



# Faculty of Agricultural and Nutritional Science

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Christian-Albrechts-University  
Kiel

Institute of Animal Breeding and Husbandry

## Measuring the affective state in pigs: the role of immunoglobulin A

F. Warnken<sup>1</sup>, K. Krugmann<sup>1</sup>, I. Czycholl<sup>1</sup>, R. Lucius<sup>2</sup>,  
A. Tholey<sup>3</sup>, J. Krieter<sup>1</sup>

<sup>1</sup> Institute of Animal Breeding and Husbandry, Christian-Albrechts-University Kiel, Germany

<sup>2</sup> Institute of Anatomy, Christian-Albrechts-University Kiel, Germany

<sup>3</sup> Institute for Experimental Medicine, Christian-Albrechts-University Kiel, Germany

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**[fwarnken@tierzucht.uni-kiel.de](mailto:fwarnken@tierzucht.uni-kiel.de)**

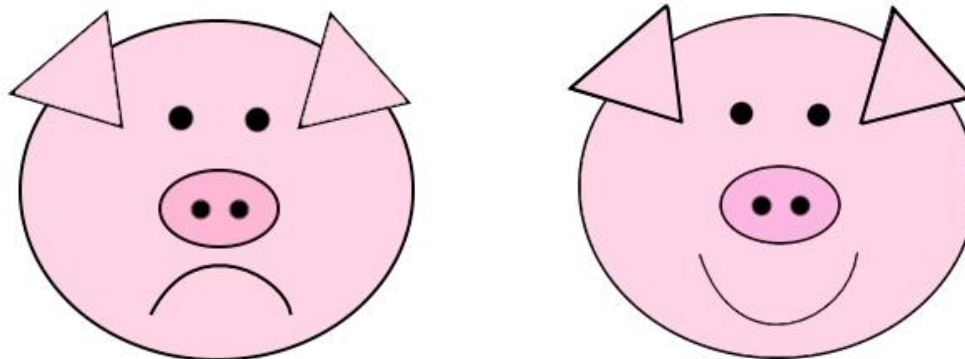




# The affective state

- Growing consumers' wish: products from animal friendly housing (Roex & Miele, 2005)
- Affective state as important part of animal welfare (Vanhonacker et al., 2008)
- Low reliability and high subjectivity of existing measurement methods (Czycholl et al., 2017)

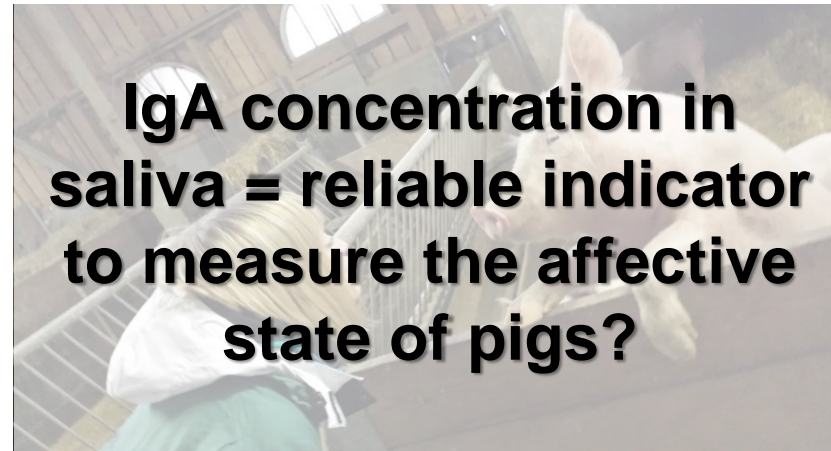
→ **Need for objective indicators to measure the animals affective state** (Webster, 2005)





# Aim of the present study

- Immunoglobulin A (IgA) in human studies
  - Humor arousal increases IgA concentration in human saliva (McClelland & Cheriff, 1997)
  - Reduction of salivary IgA in stress conditions (Afrisham et al., 2016)
- Pigs as an often described animal model for humans
  - Similar oral maxillofacial region (Wang et al., 2007)
  - Porcine immune system resembles humans for >80% (Dawson, 2011)





# Animals & housing

- 288 cross breed ((LW x LR) x Pi) fattening pigs
  - 125 male
  - 163 female
- Three different housing systems in Northern Germany
  - Conventional system
  - Straw interspersed indoor and outdoor area
  - Straw interspersed indoor and outdoor area + rooting area
- Two batches (summer, winter)
- Undocked, castrated (males)

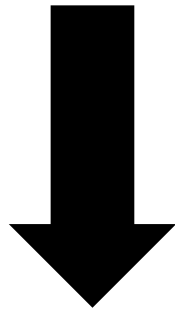






# Saliva sampling & analysis

- End of final fattening (body weight ~ 100kg)
- Synthetic fiber role (Cortisol-Salivette®, Sarstedt AG & Co, Nümbrecht – Germany)
- Immediate freezing



- Defreezing & centrifugation (1000xg, 20°C, 2 min)
- Direct quantitative sandwich-ELISA-Kit for pig-IgA (Celltrend GmbH, Luckenwalde – Germany)





# Statistical analysis

- SAS<sup>®</sup> 9.4 (SAS Institute Inc., 2017)
  - Log10-transformation for normal distribution
  - Linear mixed model (PROC MIXED)

$$y_{ijkl} = \mu + F_i + S_j + B_{ik} + e_{ijkl}$$

$y_{ijkl}$  =  $l^{\text{th}}$  observation of the log10-IgA concentration ( $l = 1, \dots, 288$ )

$\mu$  = general mean

$F_i$  = fixed effect of the  $i^{\text{th}}$  farm ( $i = 1, 2, 3$ )

$S_j$  = fixed effect of the  $j^{\text{th}}$  sex ( $j = 1$  (female), 2 (male))

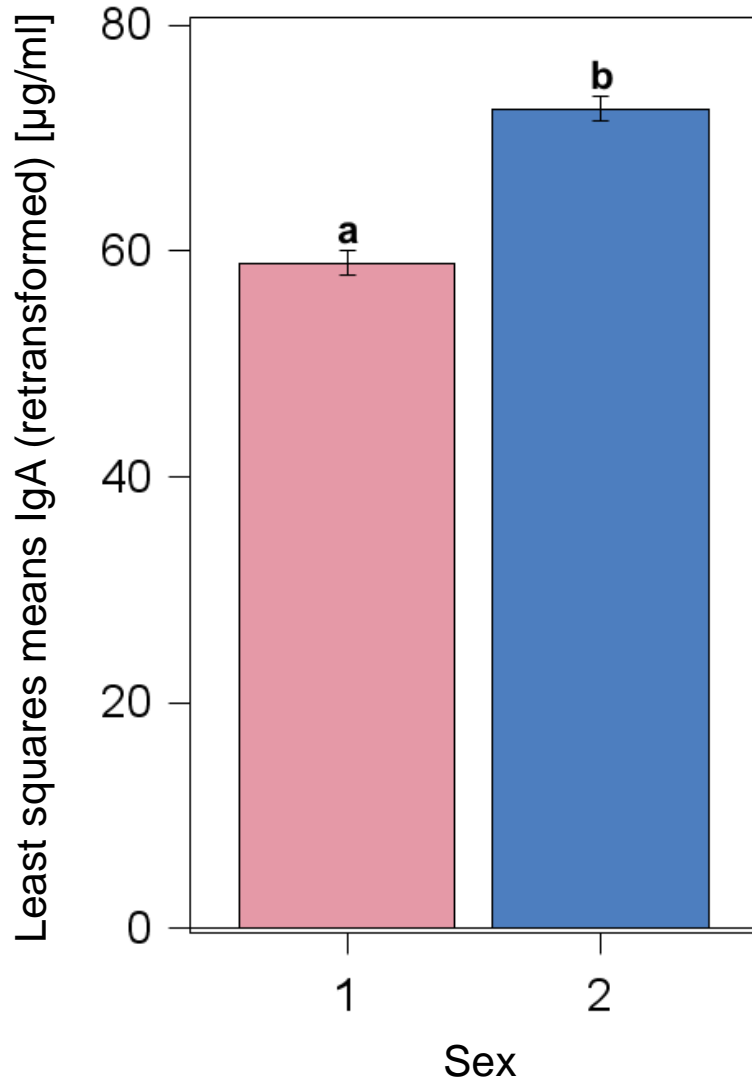
$B_{ik}$  = fixed effect of the  $k^{\text{th}}$  batch within the  $i^{\text{th}}$  farm ( $k = 1, 2$ )

$e_{ijkl}$  = random residual error

- Significance level: 5%



# Effect of sex

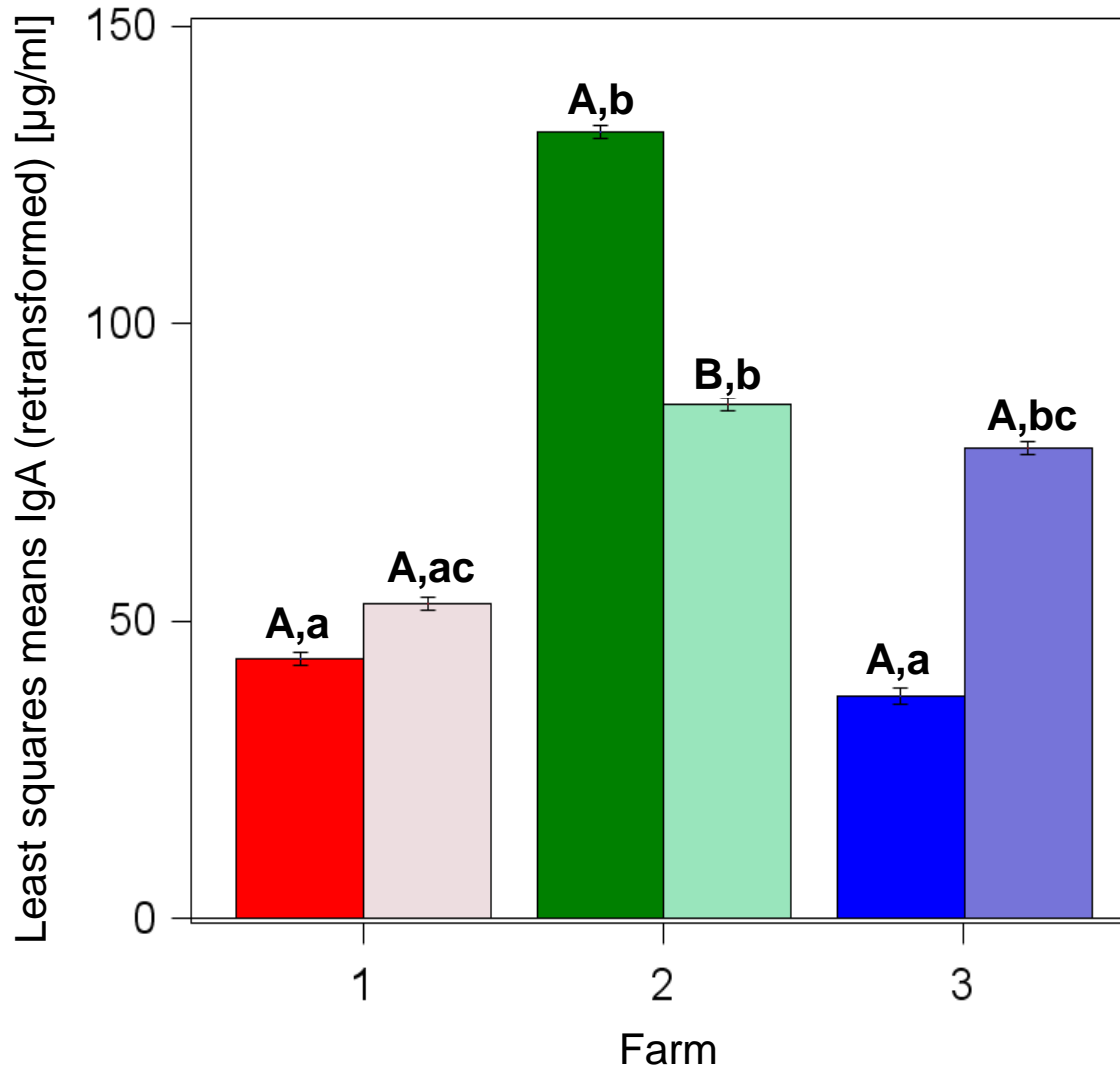


Sex	LSM $\pm$ SE [ $\mu\text{g/ml}$ ]
Female	58.9 $\pm$ 1.1
Male	72.6 $\pm$ 1.1

a, b: significant differences between the sexes



# Effect of batch within the farm



Farm	Batch	LSM±SE [µg/ml]
1	1 <span style="color:red">■</span>	43.7 ± 1.1
	2 <span style="color:pink">■</span>	53.0 ± 1.1
2	1 <span style="color:green">■</span>	132.2 ± 1.1
	2 <span style="color:lightgreen">■</span>	86.5 ± 1.1
3	1 <span style="color:blue">■</span>	37.4 ± 1.3
	2 <span style="color:purple">■</span>	79.1 ± 1.2

A, B: significant differences between the batches within the farm  
a - c: significant differences between the farms within the batches

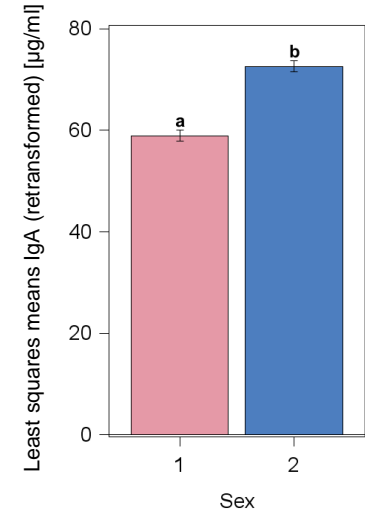




# IgA = suitable indicator?

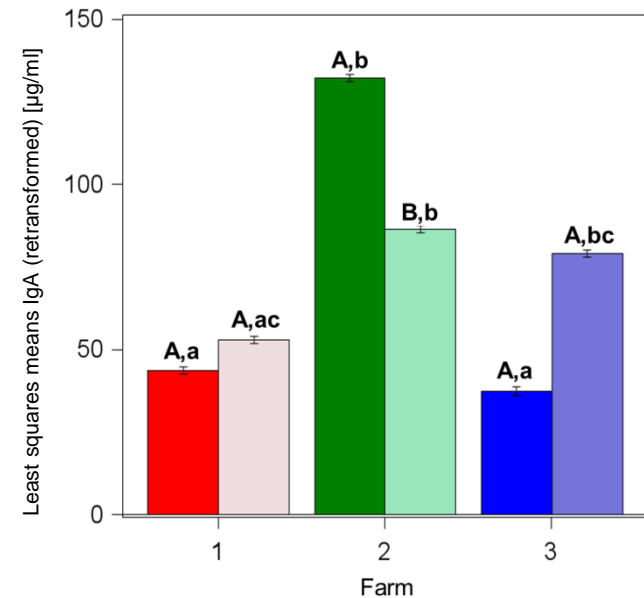
- Effect of sex

- Influence of sex hormones (Gaillard & Spinedi, 1998)
  - Estrogen = IgA $\uparrow$ , androgen = IgA $\downarrow$  (Grossmann, 1984)
  - Castration (Grossmann, 1984)

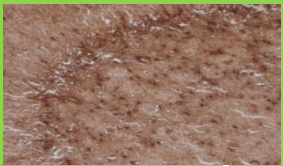


- Effect of batch within the farm

- Different environments: barren vs. enriched
  - Affective state (Bosch et al., 2004)
  - Health (Kelley, 1980, Neville, 2008)
  - Interindividual, e.g. genetics (Calder & Kew, 2002, Mangino et al., 2017)



# Outlook





# Thank you for your attention!

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# Attachment

- Feeding conditions
  - Farm 1
    - 16.5 % (foremast) – 15.5%(final fattening) raw protein
    - Main protein supply: soy extraction meal
  - Farm 2
    - 22.4% (foremast) – 15.4% (final fattening) raw protein
    - Main protein supply: field beans, peas, potato protein
  - Farm 3
    - 20.5% raw protein
    - Main protein supply: field beans