



Cardiovascular monitoring towards novel proxies for feed efficiency in the bovine

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Introduction Feed Efficiency



Feed Efficiency



Introduction Residual Feed Intake

**Residual Feed Intake (RFI)=
Actual Feed Intake – Predicted Feed Intake**



High RFI= Actual > Predicted



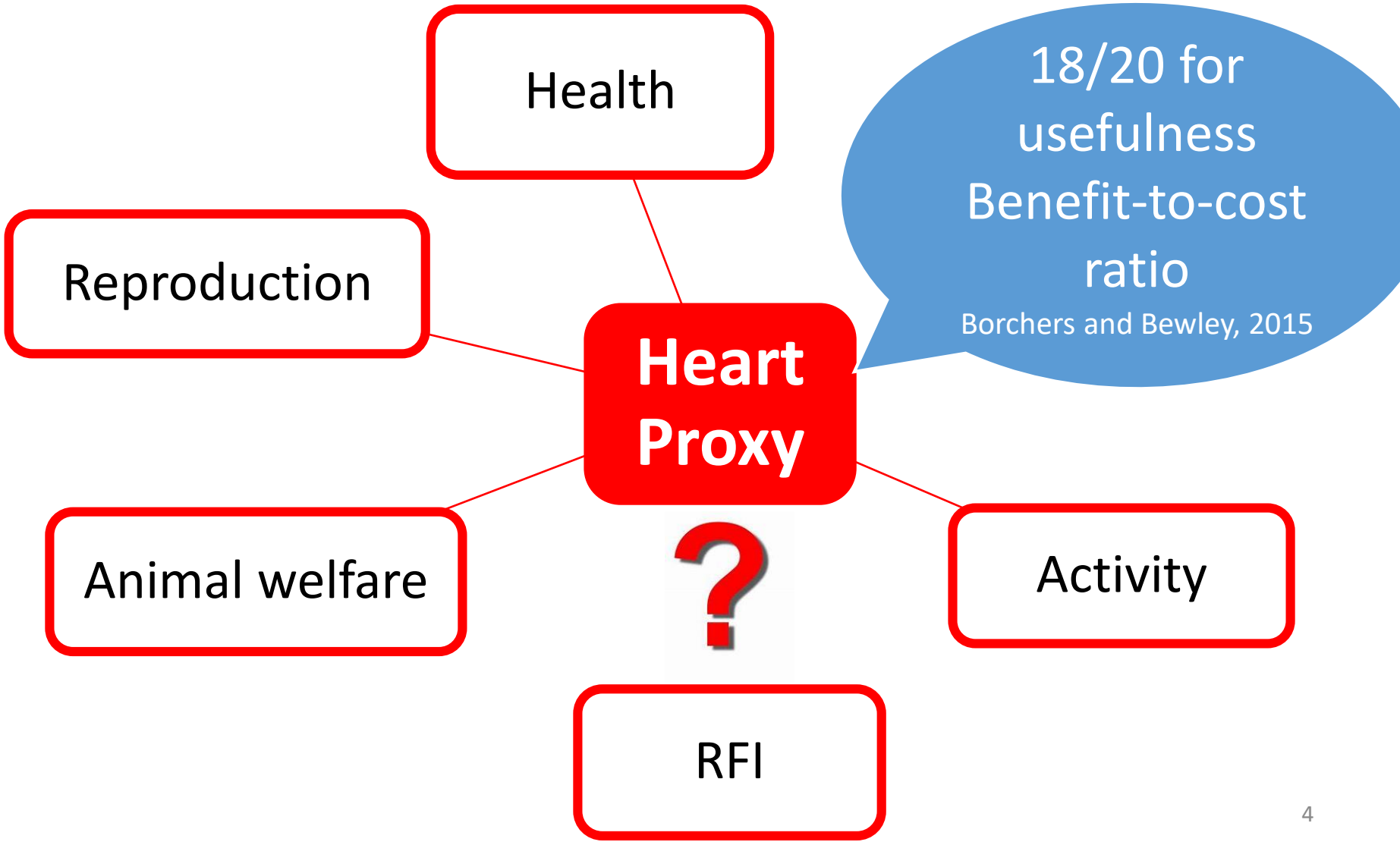
Low RFI= Actual < Predicted



**Cost
Time
Labor**

Proxy?

Introduction Heart Proxy



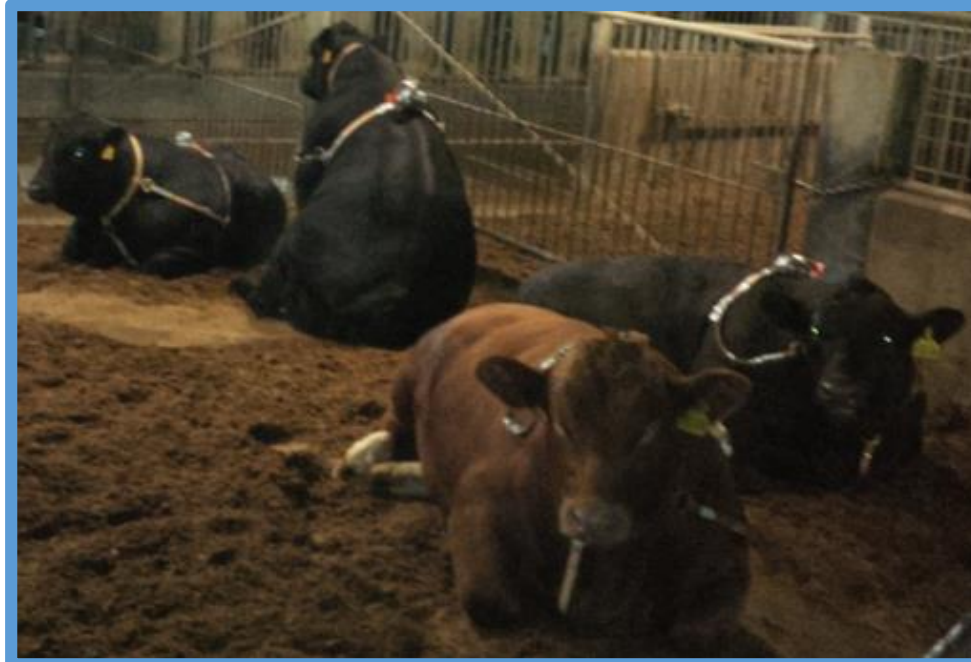
Introduction Supportive Heart Research

Animal (2017), 11:3, pp 452–460 © The Animal Consortium 2016
doi:10.1017/S1751731116001695

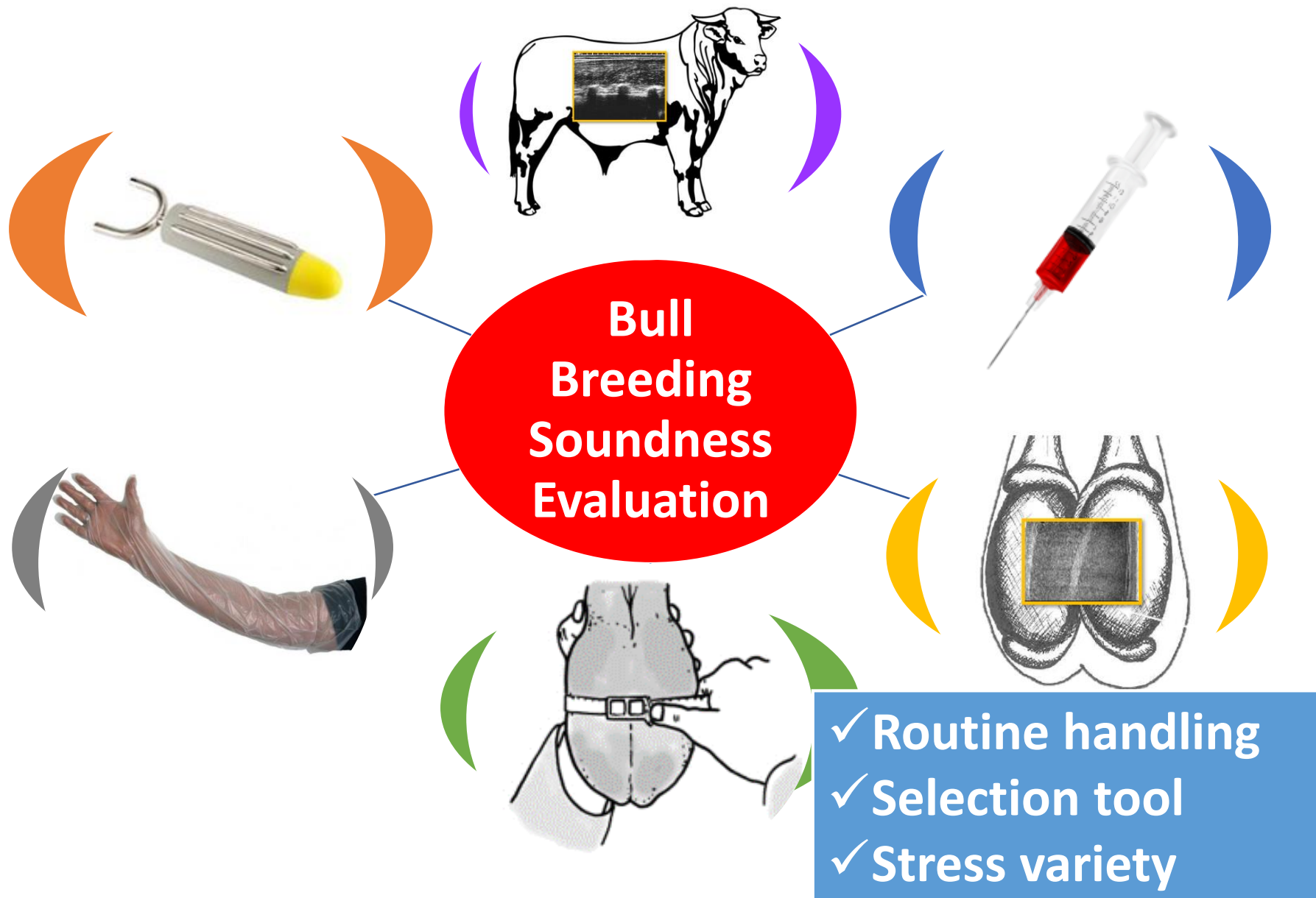


Associations of acute stress and overnight heart rate with feed efficiency in beef heifers

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Introduction Bull Breeding Soundness Evaluation



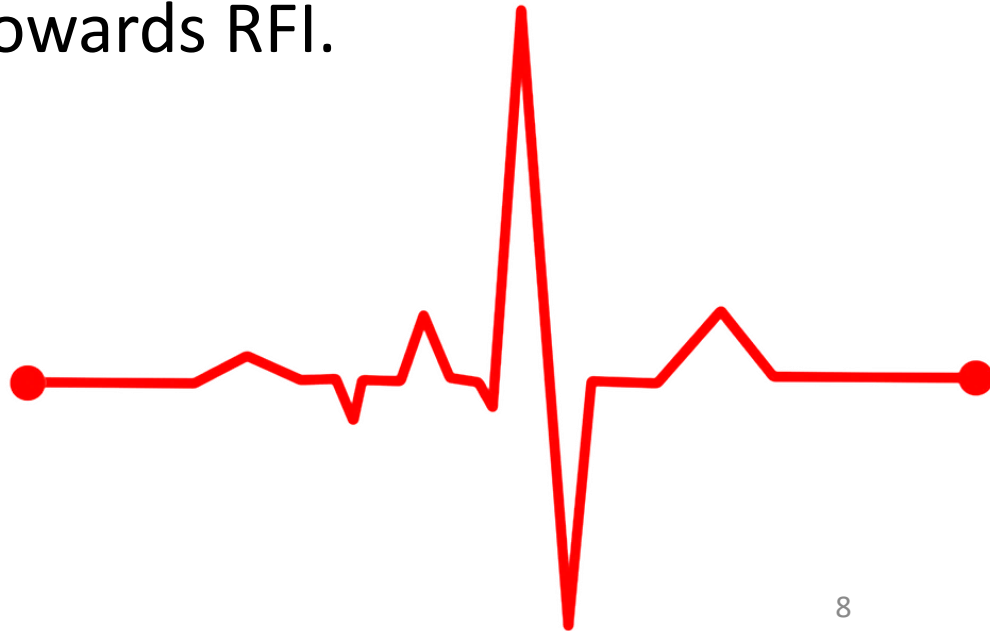
Hypothesis

The **bull breeding soundness evaluation** involves a variety of stimuli which influence **heart function**, therefore it may be a source of proxies towards complex traits, such as **feed efficiency**.



Objectives

1. Assess the **relationships** of heart function with RFI (feed efficiency) recorded during the bull breeding soundness evaluation.
2. Determine potential heart traits of relevance for **proxy development** towards RFI.



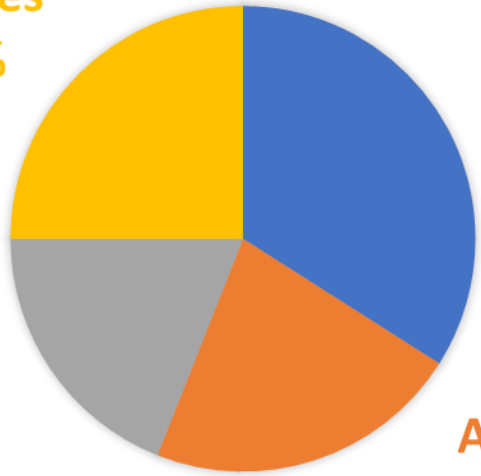
Materials & Methods Animal Management

Young beef bulls

- n = 107
- Age = 14 months
- Weight = 511 kg

Crosses
25%

Simmental
34%

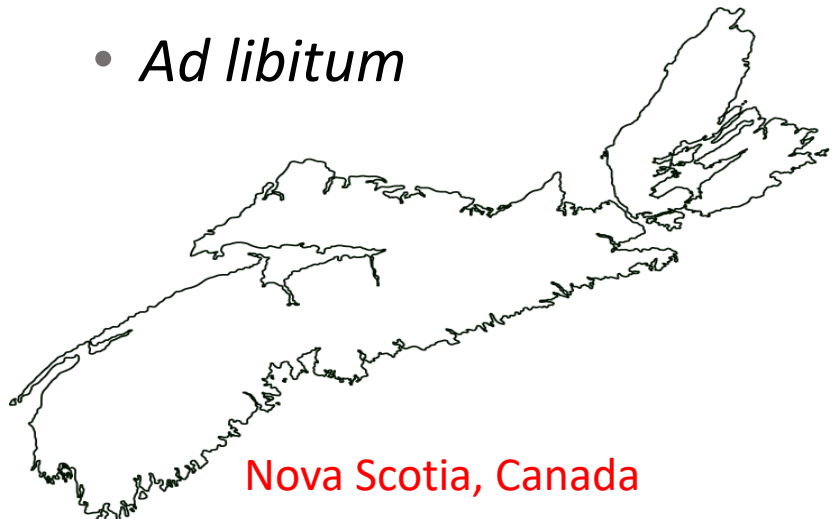


Charolais
19%

Angus
22%

Management

- Beef testing station
- *Ad libitum*



Nova Scotia, Canada

<u>Feed composition</u>	<u>As fed (%)</u>
Grass Silage	70.00
Corn silage	15.42
Barley grain	12.75
Soybean meal	1.08
Premix	0.83

Materials & Methods Productive Performance

14 day adaptation

112 day evaluation



Growth

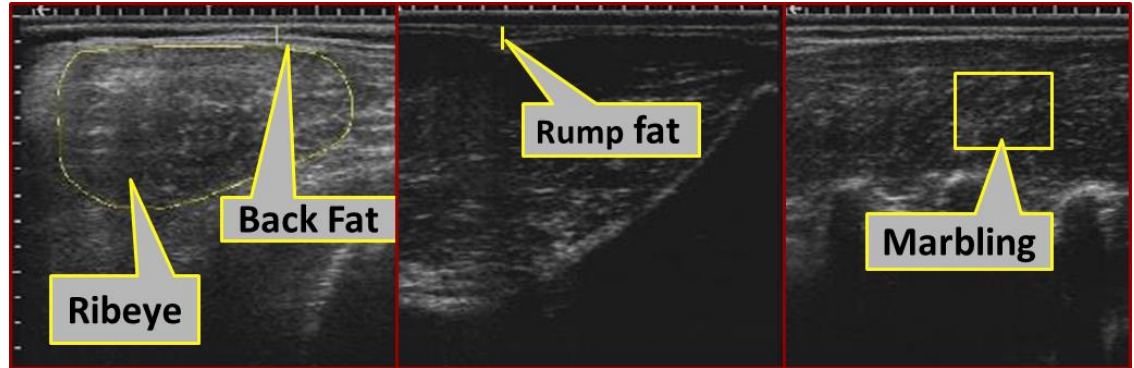


Body Size

$$\text{Predicted Feed Intake} = \beta_0 + \beta_1(\text{Average Daily Gain}) + \beta_2(\text{Body Weight}) + \beta_3(\text{Back Fat}) + \beta_4(\text{Marbling}) + \beta_6(\text{Rump Fat}) + \beta_5(\text{Ribeye Area}) + \text{RFI}$$

Body Composition

$R^2=0.60$



Materials & Methods Experimental Procedure



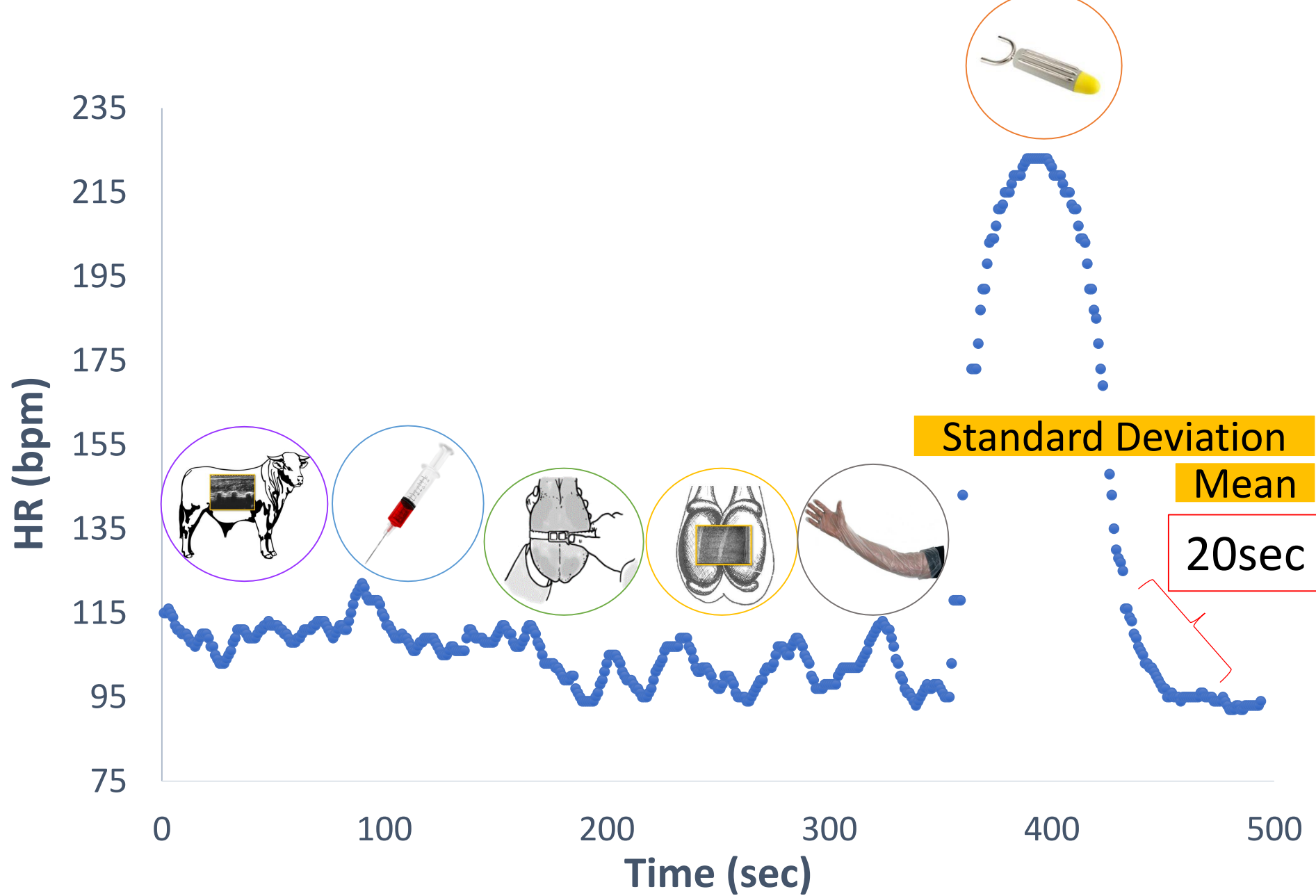
HR (bpm)

Polar RS 800CX Science, telemetry, external electrodes



Materials & Methods

Full Procedure HR Curve



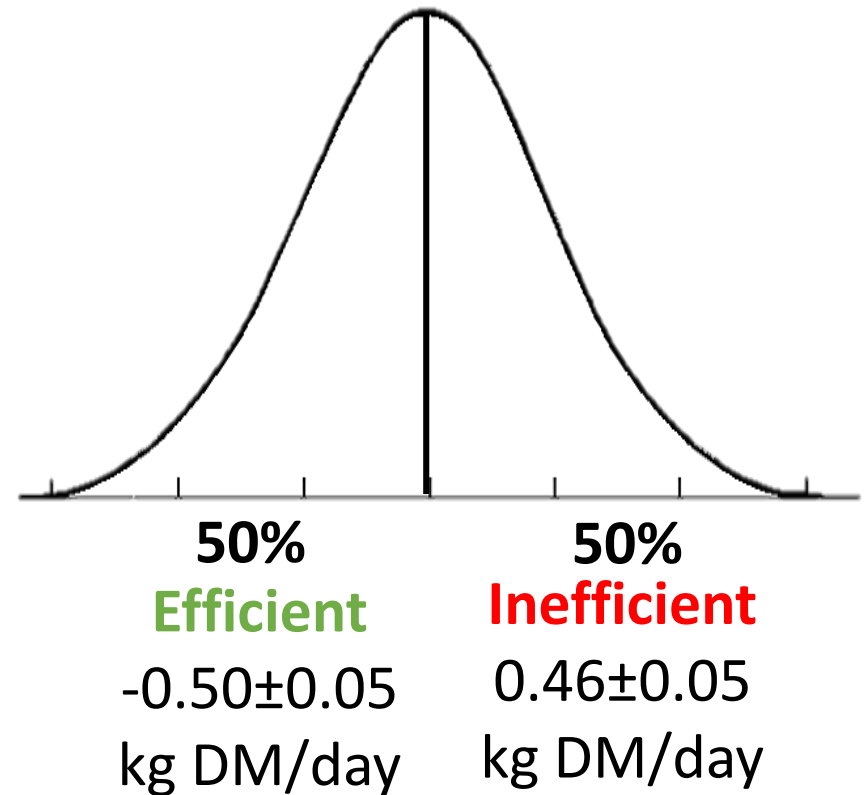
Materials & Methods Statistical Analysis

Categorical analysis

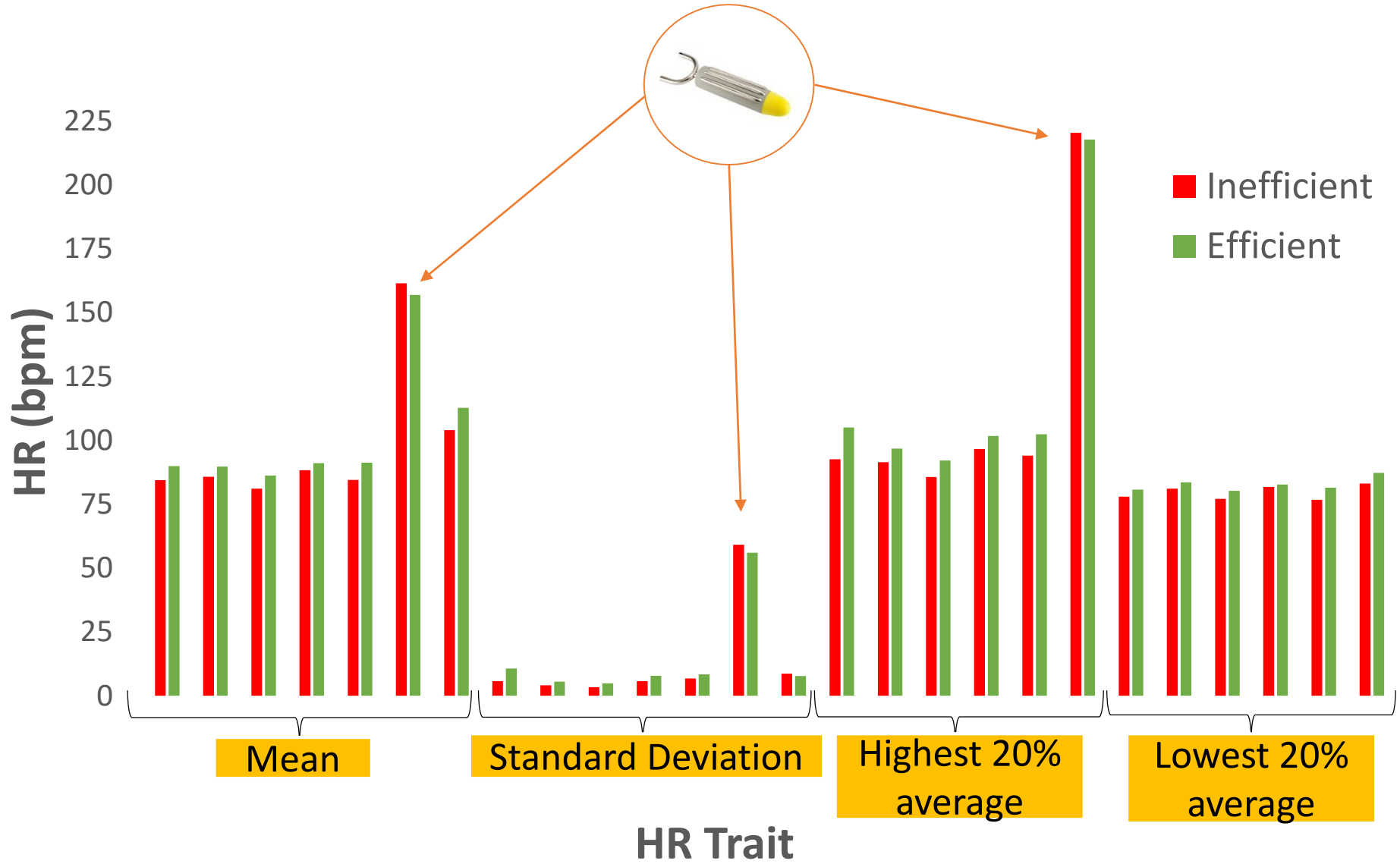
- Efficient vs. Inefficient
- Normality
- Least square means

Continuous analysis

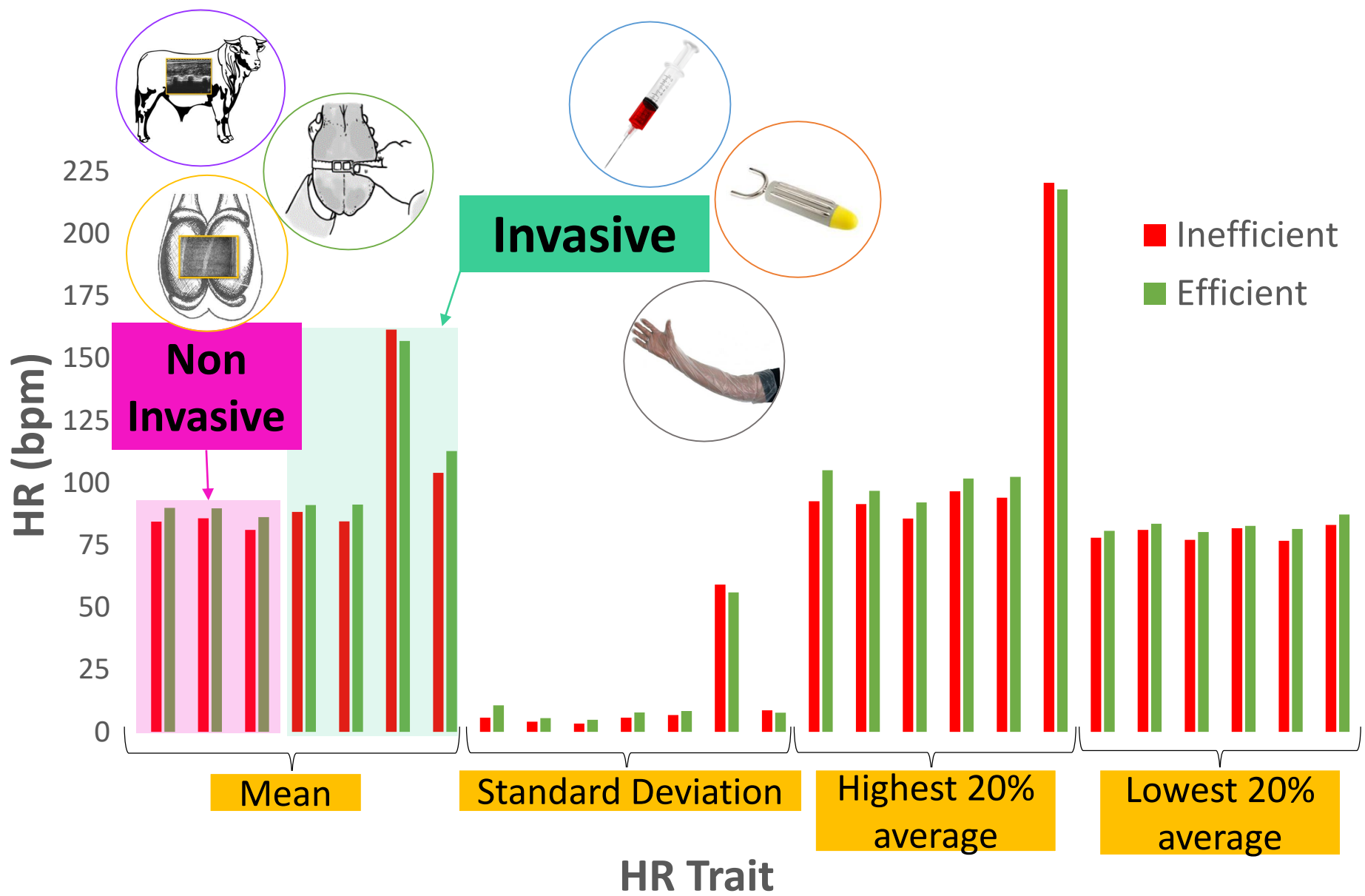
- Pearson's correlation
- Partial R^2 summed across linear and quadratic effects



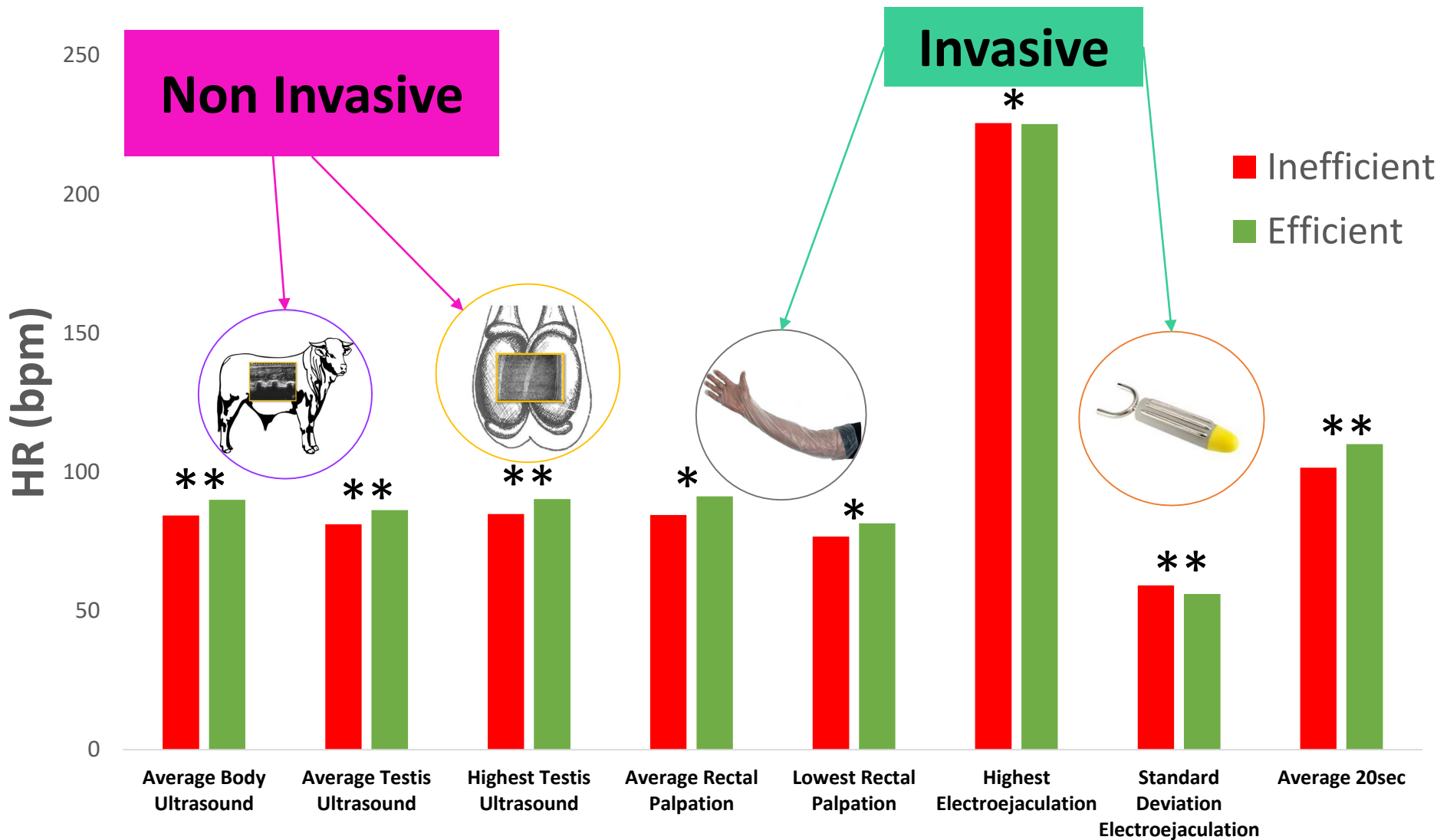
Results & Discussion Mean Comparison across all HR Traits



Results & Discussion Mean Comparison across all HR traits



Results & Discussion Relevant Procedural HR



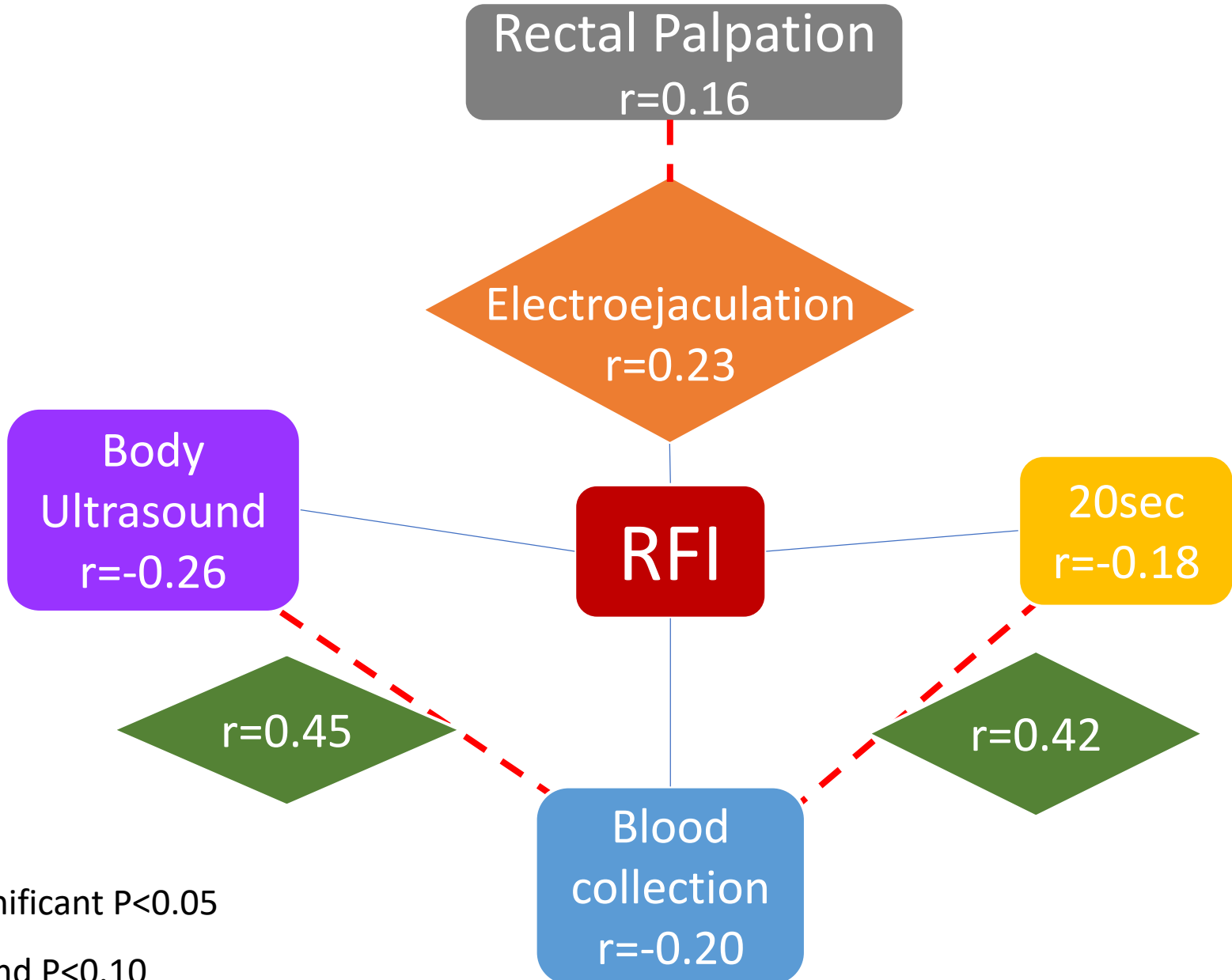
* Significant P<0.05

** Trend P<0.10

HR Traits

Results & Discussion

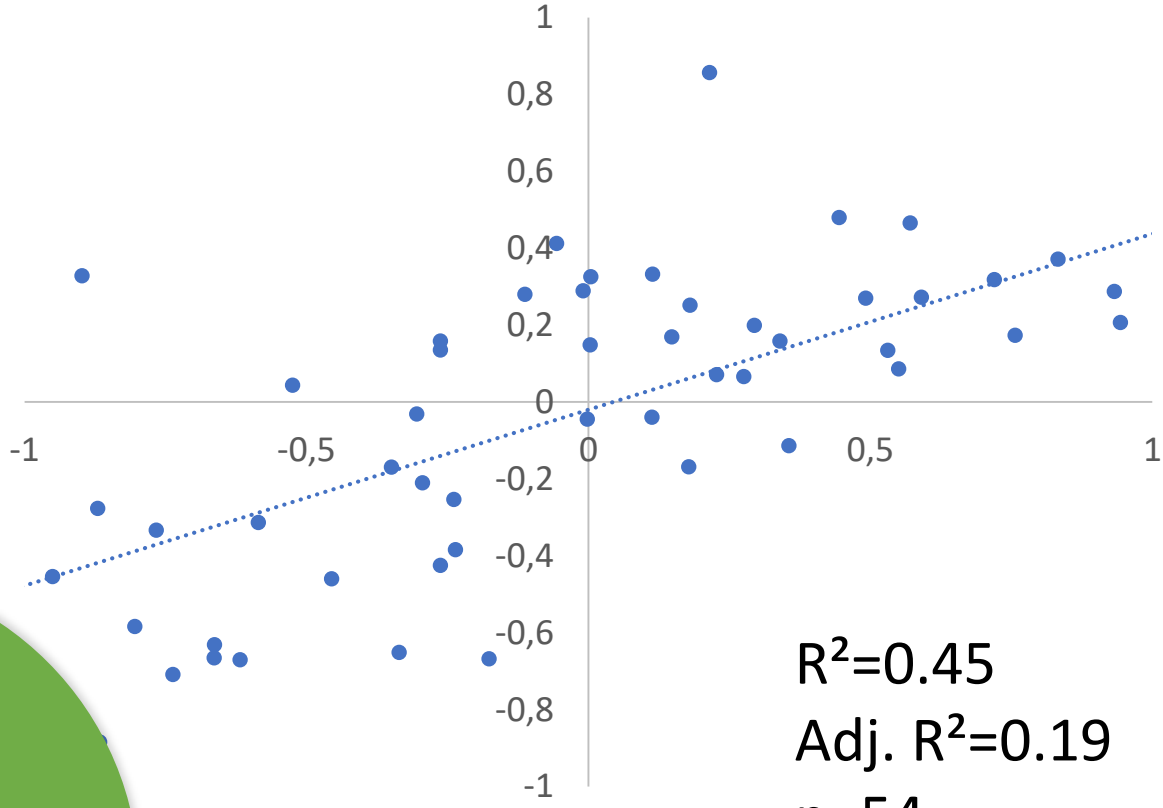
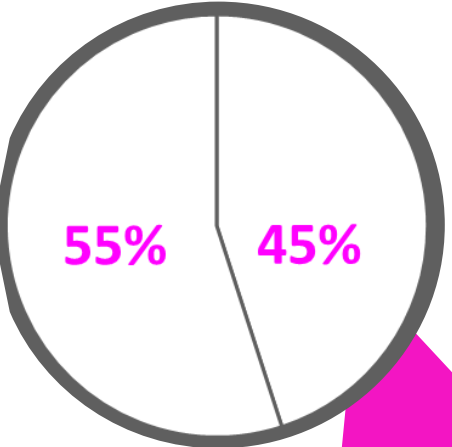
Relationship of HR with RFI



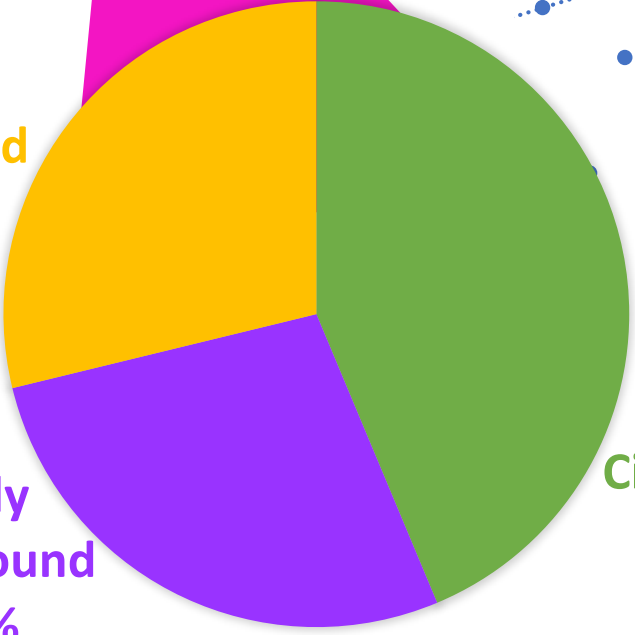
Results & Discussion

Variation in RFI

Non Invasive



**Testis
Ultrasound
29%**



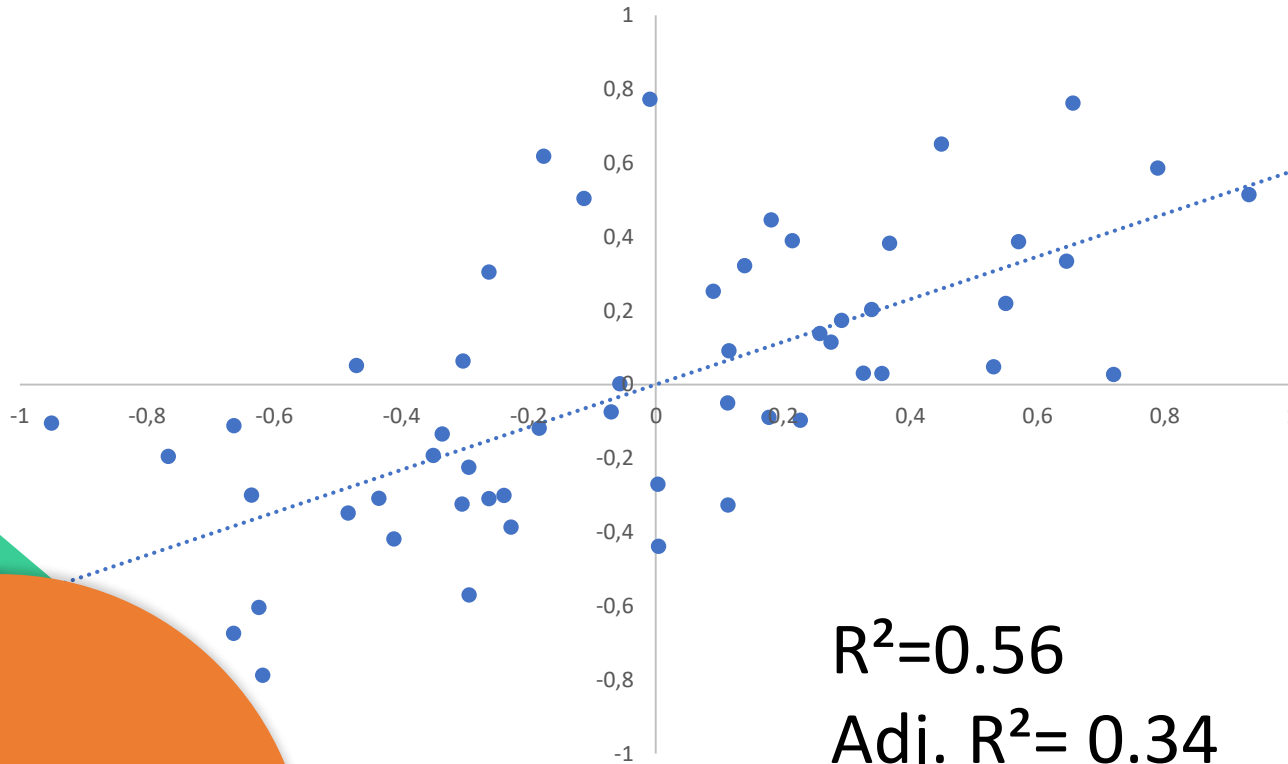
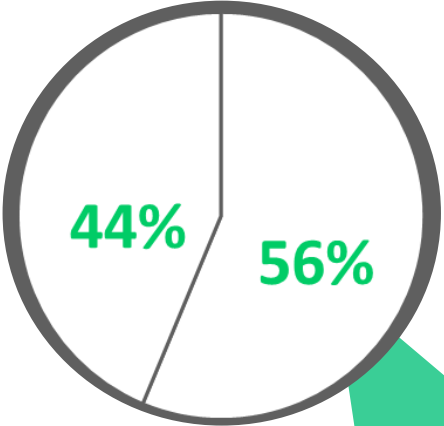
**Scrotal
Circumference
44%**

**Body
Ultrasound
27%**

Results & Discussion

Variation in RFI

Invasive

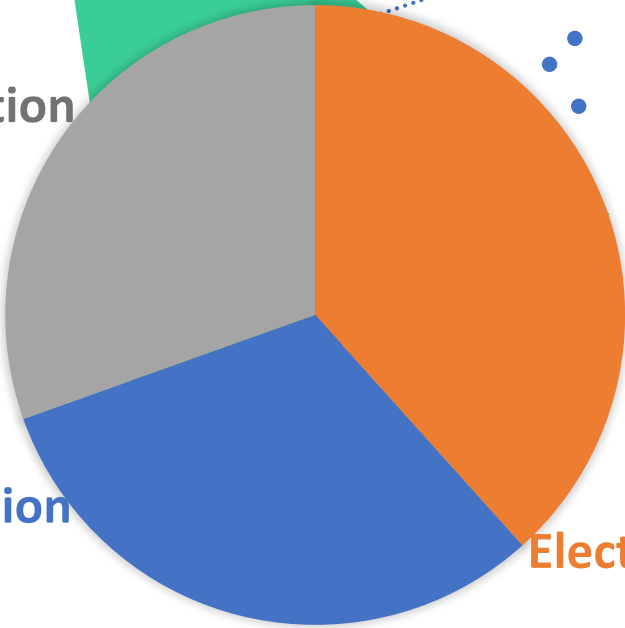


$R^2=0.56$
 $Adj. R^2= 0.34$
 $n=63$
 $P=0.002$

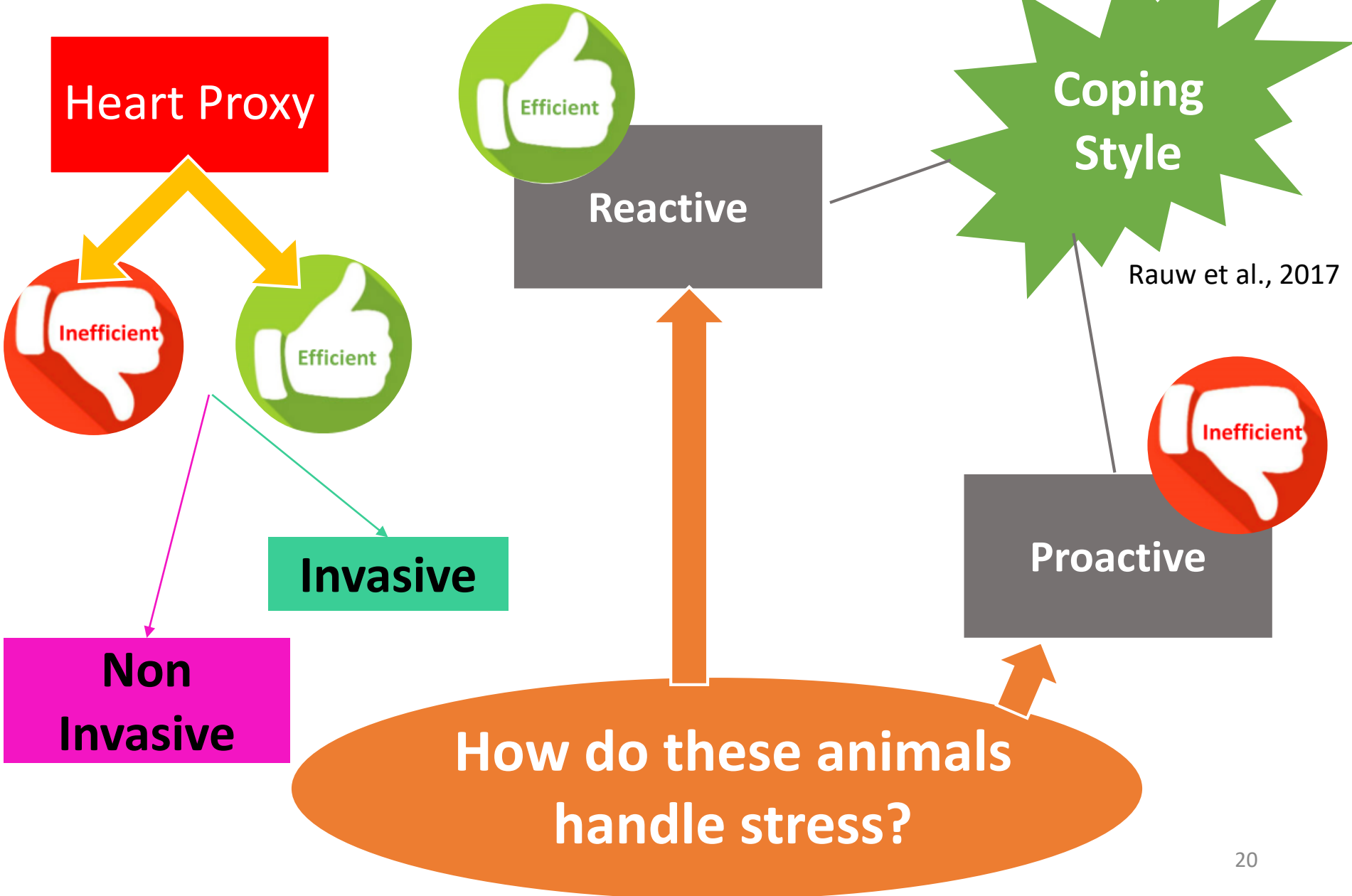
Rectal Palpation
31%

Blood Collection
31%

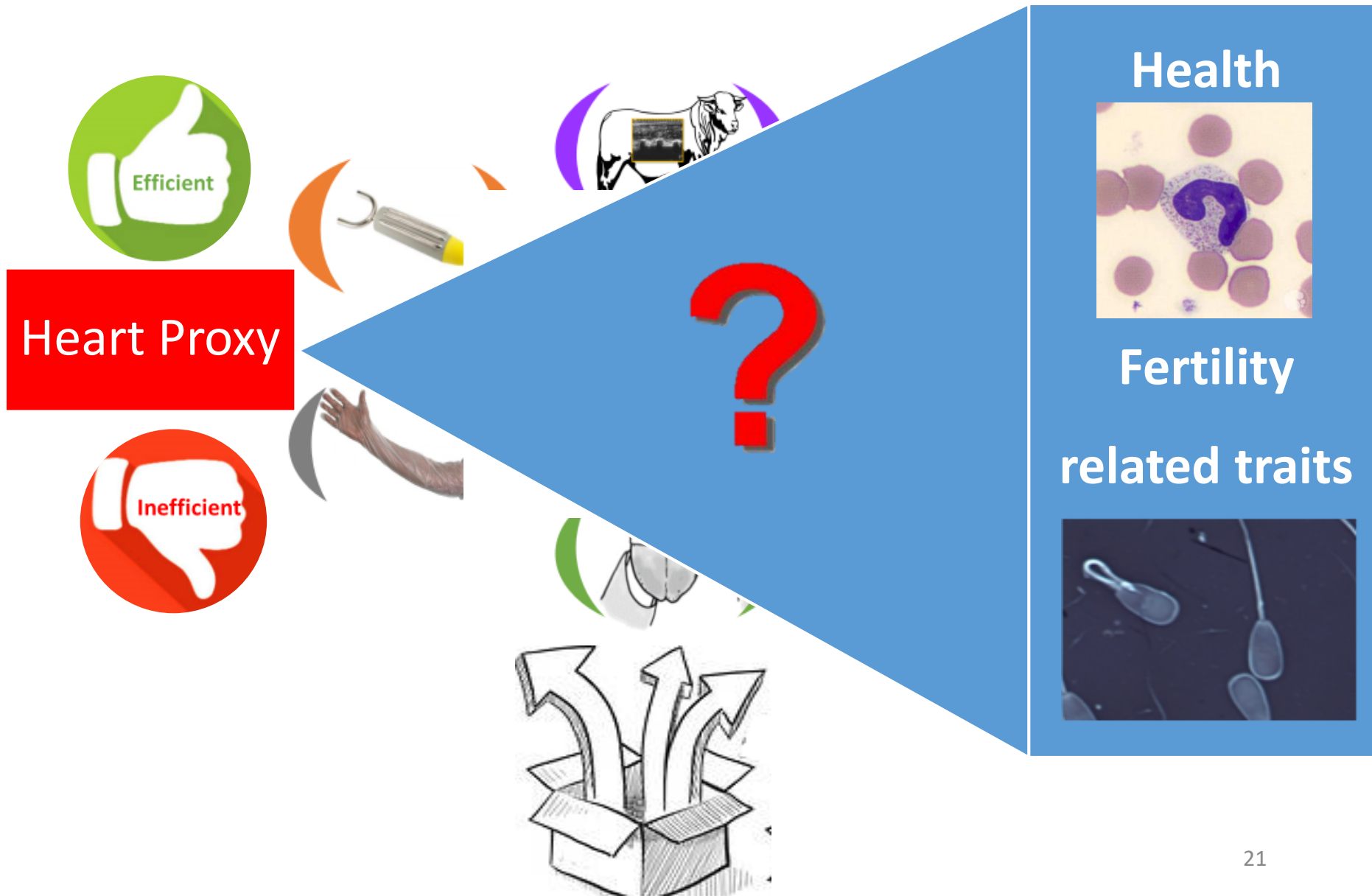
Electroejaculation
38%



Results & Discussion



Ongoing Research



Conclusion

- Heart rate serves as a proxy for feed efficiency during the breeding soundness evaluation.
- Proxy development should focus on invasive procedures.
- Screening for feed efficiency relies on challenging the coping abilities.
- Industry application is possible with further refinements.



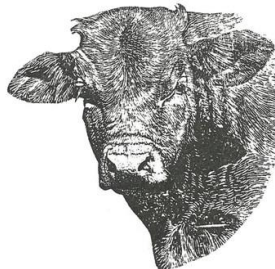
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Martime Beef



Testing Society



Labour and Advanced Education



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University