

## Kerns, Karl

### A. Education and Training:

B.S. 5/2014 Iowa State University, Ames, IA; Animal Science, Honors, Pre-Graduate  
Ph.D. 2/2019 University of Missouri, Columbia, MO; Animal Science, Repro. Physiology  
Postdoc. 8/2020 University of Missouri, Columbia, MO; Bioinformatics & Ani. Sci.

### B. Professional Experience:

#### Teaching Experiences

**Societal Issues Facing Animal Ag** (MU AnS 2111) – Teaching Assistant (2015 - 2018)  
**World Food Issues: Past and Present** (ISU Agron 342) – Teaching Assistant (2013 & '14)  
**Animal Science Anatomy & Physiology Lab** (ISU AnS 214L) – Lab TA (2012 & 2013)

#### Oral Presentations

Artificial Intelligence Analysis of the Mammalian Sperm Zinc Signature Predicts Male-factor Subfertility. Oral ePoster Competition. Society for the Study of Reproduction Annual Meeting, Online. (2020)

Sperm Capacitation-induced Zinc Efflux is Necessary for Increased Proteasomal Activity and Release from Oviduct Glycans of the Sperm Reservoir. Flash Oral Talk. Society for the Study of Reproduction Annual Meeting, San Jose, CA (2019)

Zinc Signature of Mammalian Sperm Capacitation, Oral Platform Presentation (Top 1% of 600+ abstracts). Society for the Study of Reproduction Annual Meeting, Washington, DC (2017)

Artificial Insemination and the Porcine Reproductive Toolbox. Producer Workshop, Eldon, MO (2018)

From A(xoneme) to Z(inc): A New Paradigm for Boar Spermatozoa Fertility, Function, and Storage to Maximize Genetic Usage. North American PRRS Symposium on PRRS, Emerging & Foreign Animal Diseases and National Swine Improvement Federation Conference, Chicago, IL (2017)

Dual Propose with Dual Benefit: A One Health Research Perspective for Iowa, Luncheon Keynote, Iowa One Health Conference, Iowa City, IA (2017)

Unique Zinc Signature of Boar Capacitation. International Conference on Pig Reproduction, Columbia, MO (2017)

Innovation and Entrepreneurship in Academia, Oral Presentation & Panel, Borlaug Dialogue International Symposium Iowa Ag Leaders Dinner, World Food Prize, Des Moines, IA (2016)

Discovery and Validation of Boar Sperm Quality and Sperm Capacitation Biomarkers Using Next Generation Image-based Flow Cytometry. Midwest Boar Stud Managers Conference, St. Louis, MO (2016)

Capacitation-induced Changes of Candidate Proteasomal Interactors ADAM5 and NEDL2, Measured by Image-based Flow Cytometry in Porcine Spermatozoa. Oral Flash Talk, Society for the Study of Reproduction Annual Meeting, San Diego, CA (16)

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Localization of Candidate Proteasomal Interactors ADAM5 and NEDL2 in Porcine Spermatsids and Spermatozoa. VIII International Conference on Boar Semen Preservation, IL (2015)

### **Poster Presentations** (when no associated with oral presentation)

- Sperm Tail Mitochondrial Sheath Length Correlates with Bull Fertility Outcomes. Grace Wiley, Eriklis Nogueira, Camile Sanches, **Karl Kerns**, Peter Sutovsky. Society for the Study of Reproduction Annual Meeting, San Jose, CA (2019)
- Impact of High Fat Diet-Induced Obesity on Ovarian DNA Damage Repair Proteins In Rats. Bailey C. McGuire, María E. González Alvarez, **Karl Kerns**, Peter Sutovsky, Aileen F. Keating. Society for the Study of Reproduction Annual Meeting, San Jose, CA (2019)
- Impact of High Fat Diet-Induced Obesity on Ovarian Chemical Metabolism Proteins in Rats. María E. González Alvarez, Bailey C. McGuire, **Karl Kerns**, Peter Sutovsky, Aileen F. Keating. Society for the Study of Reproduction Annual Meeting, San Jose, CA (2019)
- Identification of a Rare, Fertility Affecting Mutation in Bovine Eml5. Michal Zigo, Eriklis Nogueira, **Karl Kerns**, Miriam Sutovsky, Jaewoo Kim, Filip Tirpak, Thomas E. Spencer, Jeremy F. Taylor, Robert D. Schnabel, Peter Sutovsky. Society for the Study of Reproduction Annual Meeting, San Jose, CA (2019)
- Sire Influences Gene Expression in Trophoblast Cell Markers In Vitro. M. Sofia Ortega, **Karl Kerns**, Thomas E. Spencer. Society for the Study of Reproduction Annual Meeting, San Jose, CA (2019)
- A(xoneme) to Z(inc): New Paradigm for Mammalian Sperm Fertilization Competency. **Karl Kerns**, Michal Zigo, Wei Xu, Erma Drobnis, Lauren Hamilton, Miriam Sutovsky, Richard Oko, Peter Sutovsky. Yanagimachi 90<sup>th</sup> Birthday Symposium, Honolulu, HI (2018)
- Boar Sperm Zinc Ion Fluctuations from Spermiogenesis to Fertilization. **Karl Kerns**, Michal Zigo, Peter Sutovsky. Biennial Conference of the Association for Applied Animal Andrology, New Orleans, LA (2018)
- Mammalian Sperm Zinc Ion Fluctuations from Spermiogenesis to Fertilization. **Karl Kerns**, Michal Zigo, Peter Sutovsky. Society for the Study of Reproduction Annual Meeting, New Orleans, LA (2018)
- Ubiquitin-Proteasome System (UPS) Regulates Spermadhesin Release During Boar Sperm Capacitation. Michal Zigo, Pavla Postlerova, Vera Jonakova, **Karl Kerns**, Peter Sutovsky. Society for the Study of Reproduction Annual Meeting, New Orleans, LA (2018)
- New Insights into the Involvement of Ubiquitin-Proteasome System (UPS) in Boar Sperm Capacitation. Michal Zigo, **Karl Kerns**, Miriam Sutovsky, Peter Sutovsky. Society for the Study of Reproduction Annual Meeting, Washington, DC (2017)
- Proteasomal Activity is Necessary for Porcine Sperm Release from Immobilized Oviduct Glycans. Momal Sharif, **Karl Kerns**, Peter Sutovsky, David Miller. Society for the Study of Reproduction Annual Meeting, Washington, DC (2017)
- Capacitation-induced Changes of Candidate Proteasomal Interactors ADAM5 and NEDL2, Measured by Image-based Flow Cytometry in Porcine Spermatozoa. **Karl Kerns**, Miriam

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Sutovsky, Peter Sutovsky. Society for the Study of Reproduction Annual Meeting, San Diego, CA (2016)

Localization of Candidate Proteasomal Interactors ADAM5 and NEDL2 in Porcine

Spermatozoa. **Karl Kerns**, Michal Zigo, Miriam Sutovsky, Peter Sutovsky. Society for the Study of Reproduction Annual Meeting, San Juan, PR (2015)

### **Research Positions and Employment**

2020 - **Iowa State University**, Department of Animal Science, Lecturer, IA

2019 - 2020 **USDA NIFA Postdoctoral Fellow**, Xu/Behura/Sutovsky Labs, MO

Summer 2013 **USDA ARS - Dr. David Guthrie Lab**, Intern, Beltsville, MD

Summer 2011 **Trans Ova Genetics**, Sexed Semen and In-vitro Fertilization Lab Intern, IA

Summer 2012 **Smithfield Premium Genetics**, Management & Operations Intern, NC & TX

2011 – 2014 **Iowa State University - Dr. Jason Ross Lab**, Undergraduate Research, IA

2008 – 2013 **University of Nebraska & Bellweather Farms**, NE

2004 – 2014 **International Boar Semen**, IA

### **International Experiences**

Summer 2013 **University of Adelaide**, Australia (Van Wettere Lab Internship)

Summer 2012 **Intl Collegiate Agricultural Leadership Program to S.E. Asia**

### **Leadership Experiences**

2019 - **USDA ARS Meat Animal Research Center Swine Focus Group** – Member

2017 - '20 **Interdisciplinary Reproduction & Health Group Trainee Assoc.** – Treasurer

2017 **International Conference on Pig Reproduction** – Local Organizing Committee

2010 -'14 **VEISHEA, Inc.** - General Co-Chair (2014); General Business Manager (2013)

2012 -'14 **Ag Entrepreneurship Initiative** - Student Advisory Team ('12-'13)

2012 -'13 **Student Federation for Agriculture (Ag Advocates)** – Founding Treasurer

2010 -'12 **College of Agriculture & Life Sciences Ambassador** – Alumni Committee

2013 **Bacon Expo** – Founding Business Manager

### **Professional & Honor Memberships**

2015 - Society for the Study of Reproduction (SSR), Trainee

2015 - American Association for the Advancement of Science (AAAS)

2015 - Iowa State University, CALS Curtiss League

2013 Beta Beta Beta Biological Honors Society

2013 Cardinal Key Honor Society

2011 Alpha Zeta Honor Fraternity

### **Awards**

2020 SSR Postdoctoral Poster Competition – 1st Place

2020 USDA NIFA AFRI SSR Scientific Merit and Impact Award

2020 University of Missouri Distinguished Dissertation Award

2019 USDA National Institute of Food and Agriculture Postdoctoral Fellow (**\$165,000**)

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- 2019 Society for the Study of Reproduction (SSR) Trainee Travel Award (1 of 20)
- 2019 Missouri Life Sciences Week; Animal Biology, Health & Disease - 1st Place
- 2019 Iowa State University STATEment Maker, Academia Division
- 2018 Missouri Life Sciences Week Plant and Animal Physiology & Health, 2nd Place
- 2018 Animal Science Graduate Forum, University of Missouri - 1st Place PhD Oral
- 2015 - '18 Larry Ewing Memorial Trainee Travel Award, SSR
- 2017 National Swine Improvement Federation (NSIF) Graduate Student Award
- 2015 & '17 Douglas D. Randall Young Scientists Development Award, University of MO
- 2017 USDA NIFA AFRI SSR Scientific Merit and Impact Award
- 2017 SSR Trainee Platform Finalist (Top 1% of 600+ abstracts)
- 2017 USDA National Institute of Food and Agriculture Predoctoral Fellow (**\$95,000**)
- 2015 Animal Science Graduate Forum, University of Missouri, 2nd Place PhD Poster
- 2014 - '16 Miller Fellow, University of Missouri
- 2014 - '16 Graduate College Fellow, University of Missouri
- 2014 ISU CALS Senior Leadership Award
- 2013 Murray Wise Agricultural Entrepreneurship Award (\$10,000)
- 2013 Iowa Governor Branstad Agricultural Leadership Award

### **Funding - \$1.01 million in Federal Funding**

- 2020 - \$650,000 - USDA NIFA SBIR Phase II, Proposal No. 2020-06323
- 2019 - '20 \$100,000 - USDA NIFA SBIR Phase I, Award No. 2019-33610-29800
- 2019 - '20 \$165,000 - USDA NIFA Postdoctoral Fellowship, Award No. 2019-67012-29714
- 2017 - '19 \$95,000 - USDA NIFA Predoctoral Fellowship, Award No. 2017-67011-26023

### **Journal Peer Reviewer:**

- Scientific Reports
- Journal of Assisted Reproduction and Genetics
- Cell and Tissue Research
- International Journal of Nanomedicine

### **Patents:**

1. Sperm Fertility Capacity Test & Decapacitating Supplement. Status: Provisional, May 2018, International U.S. Priority Application No. 62/673,356, University of Missouri IDF 18UMC071/18UMC072

Two additional university IP disclosures under consideration for patenting:

2. Method of identifying X/Y-bearing spermatozoa
3. Medium-term liquid preservation supplement for boar semen

**C. Publications:**

1. **Kerns K**, Zigo M, Sutovsky M, Drobnis E, Sutovsky P. 2018. Zinc Ion Flux of Mammalian Spermatozoa Capacitation. *Nature Communications*. DOI:10.1038/s41467-018-04523-y
2. **Kerns K**, Sharif M, Zigo M, Xu W, Hamilton LE, Sutovsky M, Ellersieck M, Drobnis EZ, Bovin N, Oko R, Miller D, Sutovsky P. 2020. Sperm Cohort-Specific Zinc Signature Acquisition and Capacitation-Induced Zinc Flux Regulate Sperm-Oviduct and Sperm-Zona Pellucida Interactions. *Int. J. Mol. Sci.* 21(6), 2121; DOI: 10.3390/ijms21062121.
3. **Kerns K**, Zigo M, Sutovsky P. 2018. Zinc: A Necessary Ion for Mammalian Sperm Fertilization Competency. *Int. J. Mol. Sci.* 19 (12), 4097. DOI:10.3390/ijms19124097
4. **Kerns K**, Morales P, Sutovsky P. 2016. Regulation of Sperm Capacitation by the 26S proteasome: An emerging New Paradigm in Spermatology. *Biol Reprod* 94(5):117. DOI: 10.1095/biolreprod.115.136622
5. Zigo M, Maňásková-Postlerová P, Zuidema D, **Kerns K**, Jonáková V, Tůmová L, Bubeníčková F, Sutovsky P. 2020. Porcine model for the study of sperm capacitation, fertilization, and male fertility. *Cell Tissue Res.* 380(2):237-262. DOI: 10.1007/s00441-020-03181-1.
6. Mordhorst BR, **Kerns KC**, Schauflinger M, Murphy SL, Ross RM, Samuel MS, Wells KD, Green JA, Sutovsky P, Prather RS. 2019. Pharmacologic reprogramming designed to induce a Warburg Effect in porcine fetal fibroblasts decreases mitochondrial membrane potential and increases the quantity of autolysosomes, without impacting the overall quantity or size mitochondria. *Scientific Reports*. DOI:10.1038/s41598-019-45850-4
7. Zigo M, Manaskova-Postlerova P, Jonakova V, **Kerns K**, Sutovsky P. 2019. Compartmentalization of the proteasome-interacting proteins during sperm capacitation. *Scientific Reports*. DOI:10.1038/s41598-019-49024-0
8. Kelsey KM, Zigo M, Thompson WE, **Kerns K**, Manandhar G, Sutovsky M, Sutovsky P. 2019. Reciprocal Surface Expression of Arylsulfatase A and Ubiquitin in Normal and Defective Mammalian Spermatozoa. *Cell Tissue Res.* In press.
9. Sutovsky P, **Kerns K**, Zigo M, Zuidema D. 2019. Boar Semen Improvement through Sperm Capacitation Management, With Emphasis on Zinc Ion Homeostasis. *Theriogenology*. DOI: 10.1016/j.theriogenology.2019.05.037
10. Chinchilla-Vargas J, **Kerns K**, Rothschild MF. 2017. Climatic and lunar effects on boar semen traits. *Anim Reprod Sci.* DOI:10.1016/j.anireprosci.2018.04.006
11. Zigo M, Manaskova-Postlerova P, Jonakova V, **Kerns K**, Sutovsky P. 2019. Ubiquitin-proteasome system participates in the de-aggregation of spermadhesion and DQH protein during boar sperm capacitation. *Reprod.* DOI: 10.1530/REP-18-0413
12. Zigo M, **Kerns K**, Sutovsky M, Sutovsky P. 2018. Modifications of the 26S proteasome during boar sperm capacitation. *Cell Tissue Res.* DOI:10.1007/s00441-017-2786-6
13. Walters EM, **Kerns K**, Burlak C. 2017. Xenotransplantation literature update, May/June 2017. *Xenotransplantation* 24(4): e12323. DOI: 10.1111/xen.12323

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14. **Kerns K**, Hua A, Burlak C. 2017. Xenotransplantation literature update, January/February 2017. *Xenotransplantation* 24(2): e12304. DOI: 10.1111/xen.12304
15. Burlak C and **Kerns KC**. 2015. Xenotransplantation literature update, January-February 2015. *Xenotransplantation* 22(2): 155-157. DOI: 10.1111/xen.12168
16. Burlak C, **Kerns KC**, Taylor RT. 2015. Xenotransplantation literature update, March-April 2015. *Xenotransplantation* 22(3): 236-238. DOI: 10.1111/xen.12171

### Ready to Submit / In Preparation:

17. **Kerns K**, Jankovitz J\*, Minton A, Kuster C, Sutovsky P. Relationship between the length of sperm tail mitochondrial sheath and fertility traits in boars used for artificial insemination. Submitted.
18. **Kerns K**, Sutovsky M, Sutovsky P. Characterization of spermatozoa plasma membrane changes and zinc super resolution 3D modeling during capacitation. In preparation.
19. Costello K, **Kerns K**, Sutovsky P, Timms K. 2018. Paternal Development Exposure to Endometriosis Causes Negative Transgenerational Impacts on Male Fertility. Ready to submit.
20. Nogueira E, **Kerns K**, Wiley G, Sutovsky P. Bull fertility predictive model using a biomarker approach. In late stage preparation.
21. Grusenmeyer E, **Kerns K**, Zulovich J, Sutovsky P, Lamberson W, Lucy M, Safranski T. Heat stress mitigation strategies for boars and the impact on sperm quality parameters. In preparation.

\*Designates co-first author.