Sheep genetics research

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Outline

1. **Overview Irish breeding programme**

2. **Genomic Selection**

3. **Future research priorities**

4. **Ireland's long term strategy**

Irish sheep breeding programme

Data Sources

Ped

Commercial

LambPlus

Rams to commercial flocks

Central progeny test (CPT)

4 commercial flocks

Matings to provide linkage

Teagasc BETTER farms

Commercial data

Teagasc
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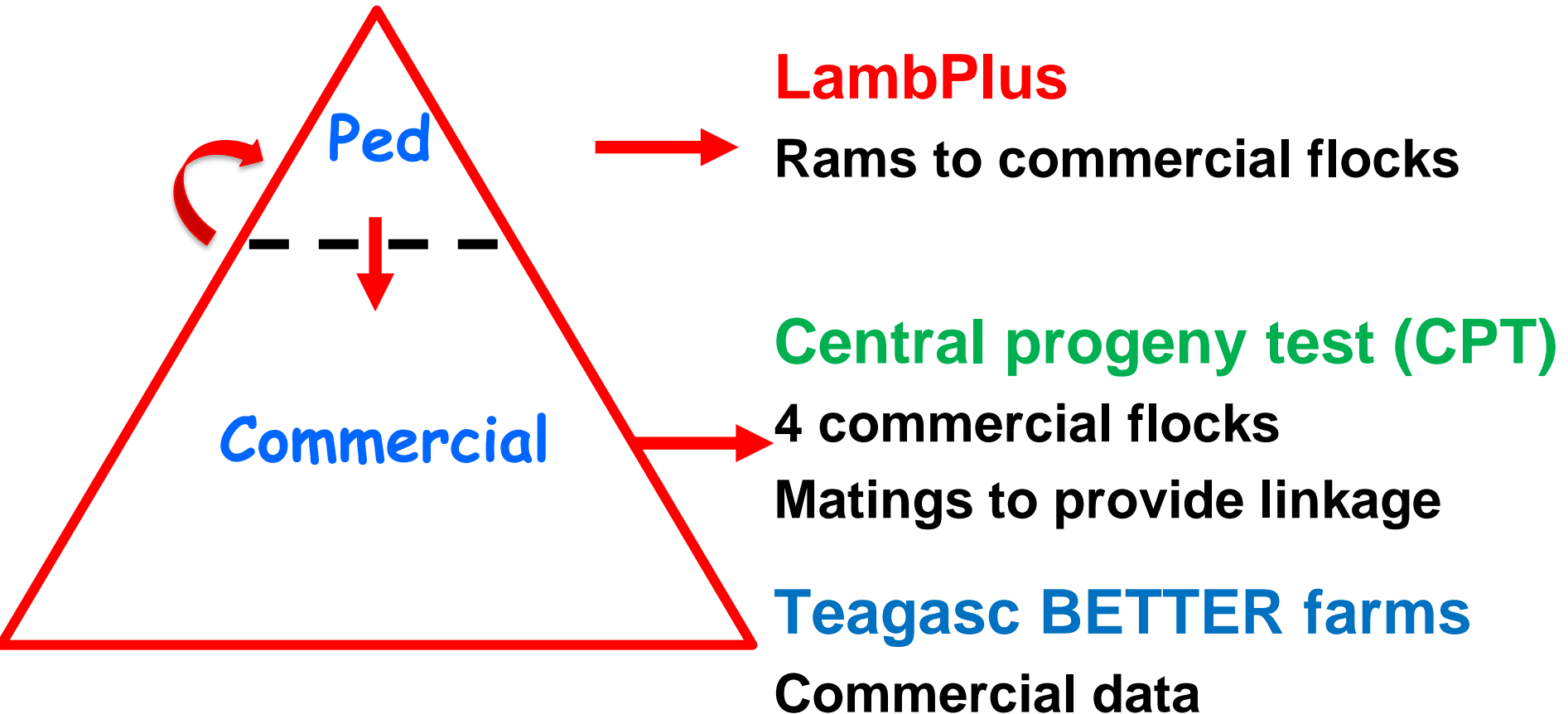
Irish sheep breeding programme

Breeding Objectives

€

Terminal

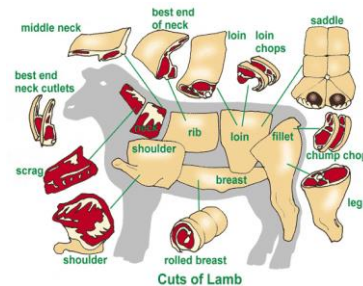**Replacement**

Lambing

Growth

Meat

Health

Difficulty & Survival

Days to slaughter

Carcass fat & conformation

Lameness & dag score

Irish sheep breeding programme

Sheep Ireland
www.sheep.ie

Breeding Objectives
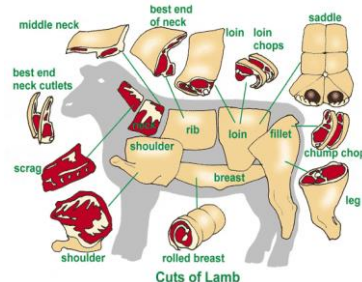
€

Replacement

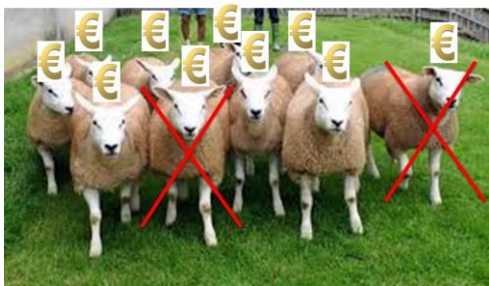| Ewe traits | Lambing | Meat | Health |

Milk Yield
No. lambs born
Ewe weight

Difficulty & Survival

Carcass fat & conformation

Lameness & dag score

Recent Improvements

Parentage Corrections

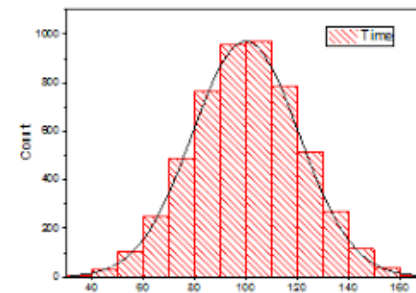**Scrapie Validation**

Carcass Data

Across-Breed Model

ACROSS-BREED GENOMIC EVALUATIONS

Updating Genetic parameters

New Traits

- **Barren Rate**
  - **Lameness**
  - **Dag Scores**

Genomic Selection
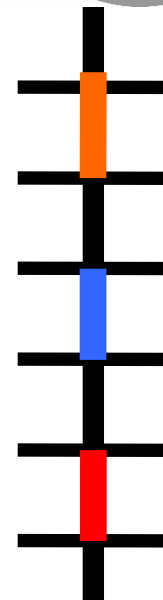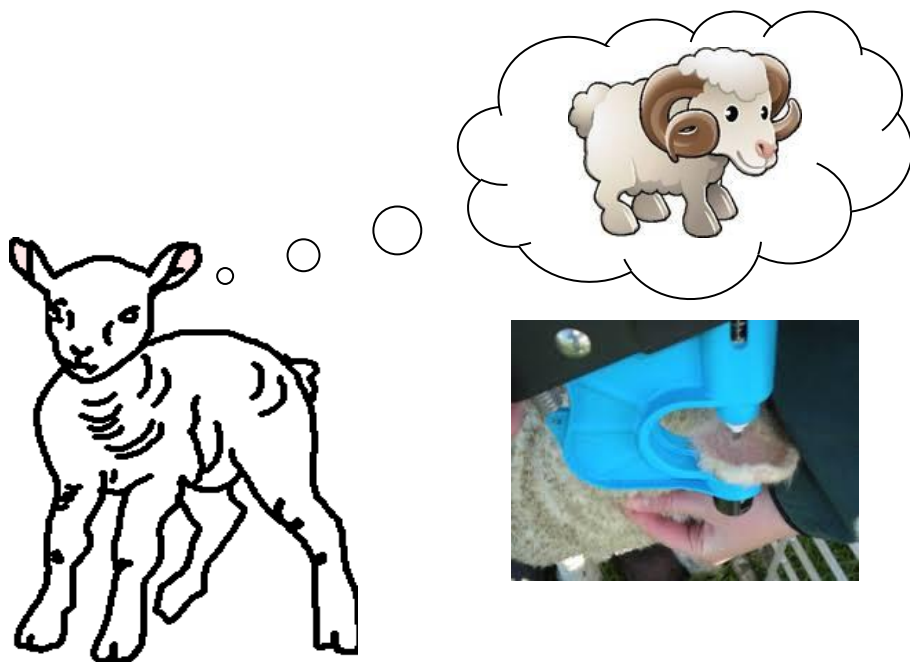
- **At birth we know parts of the lamb's DNA**

- **Lamb accuracy increase by 15 to 52%**

  - » **Equiv. of 6 (51) progeny for high (low) h^2**

Genomic Selection

- **Applied to all genes & all traits**

Parentage

- **Low cost option for hill and commercial flocks**

Major gene effects

- **Scrapie, lethal recessive genes….**

Breed mapping

- **How closely related are breeds??**

Number of genotyped sheep

Breed	Total
Belclare	4,145
Charollais	4,843
Suffolk	4,860
Texel	8,472
Vendeen	1,956
Other - pedigree	1,337
Other - crossbred	29,808
Total	55,421
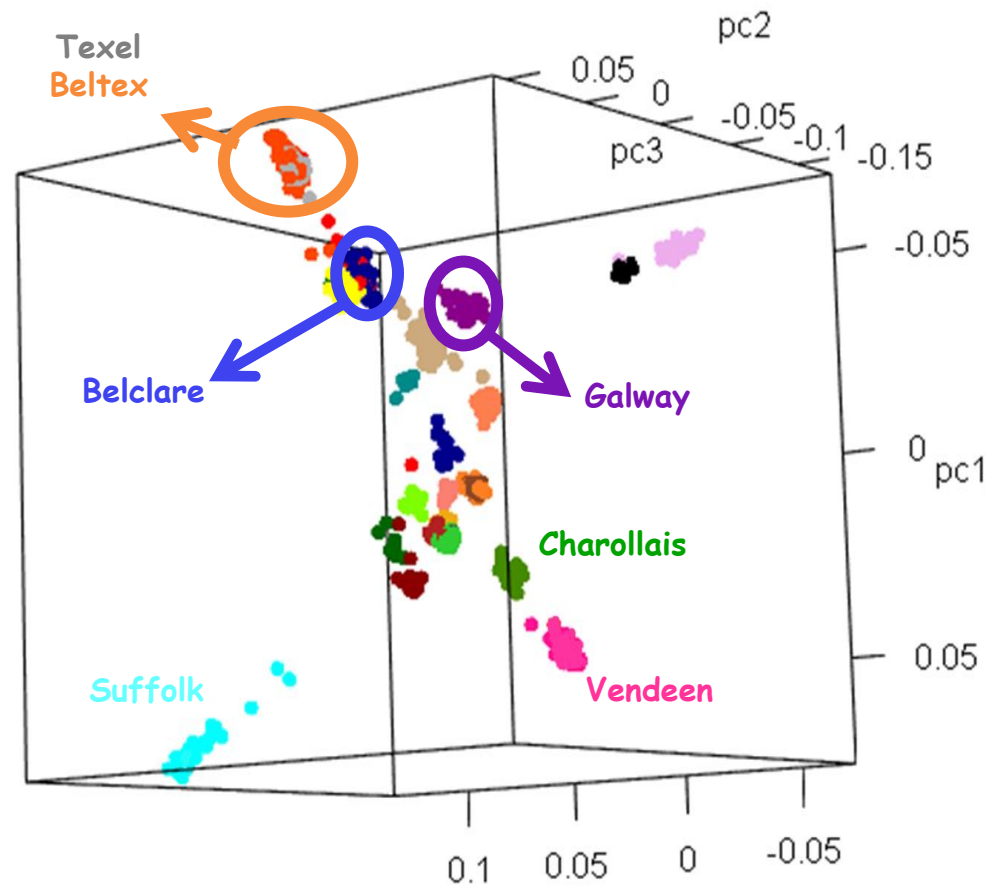
Parentage assignment

Genomic evaluations

Gender determination

Breed determination

Inbreeding

Monitoring major genes

Monitoring lethal genes

Scrapie

Parentage

89%
Animals
Sire Verified

83%
Animals
Dam Verified
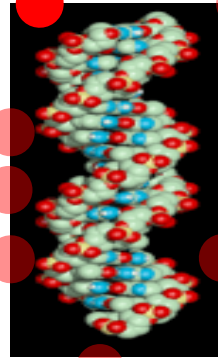
Search

○ Invalidated Sample   ○ Resample Needed   ○ Sire Mismatch   ○ Dam Mismatch   ● All
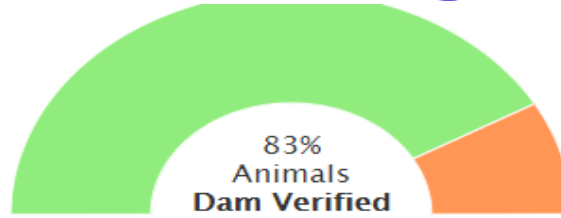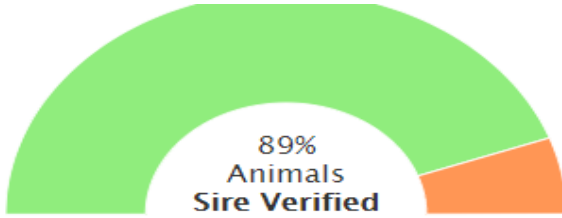
18 animals of 521 animals found, 18 displayed

Animal	Sex	DOB	Breed	Animal Result	Tested Sire	Sire Result	Tested Dam	Dam Result
IE0424133328**25H**	F	16-MAR-2020	SU	Resample Needed				
IE042413328**57F**	F	17-MAR-2020	SU	Genotyped	IE042413326083G	~~Mismatch~~ New Sire IE043538902911J	IE042413324615E	Match
IE042413328**51C**	F	17-MAR-2020	TX 🚩	Genotyped		~~Not Recorded on Database~~ New Sire MURPHYS CHURCHILL	IE042413321911J	Match
IE042413328**83A**	F	17-MAR-2020	BR 🚩	Genotyped	TEAGASC BEAUTY	Match	IE042413323348G	No Result Available
IE042413328**81F**	F	17-MAR-2020	BR	Genotyped	COOLKELLURE DUSTIN	Match	IE042413324881H	No Result Available
IE042413328**88B**	F	17-MAR-2020	BR	Genotyped	ALLOON DANE	Match	IE042413326568G	No Result Available
IE042413328**31A**	F	16-MAR-2020	BR	Genotyped	FORAS EASTON	Match	IE042413326537B	No Result Available
								No Result

Parentage assignment

Genomic evaluations

Gender determination

Scrapie

Inbreeding

Monitoring major genes

Monitoring lethal genes

Teagasc

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Major genes

- **Prolificacy genes**

- **BMP15 Xb → associated with Belclare breed**

- **1 copy increased ovulation rate**

- **2 copies sterile**

Genotyped	1 copy
All population	0.07%
Belclare	9.78%

+0.53 lambs born

Sales Catalogue

Owner: Finbarr Godfrey (DQI: 99%); Churchground, Kilgarvan, Co. Kerry	
Breeder: Finbarr Godfrey; Churchground, Kilgarvan, Co. Kerry	

Animal

IE042576105092D

H521006

Cregeen

DOB: 01-Jan-2021

Charollais

Male

Twin

Parentage DNA Verified

Scrapie: ARR / ARR

Ancestry

GS **Bawnard Bob**
D3215045

GD **Knockin Sylvia**
17XXJ00375

Redtrench Volcano
J6020008

Cregeen
H518015

GS **Duiske Oscar**
D817016

GD **Cregeen**
H514013

€uroStars   06/05/2021

Replacement (€3.48)	Terminal (€2.2)
Acc 67% Rank Top 3%	Acc 67% Rank Top 4%
★★★★★	★★★★★

Lamb Survivability (-0.08%)
Poor — Excellent
0% ——— V Btm 49% 100%
Acc 62.8%
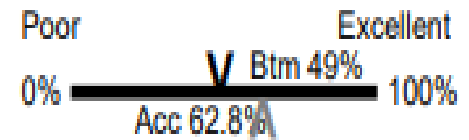
Days to Slaughter -18.88 days
0% ——— Top 2% V 100%
Acc 72.2%

No. of Lambs Born (€0.87)
0% ——— Top 18% V 100%
Acc 66%
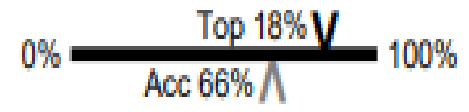
Daughters Milk (€0.14)
0% ——— Top 11% V 100%
Acc 70%
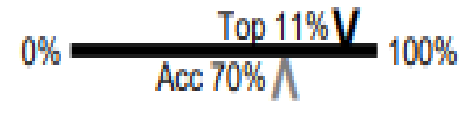
Comment: ← **Major genes, inbreeding**

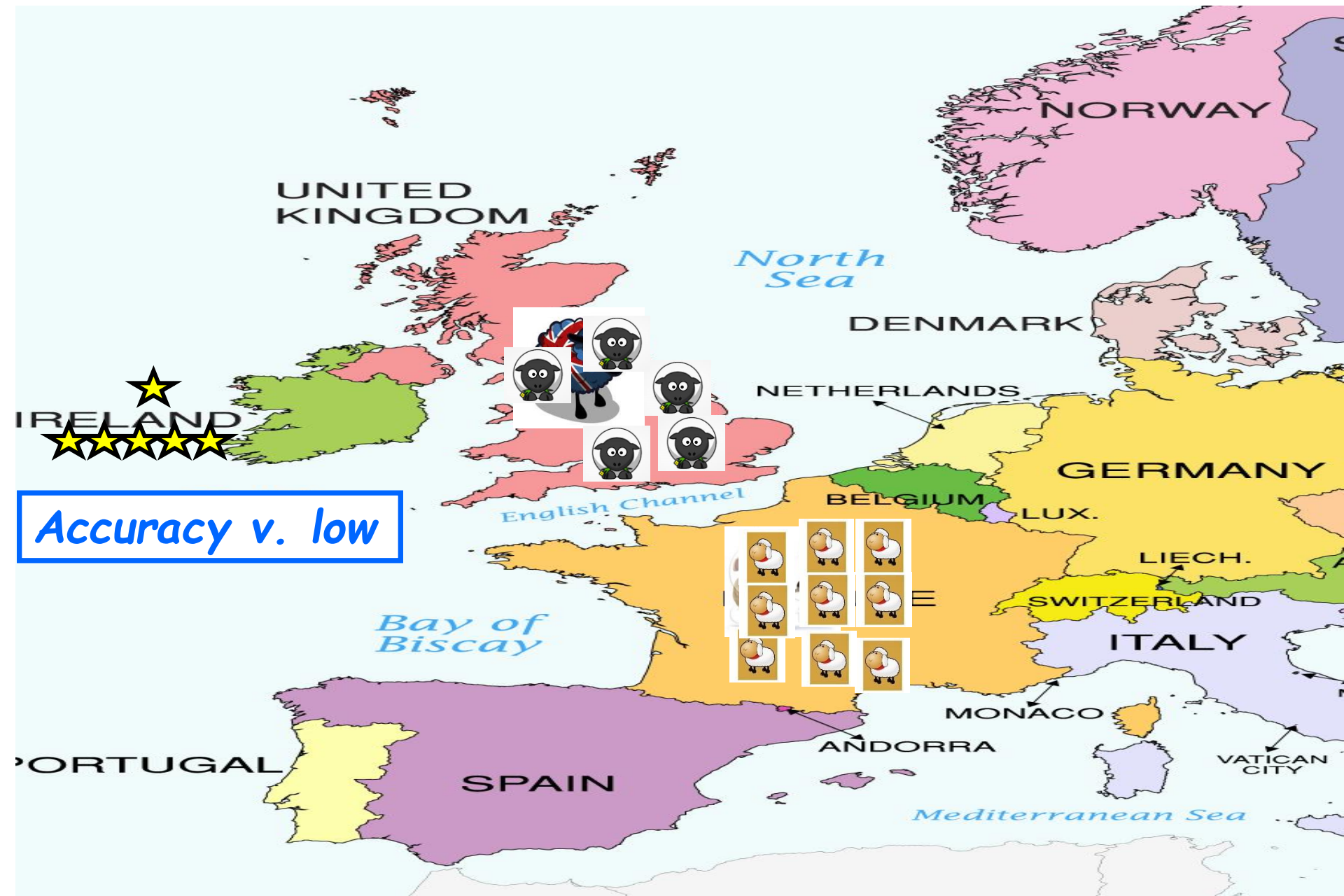# Future Research

- Across country evaluations

- Health

  - FEC, mastitis

- Methane emissions

- Survival to Weaning

- Ewe longevity/Stay-ability

International data

Accuracy v. low

Ireland versus UK

- Case-study → Texel breed

- Large number of common animals

- Strong genetic correlations between traits

Current rate of genetic gain (%)		
Pre weaning	1.81	2.37
Post weaning	5.31	3.38
Muscle	2.42	1.49

- Increase accuracy and genetic gain by sharing data

eagasc
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Ireland versus New Zealand

CON
Conservative breeders

PRO
Progressive breeders who never use foreign genetics

PROFOR
Progressive breeders who use foreign genetics
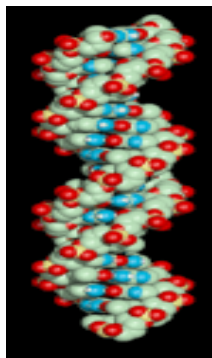
FOR
Foreign breeders who supply semen and/or live rams

	Benefit after 20 years (€m)
Current	33.598
Progressive	134.723
Foreign	135.601

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OviFec
DAFM Stimulus Funded

Developing genetic index for resistance to gastrointestinal nematode infections

Long term strategy

1. **Decision Support tools**

Decision Support tools

Lamb underperforming Sick??

Legend: —Flock ▲Individual Lamb

X-axis: Age (days)
Y-axis: Weight (kg)
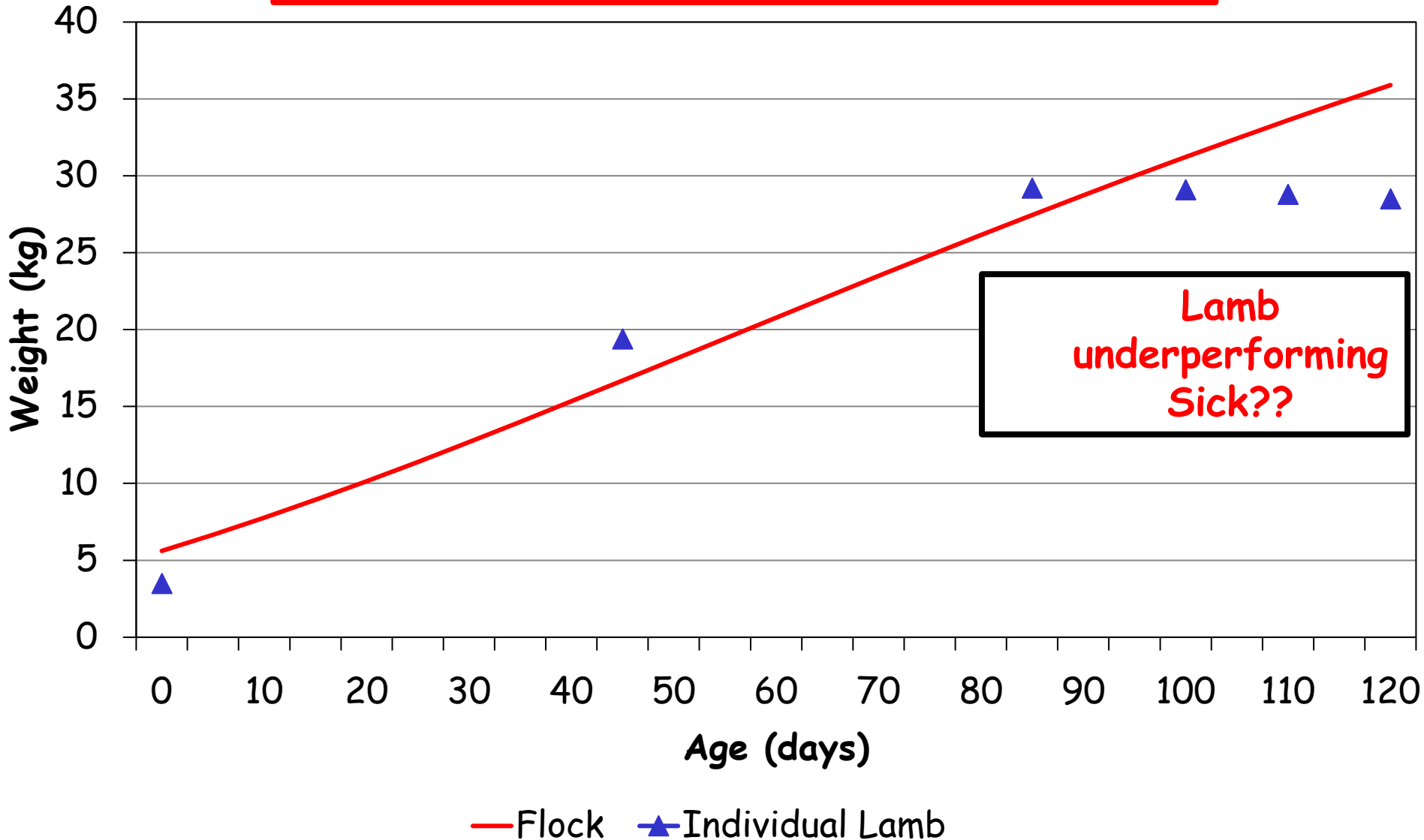
Long term strategy

1. **Decision Support tools**

2. **Animal welfare**

   - **Linked to health, lamb and ewe survival**

3. **Meat eating quality**

4. **Ram functionality**

   - **Difficulty to measure**

5. **More commercial/hill data**

   - **Genomics to provide parentage**

Conclusions

- **Large potential to increase genetic gain**

- **Short term**

    1. **Improve genetic evaluations**

    2. **Genomic selection & index validation**

- **Long term**

    - **Difficult to measure traits**

- **Integrated industry approach**

High Index Sheep Produce Less GHG per Kilo of Carcass

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Flocks Modelled

1 Star Flock

5 Star Flock

1 Star Flock

257 ewes

20 HA

Weaning 1.60 lambs/ewe

DTS : 200

5 Star Flock

257 ewes

20 HA

Weaning 1.74 lambs/ewe

DTS : 192

Using CPT commercial data

Economic and environmental output

1 Star Flock

NP = €439/ha

NP = €34/ewe

9.35 Tonnes of CO_2/HA

353 lambs

22.1 CO_2/kg

5 Star Flock

NP = €593/ha

NP = €46/ewe

9.32 Tonnes of CO_2/HA

389 lambs

21.0 CO_2/kg

1 kg Carcass

5% less CO_2/kg

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Thank you for your attention

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