




## Genetic & Biological basis of Residual Feed Intake in Pigs

Jack Dekkers *et al.*

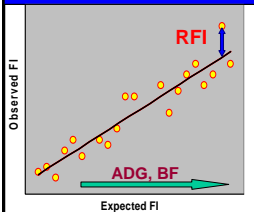




## Measures of Feed Efficiency

FCR = Feed/gain      FE = Gain/Feed

Residual Feed Intake = (Observed FI) - (Expected FI based on average energy requirements for growth and maintenance)

$RFI = FI - b_1 \text{ ADG} - b_2 \text{ BF}$



### Potential factors contributing to RFI

- Body composition
- Physical activity
- Maintenance requirements
- Digestibility
- Energetic efficiency
- Tissue turnover rates
- Immune response
- Food wastage
- Measurement error

## ISU Residual Feed Intake Selection Lines

Low RFI line

Selection

Control line

### Objectives

- Evaluate direct and correlated responses to selection on RFI
- Estimate genetic parameters
- Develop a resource population to study the biological & physiological basis of feed intake & efficiency

Develop tools to improve feed efficiency

## Selection for RFI

**Generation -1**  
94 boars 100 gilts

**Generation 0**  
76 boars 77 gilts

**Select line**  
**Generation 1**  
69 boars 70 gilts  
**Generation 2**  
68 boars 86 gilts  
**Generation 3**  
51 boars  
**Generation 4**  
77 boars 92 gilts  
**Generation 5**  
64 boars

Total N = 1087  
evaluated

**Control line**  
  
  
  
  
  
  
**Generation 4**  
76 gilts  
**Generation 5**  
87 boars

Direct comparison

Direct comparison

## ISU Yorkshire RFI Selection Experiment

Low RFI line

Selection

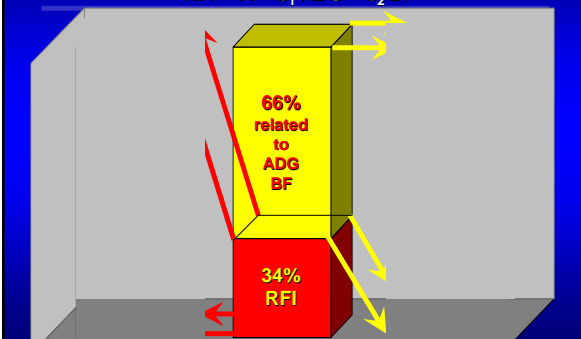
Control line

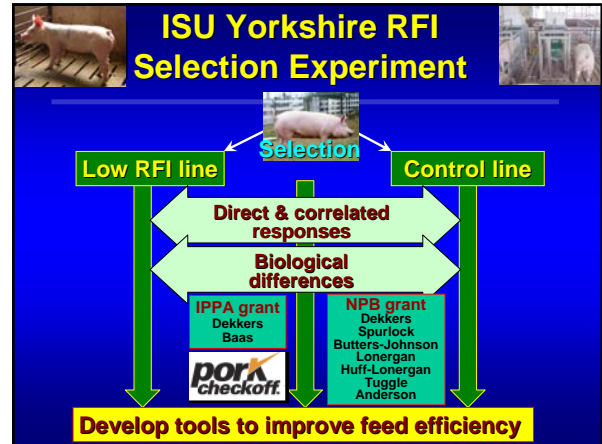
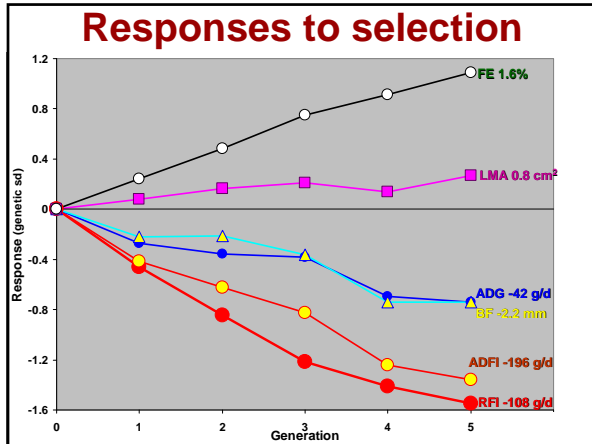
Direct & correlated responses

Develop tools to improve feed efficiency

## Sources of variation in Feed Intake

$RFI = FI - b_1 \text{ ADG} - b_2 \text{ BF}$



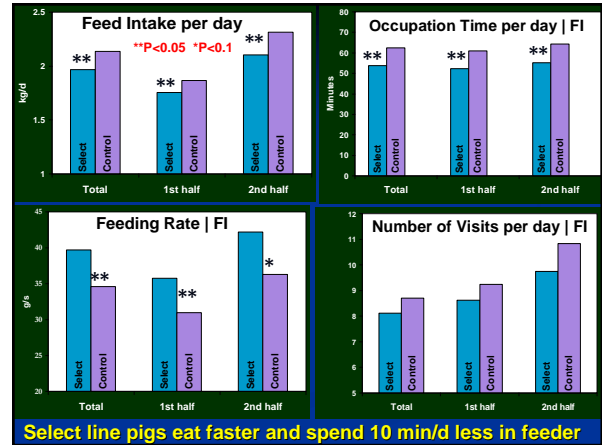


### NPB/IPPA project

#### Part I Performance Behavior Meat quality

90 Select gilts  
90 Control gilts on FIRE Feeders

- Feeding behavior (Jennifer Young)
- Pen behavior (Larry Saddler, Anna Butters-Johnson)
- Blood parameters (Sender Lhakvadorj, C. Tuggle, L. Anderson)
- Meat quality (Rachel Smith, E.&S. Lonergan, Roger Johnson (Farmland))



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### ISU Behavioral laboratory

Larry Saddler, Anna Butters-Johnson

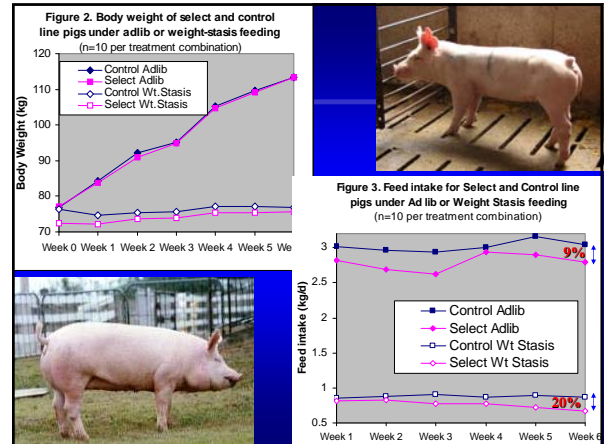
- 12 cameras
- 6 pens
- 3 DVRS
- Video → DVD

## NPB grant project

### Part II – nutrition, physiology

**Nick Boddicker, Nick Gabler, Mike Spurlock**  
Steve Lonergan, Elizabeth Lonergan  
Sender Lhkvadorj, Chris Tuggle, Lloyd Anderson

6 weeks	~20 kg		~85 kg	
barrows	Select	Control	Select	Control
Wt stasis	n=10	10	10	10
1/2 Adlib	10	10	10	10
3/4 Adlib	10	10	10	10
Adlib	10	10	10	10



## Other work planned

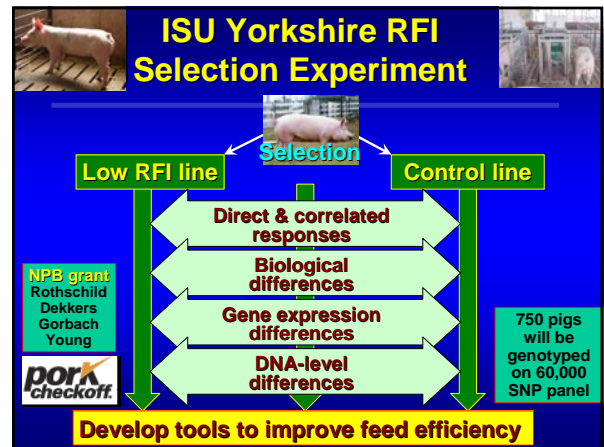
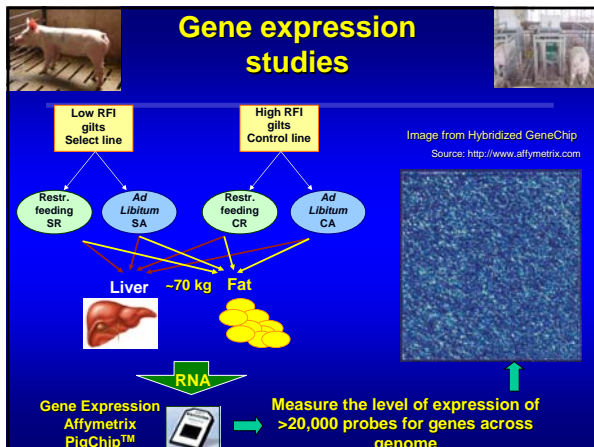
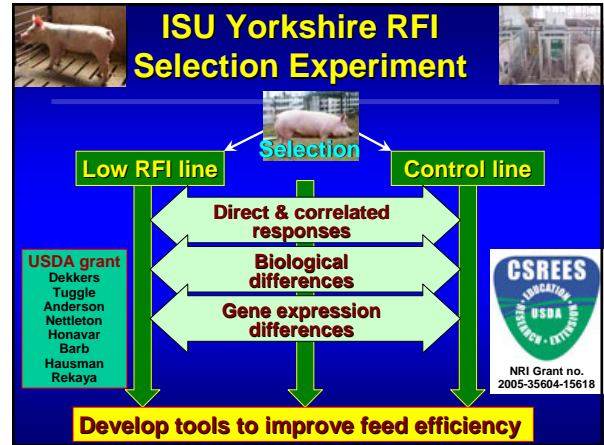
Young, Dekkers, Patience


**Does selection for efficiency in the growing phase affect efficiency and performance in the reproduction phase?**

Gene-ration	Select line		Control line	
	Parity 1	Parity 2	Parity 1	Parity 2
0	70	51	46	30
1	49	34	23	0
2	45	37	17	21
3	53	31	22	18
4	49	0	28	0
5	56	37	46	34
6	55	-	56	-
Total	377	190+	238	103+


**Sow data collected**

- Litter size
- Birth and weaning wts
- Sow weight, BF, LEA at farrowing and weaning
- Feed intake during lactation





# Summary



- ◆ ~35% of variation in feed intake is not related to ADG and BF = **RFI**
- ◆ RFI has substantial heritability (0.3)
- ◆ 5 generations of selection for RFI has resulted in significant change in RFI (~100 g/d), **with some decline in ADG and BF**
- ◆ Low RFI pigs - are more efficient under ad lib and restricted feeding
  - are leaner (lower BF, IMF, fat content, greater LEA)
  - eat faster
  - tend to have lower viscera weights
  - have similar meat quality
- ◆ The ISU RFI lines are a unique resource to study the biological and genetic aspects of feed intake and efficiency, with opportunities to develop tools to select for efficiency in industry.



# Acknowledgements



John Newton & staff at  
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