

Babesiosis - a one health approach

Crypto-infections Conference

26th-27th September 2020, UCD

Professor Willie Weir



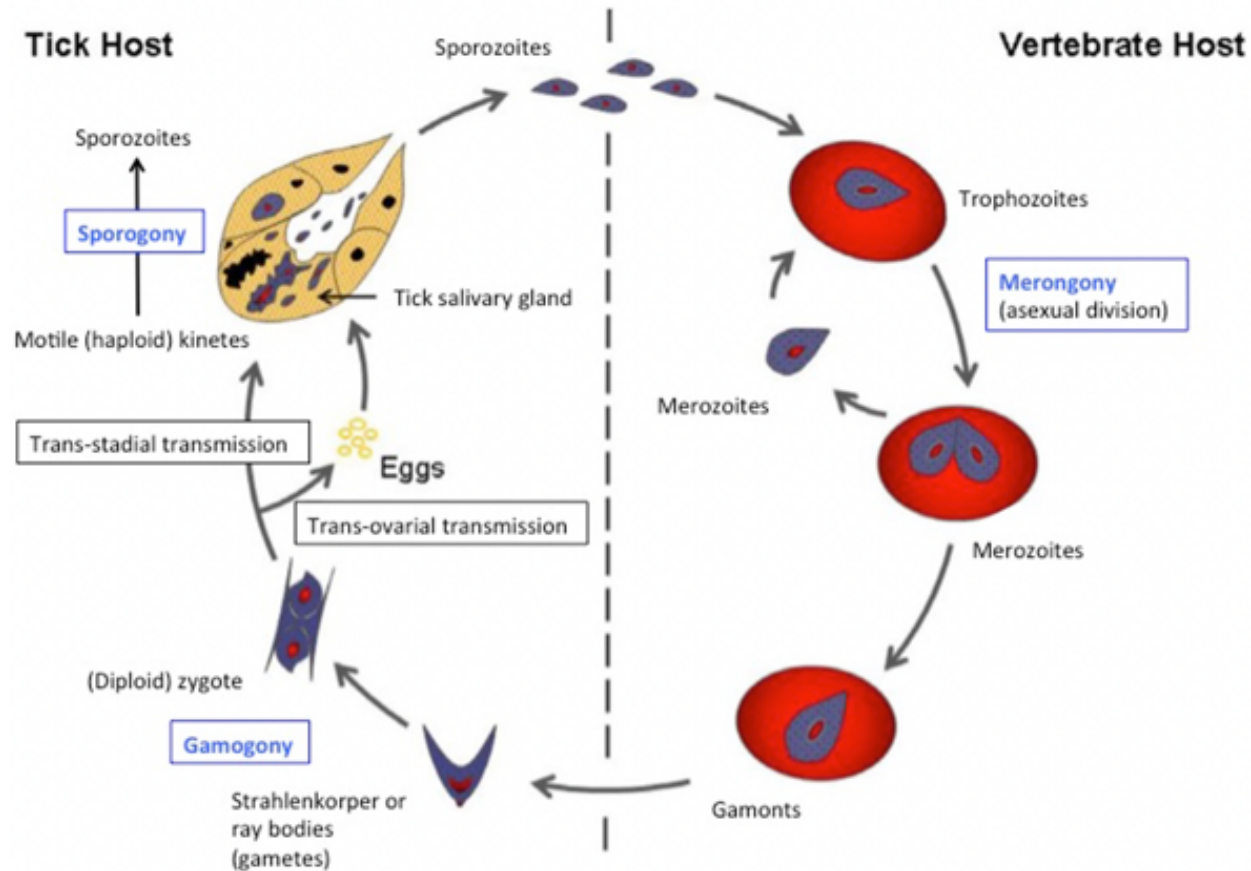
Babesiosis

- Well-recognised disease in animals
 - **Cattle**
 - Sheep
 - **Horses**
 - Pigs
 - **Dogs**
- Important in tropical/sub-tropical areas
- **Emerging disease in man**



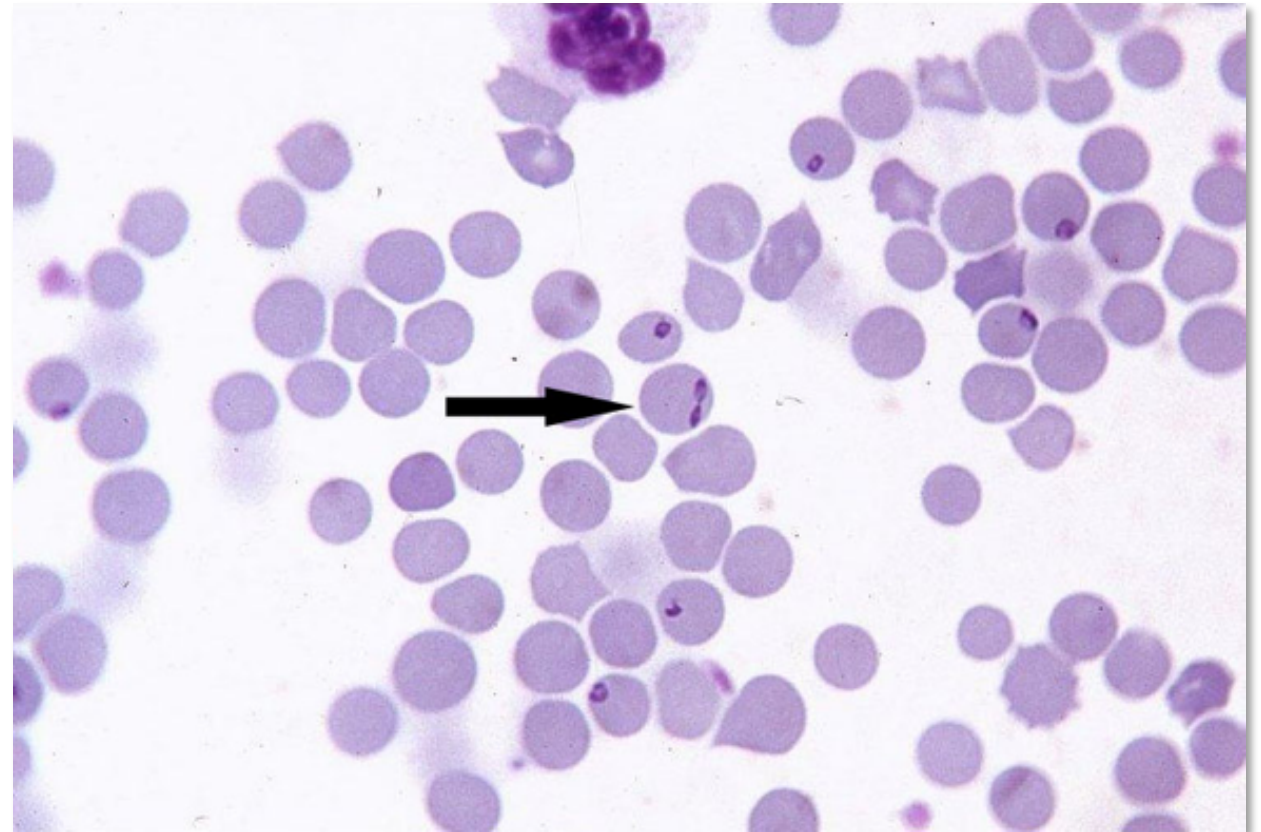
*Major tropical
cattle pathogen*

Typical life-cycle of *Babesia* spp.



Bovine babesiosis in UK/Northern Europe

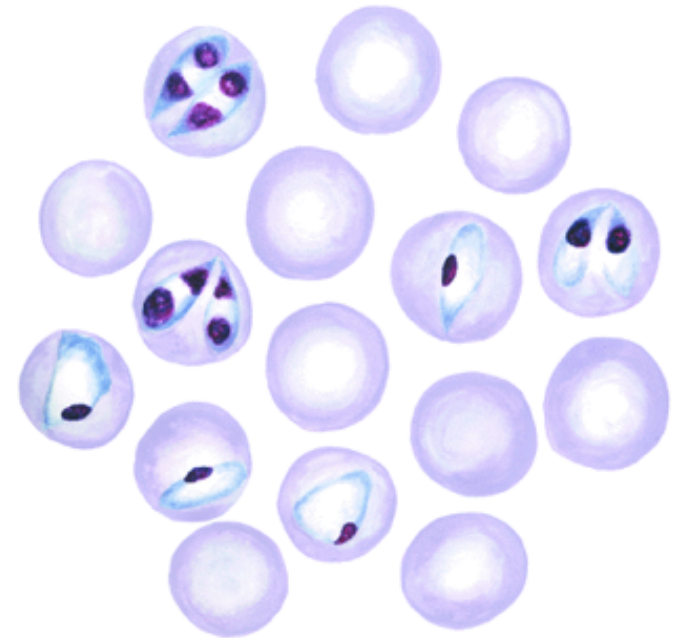
- ***B. divergens***
(small, pathogenic)
- Vector - ***Ixodes ricinus***
- Occurs throughout
Northern Europe/UK



B. divergens pathogenesis

Classical haemolytic anaemia

- Sporozoite infects erythrocytes
- Parasites multiply in erythrocytes
- Up to 40% parasitaemia
- Marked fall in PCV
- Tissue hypoxia – organ damage



Up to 75% of erythrocytes can be destroyed

- through mechanical disruption of erythrocytes by parasites
- increased osmotic fragility and phagocytosis

Clinical disease

- Fever
- Haemoglobinuria
- Time of year / tick activity
- Herd and farm circumstances:
 - Localised problem
 - Naïve animals
 - Inverse age immunity



Babesiosis in the UK

So what's changing in the UK?

Incursion of:

- Equine piroplasmosis
- Canine babesiosis

Detection of zoonotic *Babesia* in:

- Ticks
- Livestock

Occurrence of human disease

Equine piroplasmosis

- It is estimated that 90% of the world's horse population lives in equine piroplasmosis endemic areas
 - Endemic in Africa, Asia, South America, Middle East and Mediterranean
 - Cases have been reported in France, Holland and Spain (trade with the UK)
 - Isolated outbreak Ireland 2009



**Not a
notifiable/reportable
disease in the UK**

**Notifiable in Ireland
(since 2009)**

Clinical presentation of EP

Acute | Neonatal | **Chronic Disease**

Chronic Disease

Milder infection or recovered from acute disease

- Weight loss
- Reduced performance
- Life-long carriers
- Relapse of acute disease
- Abortion



Risks to the UK and Ireland

- **Tripartite Agreement** (EU council directive 2009/156/EC)
 - Reduced restrictions on movement of horses between UK, Ireland and France
- **OIE 'High Health, High performance' (HHP) travel scheme**
- **Due to climate change, tick vectors now present**
 - *Dermacentor reticulatus*
 - *Haemaphysalis spp*
- **Geographically close outbreaks**
 - Ireland (County Meath 2009)
 - Holland (Butler *et al.*, 2012)
 - France (endemic in Carmargue)



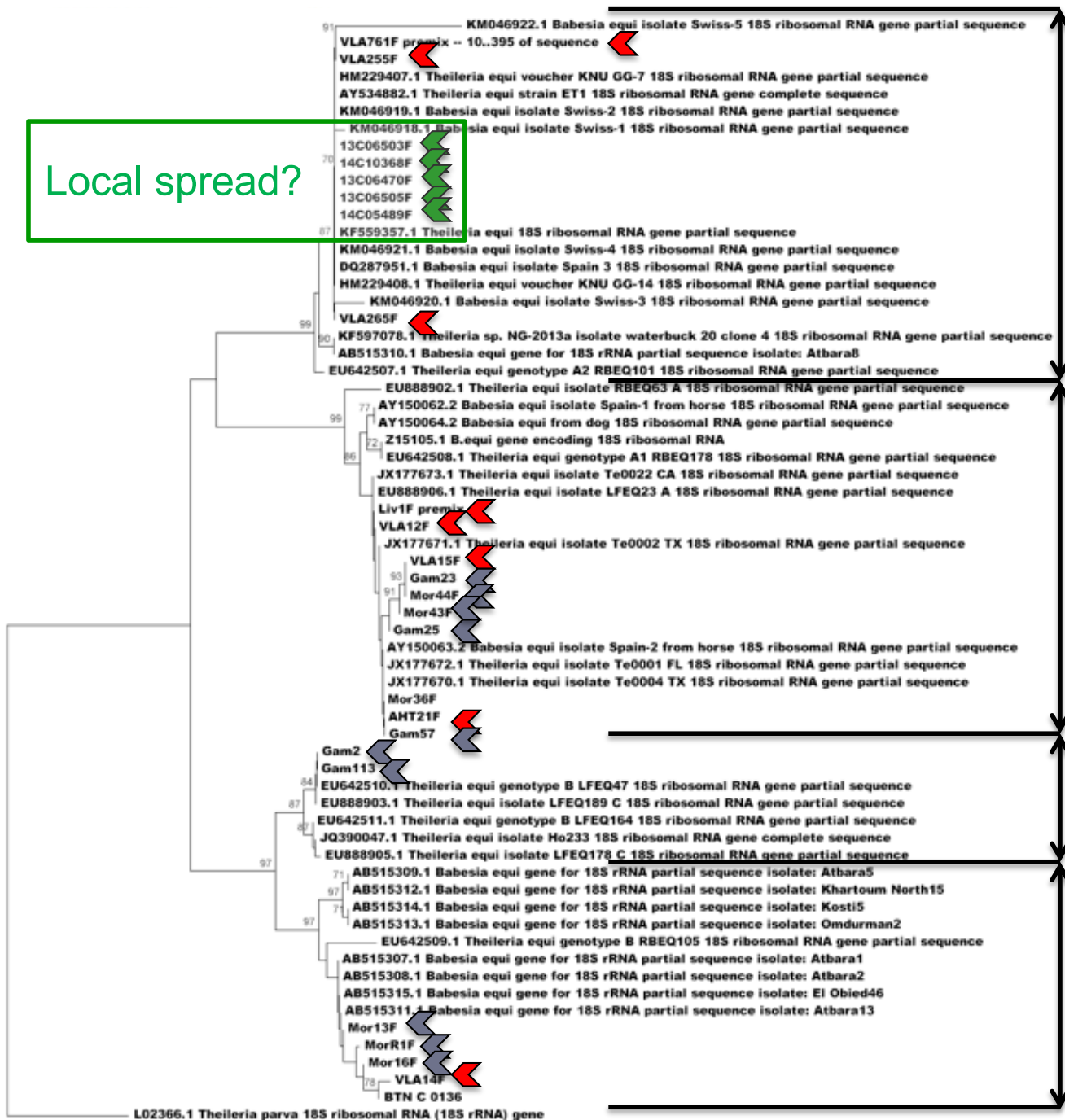
Screening export samples (US, Australia, NZ, Japan)

<i>Samples</i>	<i>T. equi</i> <i>serology</i>		<i>T. equi</i> <i>PCR</i>		<i>B. caballi</i> <i>serology</i>		<i>B. caballi</i> <i>PCR</i>	
VLA (UK)	66/1050	6.3%	7/1066	0.66%	49/1049	4.7%	0/1066	0%
AHT (UK)	4/145	2.8%	3/145	2.1%	3/145	2.1%	0/145	0%
IEC (Ireland)	53/2009	2.5%	7/49	14%*	20/2099	0.95%	0/18	0%
Gambia	--	--	62/98	63%**	--	--	--	--

Results taken from Coultous *et al.* 2019

*PCR performed on serum from serologically positive samples only.

**Animals selected for sampling based on clinical signs of anaemia. Only a sample of much larger data set.



Clade B

Clade A

Clade C

Clade D

- UK
- Gambia/Morocco
- Ireland

Local spread?

0.01

Canine babesiosis in the UK

- 1st reported in 2006
- Outbreak in 2016 in Essex
- No travel history
- Transmitted by *Dermacentor* ticks
 - Known to be in Wales, Devon and Essex
- *B. canis* detected in cases and local ticks
- *Pet Travel Scheme*



Livestock and deer *Babesia* field study



Parasite
+ve...

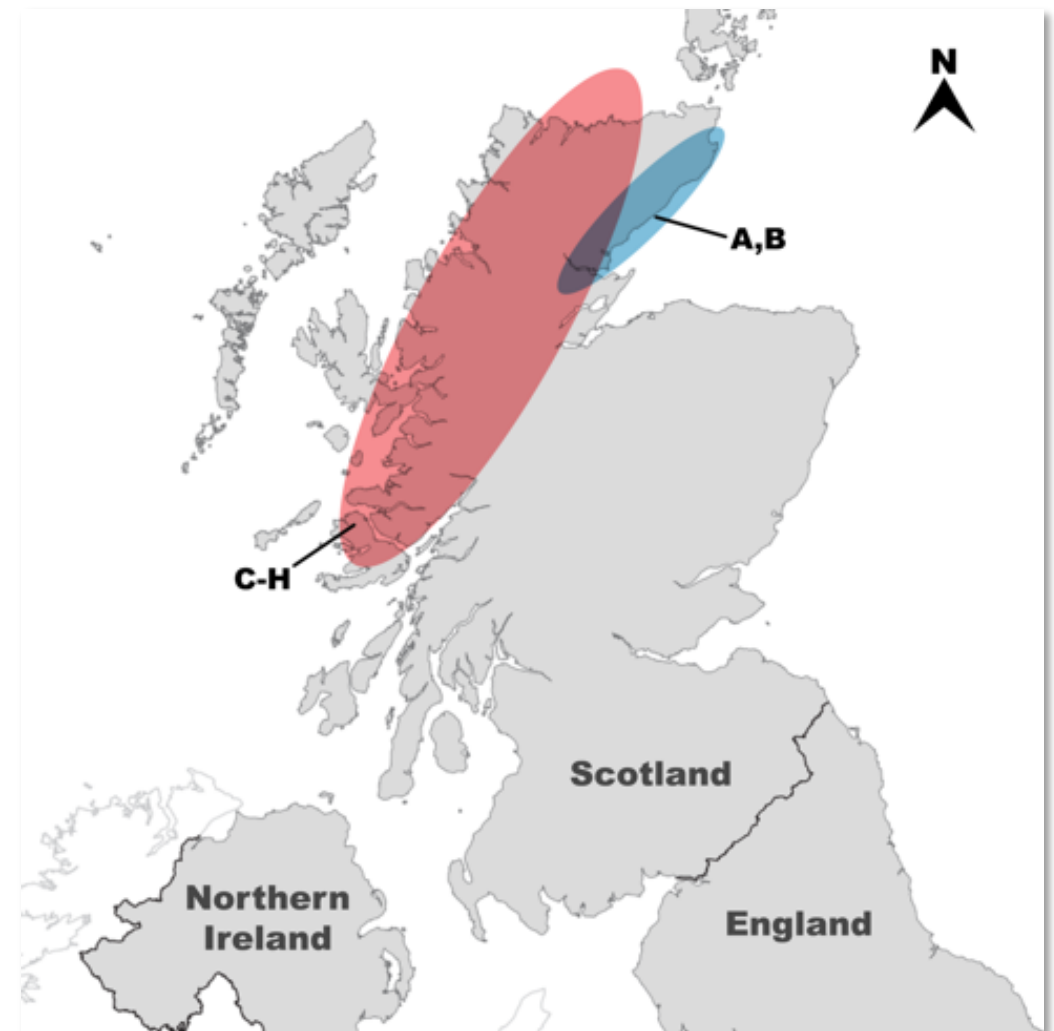
18%



6%

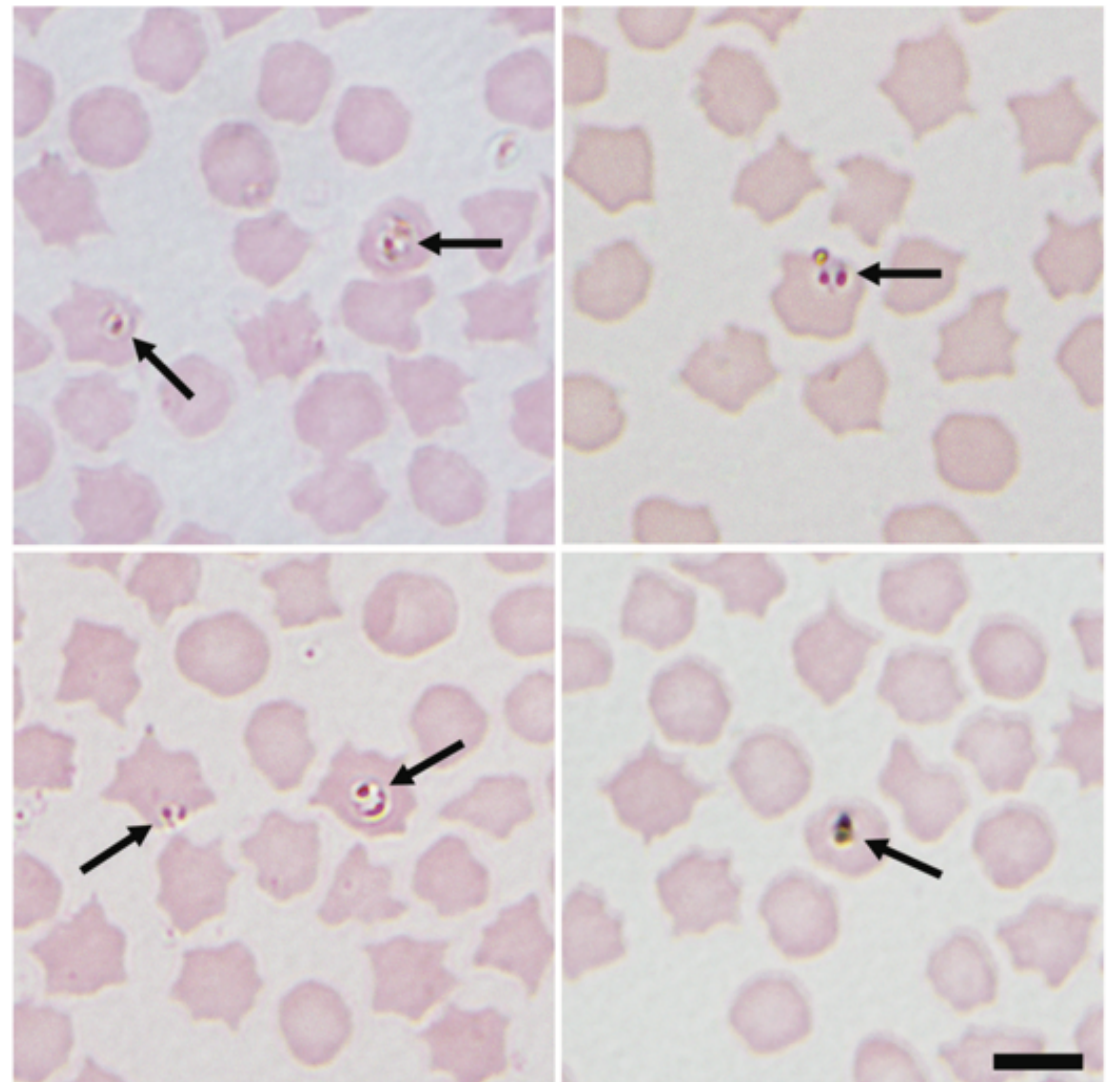
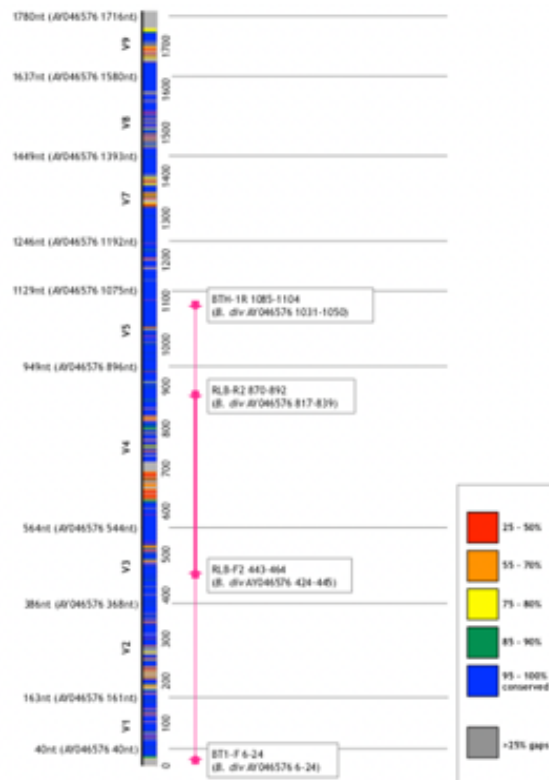


26%



Babesia detected in cattle, sheep and deer

'Catch all'
Babesia/Theileria
PCR

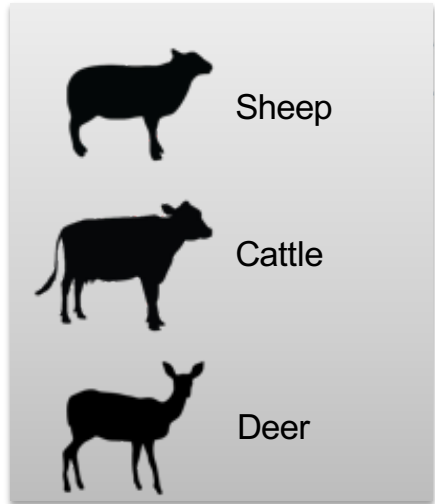


Babesia in sheep

Sampling site	Site A	Site B	
Sampling period	Oct 13	Jun 14	Nov 14
Number of animals sampled	47	40	40
<i>Babesia venatorum</i> PCR +ve	6 (13%)	1 (2.5%)	4 (10%)

Status in June 2014 / Nov 2014	Number of animals
<i>Negative / remained negative</i>	29 (85%)
<i>Negative / became positive</i>	4 (12%)
<i>Positive / became negative</i>	1 (3%)
<i>Positive / remained positive</i>	0 (0%)

Parasites detected in Scottish livestock and deer



BJun14S181
 BNov14S025
 AOct13S036
 BNov14S142



Sarcocystis tenella

Not previously confirmed by molecular means in Scotland

AOct13D002
 AOct13D010
 AOct13D012
 DSum12D048
 AOct13D007
 AOct13D015
 DSum12D017
 FSum12D033
 AOct13D008
 AOct13D021
 DSum12D015
 DSum12D042
 FSum12D056



Babesia odocoilei-like

A *Babesia odocoilei*-like species that has previously been detected in Ireland was confirmed by molecular means in red deer from Scotland for the first time.


AOct13S002
 AOct13S009
 AOct13S014
 AOct13S031
 AOct13S032
 AOct13S035
 BJun14S081
 BNov14S071
 BNov14S074
 BNov14S101
 BNov14S197



Babesia venatorum

***Babesia venatorum* was found in Scotland for the first time, in sheep, a species not previously identified with this parasite.** Normally associated with Roe deer (*Capreolus capreolus*) in Europe, it can be fatal to humans.


ADec13B018
 ADec13B031
 Bdivergens
 ADec13B041
 ADec13B059
 ADec13B071
 ADec13B072
 ADec13B084



Babesia divergens

The endemic species *Babesia divergens* was confirmed in cattle. In addition, it was confirmed by molecular means in red deer in Scotland for the first time, suggesting this species could act as a reservoir for this parasite.

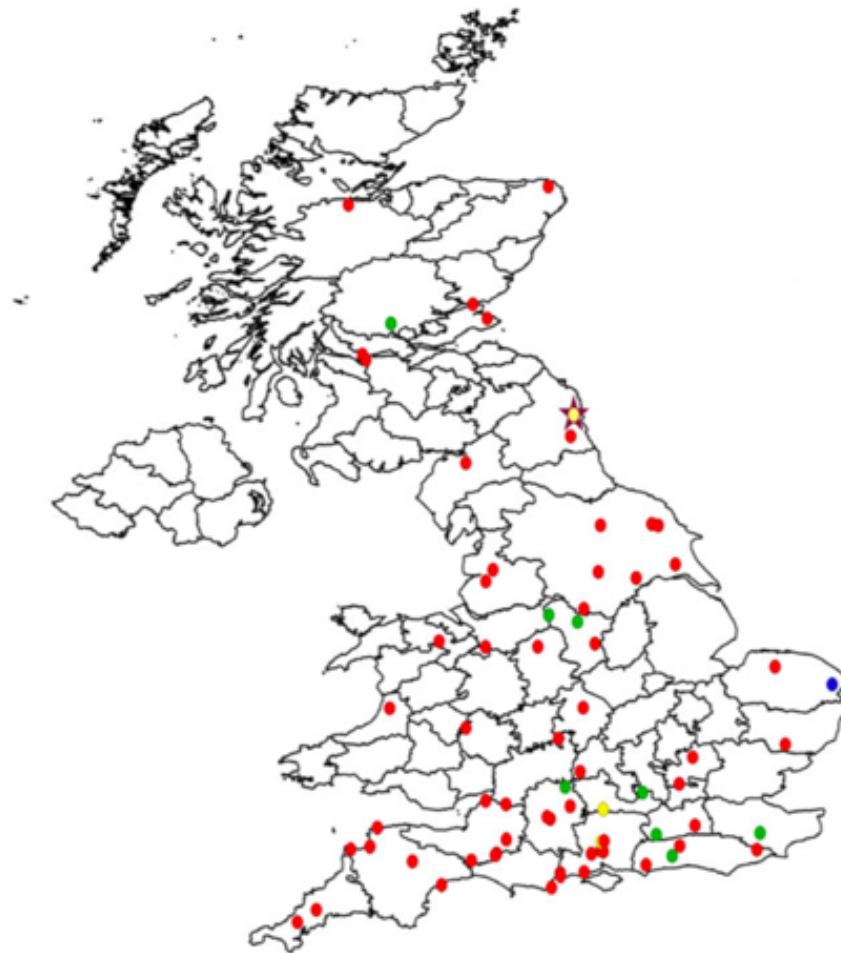
AOct13D006
 AOct13D013
 AOct13D017
 AOct13D022
 CSum12D005
 CSum12D006
 CSum12D009
 DSum12D014
 DSum12D018



Babesia divergens

Bovine
(*Bos taurus*)

Babesia venatorum



Babesia spp. distribution

- *Babesia venatorum*
- *Babesia vulpes* sp. nov.
- *Babesia divergens/Babesia capreoli*
- *Babesia microti*
- ★ *Babesia canis*

Prevalence and distribution of *Borrelia* and *Babesia* species in ticks feeding on dogs in the U.K.

S. ABDULLAH¹, C. HELPS², S. TASKER², H. NEWBURY³ and R. WALL¹

¹Veterinary Parasitology and Ecology Group, School of Biological Sciences, University of Bristol, Bristol, U.K., ²Molecular Diagnostic Unit, Langford Vets and School of Veterinary Sciences, University of Bristol, Bristol, U.K. and ³MSD Animal Health, Milton Keynes, U.K.

Seventy ticks (1.5%) were positive for *Babesia* spp. Of these:

- 84.3% *Babesia venatorum*
- 10.0% *Babesia vulpes* sp. nov.
- 2.9% *Babesia divergens/capreoli*
- 1.4% for *Babesia microti*

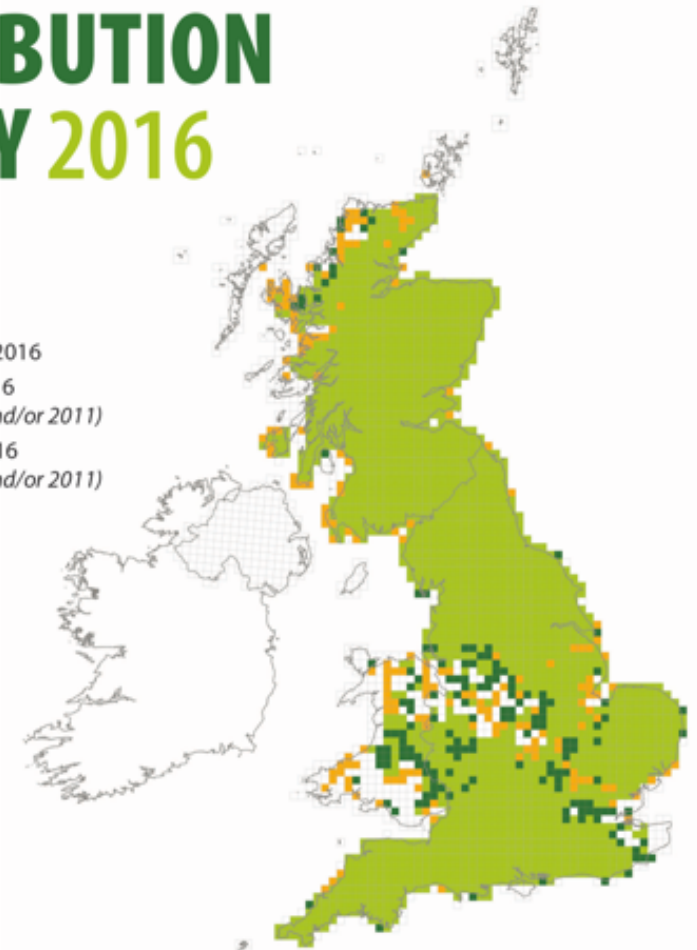
Has *B. venatorum* recently arrived in UK?

- Natural host is roe deer
- Detected in Europe
- European & UK roe deer populations have common origin
- Gene flow among ticks in Norway & UK
- *‘Seek and ye shall find’*

DEER DISTRIBUTION SURVEY 2016

Roe Deer

- Confirmed only in 2016
- Reconfirmed in 2016
(recorded in 2007 and/or 2011)
- Unconfirmed in 2016
(recorded in 2007 and/or 2011)



Human disease

Infection by a number of species:

- *B. microti**
- *B. divergens**
- *B. duncani*
- *B. venatorum**
- 'MO1'

* Detected in UK

Infection occurs through:

- The bite of an infected tick in endemic areas
- Blood transfusion from an infected donor (*less common*)
- Congenital transmission (*rare - during pregnancy or delivery*)

Human babesiosis

Risk factors for severe disease:

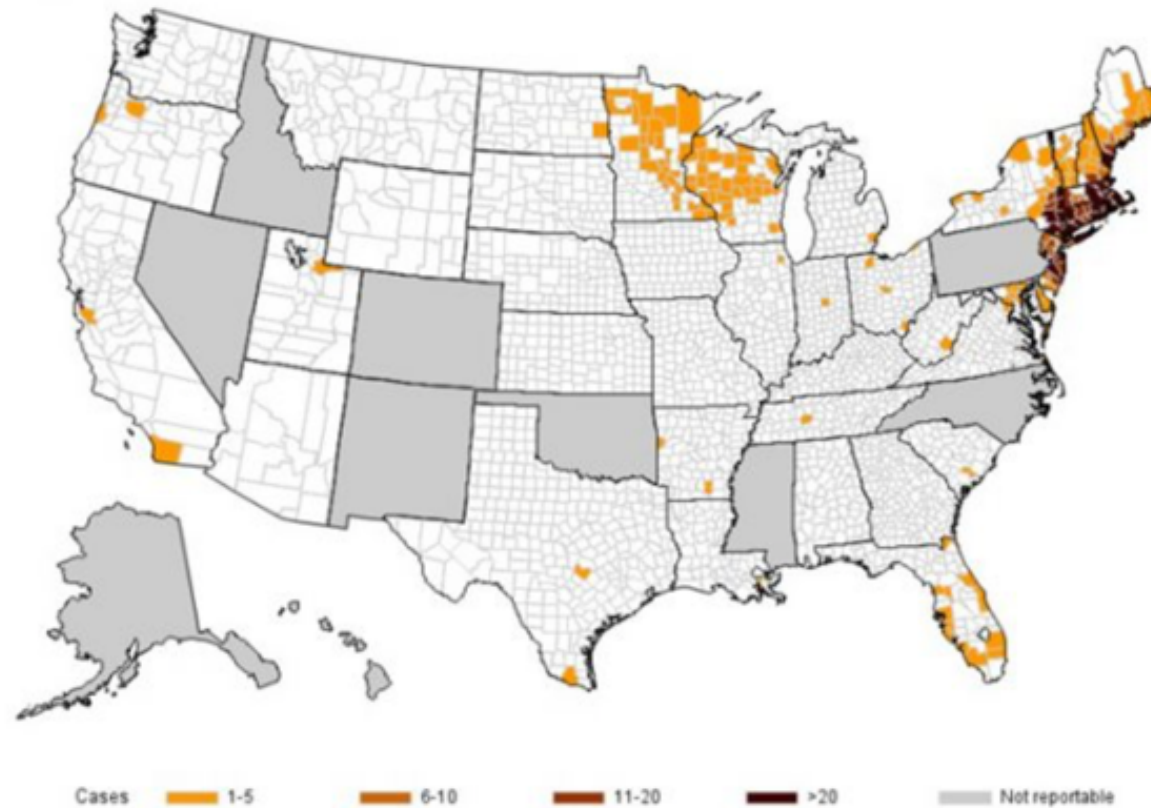
- Splenectomised individuals
- Immunocompromised (e.g. cancer or AIDS)
- Other serious health conditions (e.g. liver or kidney disease)
- Elderly

Some (weak) evidence that *B. venatorum* can cause disease in immunocompetent people.

Widespread in the US

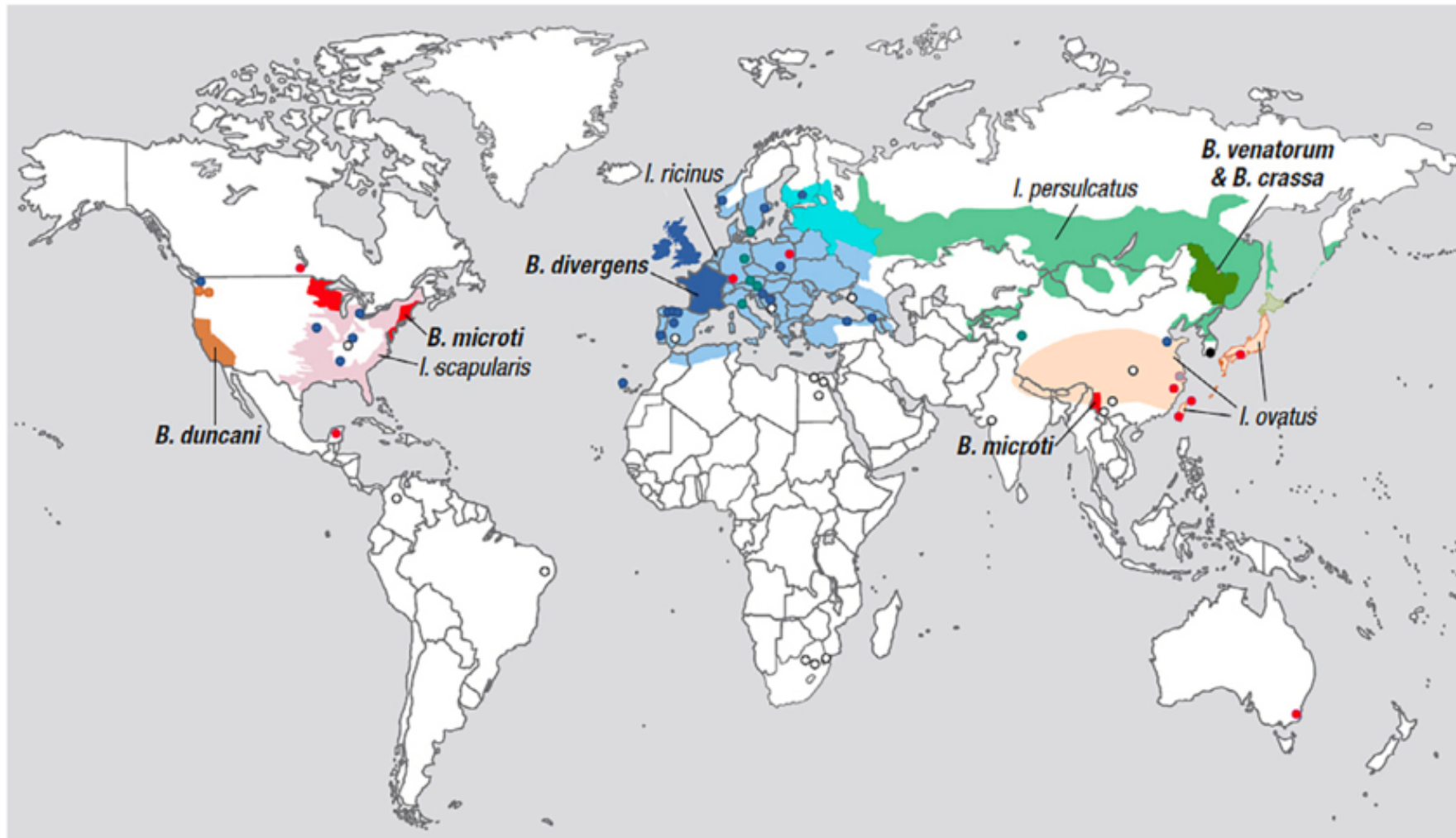
Data from 2018 ... human cases in 40 states

Babesia microti
is spread by
Ixodes scapularis
in the US



* N = 2,144; county of residence was known for all but 17 (1%) of the 2,161 total case-patients.

Global human babesiosis



Human babesiosis in the UK

News > Health

~~Babesiosis: First UK case of deadly tick-borne disease discovered in England~~

Two people living on south coast hospitalised with rare infections

Andy Gregory | Friday 31 July 2020 21:16 | 21 comments



A rare tick-borne illness has been found in the UK for the first time (Bertrand Guay/AFP via Getty Images)

Journal of Infection (1979) 1, 227-234

Babesiosis in man: report of a case from Scotland with observations on the infecting strain

**J. H. Entrican,* H. Williams,† I. A. Cook,‡ W. M. Lancaster,*
J. C. Clark,§ L. P. Joyner|| and D. Lewis¶**

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Central Veterinary Laboratory, Weybridge, Surrey
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Summary

The first case of human babesiosis in the United Kingdom and its fatal outcome in a young man from Inverness-shire, Scotland, who had previously been splenectomised, is described, together with the clinical, laboratory and post mortem findings. The organism was isolated in gerbils (*Meriones unguiculatus*) and shown to be *Babesia divergens*.

'He was a rather retiring man, fond of country pursuits and he frequently stripped to the waist when he gathered wood or worked in his parents' garden.'

What do we need to do now?



- Investigate sub-clinical infection in UK population
 - Clinical impact of 'milder' disease presentations

- Define symptoms
- Identify risk factors
- Improve diagnostics (1,2)

- Correlate sub-clinical infection with *Babesia*
- Impact on clinical disease



- Raise awareness in the medical community, specifically GPs
- Develop more specific diagnostic methods



- Define prevalence in ticks, livestock and wildlife

One Health approach

Acknowledgements

Equine piroplasmosis

Dr Rob Coultous



Animal &
Plant Health
Agency



Animal *Health* Trust



Babesia venatorum

Dr Alexander Gray



Scottish Government
Riaghaltas na h-Alba
gov.scot



- Professor Brian Shiels
- Dr Frank Katzer
- Professor David Sutton
- Dr Paul Capewell