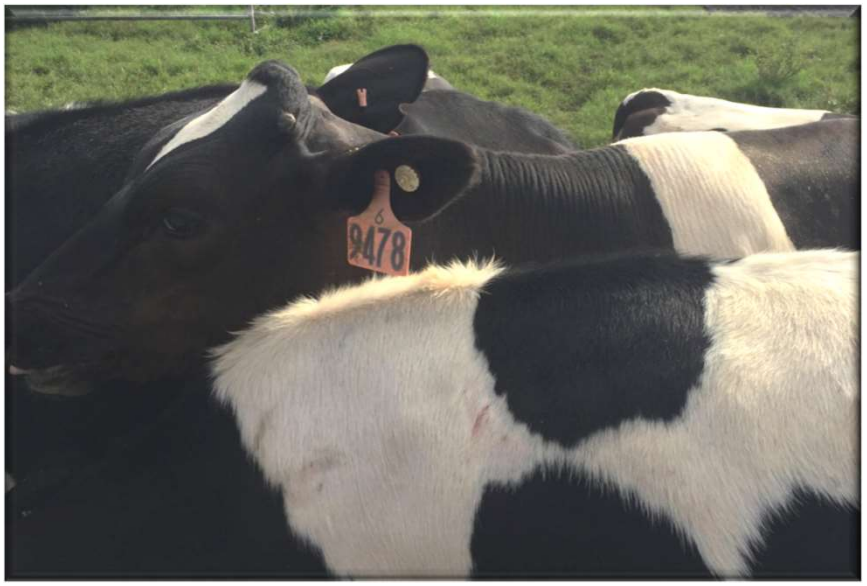
Effects of the SLICK mutation to reduce the negative impact of heat stress in Holstein cattle

Anna C. Denicol DVM, MPVM, PhD



Golden State Dairy Management Conference

March 23rd, 2022

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U.S. Registered Holsteins FOR MAXIMUM PROFIT

HOLSTEIN ASSOCIATION USA
The World's Largest Dairy Breed Association Established 1885

California dairy industry generates $ 7.47 billion/yr and plays a critical role in the state's economy

Heat stress causes dramatic losses to cattle health, production and reproduction

- Recent studies show that pre-weaned calves and pregnant heifers will become heat stressed when THI > 68
- Genetic selection for heat tolerance could be a viable strategy to decrease losses and improve animal welfare

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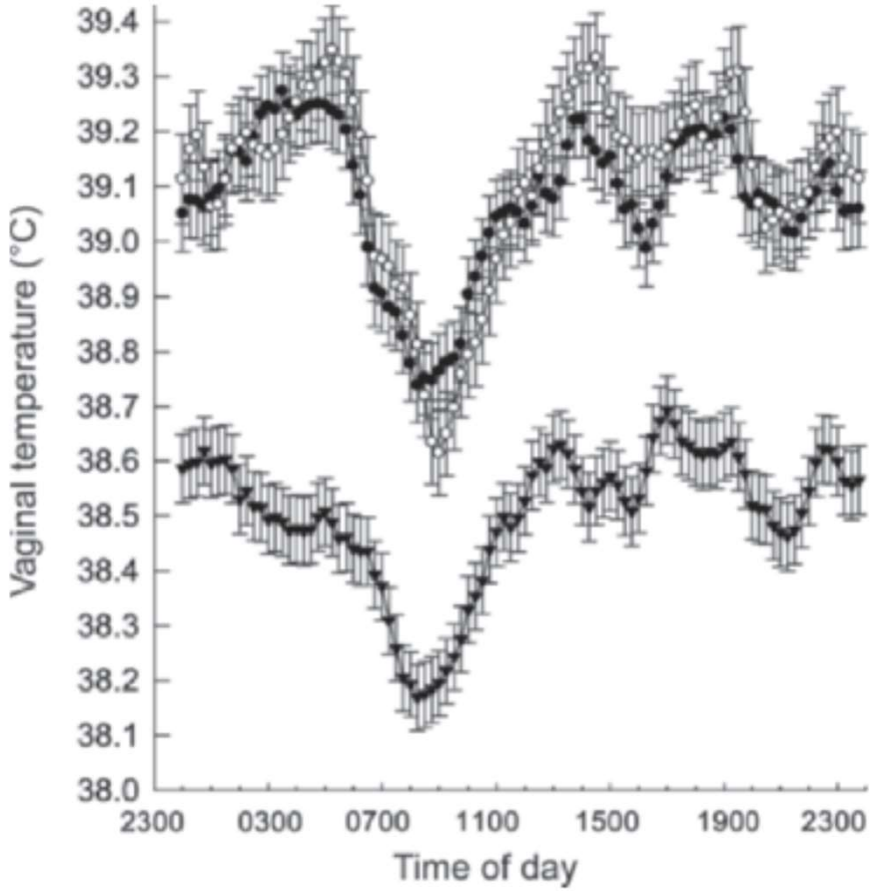
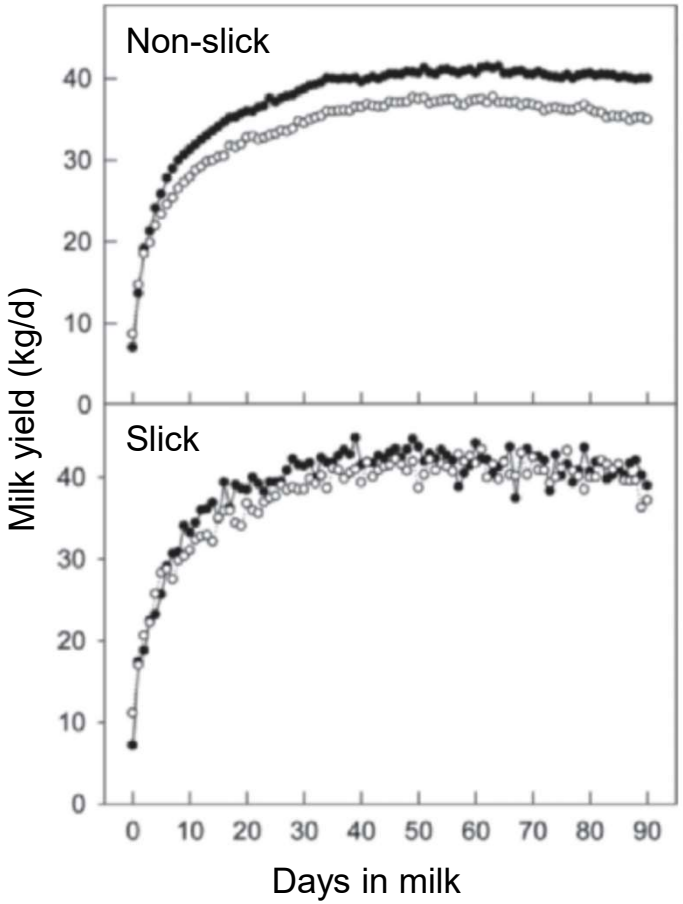
Previous studies showed that Holsteins carrying the SLICK mutation have lower body temperature



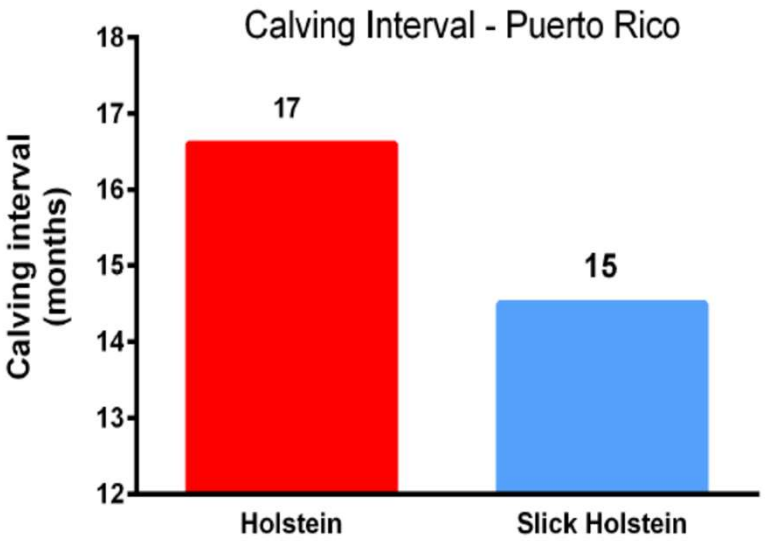
Slick Holstein cows maintained approximately 1°F lower vaginal temperature than non-slick cows

Dikmen et al., *JDS* 2014

Holsteins carrying the SLICK mutation maintain milk yield during summer months and have shorter calving interval

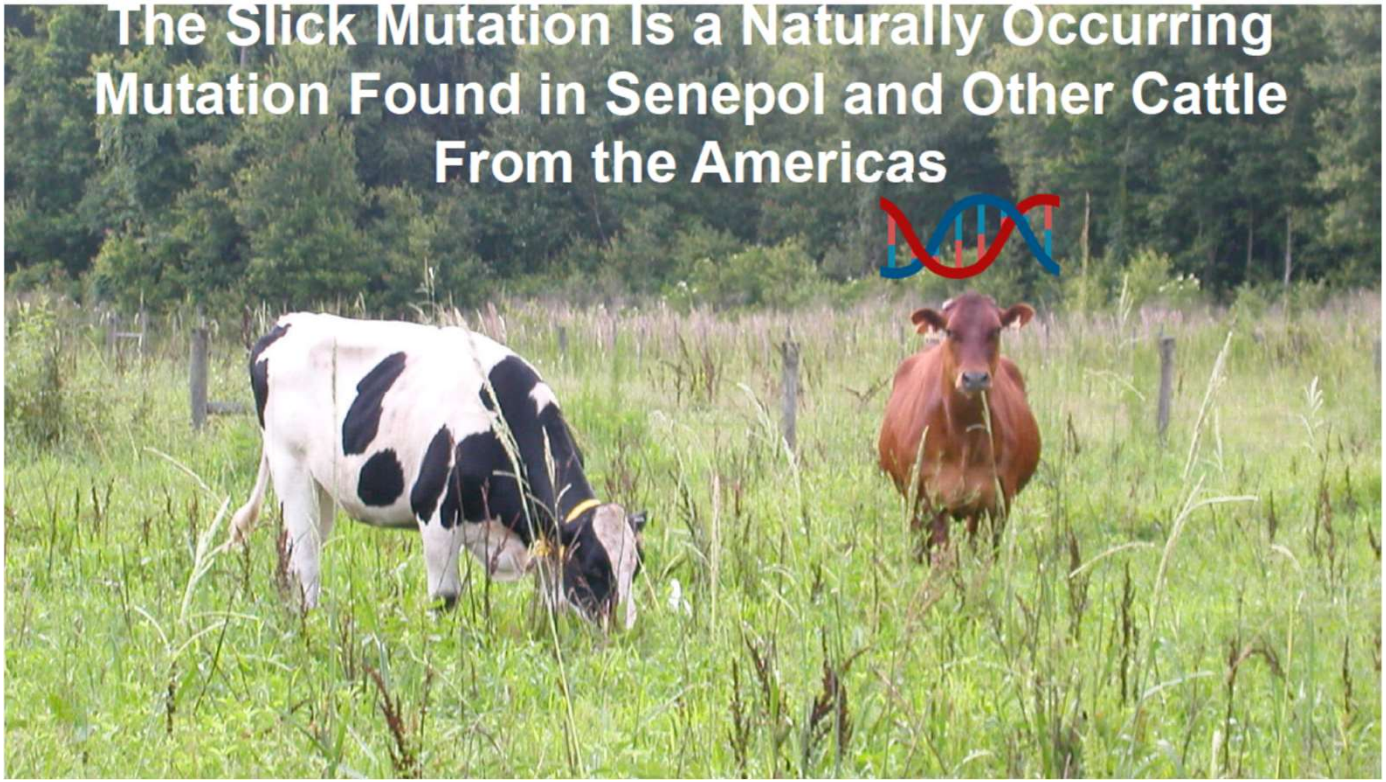


Dikmen et al., *JDS* 2014



Ortiz-Colon et al., *Clim Chnage* 2018

What is the SLICK gene?



Courtesy of Peter J. Hansen, University of Florida

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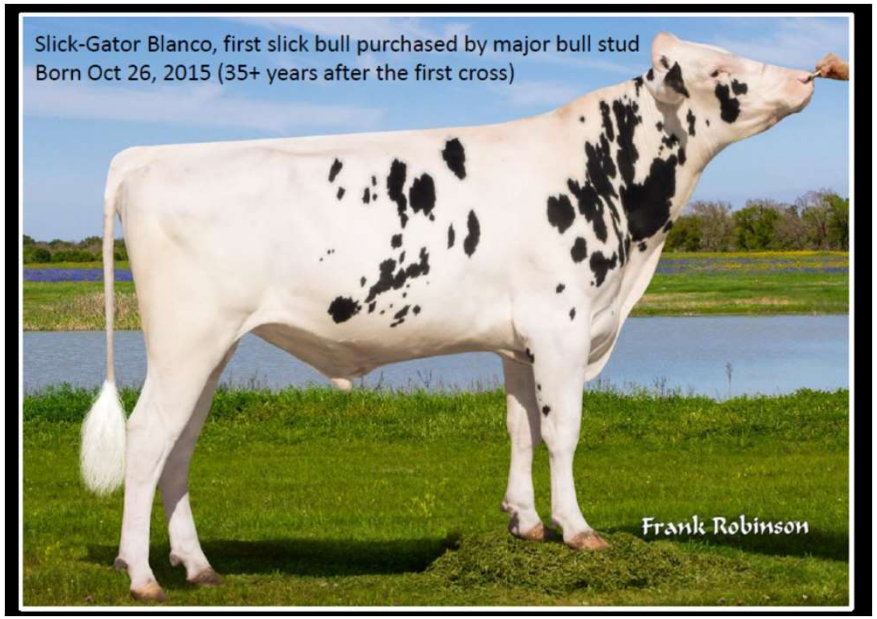
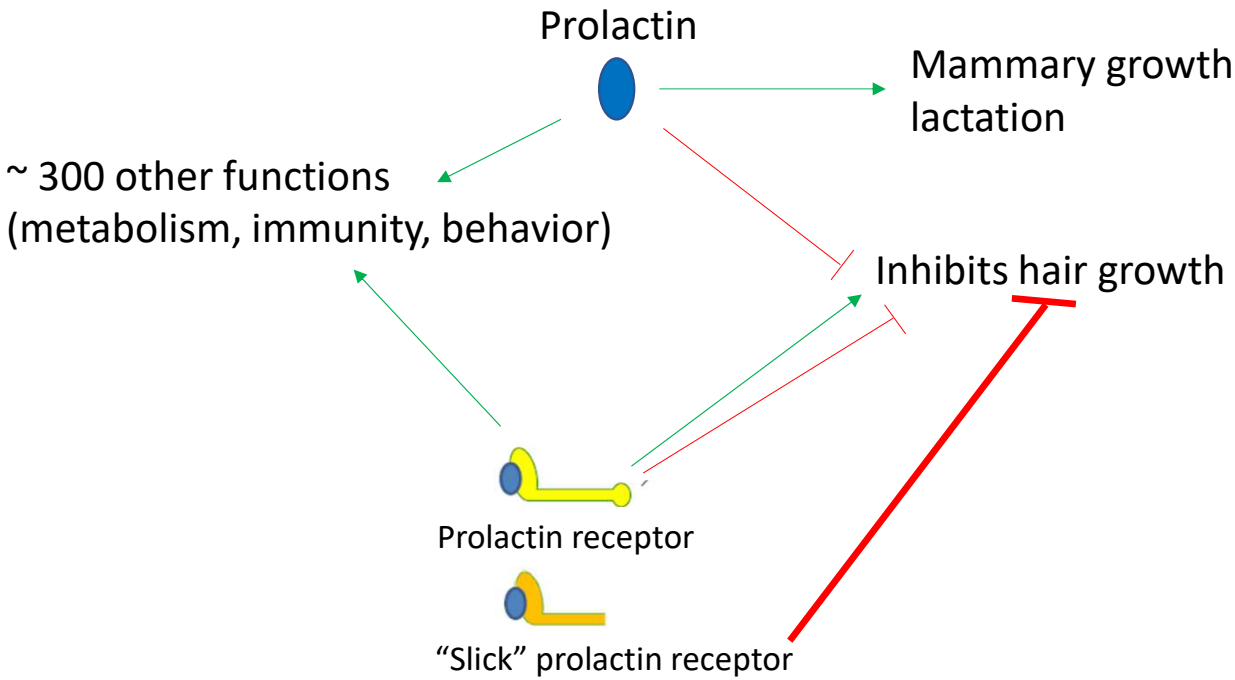


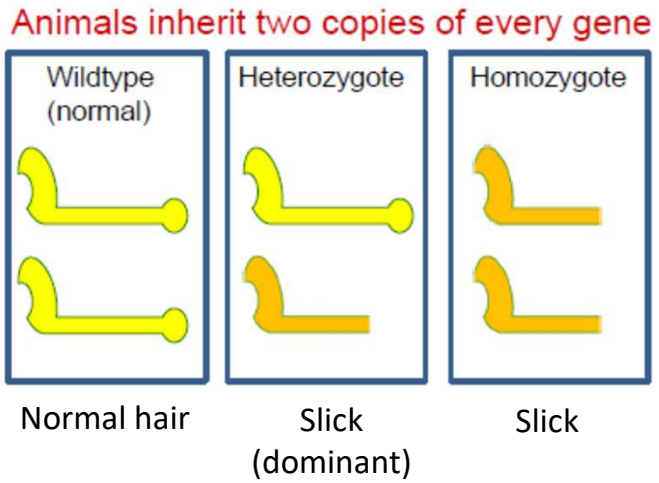
Courtesy of Peter J. Hansen, University of Florida

What is the SLICK gene?

Technically the SLICK1 mutation (there are others)

Mutation in the prolactin receptor gene that causes growth of short hair





Courtesy of Peter J. Hansen, University of Florida

Multi-state, multi-farm experiment to test the effects of the presence of the SLICK1 allele in Holsteins from birth to lactation

California: four dairy farms located in the San Joaquin Valley (central valley)

Florida: three dairy farms located in South Florida (Okeechobee area)

Lactating Holsteins were inseminated with frozen-thawed semen of two bulls heterozygous for the SLICK1 mutation

Group 1: Calves born between Nov 2019 - Mar 2020

Group 2: Calves born between June – July 2020

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Multi-state, multi-farm experiment to test the effects of the presence of the SLICK1 allele in Holsteins from birth to lactation

Physiological responses to hot weather in a subset of the females (n=203) during July-August 2020

Post-weaned heifers: 5-8 mo old (CA n = 101; FL n = 30)

Pre-weaned calves: 15-55 days old (CA n = 54; FL n = 18)

Physiological parameters tested: RT, RR, ST and SR of shaved and non-shaved skin

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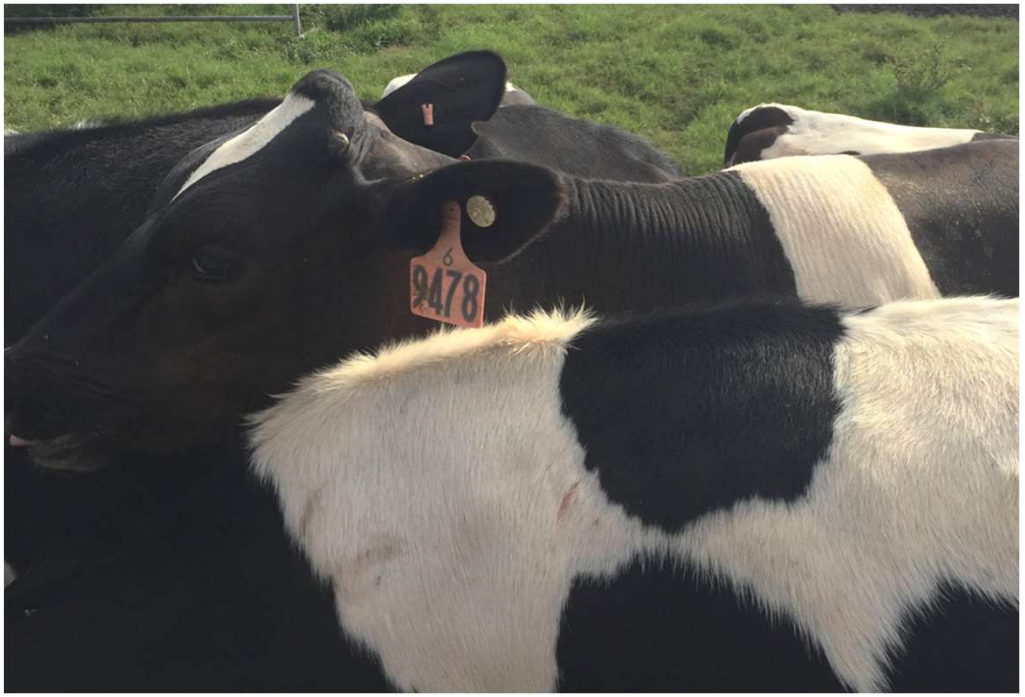
Newborn slick and non-slick female calves in CA



Slick and non-slick heifers in FL

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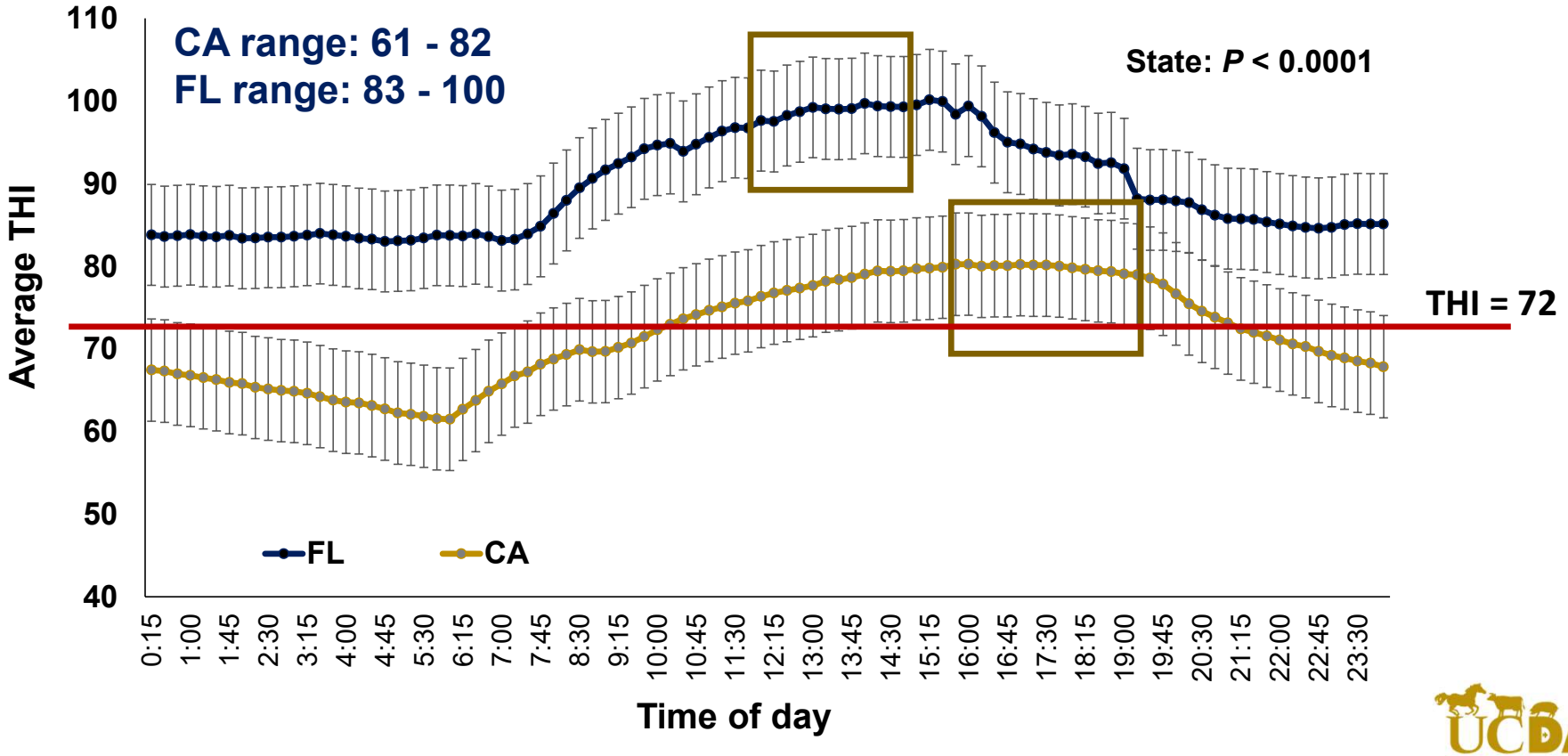
Average temperature-humidity index (THI) calculated over 24 hours in California and Florida during the experiment



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Locations where skin measurements were taken

- Clipped: hair was shaved
- Unclipped: next to the shaved area

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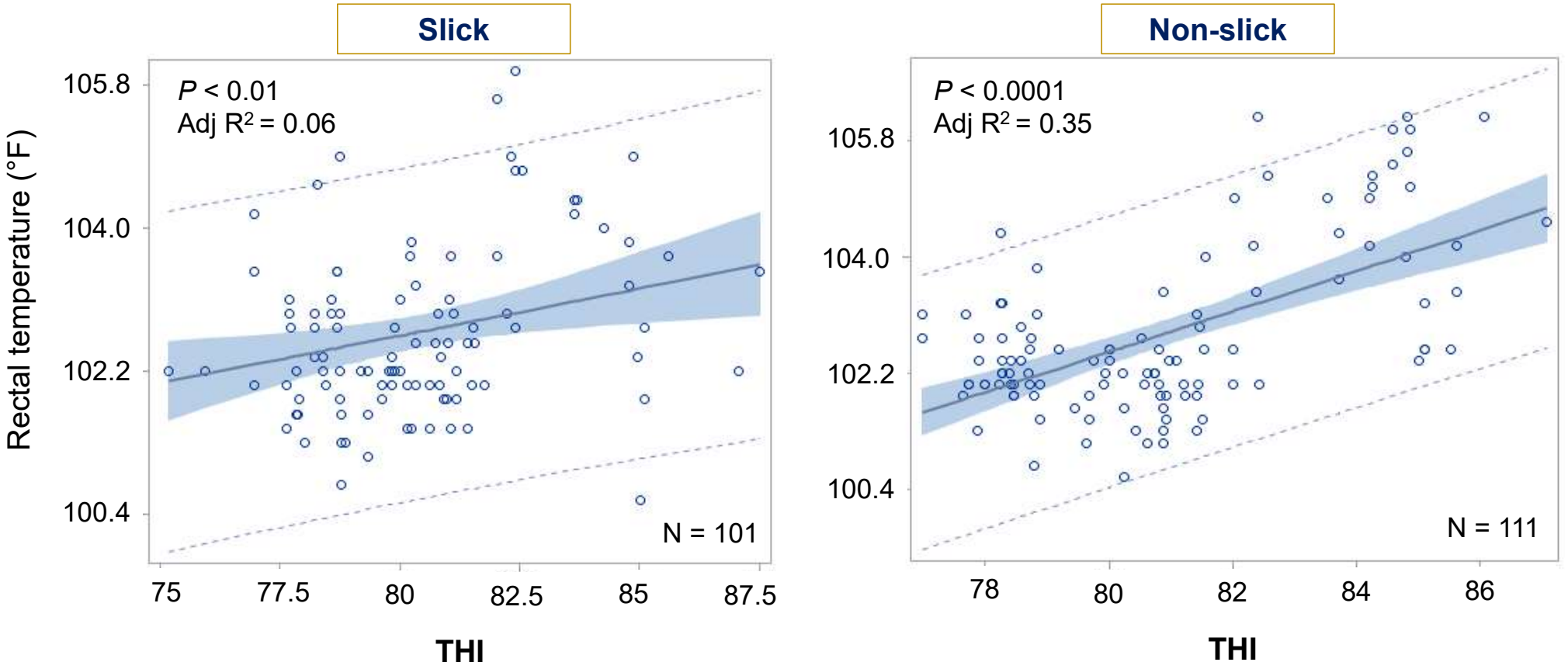
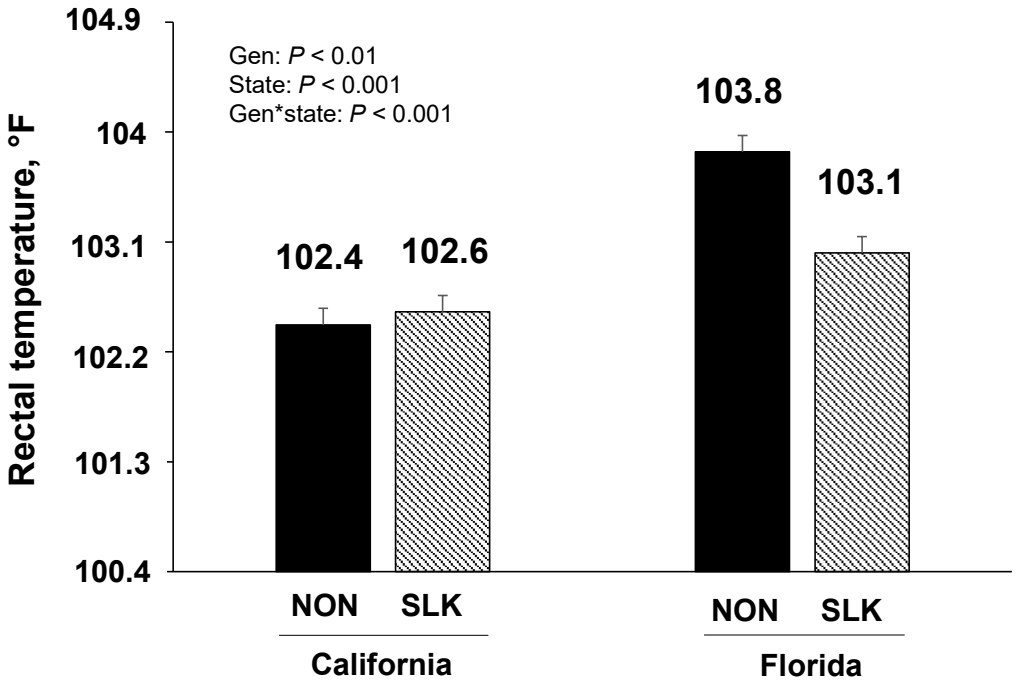
Slick animals had higher tolerance to increasing THI



Rectal temperature and sweating rate



Sick animals in FL had lower RT

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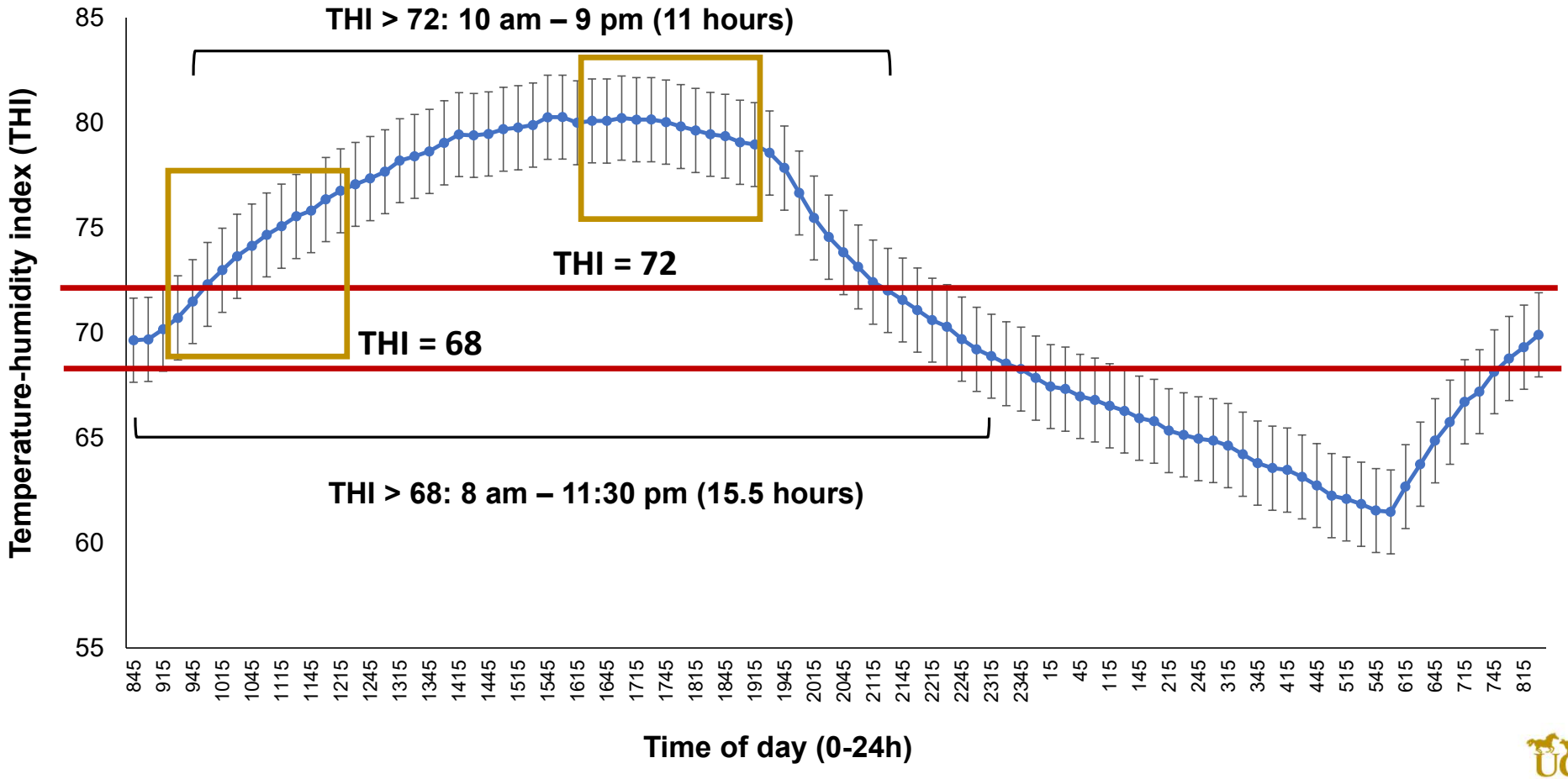
CALIFORNIA

- Physiological data were collected in dairies in Corcoran, Escalon, Hanford
- Reproductive data were compiled from dairies in Corcoran, Escalon, Hanford, and Modesto

Average THI during the 10 days of data collection in California



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Team taking measurements in July 2020

Drs. Fernanda Ferreira and Jessica Pereira

MS student Allie Carmickle and Dr. Jessica Pereira

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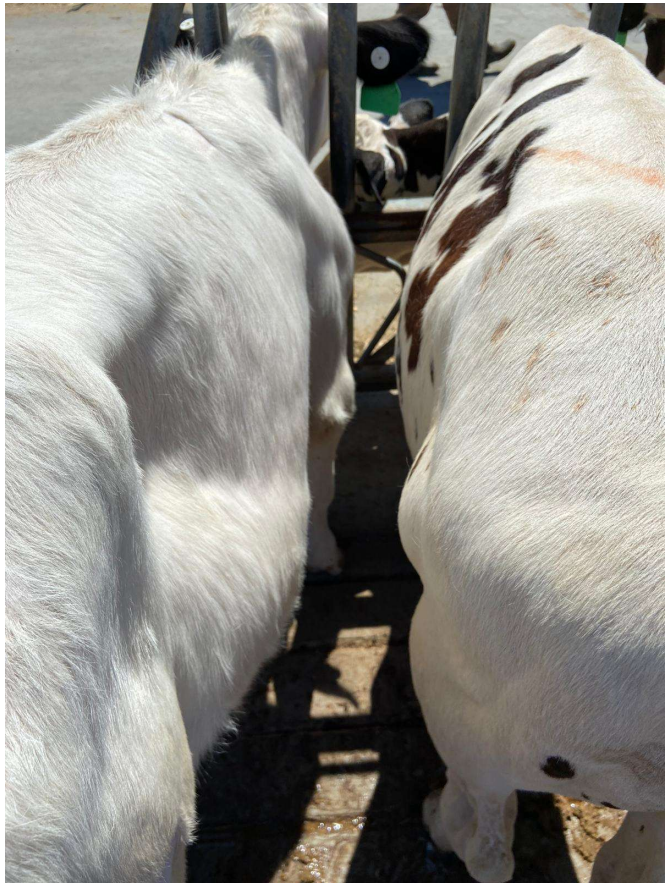

Study heifers: non-slick (left) and slick (right)

Dr. Jessica Pereira measuring sweating rate in a non-slick calf

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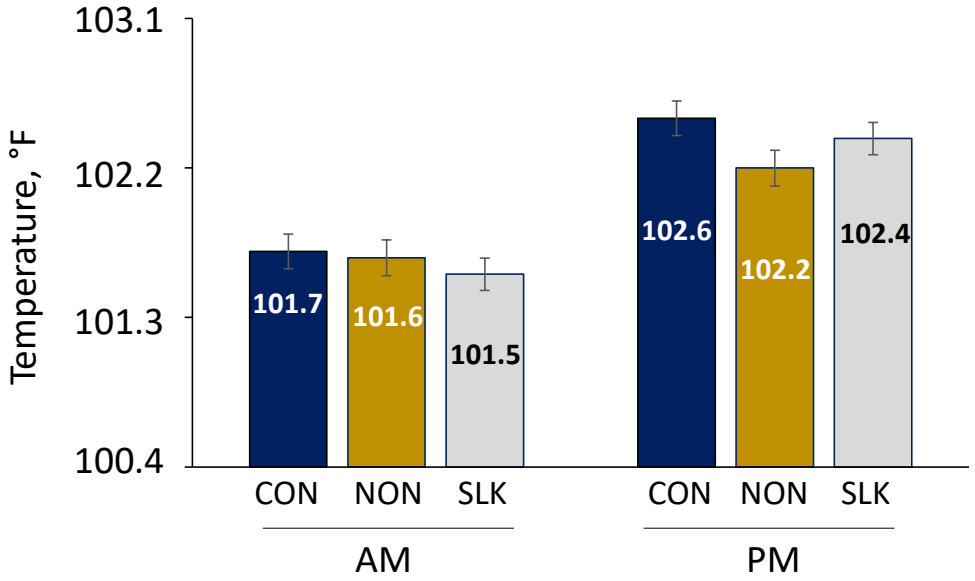
Changes in body temperature during the day in pre- and post-weaned calves



No difference in rectal temperature between slick and non-slick animals

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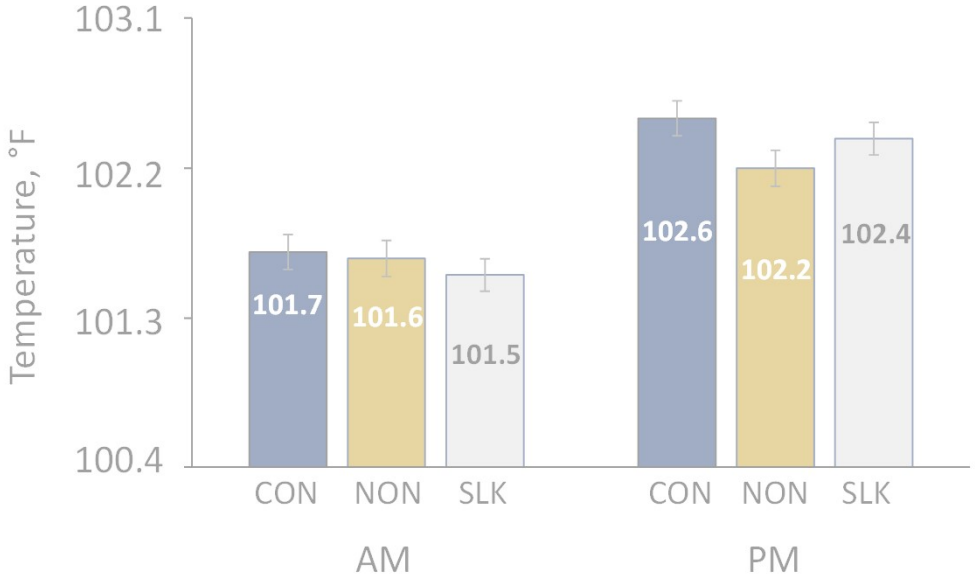
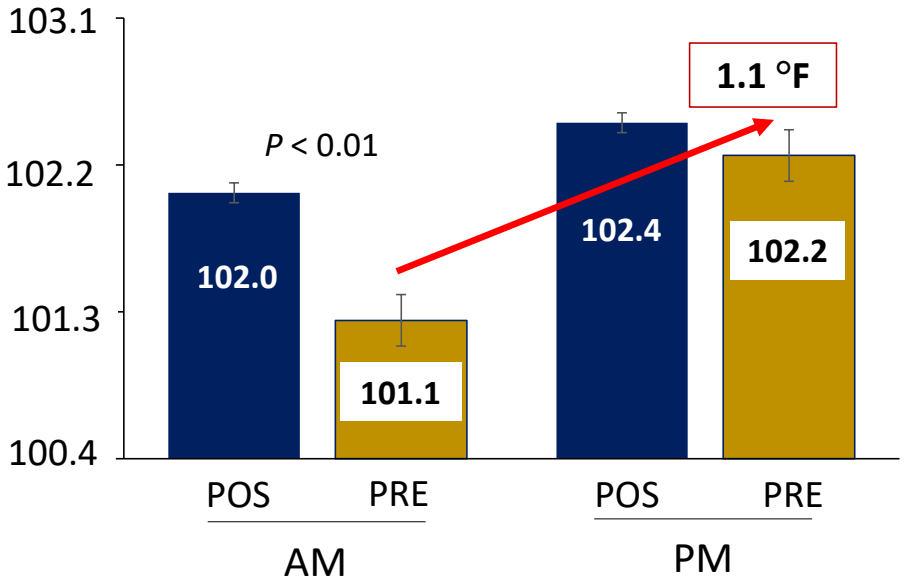
Changes in body temperature during the day in pre- and post-weaned calves



No difference in rectal temperature between slick and non-slick animals



Temperature of pre-weaned calves increased > 1°F between AM and PM

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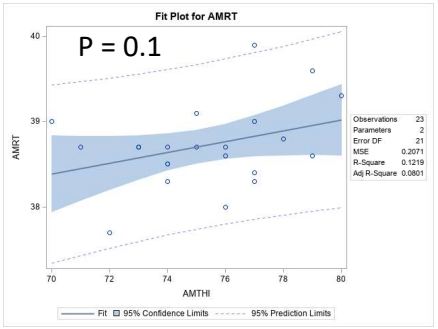
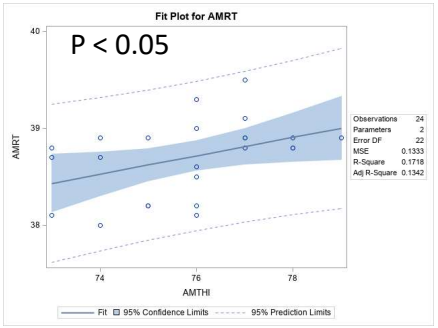
Variation in rectal temperature of pre-weaned calves in relation to THI

AM

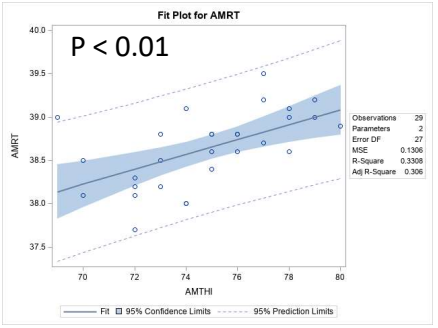
CON



NON



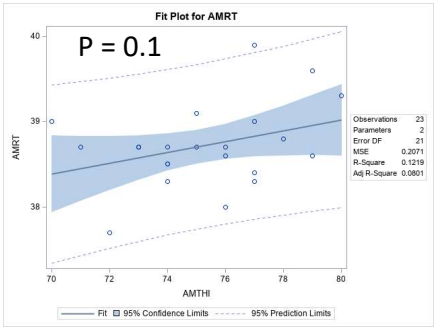
SLK

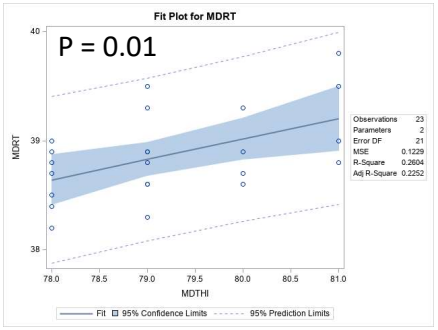


AM

MD

CON





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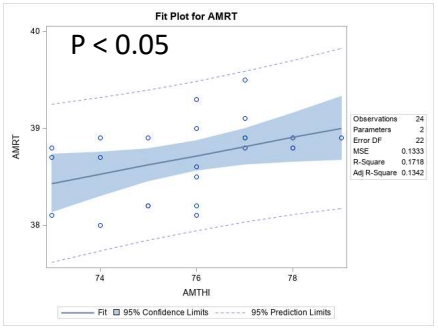

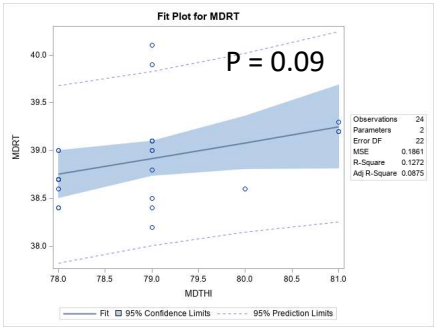

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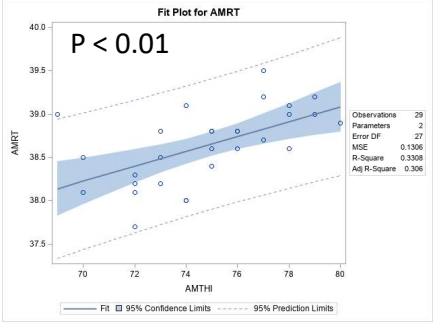

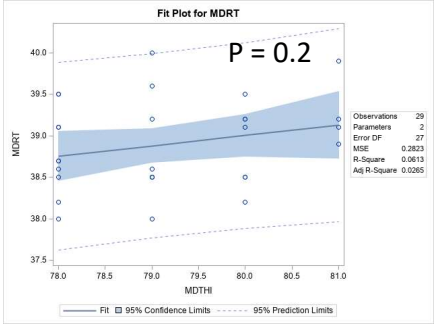

AM

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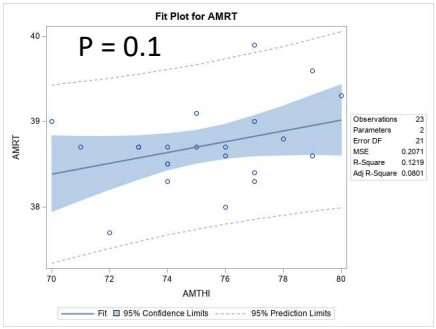

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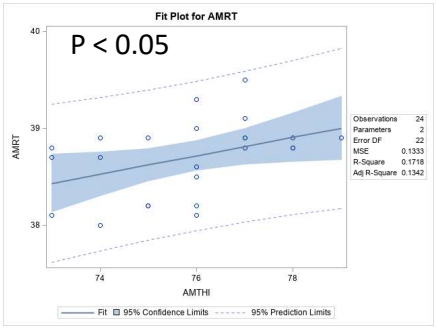

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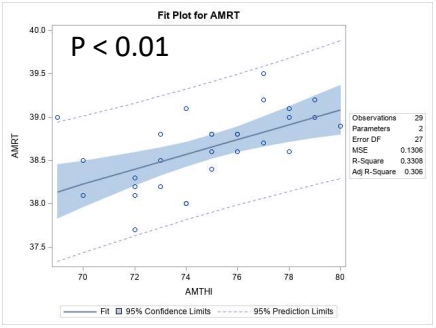
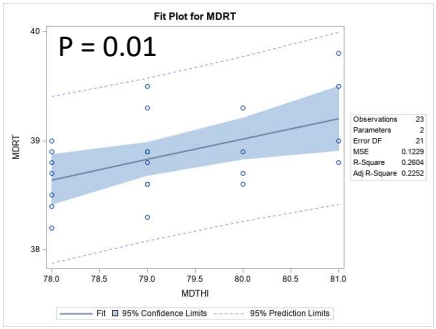


MD

CON



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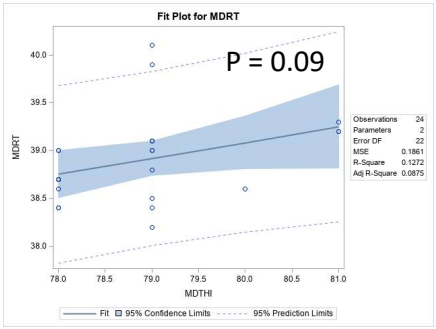

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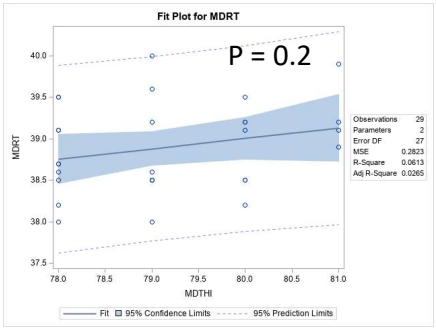

PM

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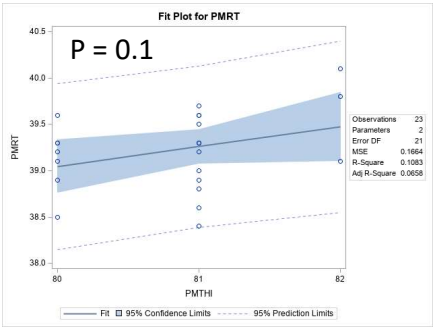

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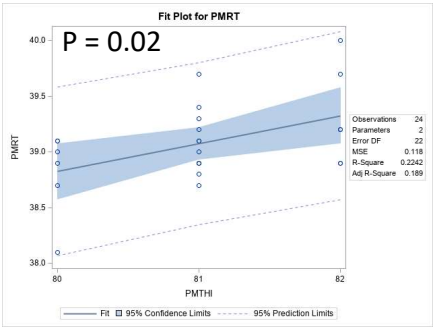
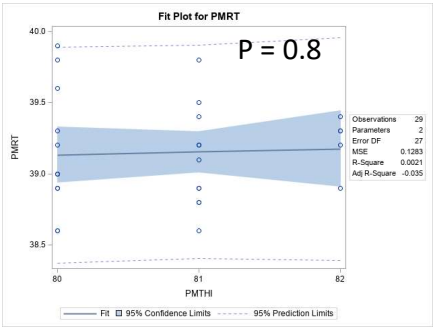
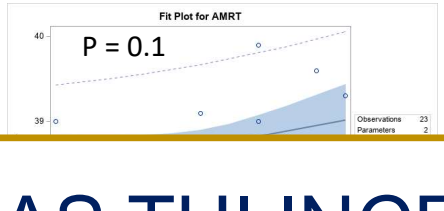


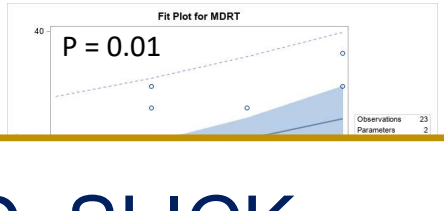
SLK

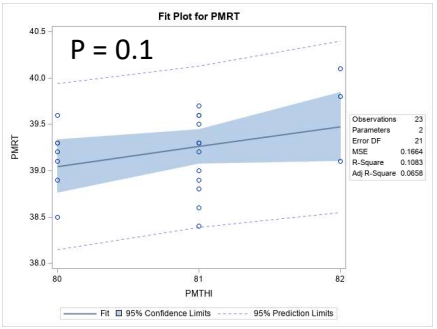


AM | **MD** | **PM**

CON







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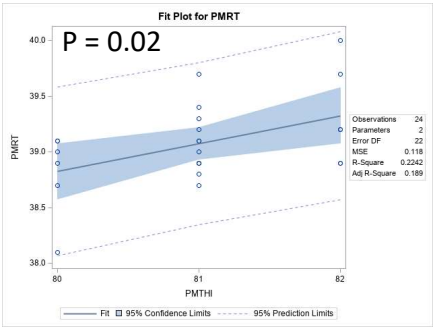

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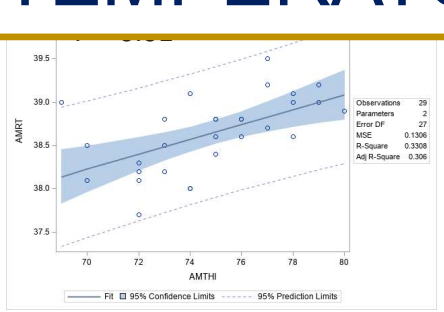
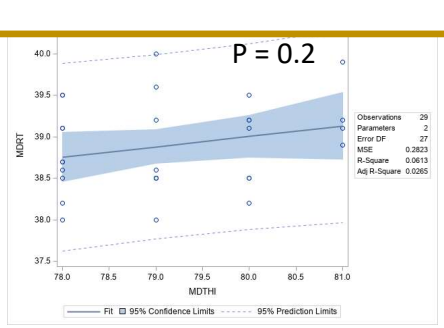
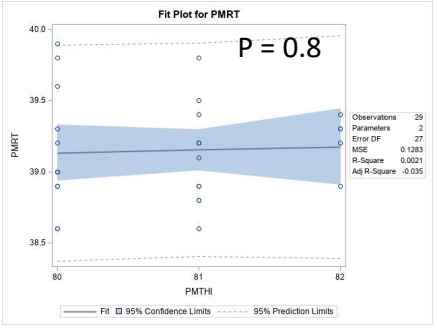




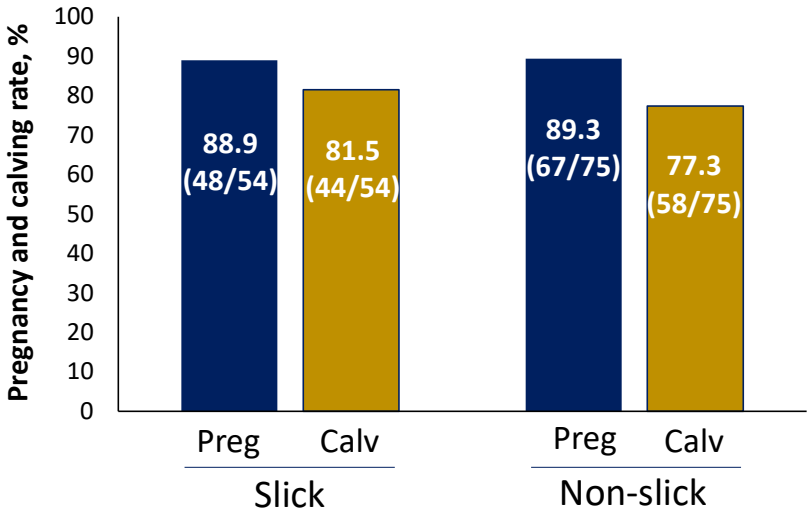


AS THI INCREASED, SLICK CALVES SEEMED TO MAINTAIN A MORE CONSTANT BODY TEMPERATURE

Preliminary analysis of reproductive performance of slick heifers

Group 1: heifers born during winter and bred between late winter and early summer

- Age at first service was 14 months for slick and non-slick heifers



Preliminary analysis of reproductive performance of slick heifers

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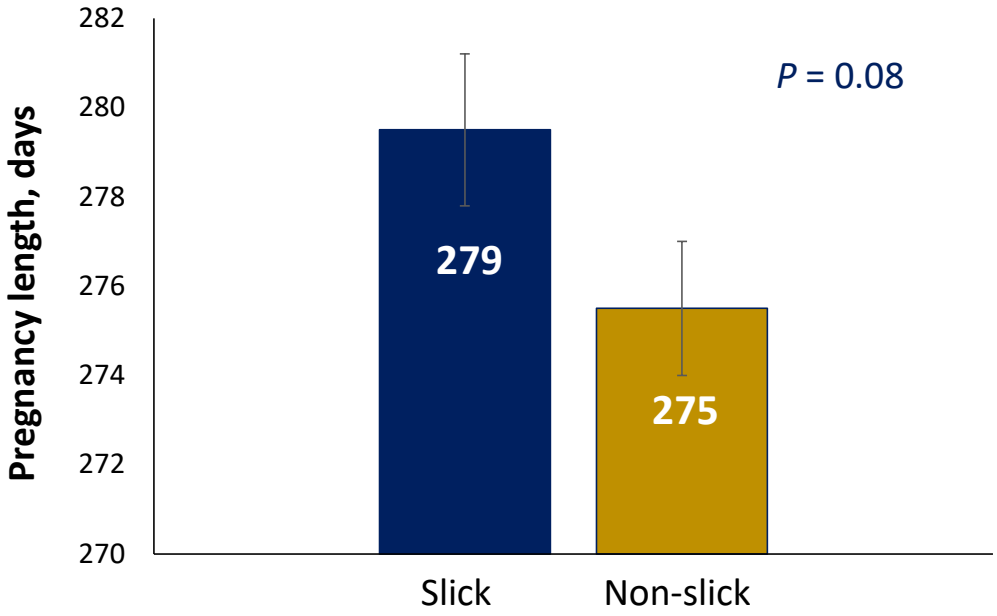

- Pregnancies are ongoing for group 2.
- We are now collecting lactation data from group 1.

Main take-home points from this study

The SLICK mutation could be a useful genetic strategy to improve the tolerance of Holsteins to heat stress in California

- Overall, slick animals seemed to be more resistant to rectal temperature changes in response to THI
- Slick animals had lower rectal temperature in FL, but not in CA
- Heat stress was more severe in Florida during the study
  - All animals tested seemed to be experiencing more or less degree of hyperthermia
- Based on our data, slick animals tended to have better pregnancy from first service

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Acknowledgments

MS student Allie Carmickle

- Collaborating dairies
- Co-PI: Peter Hansen – UF
- Fernanda Ferreira – UC Davis
- Jessica Pereira – UC Davis
- Colleen Larson – UF/IFAS
- Froylan Sosa – UF
- McKenzie Haimon - UF
- Laura Jensen – UF
- Colleagues and friends who assisted in identifying dairies

HOLSTEIN ASSOCIATION USA
The World's Largest Dairy Breed Association Established 1885

L.E. "Red" Larson Endowment

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