AgriSearch NI
Driving Excellence & Innovation

WELCOMES YOU TO

LIVER FLUKE

TRANSLATING RESEARCH INTO PRACTICE

BBSRC bioscience for the future

University of Liverpool

SRUC

CEH

Moredun

QMS

Hybu Cig Cymru Meat Promotion Wales

AHDB Agriculture & Horticulture Development Board

Control Of Worms Sustainably
COWS

Mary Vickers

Who, why, what?

Aim

COWS aims to provide the best available, evidence-based information to the cattle industry in relation to the sustainable control of parasites in cattle

www.cattleparasites.org.uk

Twitter: @COWSworms

Who?

COWS
Control Of Worms Sustainably

AgriSearch NI
Farmer Funded Research

AHDA

AHDB
BEEF & LAMB

AHDB
DAIRY

HYBU CIG CYMRU
MEAT PROMOTION WALES

AMTRA

Animal & Plant Health Agency

BISHOPTON VETERINARY GROUP

BRITISH CATTLE VETERINARY ASSOCIATION

FARM FIRST VETS

Moredun

NFU

NOAH

QMS

UNIVERSITY OF LIVERPOOL

VETERINARY MEDICINES DIRECTORATE
VMD

westpoint veterinary group

SRUC

COWS also has input from farmers and independent consultants

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AGRICULTURE & HORTICULTURE DEVELOPMENT BOARD

Why?

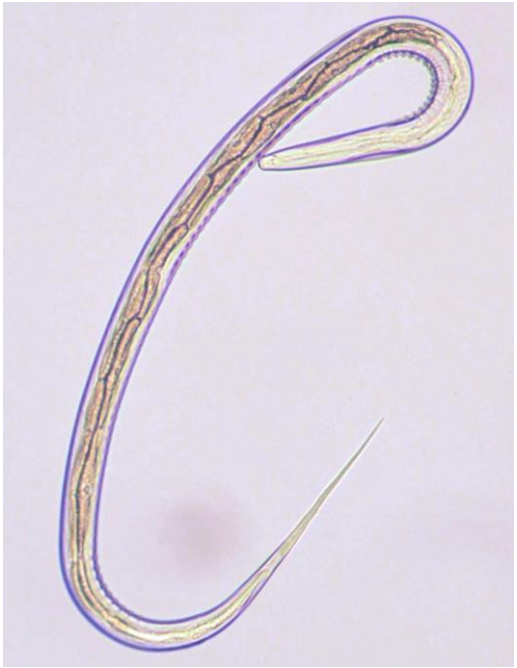
- Anthelmintic resistance less common than in sheep
- Suspect resistance reported mainly with pour-on products (macrocyclic lactones) and triclabendazole (flukicide).
- Some treatment failures reported; usually after pour-ons
- SCOPS leading the way

Current resistance/ poor efficacy status

Parasite: parasiticide	Solution
Cooperia spp to macrocyclic lactones (Intestinal worms)	In FGS calves, treat with LEV or BZD or administer concurrently with ML
F. hepatica to triclabendazole (TCBZ) (Liver fluke)	Use an alternative flukicide
P. ovis to macrocyclic lactones (Psoroptic mange)	Isolate infested animals and repeat treatment until cured

AR risk factors

- AR is inevitable
- High frequency, short interval treatments
- Under dosing



Worms: the commonest cause of ill-thrift

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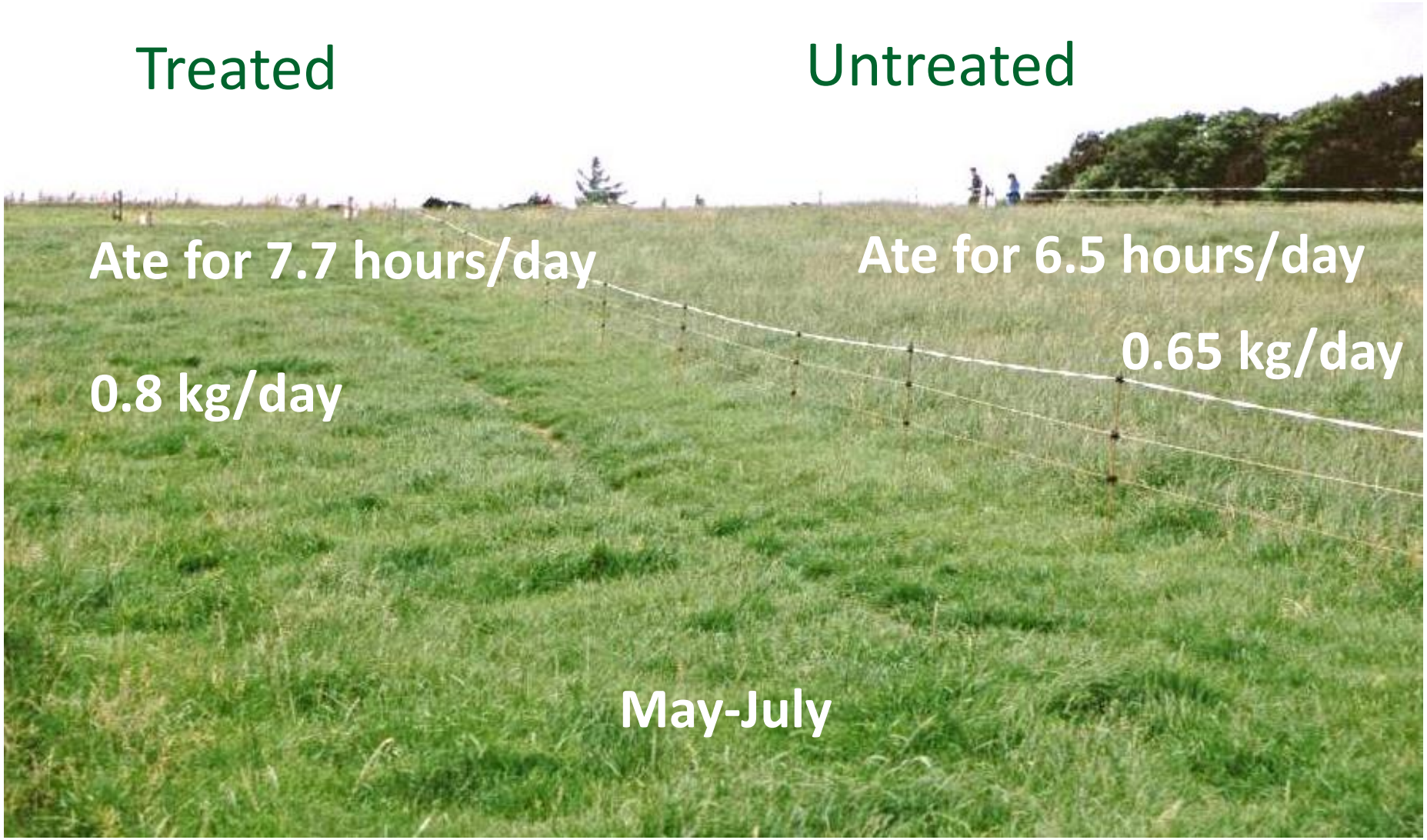
Grazing intake



Matrix for risk assessment

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Risk factor	High	Medium	Low
Age (grazing seasons, GS)	<1 year (1st GS)	1-2 yrs (2nd GS)	>2 years (adult)*
Weight gain (<2 yrs old) 2 months after turnout	<0.7 kg/day	0.7-0.8 kg/day	>0.8 kg/day
Faecal worm egg count (FGS) 2 months after TO (epg)	>200	50-200	<50
Field type	Permanent pasture	Silage/hay aftermath	Newly sown fields
Grazing history	Grazed by cattle <1 year old within last year	Grazed by cattle 1-2 years old within last year	Grazed by adult cows, sheep** or other species within last year

Incomplete table - see Integrated control chapter of technical manual p13

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COWS – current scope

- Gut worms (Parasitic gastroenteritis)
- Lungworms (Parasitic bronchitis)
- Liver fluke (Fasciolosis) + Rumen fluke
- External parasites (Lice & Mange mites)
- Farm level approach to Parasite control
- Specific subjects
  - Administration of anthelmintics
  - Anthelmintic resistance
  - Quarantine treatments

How to blend science with reality?

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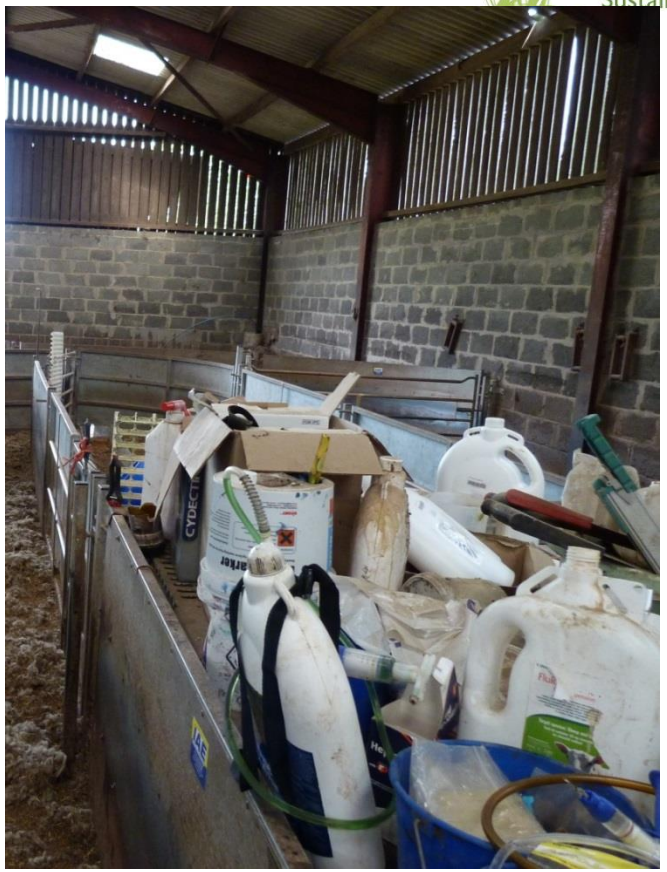
Planning treatments

- Must be evidence-based
- Must be practical for farmer
- Must consider farm system
- Should have some flexibility
- Ensure accurate dosing
- Measure the success



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The 5 R's for the effective use of wormers

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✓ Use the RIGHT product for the type of worm

Anthelmintics belong to different classes and are active against different worms, and in some cases specific developmental stages of worms.

Products should be chosen to specifically target the worm, or stage of development that is most likely to occur or already identified as present on-farm.

Other considerations, such as withdrawal periods, and any known anthelmintic resistance issues, should also be taken into account.

Consult with your vet, SQP, farm adviser or veterinary pharmacist for detailed advice on choosing the right product for specific on-farm problems.

Only use products legally authorised for use against a particular host species or type of stock in the UK.

✓ Treat the RIGHT animal

There is little to be gained from any anthelmintic treatment before weaning. However, as grazing intake increases, youngstock will potentially be exposed to high levels of worm infestations.

Effective treatments in youngstock, when they are most susceptible to worm infections, will reduce egg contamination onto pasture and further reduce levels of infection in the environment.

Older cattle generally have a good level of immunity to gut and lung worms and therefore, depending on the farm situation, treatment may not be necessary. However, animals of all ages must be included in liver fluke control plans.

✓ Treat cattle at the RIGHT time

There is no one size fits all solution to parasite control. Treatment depends on assessing various factors, including pasture risk, animal type and time of the year.

For youngstock, monitoring growth is a good indicator of when to treat for worms. If daily live weight gain (DLWG) falls below target, generally 0.7 to 0.8kg/day after weaning, anthelmintic treatment should be considered.

The risk of disease in cattle is later in the season, post mid-summer, when worms have accumulated on the pasture. However, wormers can be used in the first two months of the grazing season to reduce pasture contamination with worm eggs. A group egg-count six to eight weeks post turnout and weight/condition monitoring can give a good indication of whether early season treatment is necessary.

✓ Dose cattle at the RIGHT rate

In most situations, anthelmintics are administered at a specific dose rate (ml) according to the animals' live weight (kg).

Therefore it's important to:

1. Read the product label or summary of product characteristics (SPC).
2. Ensure dosing equipment is well maintained, calibrated and clean.
3. Weigh animals, or use a weigh band to calculate the correct dosage for each animal.

✓ Administer wormer in the RIGHT way

Anthelmintics can be administered to cattle in different ways. These include; subcutaneous injections; ear injections; intra-ruminal boluses; pour-on products; and oral drenches.

Always read the product label to ensure the selected product is administered in the correct way. Anthelmintics should not be home mixed with any other products.

Dose according to accurate live weight

Don't home mix anthelmintics

The 5 R's for the effective use of wormers

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The right product for the right type of worm

The right animal

The right time

The right dose rate

Administered in the right way

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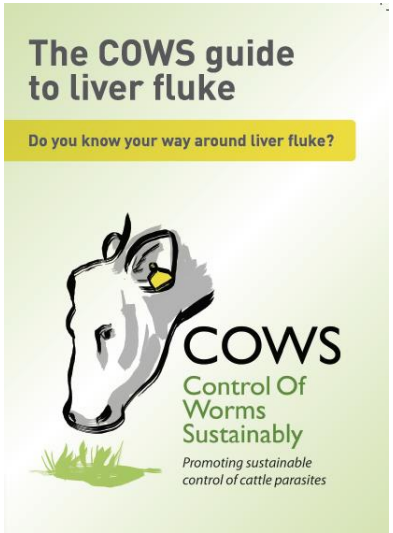
Incorrect parasiticide administration

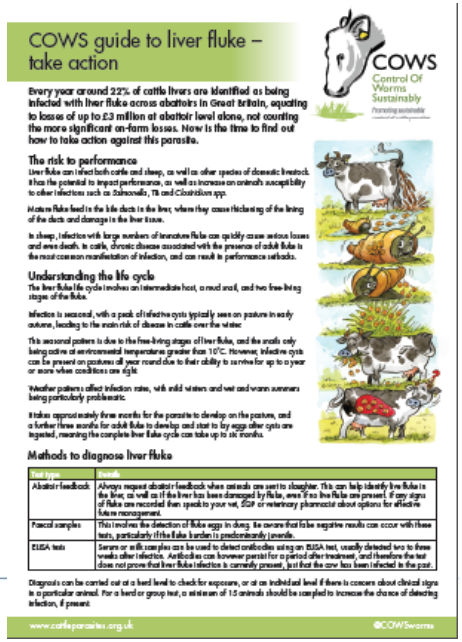
- Under-dosing
  - Poor efficacy when treating clinical cases
  - Reduced persistency & duration of protection
  - Increased risk of resistance

- Over-dosing
  - Risk of toxicity
  - Withdrawal periods for meat and milk are determined using the recommended dosage; higher dosages mean that withdrawal periods should be increased

Knowledge transfer

- Training of vets, SQPs, and farmers
- Via stakeholder comms routes
- COWS branded resources & events





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Liver fluke

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Faecal sample analysis can help detect if liver fluke is present in cattle

Reduce the exposure to high risk fluke areas

Communications

- AHDA conference
- Farmer facing shows
- Press articles
- Film clips
- Website content
- Webinars
- Leaflets
- Social media

➢ Working through partner comms routes as well

Thank you

www.cattleparasites.org.uk

Twitter: @COWSworms

Introduction to liver fluke and improved diagnosis

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Philip Skuce, Stuart Dawes, Gillian Mitchell, Grace Cuthill & Ruth Zadoks

Moredun Research Institute, Edinburgh

philip.skuce@moredun.ac.uk

BBSRC-IPA Stakeholder meeting,
AgriSearchNI, Hillsborough, 12th Oct 2016

Moredun

Liver fluke

- Highly pathogenic flatworm parasite

- Complicated life-cycle involving intermediate mud snail host

- Threat to sheep and cattle of all ages

- Risk significantly influenced by weather esp. mild winters & wet summers!...

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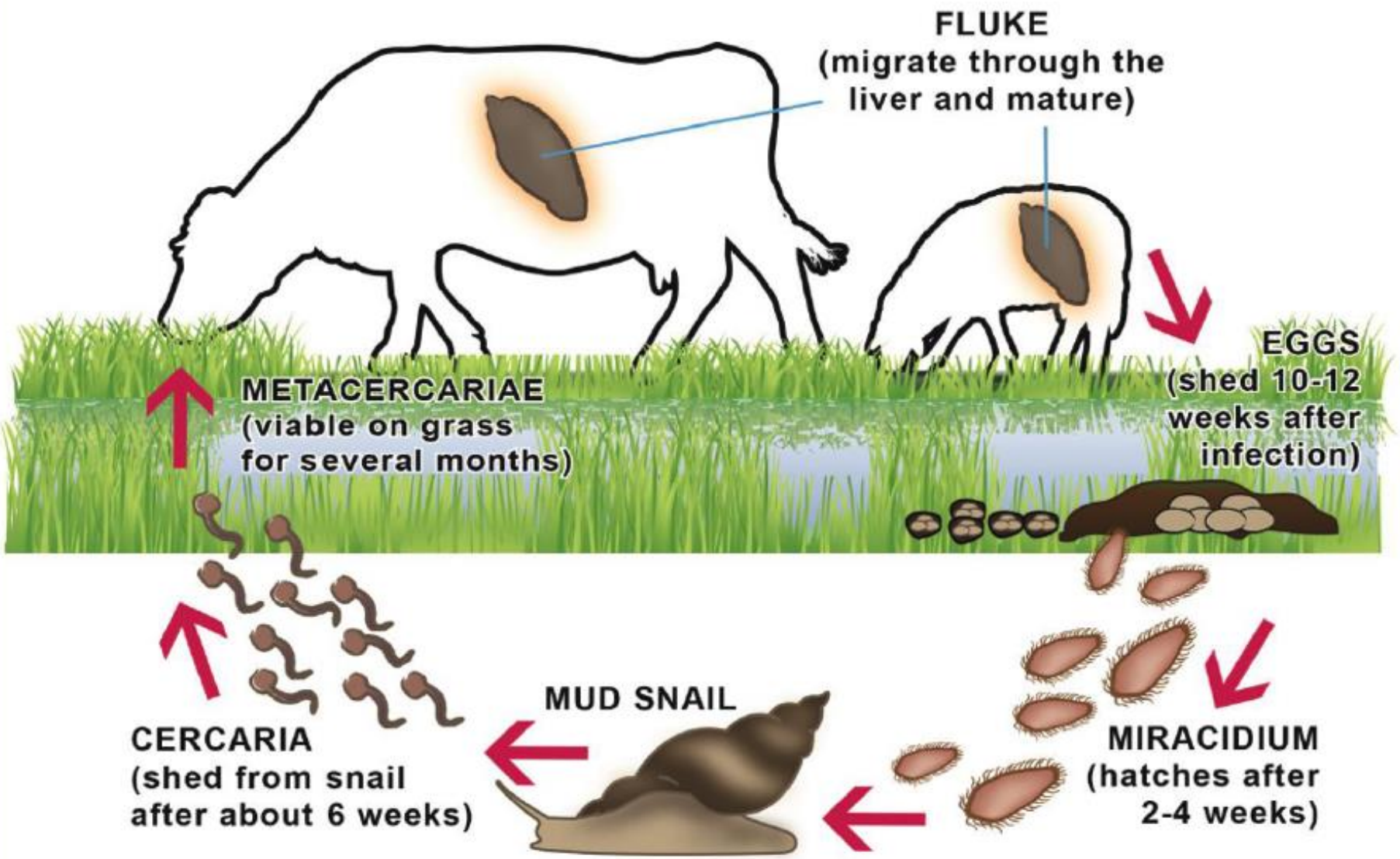
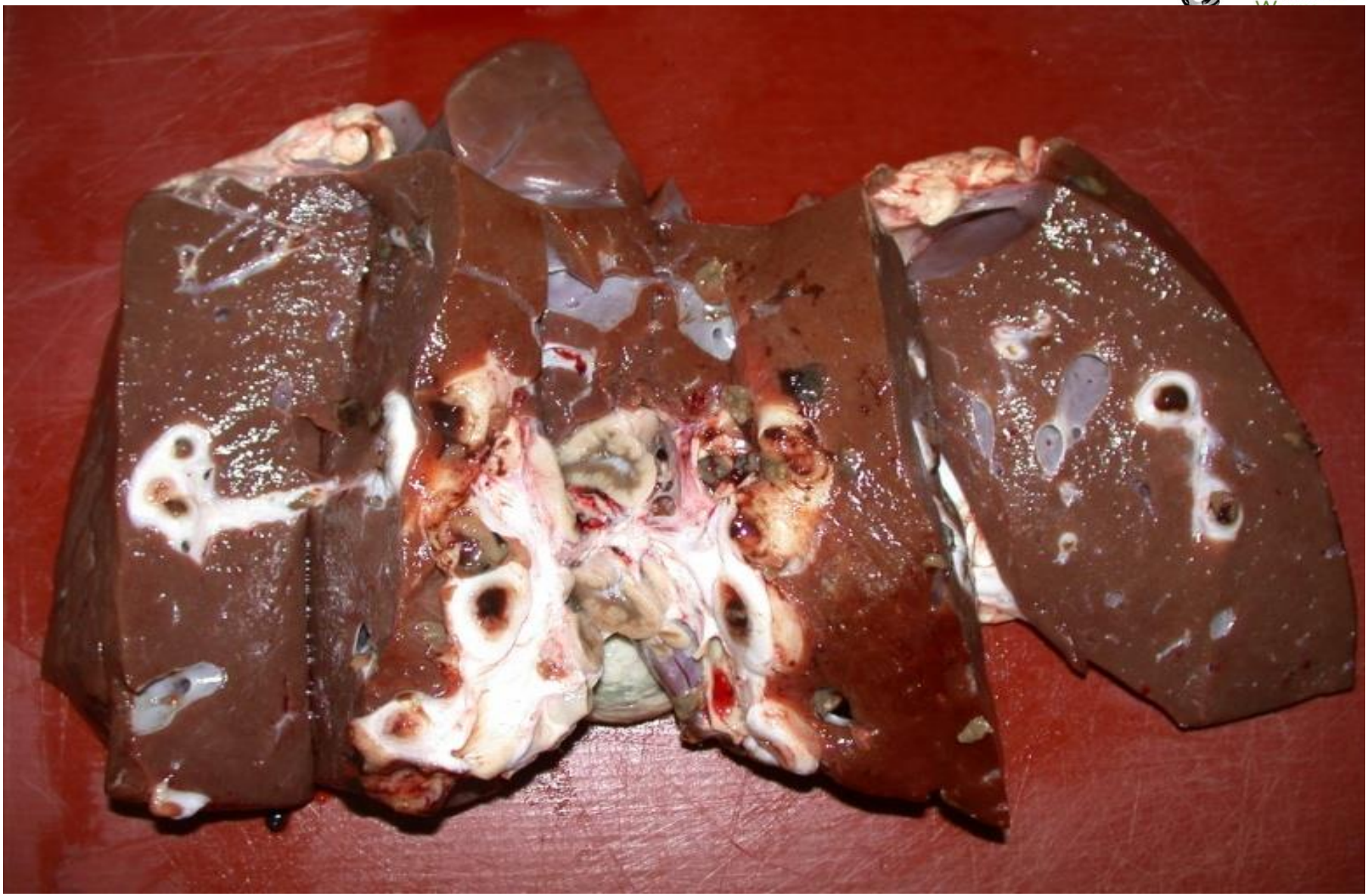
Control of Cattle Parasites Sustainably

LIVER FLUKE LIFE CYCLE



Cattle - typically, **chronic fluke**! Bovine liver responds dramatically to liver fluke infection = ‘pipestem fibrosis’



Cost of liver fluke?

- **Direct production losses:**

  – e.g. 10% reduction in adult liveweight gain, 30% reduction in lambs/calves; poor scanning rates, feed conversion ratios etc.

- **Estimated cost to the producer:**

  – EBLEX, 2011 - £25-£30 per head (sheep)

  – Swiss study, 2005 – 300€ per head (beef & dairy)

  – Harbro Ltd., 2013 – ~450,000 cattle, 'fluky' animals 2.5kg lighter @ £60, also 27 days older!

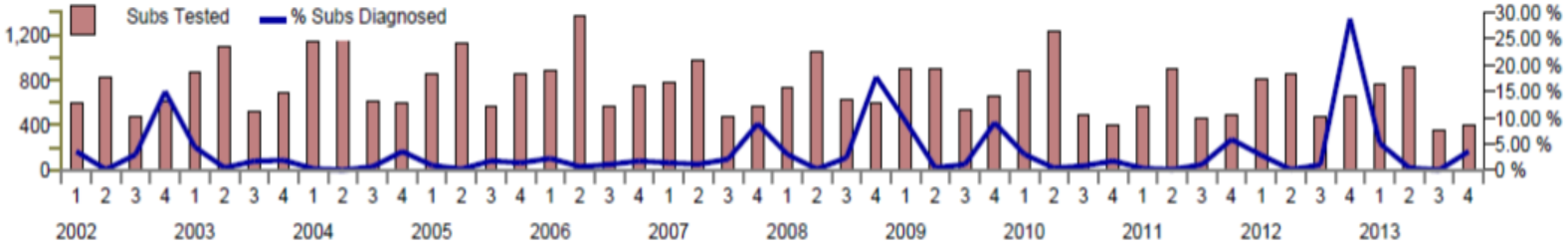
  – EBLEX figures, 2013, even higher = 10kg lighter, lower BCS @ £90!

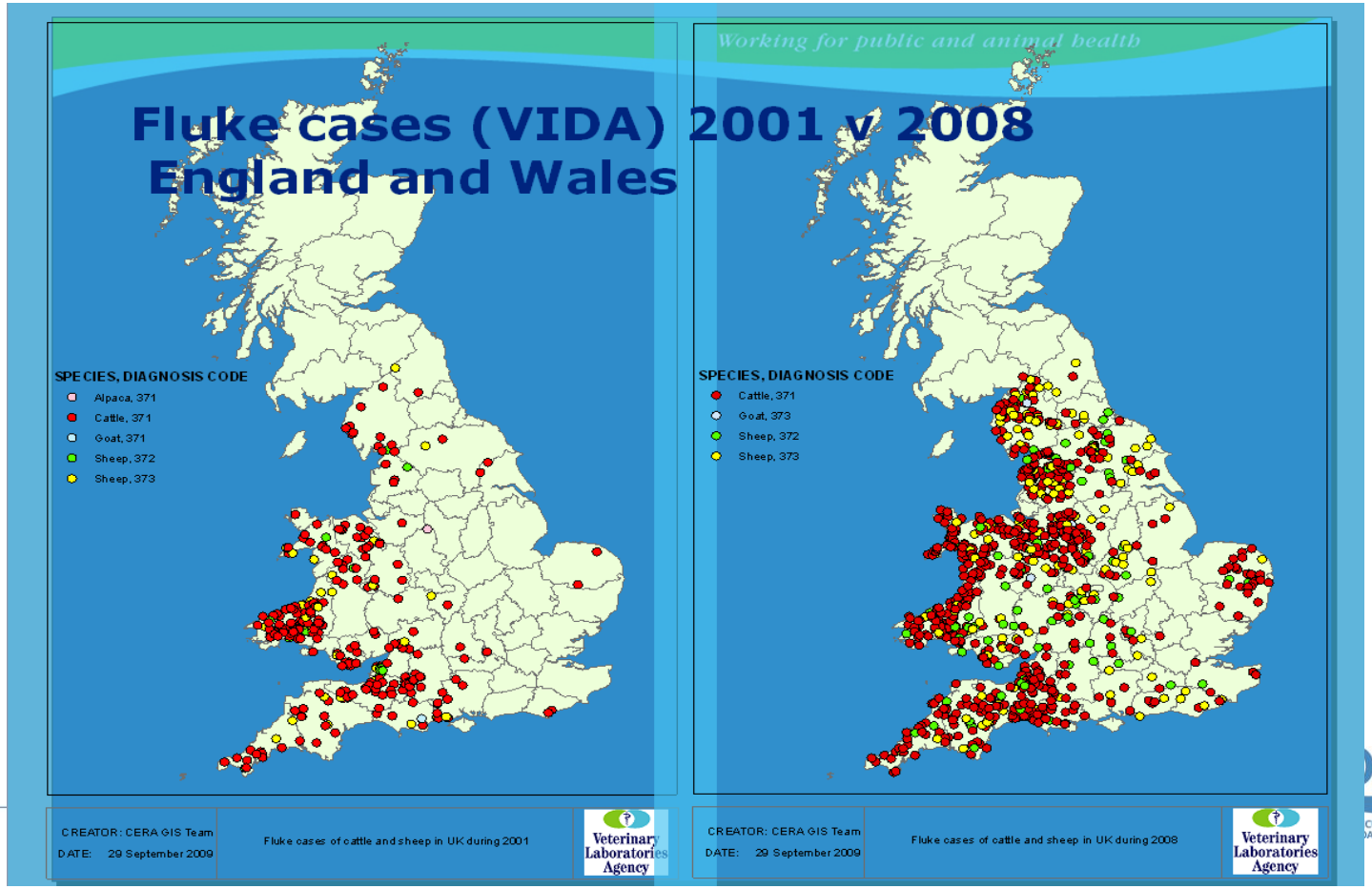
- **Liver condemnations at slaughter:**

  Can be 100s of Kg/day - UK liver condemnation rates ~10% in sheep & 25% in cattle (EBLEX, 2013)

Liver fluke prevalence

Acute fluke (sheep)

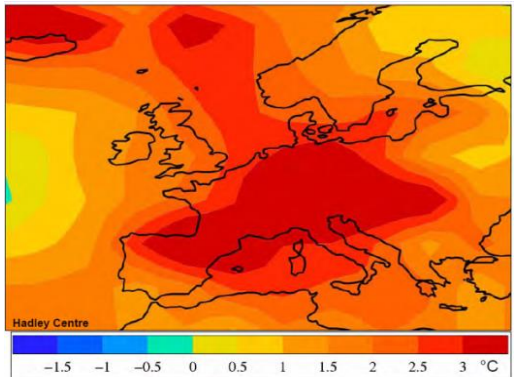




Animal & Plant Health Agency

What's changed?

- **Climate change** – warmer, wetter summers and milder winters, longer grazing = parasite seasons, more extreme events e.g. flooding
- **Drug resistance** – specifically to triclabendazole (TCBZ), drug of choice for acute fluke
- **Animal movements** – to/from farms & markets, out-wintering etc., especially without effective quarantine treatment on arrival
- **Agri-environment schemes** – wetland restoration e.g. wader scrapes for wetland birds; protected habitat for natterjack toads etc. – require to be grazed!

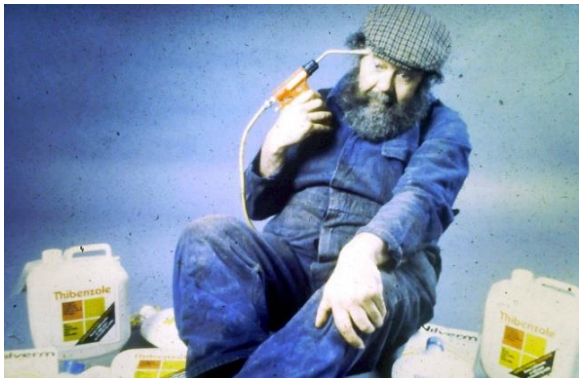


Liver fluke forecast

- Liver fluke risk essentially "predictable", and is based on "Ollerenshaw index" (1950s):

$$Mt = n\left(\frac{R}{25.4} - \frac{P}{25.4} + 5\right)$$

Mt = Fasciolosis risk value,
n = Number of rain days per month,
R = Rainfall (mm/month)
P = Potential evapotranspiration (mm/month).

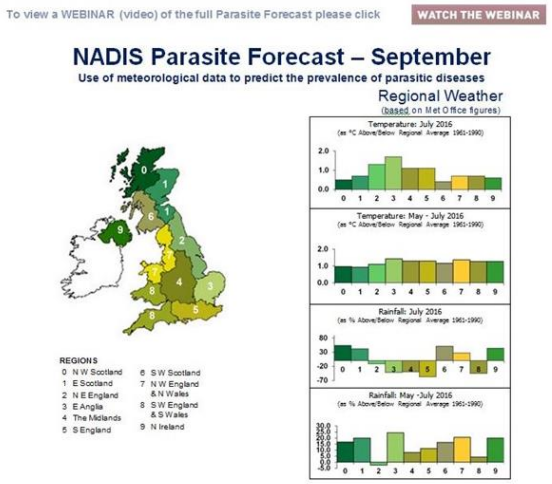


Dr C.B. Ollerenshaw, CVL Weybridge (retired)

- Still forms basis of mainland UK NADIS parasite forecast (http://www.nadis.org.uk)

- Based on regional weather patterns this year, liver fluke risk for 2016:

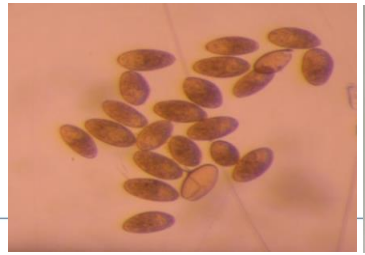
*'For Scotland, northwest England and north Wales, a **high risk** is predicted '*



Liver fluke diagnostic options

- **Invasive tests**
  - post mortem/meat inspection
  - blood sample for liver enzymes
  - blood sample for anti-fluke antibodies
- **Non-invasive tests**
  - clinical signs
  - bulk tank milk ELISA
  - **faecal egg count (FEC)**
  - **coproantigen test (cELISA)**




Liver fluke control 4-point plan

Sheep Veterinary Society

BRITISH CATTLE VETERINARY ASSOCIATION

Control Of Worms

Spring

1. **Pasture protection** - don't let the snails get infected!

Summer

2. **Reduce snail population** - drainage, topping rushes, improving poached areas etc.

Autumn

3. **Avoid high cyst challenge** - graze animals away from known/suspected high risk areas

Winter

4. **Strategic treatment of 'at risk' animals** - treat right animals at right time with appropriate product

Liver fluke control – flukicides

But, remember...

1. Drugs that kill “worms” tend **NOT** to kill fluke!...

2. Most flukicides **DON’T** kill all stages of fluke!

Summary of different flukicidal products licensed for use in cattle

Active ingredient	Administration route	Stage of fluke killed
Triclabendazole	Oral	2 weeks onwards
	Pour-on	6-8 weeks onwards
Closantel	S/c injection or pour-on	7 weeks onwards
Nitroxynil	S/c injection	8 weeks onwards
Clorsulon	S/c injection	Adults only
Oxyclozanide	Oral	Adults only
Albendazole	Oral	Adults only

Liver fluke control - know your way around...

- Liver fluke parasite
- Liver fluke life cycle
- Clinical signs of liver fluke
- Diagnosis of liver fluke
- The control and management of liver fluke

The RIGHT approach – follow the 5 R's

- ✓ The **RIGHT** product for the type of worm
- ✓ The **RIGHT** animal
- ✓ The **RIGHT** time
- ✓ The **RIGHT** dose rate
- ✓ Administered in the **RIGHT** way

COWS also has input from farmers and independent consultants

The COWS guide to liver fluke

Do you know your way around liver fluke?

COWS
Control Of Worms Sustainably
Promoting sustainable control of cattle parasites

@COWSworms
www.cattleparasites.org.uk

For more information contact us at
info@cattleparasites.org.uk @COWSworms

Getting to know your way around liver fluke

Fluke infection is estimated to cost the UK agricultural industry up to £300 million a year. With little evidence that cattle can develop immunity to fluke infection, now is the time to find out all you need to know about how to effectively control this parasite.

Getting to know the liver fluke parasite

In the UK, the most significant liver fluke is *Fasciola hepatica* for which cattle and sheep are the main hosts.

Mature *Fasciola hepatica* feed in the bile ducts and secrete enzymes that can break down blood and tissues. Sheep can suffer from acute disease caused by juvenile fluke migrating through the liver, while cattle more often only suffer from chronic disease caused by the mature flukes living in the bile ducts.

Getting to know the liver fluke life cycle

The life cycle of liver fluke involves an intermediate host, a mud snail: *Galba truncatula*, and two free-living stages of the fluke.

Liver fluke infection is seasonal, with a peak of infective cysts typically seen on pasture in late summer and early autumn, leading to the risk of disease in cattle over the winter. This seasonal pattern is due to the free-living stages of liver fluke, and the host snails only being active at environmental temperatures greater than 10°C. But, it should be noted that infective cysts can be present on pasture all year round due to their ability to survive for up to a year or more when conditions are right.

The Cycle

1. Adult fluke lay eggs in the host that are passed out in the dung of infected cattle.
2. At suitable temperatures, above 10°C, fluke eggs will develop and hatch releasing miracidia, the larval stages that look like microscopic tadpoles, which swim to their preferred host, the mud snail.
3. Each miracidium burrows into the snails' body cavity where it undergoes two developmental stages that lead to the production of infective cercariae. Under appropriate conditions, a single miracidium can produce hundreds of cercariae.
4. Cercariae emerge from the snail when temperature and moisture levels are suitable, and migrate to grass and vegetation around snail habitats forming cysts known as metacercariae.
5. Metacercariae can remain viable on pasture for several months. When eaten by grazing animals, the cysts are swallowed and hatch, eventually burrowing through the gut and into the liver.

The complete cycle can take 10 to 20 weeks, but patent infection, when adult fluke start to lay eggs, commonly occurs at 10 to 12 weeks after metacercariae are ingested. Although more commonly observed in sheep, clinical signs can be seen before eggs can be detected in dung.

Getting to know the signs of liver fluke

The severity of the disease is related to the number of fluke parasites that are ingested at grazing and which successfully colonise the liver. Cattle infected with a lower number of fluke parasites may not show clinical signs, but performance may still be reduced.

Sub clinical signs:

- For dairy cattle, may include reduced milk yield and quality
- In beef and dairy young stock, may result in a reduction in feed conversion efficiency, poor growth and reduced carcase value.

Clinical signs:

- Beef and dairy cattle may experience weight loss, loss of condition and anaemia caused by liver damage and blood feeding activity of adult fluke once in the bile ducts.

Whether subclinical or clinical fluke infection is seen, both will have a significant impact on productivity, and increase an animal's susceptibility to other infections.

***Summary of different flukicidal active ingredients licensed for use in cattle**

Active ingredient	Administration route	Stage of fluke killed
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	Pour-on	6-8 weeks onwards
Closantel	s/c injection or pour-on	7 weeks onwards
Nitroxynil	s/c injection	8 weeks onwards
Clorsulon	s/c injection	Adults only
Oxyclozanide	Oral	Adults only
Albendazole	Oral	Adults only

*Note: This information was correct as when this document went to press and current data sheets must always be checked before treatment. More information is available at www.noah.co.uk

Getting to know how to diagnose liver fluke

Diagnosis can be performed at herd level to check for exposure, or at an individual level if there is concern about clinical signs in a particular animal.

Methods of diagnosis include:

1. Feedback from abattoir reports – these will identify if liver fluke are present in livers, even when clinical signs are not seen.
2. Faecal egg counts – these will confirm the presence of adult liver fluke, but false negatives (i.e. no eggs detected in the presence of infection) can result from the presence of a predominantly juvenile population of fluke, intermittent egg-shedding by adult worms or low sensitivity of the methodology.
3. Antibody detection (ELISA) tests – bulk milk tank samples and individual blood samples can be sent for analysis, which helps identify if cattle have been exposed to liver fluke over the past months.

Getting to know how to control and manage liver fluke

Liver fluke control plans should take into account herd fluke history, past treatment, the presence of high risk areas for snail habitats, and time of year.

An effective control plan will include the use of flukicides to prevent disease and reduce pasture contamination, as well as grazing strategies to avoid heavily contaminated pasture.

Young stock and adult cattle should be treated after housing, and animals kept outside may require additional treatments depending on risk.

Farmers should discuss product choice with their vet, suitably qualified person (SQP), farm adviser or veterinary pharmacist as part of their herd health plan.

Flukicides have no persistent activity and allowing recently treated cattle onto infected pasture re-exposes them to the risk of infection. Turning cattle onto 'low risk' pastures or fencing off wet and boggy areas within a field can help reduce the risk of infection. There is also the risk that freshly cut grass could be a potential source of infection if harvested from fluke contaminated pasture.

When treating cattle with anthelmintics, always ensure the COWS SP's guidelines are followed. Withdrawal periods should be taken note of, and re-treatment time frames should be complied with. Be aware that certain products cannot be used in animals destined to produce milk for human consumption.

Quarantine of incoming cattle is important to help prevent the introduction of liver fluke onto fluke free farms that have potential snail habitats and, to prevent the introduction of triclabendazole resistant liver fluke populations onto farms with no evidence of resistance.

When developing a parasite control plan, make sure you speak to your vet, SQP, farm adviser or veterinary pharmacist.

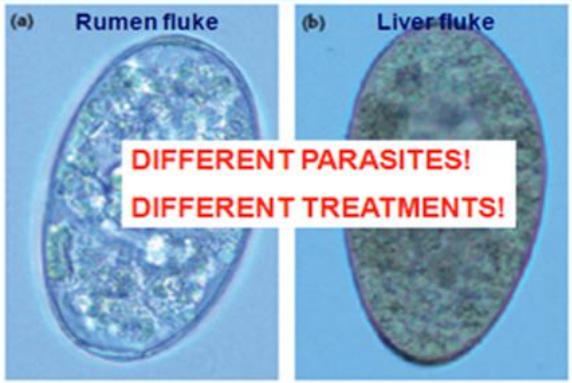
Take home messages…

- ✓ Fluke is a year-round issue…
- ✓ Make best use of all available information – farm history, farm location, abattoir returns, diagnostic samples, on-farm risk factors, climatic conditions = informed decision-making!
- ✓ Consider management options and, if you need to treat, use **right** drug at **right** time on **right** animals at **right** dose
- ✓ Work with your vet and AH advisor to devise sustainable fluke control strategies tailored to your individual farm

WP1: Aims

1. Development and validation of herd-level diagnostic tests to identify cattle farms with fluke infection

2. To discriminate between liver fluke and rumen fluke (paramphistome) infection

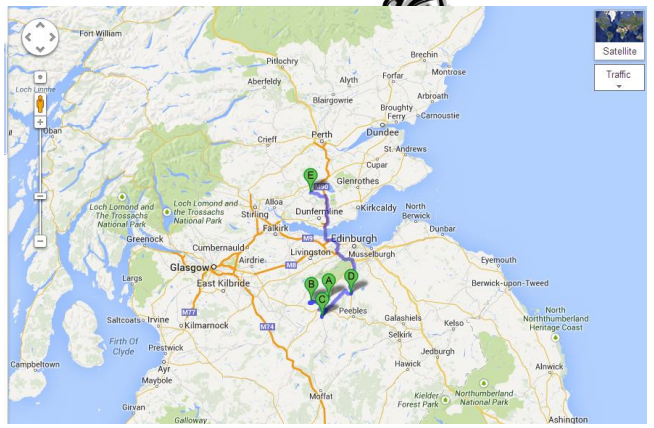


WP1 Update

- Selection of 5 study farms (in discussion with CEH) - based on proximity, logistics, type of operation, fluke history etc.

- 3 rounds of sampling completed over grazing season 2014, >600 faecal samples analysed

- Weather exceptionally dry and warm 2014-2015, not ideal for fluke or snails!



BBSRC bioscience for the future

WP1 Update

- Taking faecal samples from ~40 animals/visit to compare…

✓‘Grab’ vs ‘floor’

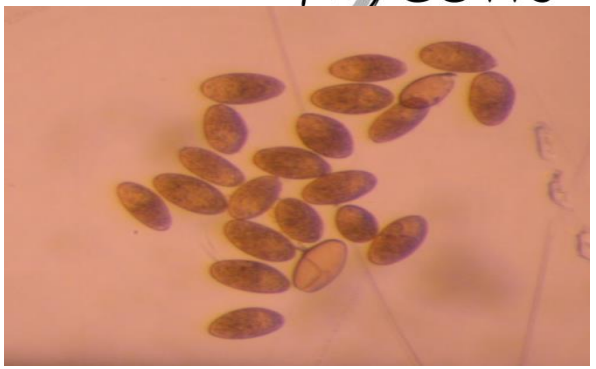
✓ FEC vs cELISA

✓ 10g vs 40g sample

✓ cELISA +/- Australian modifications

- overnight soak to improve SN
- reducing kit cut-off by 1/3

✓ Inclusion of genuine fluke-free controls – practical?



Overall agreement FEC v cELISA

Kappa 0.22

		cELISA		
		+	-	Total
FEC	+	36	**143**	179
	-	13	412	425
	Total	49	555	604

cELISA consistently less sensitive than FEC in cattle, as in sheep (worked better in deer!)

Pooled faecal sample testing

Comp.	cELISA	EPG
1	1.329873	0.2
2	7.946805	0.4
3	4.768083	0.3
4	10.41194	0.45
5	1.978592	0.2
6	1.589361	0.2
7	7.233214	0.2
8	1.492053	0.1
9	1.364764	0.1
10	7.071960	0.2

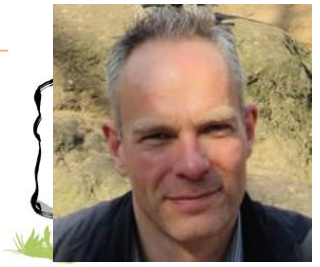
- Composites made using 40 samples from a herd
- 10 g from individual samples selected at random to make up a composite of 100g, 10g tested
- **Composites: cELISA less sensitive than FEC**

3 +ves in 10 reliably detected; 1 +ve in 10 not reliably detected by FEC, none by cELISA

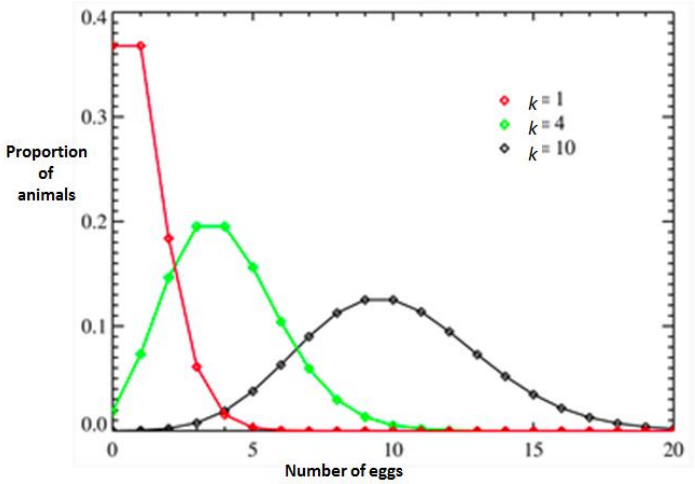
Herd-level testing?

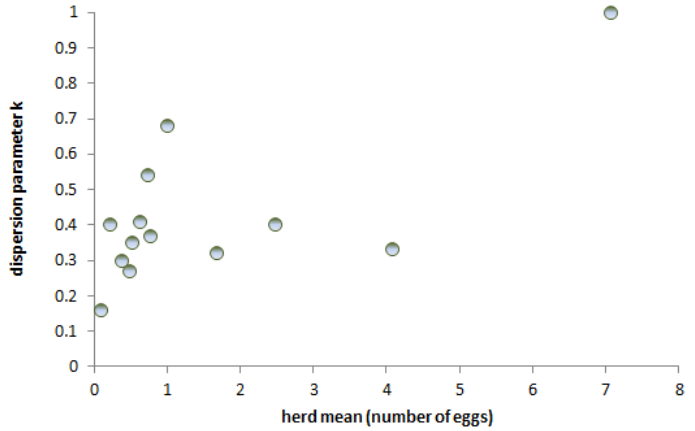
UNIVERSITY OF LIVERPOOL

Jan van Dijk



- Still need cheap, quick test that can be easily carried out in (veterinary) practice – based on composite FEC, not cELISA*
- Detailed mathematical modelling approach used to explore number of samples required, impact of re-sampling same animals etc.
- Pooled FEC, based on 10 x 10g samples, still method of choice for herd-level testing





BBSRC bioscience for the future

*BioX launched 'new & improved' cELISA, March 2016 – need to re-evaluate?

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(Proposed) Test for Adult Cow

- Sample only cattle not wormed within the last 13 weeks
- Collect 10 individual randomly-picked fresh >10g samples
- To increase likelihood of testing positive when fluke is present, test at housing, during winter/spring
- If test is *negative,* herd needs to be re-sampled at least once
- Two consecutive negative tests would give 95% confidence that fluke is truly absent
- Caveat: don't know how FEC relates to fluke damage or economic impact!

BBSRC bioscience for the future

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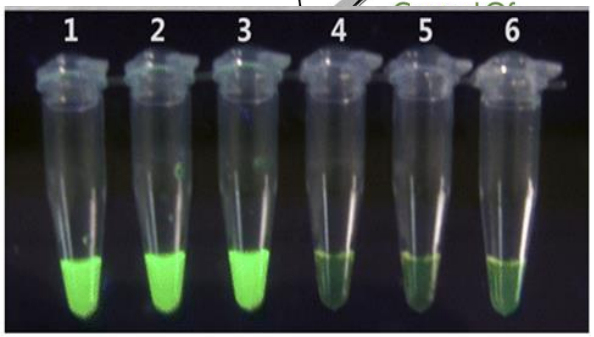
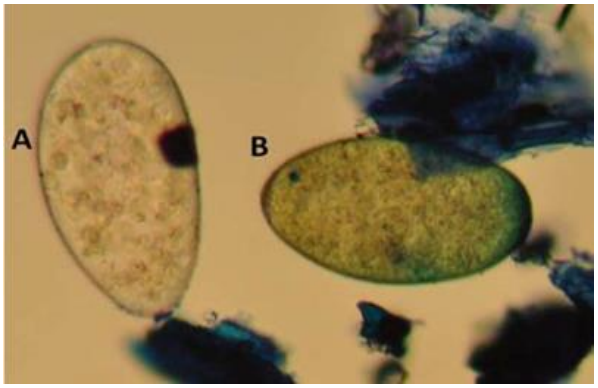
DNA-based testing?

1. Evaluating LAMP – rapid visual readout with potential advantages over PCR
2. Have developed liver fluke and rumen fluke LAMP assays
3. LAMP for liver fluke
   – specific in faeces, specific in snails
   – sensitivity similar to FEC
4. LAMP for rumen fluke
   – specific in faeces, non-specific in snails
   – sensitivity higher than FEC?

More work to do on faeces, but useful for screening environmental samples

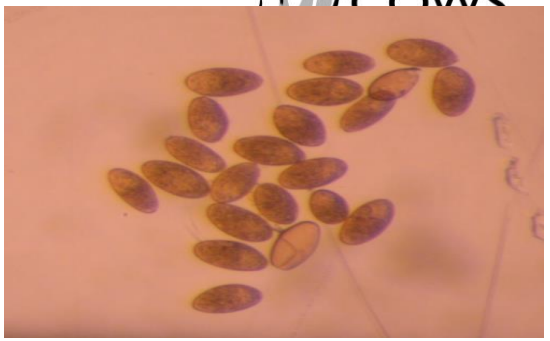




BBSRC bioscience for the future

Summary

- cELISA more rapid & convenient test for processing multiple samples **BUT…**
- cELISA consistently less sensitive than FEC
  - even with modified cut-offs
  - individual and composite samples
- Pooled FEC, based on 10 x 10g samples, still method of choice for herd-level testing
- Have produced DNA-based methods to discriminate between liver fluke and rumen fluke in faecal and environmental samples



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Thanks to Moredun team, BBSRC-IPA collaborators & funders!

QMS QUALITY MEAT SCOTLAND

HYBU CIG CYMRU MEAT PROMOTION WALES

EBLEX

DairyCo

BBSRC bioscience for the future

AgriSearch NI Farmer Funded Research

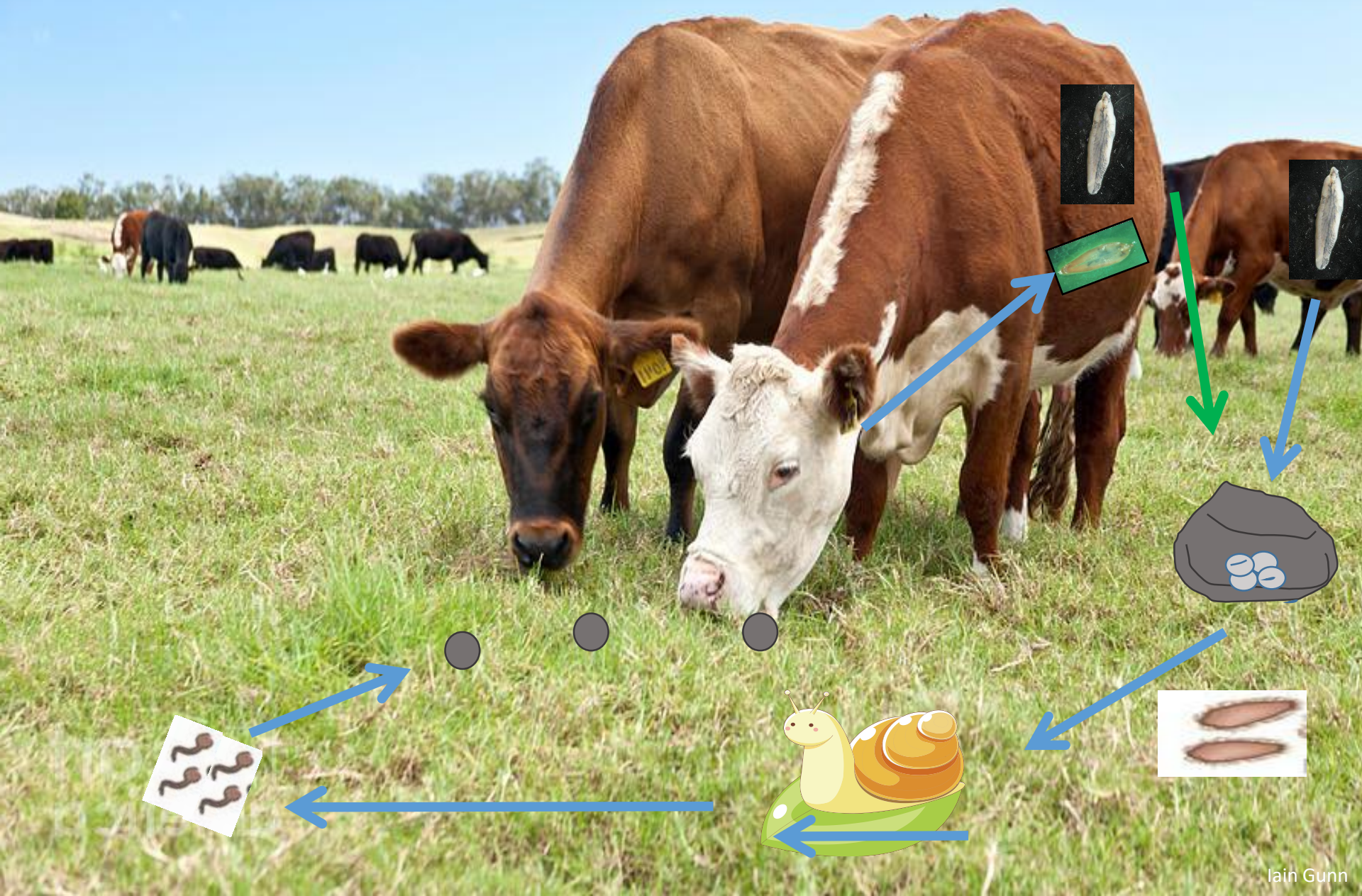
Translating research into practice

How much is liver fluke costing you?

Sue C. Tongue

Alyson Barratt, Jude I. Eze, Carla Correia-Gomes, Madeleine K. Henry, Cath E. Milne, Alistair W. Stott and others

Liver fluke has an adverse impact on health, welfare and productivity



Iain Gunn


CHANGED
PRIORITIES
AHEAD


WIN
LOSE
WIN
LOSE


P. Skuce


?
H. Auty

There is some evidence that liver fluke affects some production parameters

COWS Control Of Worms Sustainably

welcome to qboxanalysis

- Scottish abattoir data
- Average adjusted carcase weight reduced by 0.63kg (0.33 – 0.93kg) - Sanchez-Vazquez & Lewis, 2013
- Average adjusted carcase weight reduced by similar amounts – analysis of updated data set

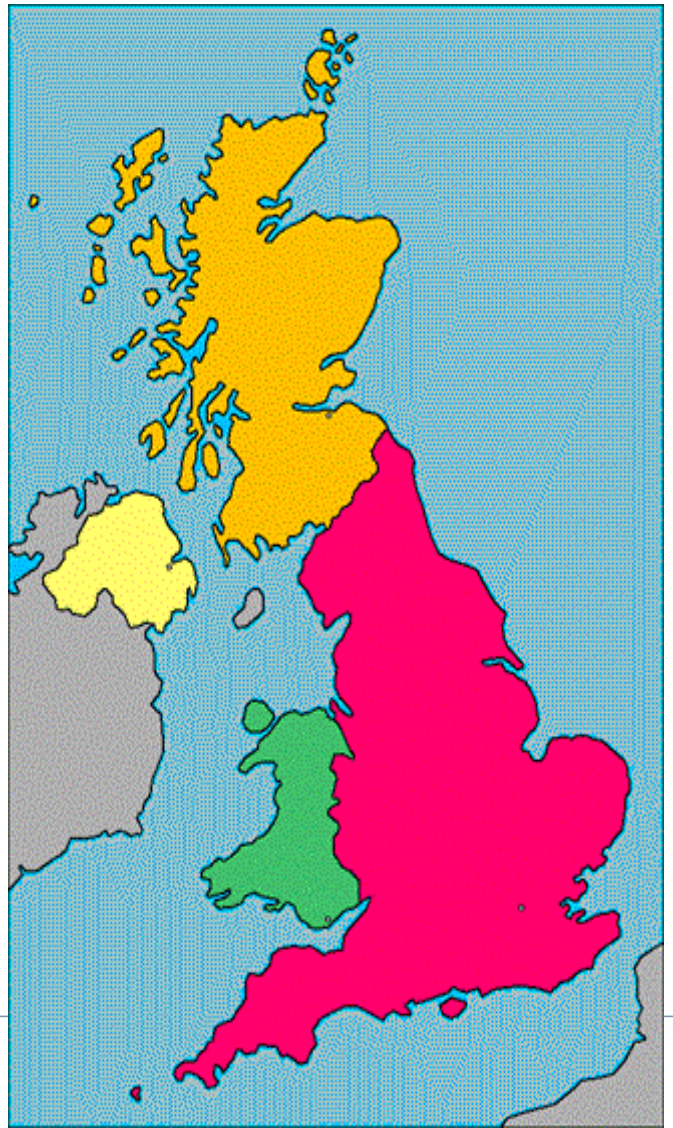
- Dairy data (University of Liverpool & Tesco)
- Reduced milk yield – Howell *et al.*, 2015
- Possibly other factors

Improving the Control of Liver Fluke Infection in Cattle in the U.K.

The United Kingdom of Great Britain and Northern Ireland.

COWS Control Of Worms Sustainably

Four countries



Dec 2015

9.75 M cattle

1.75 M – Dairy breeding herd

1.60 M – Beef breeding herd

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The British cattle industry is extremely varied.

Sustainably

The British cattle industry is extremely varied.

This leads to a number of challenges….

Control Of Worms

Aim: relative costs of control measures?
Who benefits? Who pays?

Translating the diversity of practice into a research question and an appropriate framework

A suite of herd-level bio-economic models

- The dairy cow

- The beef suckler cow

- The growing animal

- Stochastic
  - @Risk
- Partial budget models

Fluke

v.

No fluke

Inputs

SRUC

Outputs

COWS Control Of Worms Sustainably

Parameters:

- Physical
  - e.g. herd size, production system etc
- Performance
  - e.g. calving interval, milk yield, daily live weight gain (DLWG) etc
- Fluke prevalence
- Economic
  - e.g. fluke related losses, milk price, value of cull cows, heifer and fattening animal etc

Average loss per infected animal in the herd (£/year)

ALPIAH

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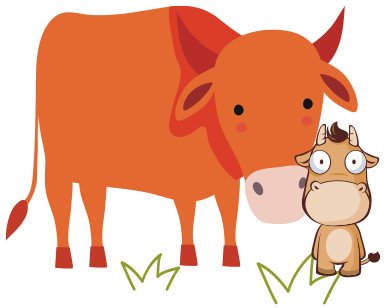
OUTPUTS

Comparative Losses

The average (median) loss per infected animal (£/year) in a dairy herd **varies** depending on the average milk yield per herd (l/cow/year).

5500-7000	7001 - 8500	8501 - 9000

The average loss per infected animal (£/year) is **lower** for autumn/winter calving suckler herds than for spring/summer calving herds.



Comparative average losses – dairy cow and beef suckler cow model options

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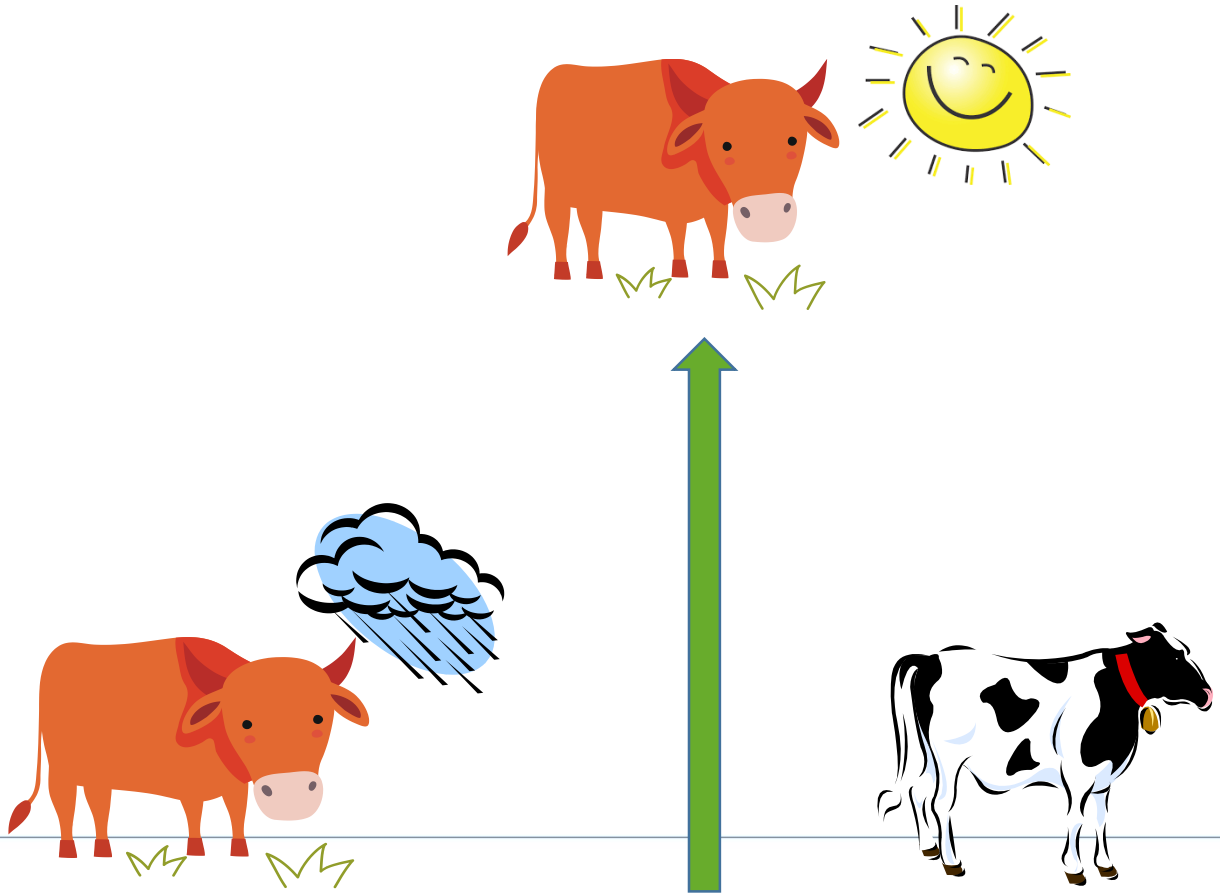
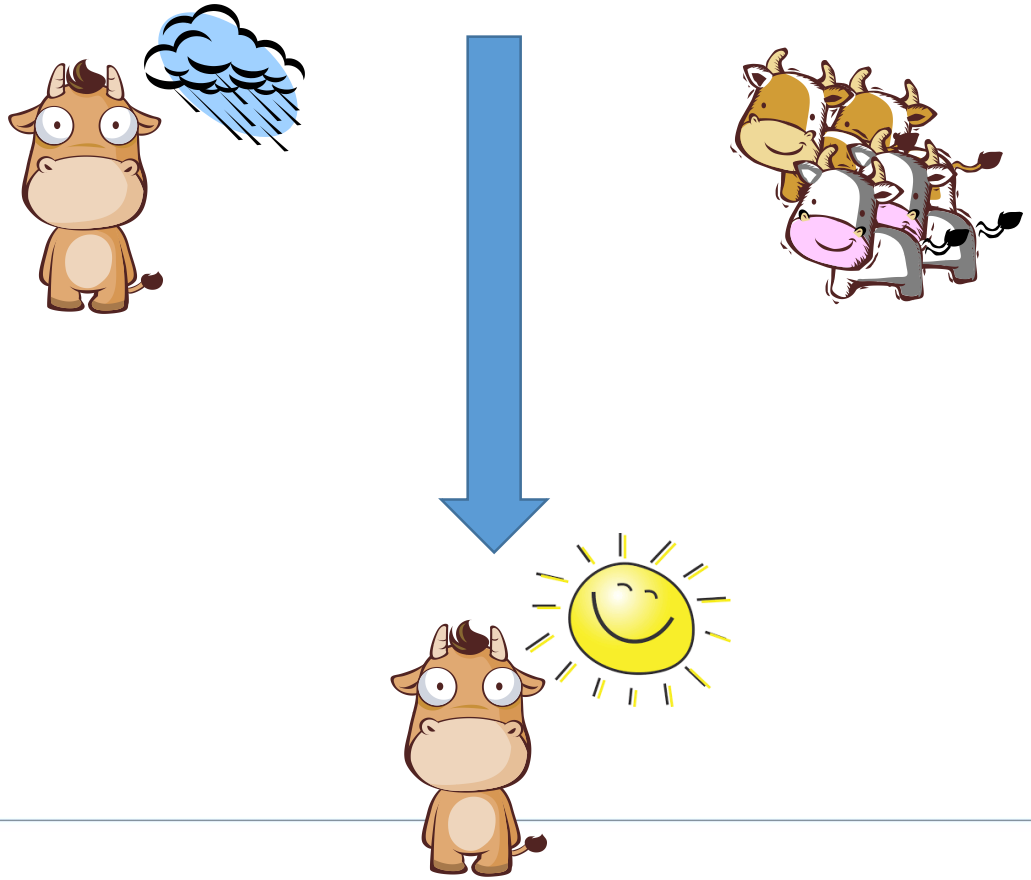
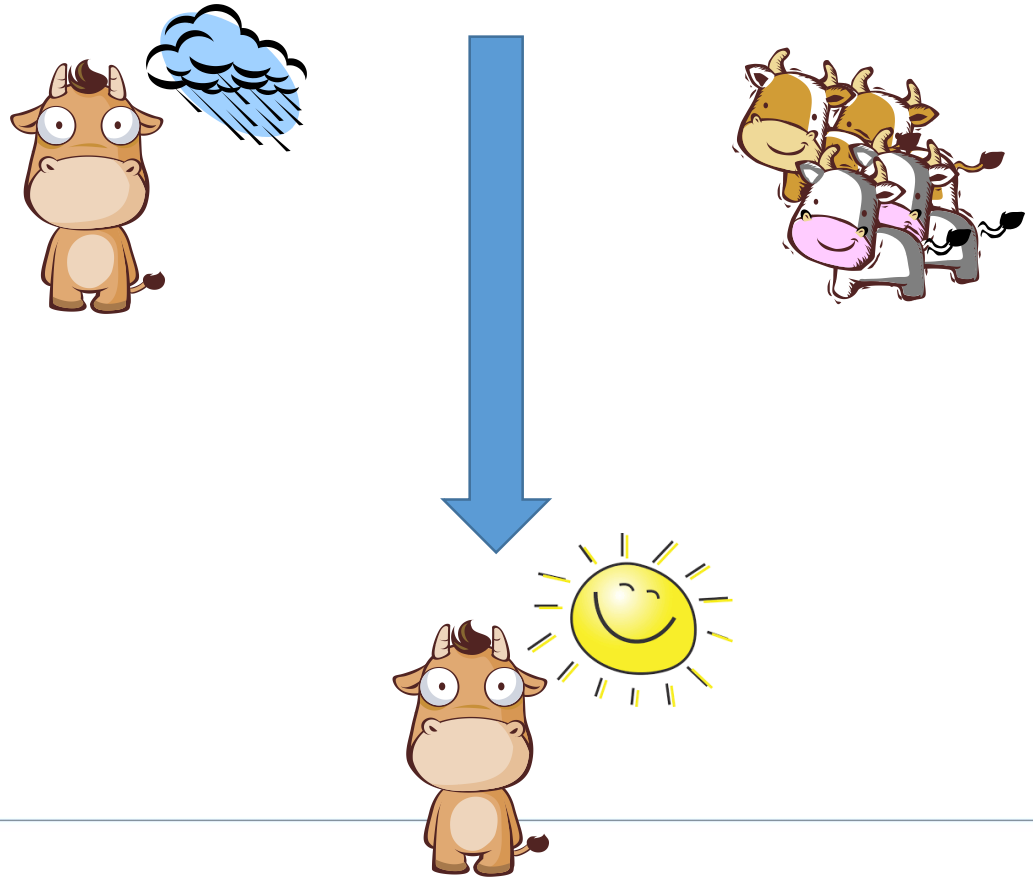
The average loss per infected animal (£/year) is **higher** for spring/summer born beef replacement heifers than others.



The average loss per infected animal (£/year) is **lower** for spring/summer born beef finishers than others (18 month system).



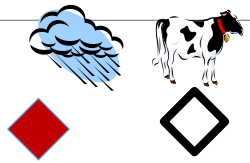
The average loss per infected animal (£/year) is **lower** for spring/summer born beef finishers than others (24 month system).



Comparative average losses – growing animal model options

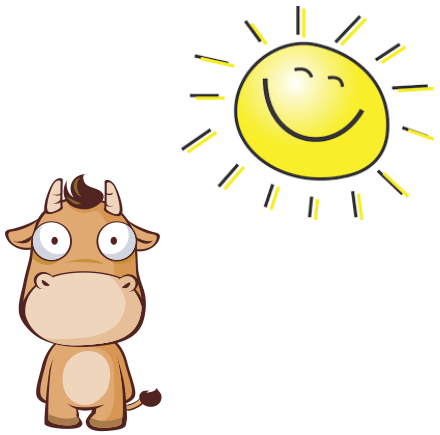
0

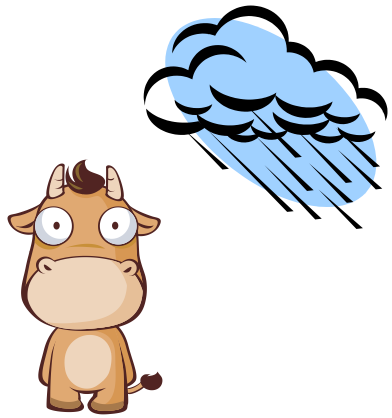
ALPIAH

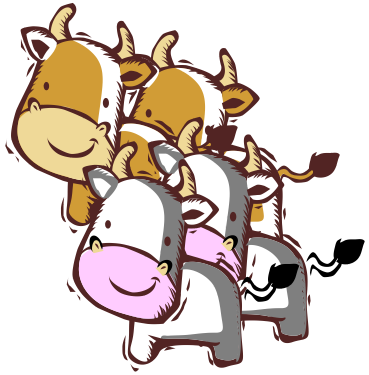


Sensitivity analysis

Beef finishing systems (all)



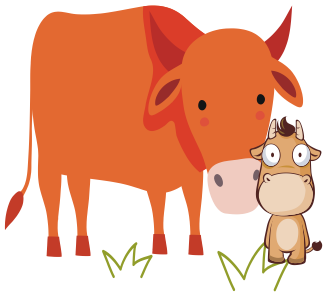




Herd fluke prevalence within finishing system

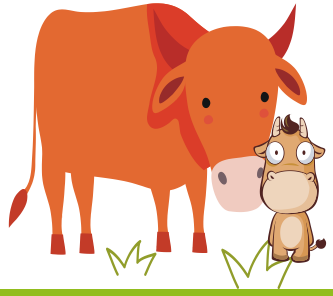
Herd fluke prevalence at entry to finishing system

Expected daily lwg (no fluke)



Spring/Summer calving suckler herd

Fluke prevalence in cows
Fluke prevalence in calves
Reduced calf growth due to own infection



Autumn/Winter calving suckler herd

Reduced calf growth due to reduced milk
Additional costs for fluke affected cows
Expected daily lwg calf (no fluke)

Dairy herd

Reduced milk yield

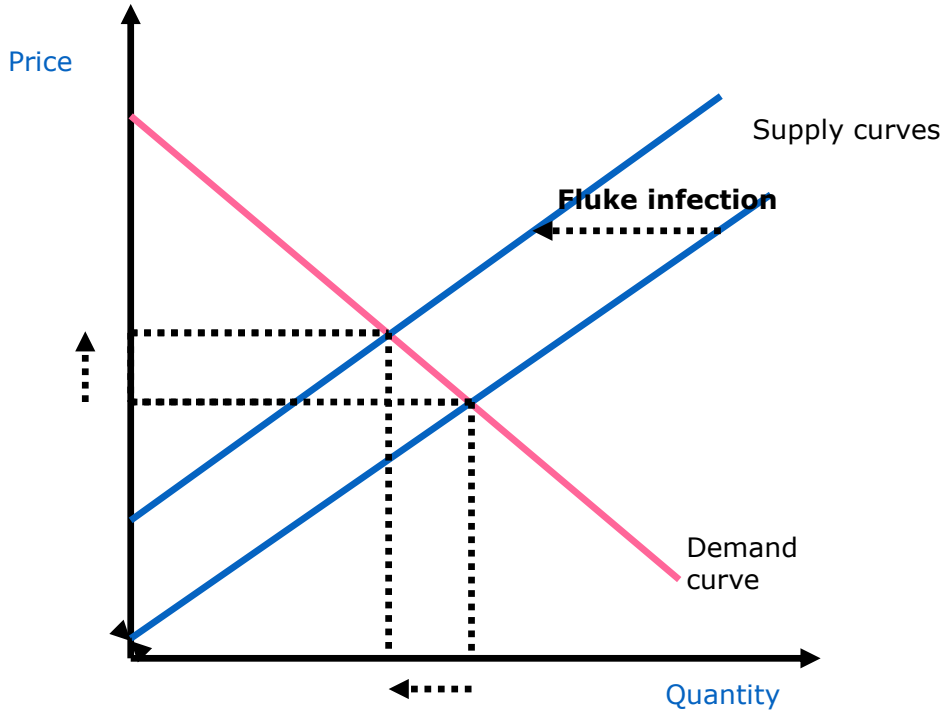
Affected cows - additional costs

Average milk price per litre


Aim: relative costs of control measures?
Who benefits? Who pays?
National Economic Welfare Models
Herd-level & PBM

National economic welfare methodology

- Initial equilibrium market price and quantity
- Introduction of liver fluke
  - Fall in supply
- No shift in demand



Lichtenberg et al., (1988); Andersson et al., (1997); Ebel et al., (1992), Forsythe & Corso (1994); Weldegebriel at al., (2009).

The national models

- The dairy cow

- The growing animal (x2)

Animal level prevalence in national dairy herd of approximately

10% 20% 30%

£ per household per year

COWS
Control Of Worms Sustainably

Animal level prevalence in national dairy herd of approximately

10% 20% 30%

-50% BASELINE +50%

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£ per household per year

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Animal level prevalence in national dairy herd of approximately

10% 20% 30%

-50% BASELINE +50%

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Not infested - NI

Infested - I

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£ per cow per year

COWS
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WIN!

Animal level prevalence in national dairy herd of approximately

10% 20% 30%

-50% BASELINE +60%

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£ per cow per year

COWS
Control Of Worms Sustainably

WIN!

Animal level prevalence in national dairy herd of approximately

10% 20% 30%

-50% BASELINE +60%

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£ per cow per year

COWS Control Of Worms Sustainably

Animal level prevalence in national dairy herd of approximately

10%	20%	30%
+13%	BASELINE	-15%

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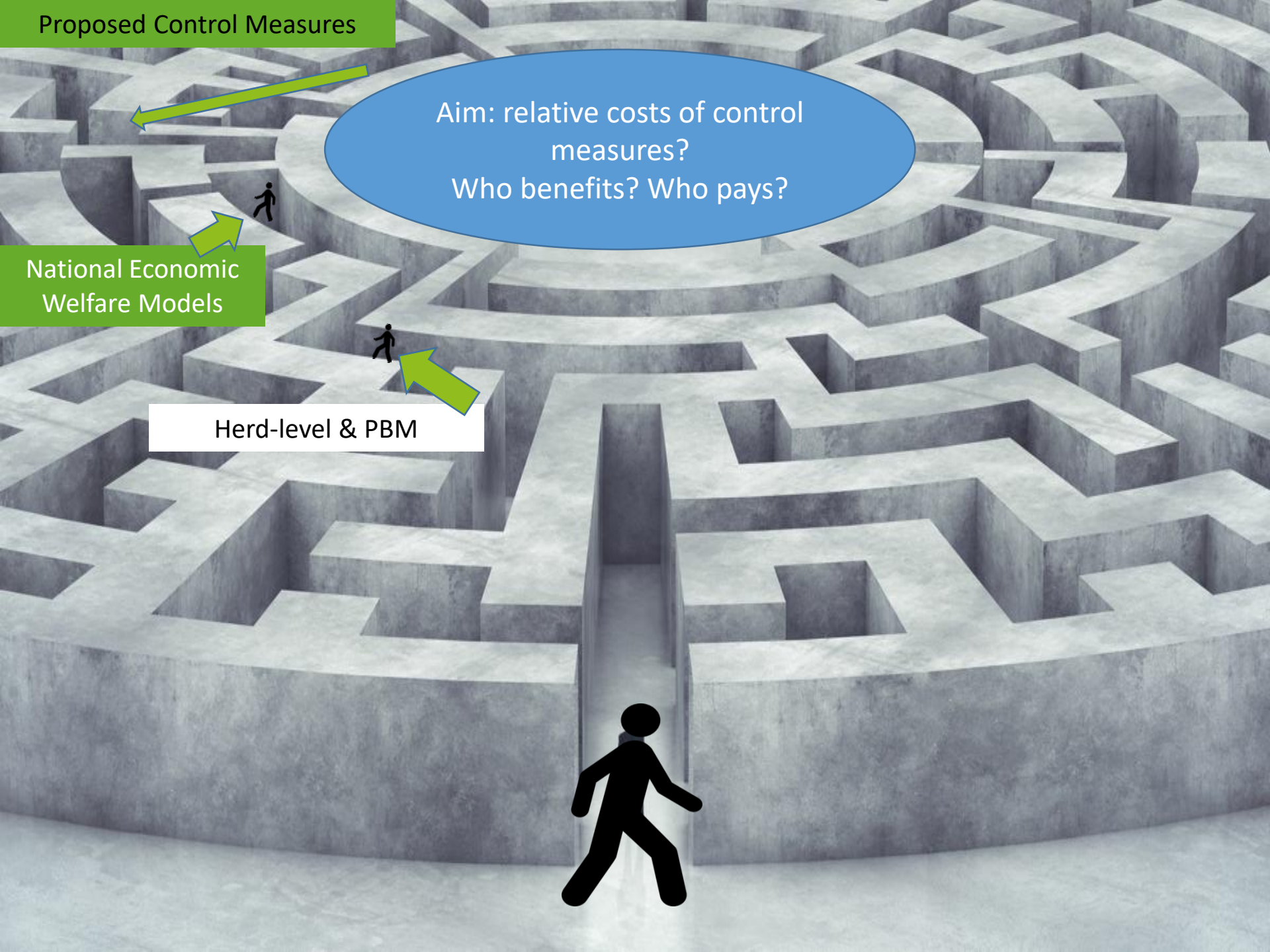
£ per cow per year

Animal level prevalence in national dairy herd of approximately

10%	20%	30%
+13%	BASELINE	-15%

The national models

- The growing animal (x2)


Proposed Control Measures
Aim: relative costs of control measures?
Who benefits? Who pays?
National Economic Welfare Models
Herd-level & PBM

COWS
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Not infested - NI

Infested - I

?

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Translating research into practice

COWS Control Of Worms Sustainably

How much is liver fluke costing you?

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Comparative average losses – dairy cow and beef suckler cow model options

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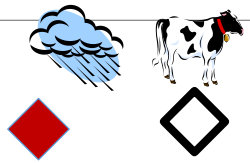
Comparative average losses – growing animal model options

0

ALPIAH



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Known non-infested

Known infested

Unknown

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Improving the Control of Liver Fluke Infection in Cattle in the U.K.

bbsrc
biotechnology and biological sciences research council

Control Of Worms Sustainably

AgriSearch NI
Farmer Funded Research

AHDB
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Any questions?

SRUC

Leading the way in Agriculture and Rural Research, Education and Consulting

Translating research into practice

All about “the snail”

Nicola Beesley

University of Liverpool

Why is “the snail” important?

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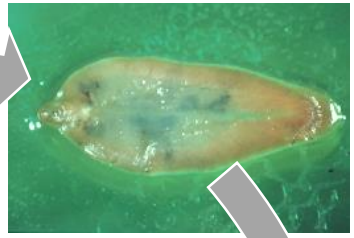
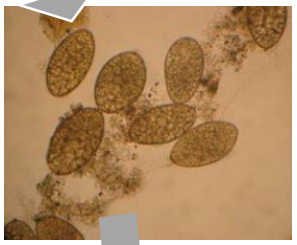


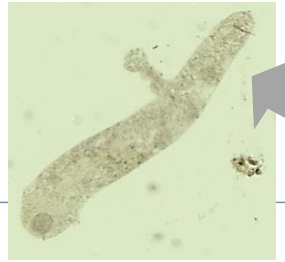
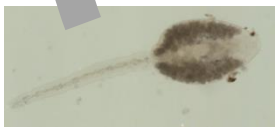
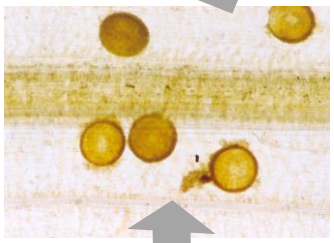

ESSENTIAL FOR PARASITE DEVELOPMENT

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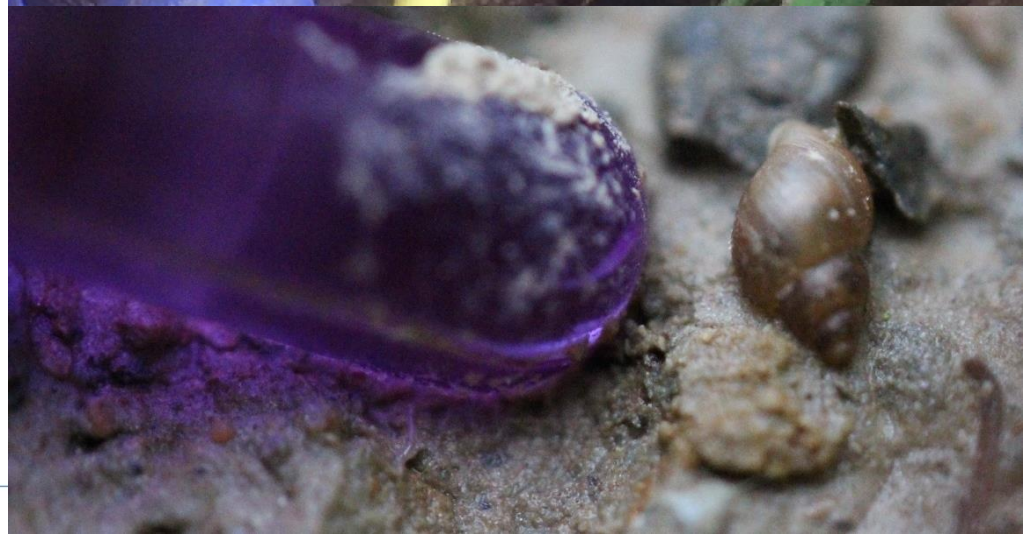
LIVERPOOL

Who is “the snail”?

- *Galba truncatula*
- Warm and wet conditions
- Resistant to drought and frost
- Hermaphrodites
- They are tiny!



Where is “the snail”?

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LIVERPOOL

When does “the snail” get infected?

- Summer infection
  - Snails infected between May and June
  - Metacercariae produced from August to October

- Winter infection
  - Snails infected in late autumn
  - Metacercariae produced the following year

HIGH RISK PERIOD = AUTUMN

How does “the snail” influence the liver fluke life cycle?

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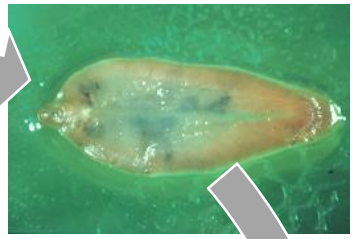
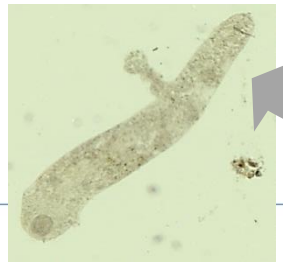
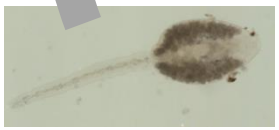
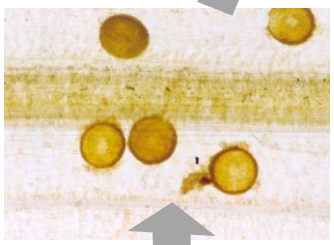


HIGH GENETIC DIVERSITY







SNAILS SHED MANY CERCARIAE OVER TIME

CLONAL EXPANSION IN THE SNAIL

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LIVERPOOL

How might “the snail” contribute to liver fluke diversity?

Lots of snails infected with parasites

- Republic of Ireland
  - 13.8 %
- Wales
  - 13.4 %
- Can be as low as 0.5 %

Snails might be infected by more than one miracidia

- Experimental infections
- Snails can become infected with more than one genetically distinct isolate

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INSTITUTE OF INFECTION AND GLOBAL HEALTH LIVERPOOL

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What are **we** doing to understand “the snail” better?

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- Field study on 40 farms in Shropshire
  - Some fluke positive, some fluke negative
  - Identifying and categorising snail habitats
  - Collecting snails to identify infection
  - Identify risk factors and the benefits of changing practice to combat these risk factors

- Where are the infective stages on pasture

What can **you** do to combat "the snail"?

- Fence off "suitable habitats"
- Avoid wet pastures during fluke season (September / October)
- Plough, reseed or crop rotation of heavily grazed areas
- Drain wet areas (dependent on your agri-environmental status)
- Fix leaks promptly to avoid temporary habitats establishing

Acknowledgments

Our work is funded by:

AHDB
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HYBU CIG CYMRU
MEAT PROMOTION WALES

QMS
QUALITY MEAT SCOTLAND

bbsrc
biotechnology and biological sciences research council

AgriSearch NI
Farmer Funded Research

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LIVERPOOL

paravac

COWS
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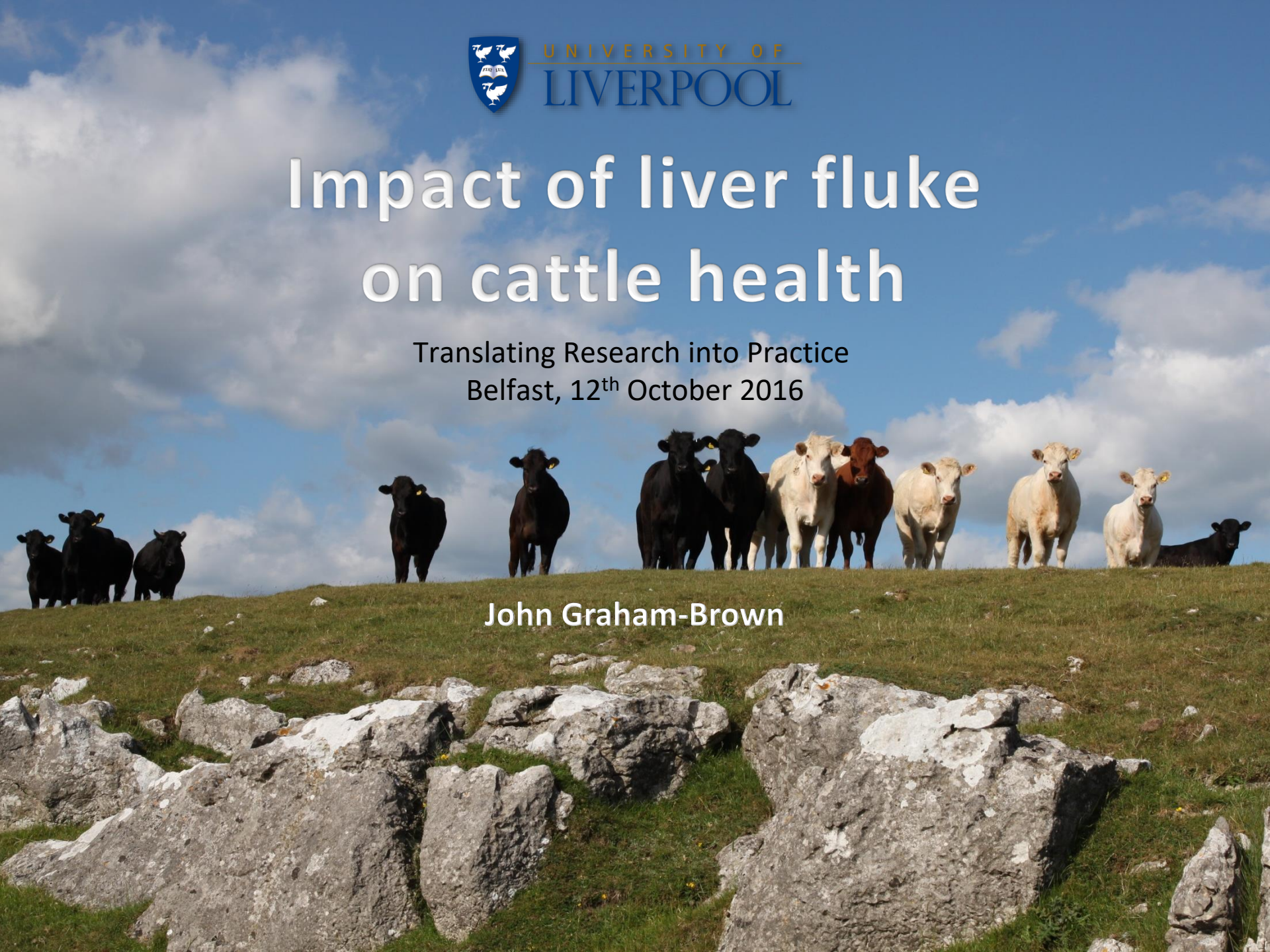
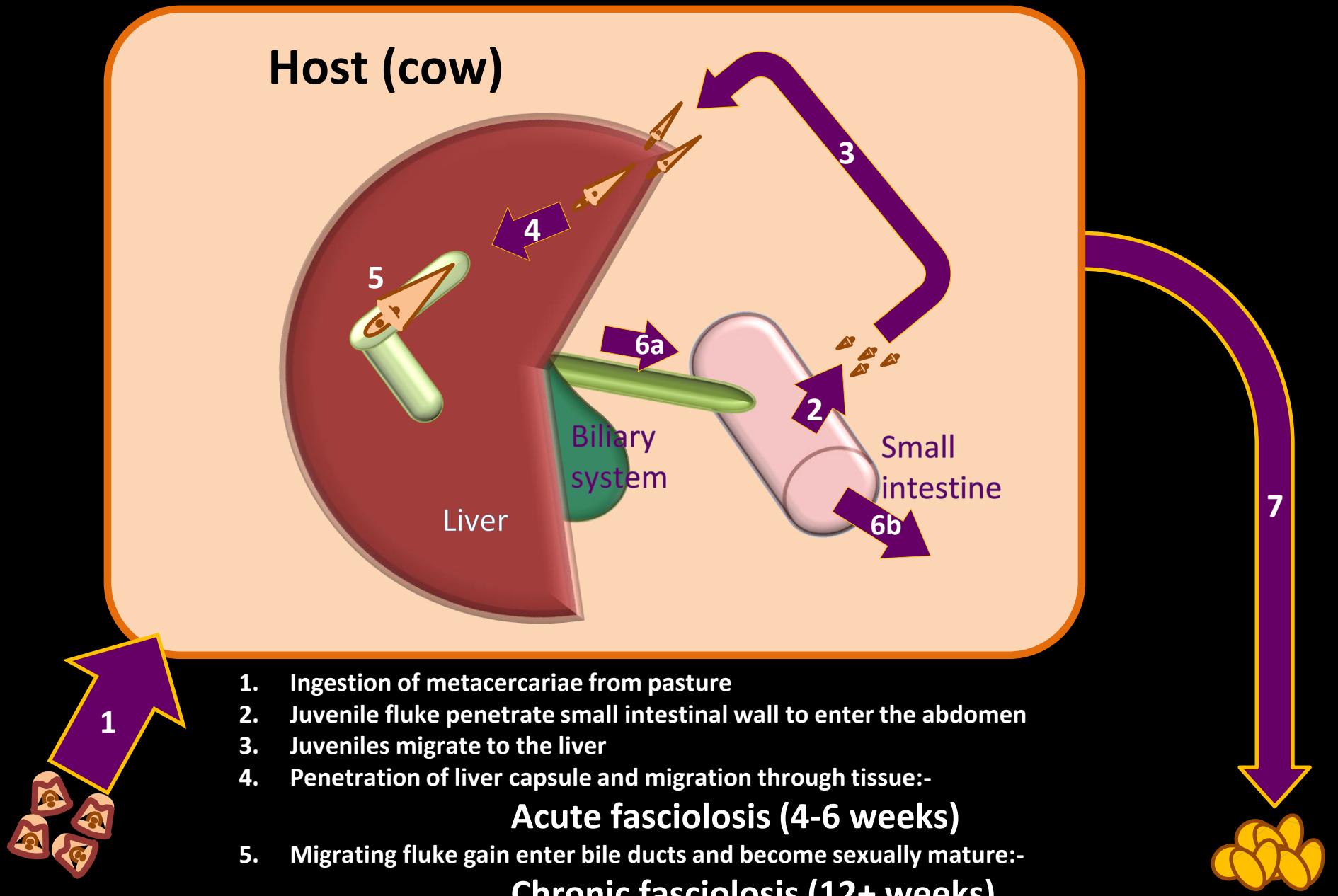

UNIVERSITY OF
LIVERPOOL
Impact of liver fluke on cattle health
Translating Research into Practice
Belfast, 12th October 2016
John Graham-Brown

Introduction

- The parasite
- The disease
  - Stages
  - Numbers
- The effects
  - Direct
  - Indirect
- The solution?
  - Vaccination

The parasite

- Infects several mammalian species
  - Cattle
  - Sheep
  - Humans
- Infection through consumption of contaminated plant material
  - Grass or similar pasture based forage
- Juvenile worms migrate through the intestines and liver
- Adult worms live in the bile ducts of the liver
  - 2.5cm
  - Feed on blood



1. Ingestion of metacercariae from pasture
2. Juvenile fluke penetrate small intestinal wall to enter the abdomen
3. Juveniles migrate to the liver
4. Penetration of liver capsule and migration through tissue:-

Acute fasciolosis (4-6 weeks)

5. Migrating fluke gain enter bile ducts and become sexually mature:-

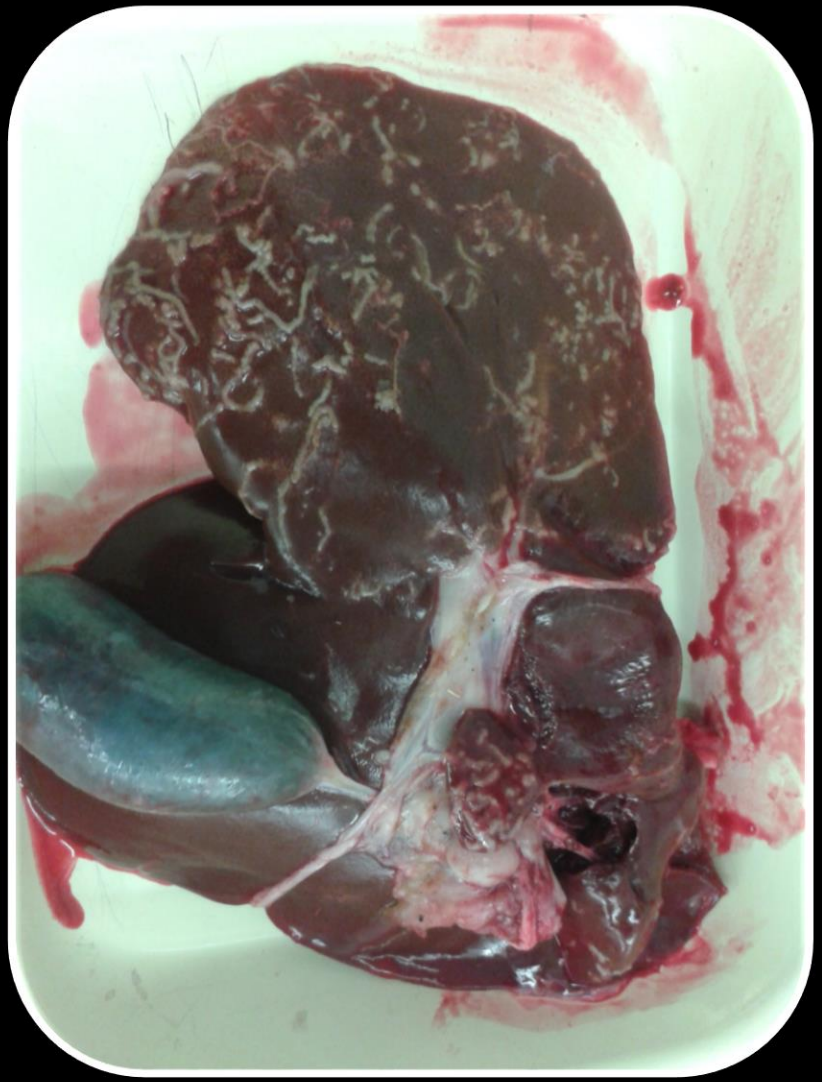
Chronic fasciolosis (12+ weeks)

6. Eggs are produced and passed back to the digestive tract
7. Eggs passed in faeces

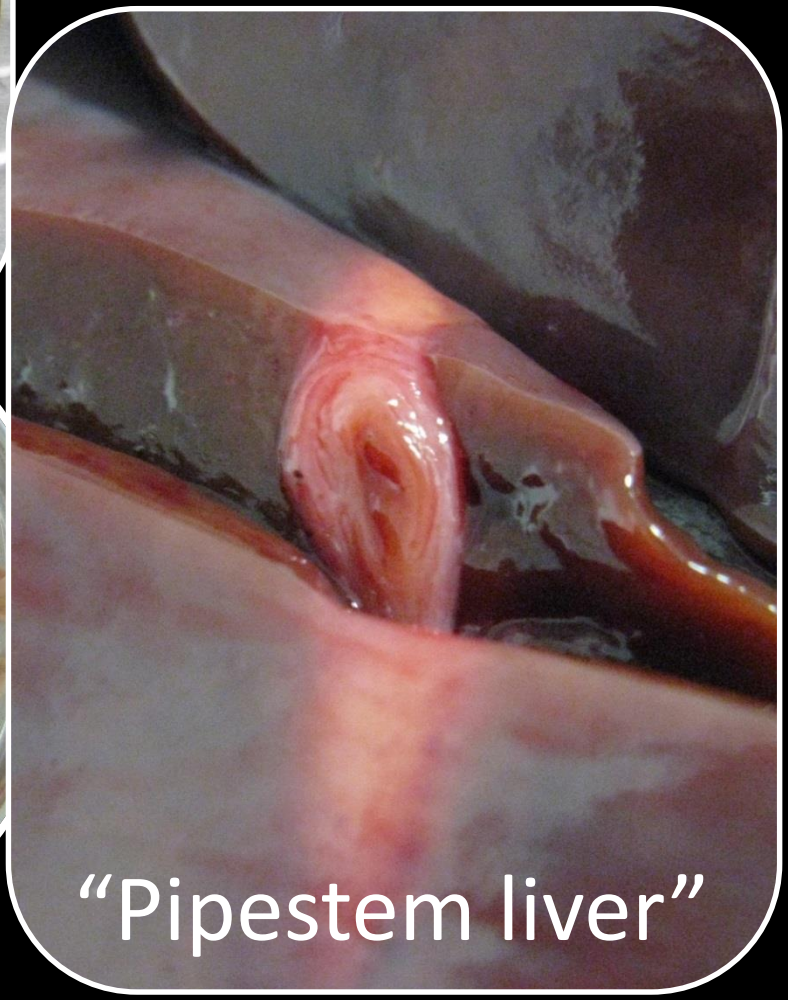
The disease: Stages

- Acute (juvenile) infection
  - 4-6 weeks post infection
  - More common in sheep
  - Juvenile flukes penetrate liver capsule and migrate through parenchyma
    - Cause damage and haemorrhage
  - Diagnosis based on antibody ELISA
- Chronic (adult) infection
  - 12+ weeks post infection
  - Adult fluke reside within bile ducts
    - Feed on blood
  - Diagnosis on ELISA and faecal egg counts

Acute



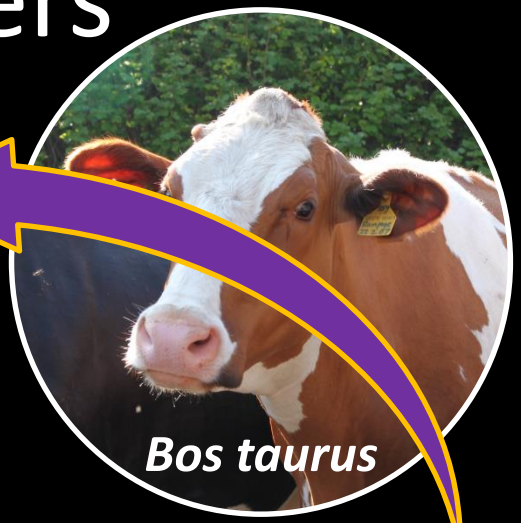
Chronic

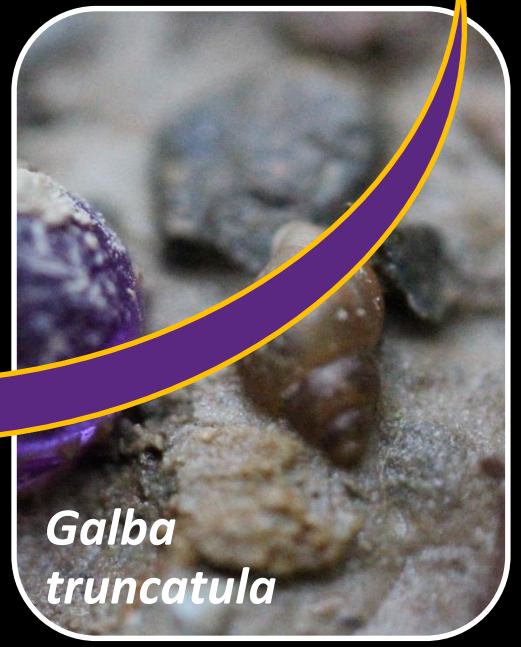


“Pipestem liver”

The disease: Numbers

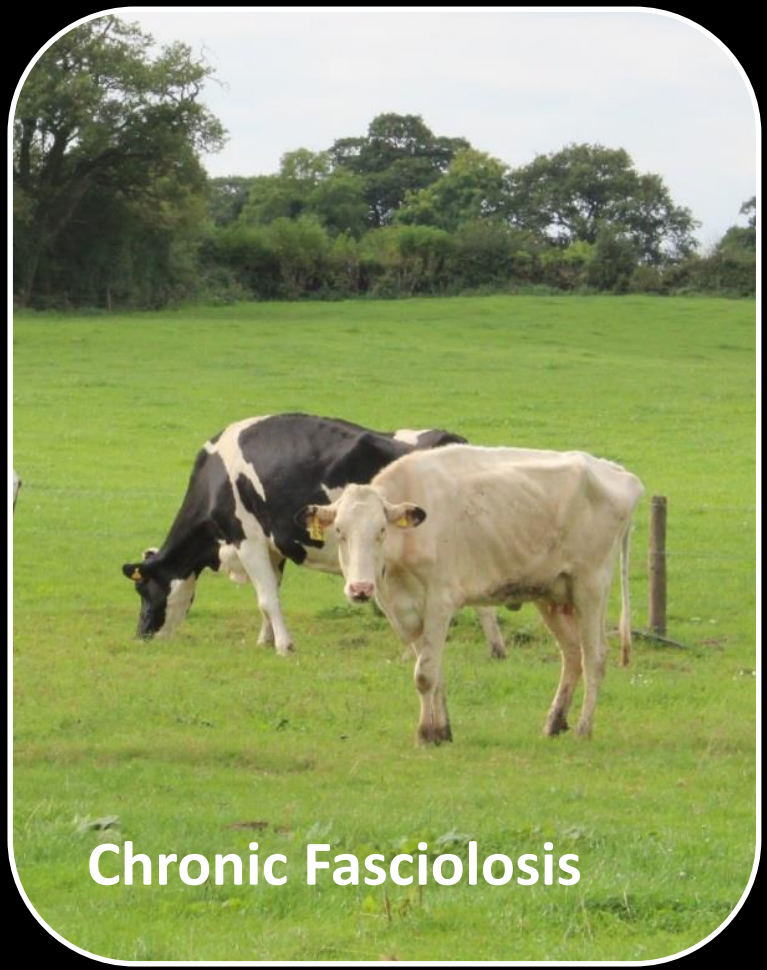
- 1 adult fluke:
  - Drinks ½ ml blood per. day
  - Produce 10,000s eggs per. day
- 1 egg:
  - Infects 1 snail
- 1 infected snail:
  - Produces 1000s of metacercariae
- 1 cow/sheep:
  - Can be infected by 100s - 1000s fluke





The effects: Direct

- In cattle often “sub-clinical”
  - Often undiagnosed/treated
- Liver condemnation
  - ~500,000 in UK (2010)
- Weight-loss/Poor growth
- “Bottle jaw”
  - Blood loss
  - Accumulating infection
- Reduced milk yield
  - Estimated 8-15% overall reduction
  - Reduction in butterfat
- Impaired fertility
  - Delayed bulling in infected heifers
- Untreated can remain infected for years
  - Ongoing losses
  - **No immunity**

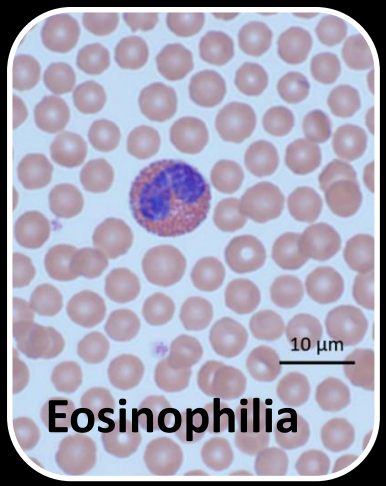


Chronic Fasciolosis

The effects: Indirect (1)

F. hepatica causes “immune-modulation”

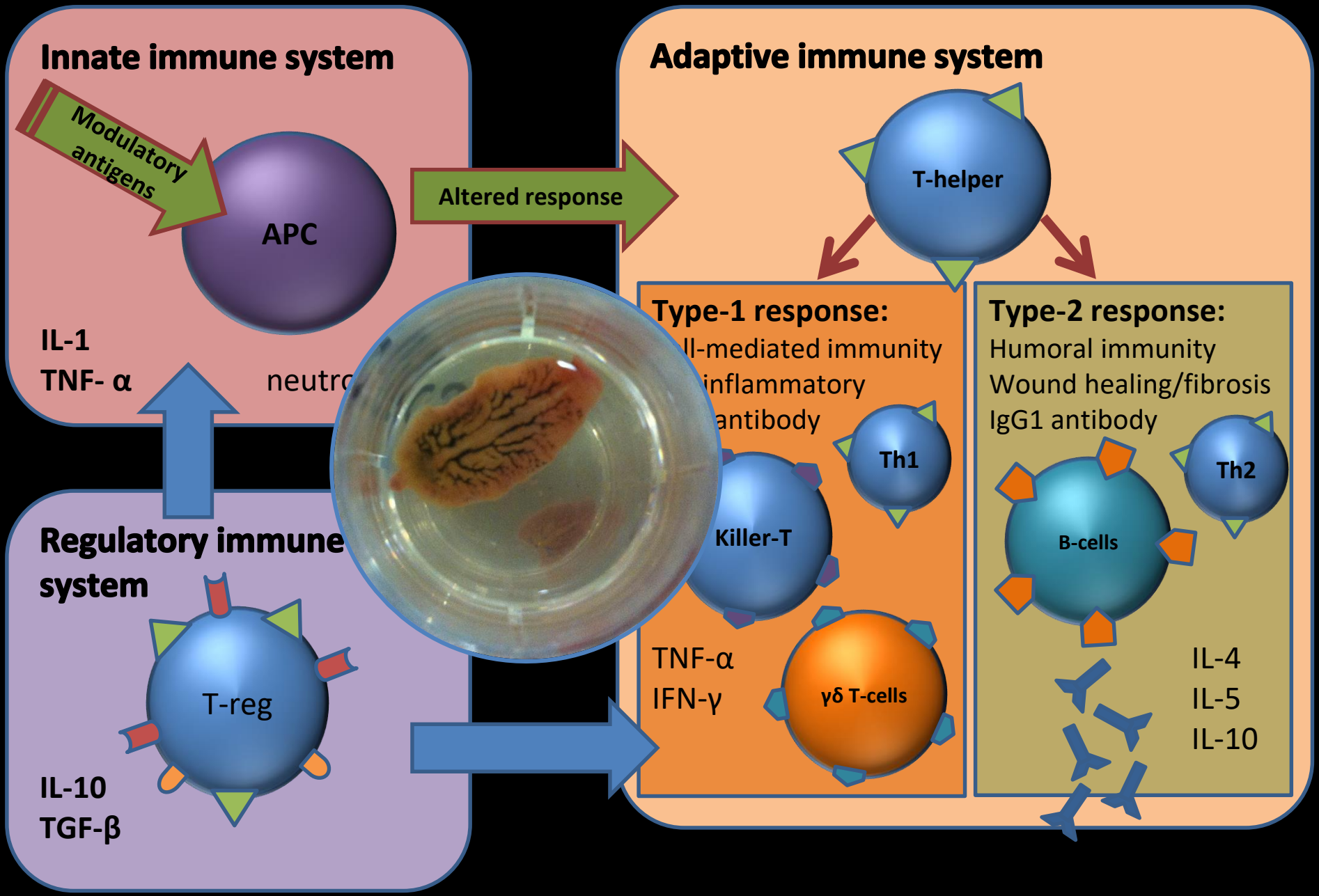
- Extends parasite longevity within host
- Action through production of modulatory antigens
  - “Excretory-Secretory” products (cathepsin-proteases)
  - Tegumental proteins
- Alter the immune response and reduce protective effects
  - Impaired cell mediated responses
  - Increased regulatory responses
  - Non-protective immunity



Eosinophilia

- **Evidence of a generalised immune-modulation**

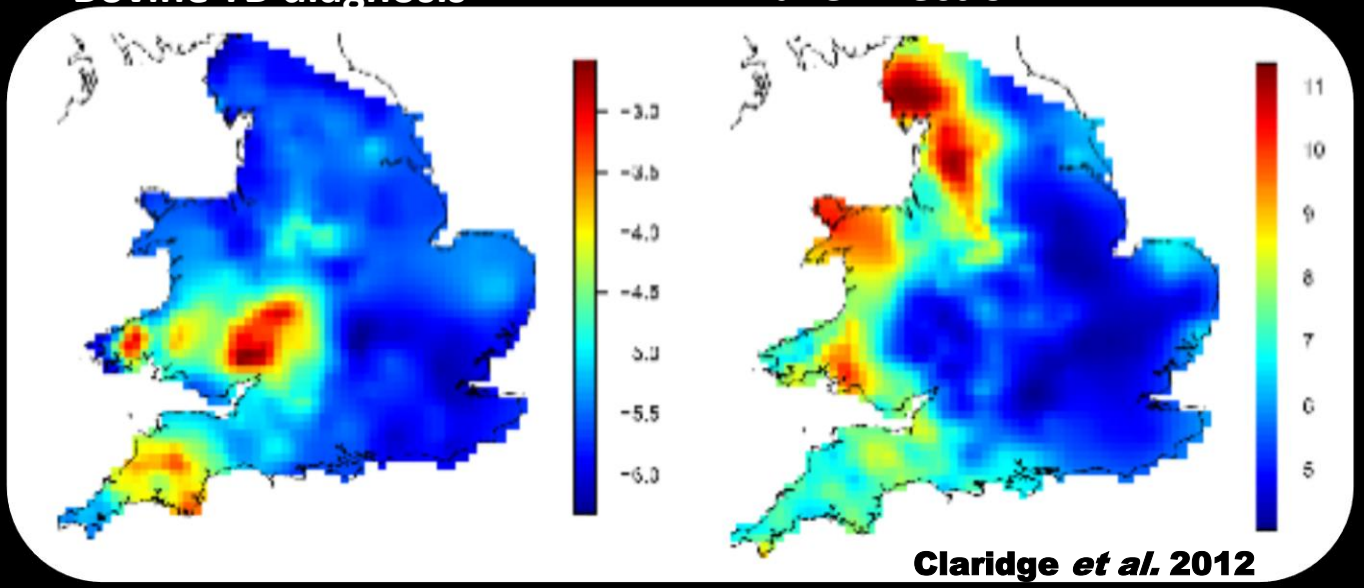
Bovine Immunology



The effects: Indirect (2)

- **Evidence of a generalised immune-modulation**
- Altered immune responses to other diseases
  - *Salmonella dublin*
  - *Mycobacterium bovis*: Infection and diagnosis

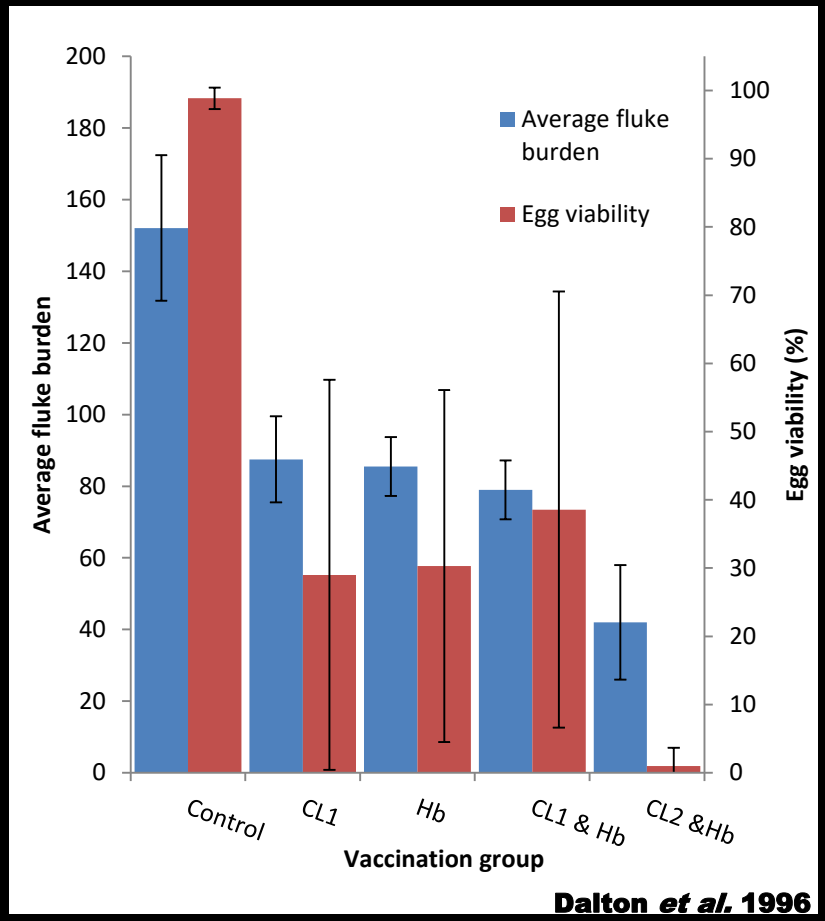
Bovine TB diagnosis **Fluke infection**



Claridge *et al.* 2012

The solution?

- Improved control
  - Less reliance on Fluke drenches: drug resistance
- Better management techniques
  - Increased availability and uptake of diagnostics
  - Pasture management
  - Parasite forecasting
- Vaccination?
  - Trials are ongoing
  - Reduce fluke burden and egg production



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References:

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Websites:

www.cattleparasites.org.uk
www.liv.ac.uk/liver-fluke

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