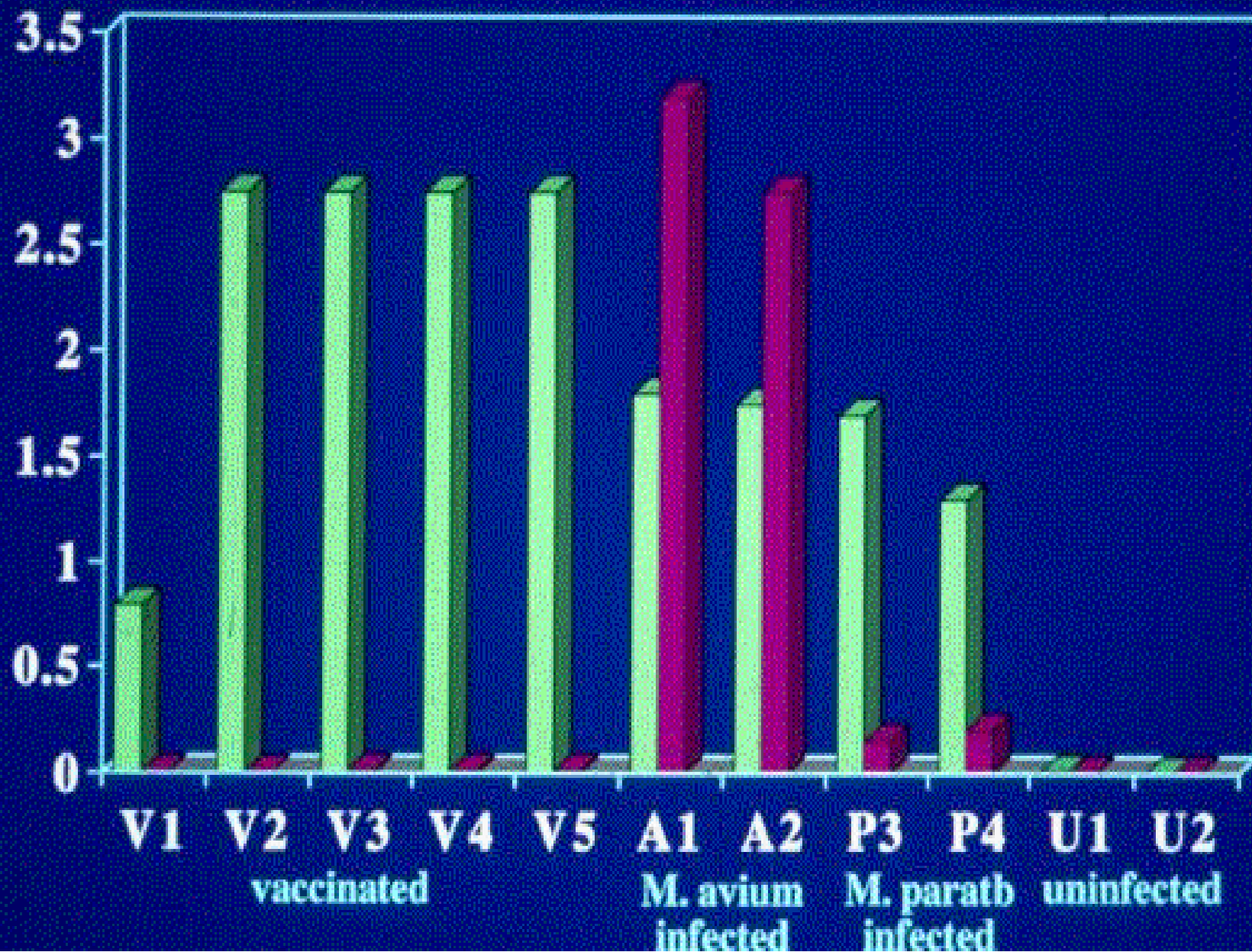
## But genomics is not the whole story

	P40		AhpC		AhpD	
	gene	protein	gene	protein	gene	protein
<i>M.a.avium</i> IS901 <sup>+</sup>	+	+	+	-	+	-
<i>M.a.paratuberculosis</i>	+	-	+	+	+	+
Other mycobacteria	+	-	+	-*	+	-*



■ PPD - stimulated cultures

■ 40 kDa - stimulated cultures





- **Global approach, both genomic and proteomic are needed**
- **Incorporate immunogenic molecules in vaccines**



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