

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; Animal Science & Bioinformatics

B. Professional Experience:

Invited Talks

Deep Learning Classification of Boar Sperm Morphology. Society for the Study of Reproduction Annual Meeting. St. Louis, MO (2021)

Bull Sperm Zinc Ion Flux as a Marker for the Acquisition of Fertilization Competency. Brazilian Association of Animal Andrology. Campo Grande, Brazil (2021; *online due to COVID*).

Opening the Black Box of Fertility Prediction. Midwest American Society of Animal Science Swine Translational Symposium. Online (2021)

Zinc Ion Fluxes on the Pathway to Mammalian Sperm Fertilization Competency. Iowa State University Department Seminar Series (2021)

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 (2016)

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

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Popular Media (Since 2021)

The Swine Report, “Capturing Relative Phenotypes to Help Us Understand Boar Fertility”

<https://www.youtube.com/watch?v=aiQzUPGezuQ>

Farms.com, “Addressing Heat Stress in Boars.” <https://www.farms.com/videos/livestock/addressing-heat-stress-in-boars-dr-karl-kerns-172414.aspx>

Swine It, “The Boar – The Forgotten Animal in the Swine Industry.”

<https://www.youtube.com/watch?v=4iyNhp9j398>

Iowa PBS Education, “Studying Genetics for Increased Food Production.”

<https://www.youtube.com/watch?v=4zSu9hWSShA>

Poster Presentations

Deep Learning, Artificial Intelligence Methods to Predict Boar Sperm Acrosome Health. Keller A, **Kerns K**. Iowa Pork Congress. Des Moines, IA (2022)

Bull Field Fertility Differences can be Estimated with In Vitro Sperm Capacitation and Flow Cytometry. Zoca S, Geary T, Zezeski A, **Kerns K**, Dalton J, Harstine B, Utt M, Cushman R, Walker J, Perry G. Society for the Study of Reproduction. St. Louis, MO (2021)

An Exploration of Semen Analysis and Sperm Selection for Livestock Artificial Insemination. Zuidema D, **Kerns K**, Zigo M, Hamilton L, Sutovsky P. National Association of Animal Breeders. Online due to COVID-19 (2021)

Male Infertility and Semen Evaluation: Andrology in the Age of Precision Medicine and Agriculture. Sutovsky P, Zuidema D, **Kerns K**, Zigo M, Hamilton L, Sutovsky M. Arnold Theiler Memorial Lecture, University of Pretoria, South Africa (2021)

A deleterious Single Nucleotide Polymorphism in the TAPE domain of EML5 is associated with decreased fertility in Angus bulls. Hamilton L, Nogueira E, Tirpak F, Zigo M, **Kerns K**, Sutovsky M, Kim J, Volkmann D, Jovine L, Taylor J, Schnabel R, Sutovsky P. Society for the Study of Reproduction. St. Louis, MO (2021)

A Reappraisal of Mesenchymal-Epithelial Transition in Endometrial Epithelialization. Spooner M, **Kerns K**, Zigo M, Sutovsky P, Patterson A. Society for the Study of Reproduction. St. Louis, MO (2021)

Participation of the ubiquitin-proteasome system in sperm surface proteome remodeling during capacitation. Zigo M, **Kerns K**, Sutovsky P. Society for the Study of Reproduction. St. Louis, MO (2021)

Artificial Intelligence Analysis of the Mammalian Sperm Zinc Signature Predicts Male-factor Subfertility. **Kerns K**, Kramer S, Zigo M, Minton A, Xu D, Behura S, Sutovsky P. Society for the Study of Reproduction Annual Meeting. Virtual due to COVID (2020)

Zinc Interacting Profile Changes During In Vitro Capacitation of Boar Spermatozoa. Zigo M, **Kerns K**, Sen S, Essien C, Xu D, Sutovsky P. Society for the Study of Reproduction Annual Meeting. Virtual due to COVID (2020)

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)

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- 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. Yanagmachi 90th 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)
- Identification of Seminal Parameters Predictive of Conception Rates in Bos Indicus Cows Submitted to Timed-Artificial Insemination. E Nogueira, C Sanches, EV COSTA E SILVA, A Mendes, MAN Dode, G Wiley, K Kerns, P Sutovsky. 32nd Annual Meeting of the Brazilian Embryo Technology Society. (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 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)

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Research Positions and Employment

- 2021 - **Iowa State University**, Department of Animal Science, Assistant Professor, IA
- 2020 - **University of Missouri**, Division of Animal Sciences, Adj. Assistant Professor, MO
- 2020 - 2021 **Iowa State University**, Department of Animal Science, Lecturer, IA
- 2019 - 2020 **USDA NIFA Postdoctoral Fellow**, Sutovsky/Behura/Xu Labs, MO
- 2014 - 2019 **Miller and USDA NIFA Predoctoral Fellow**, Sutovsky Lab, 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

- 2021 - **Gamma Sigma Delta** – Vice President
- 2021 - **Association of Graduate Animal Scientists** – Adviser
- 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

CONTRIBUTIONS IN TEACHING, 2011 – 2021 (Have Been at ISU Since August 2020):

- 2021 AnS 214L – Instructor (Fall)
- 2021 AnS 211 – Guest Speaker (Fall)
- 2021 AnS 214L – Instructor (Spring)
- 2021 AnS 190 – Coordinator (Spring)
- 2021 AnS 211 – Guest Speaker (Spring)
- 2020 AnS 211 – Guest Speaker (Fall)
- 2020 AnS 214L – Co-Taught (Fall)

CONTRIBUTIONS TO FACULTY GOVERNANCE AND UNIVERSITY SERVICE:

- 2021 Chuckwagon/Graduate Breakfasts – Member
- 2021 Seminar Committee – Member
- 2021 College Innovation Fellows Committee – Member
- 2020 ADVANCE Department Review Task Force – Member

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Professional & Honor Memberships

- 2021 - Gamma Sigma Delta
- 2021 - Sigma Xi, The Scientific Society
- 2015 - Society for the Study of Reproduction (SSR)
- 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**)
- 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 As PI - *\$1.56 million in Federal Funding*

- 2022 - \$550,000 - USDA AFRI NIFA, Proposal No. Proposal 2021-06790
- 2020 - \$650,000 - USDA NIFA SBIR Phase II, Award No. 2020-51103-32563
- 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

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Funding As Co-PI - \$1.15 million in Federal Funding

- 2022 - \$650,000 - USDA AFRI NIFA, Proposal No. Proposal 2021-06790
- 2022 - \$500,000 - USDA AFRI CARE, Proposal No. Proposal 2021-09860

Donations Acquired for Iowa State University

- 2020 \$92,571 - Minitube USA, CASA Microscope System & Microfluidic System

Internal Grants

- 2021 \$69,244 - CoSPRT from VPR Office, ImageStream Mk II^X Dual Camera System
- 2020 \$14,040 - CoSPRT from VPR Office, THUNDER Computation Clearing System

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

Internal Intellectual Property Disclosures:

University of Missouri

1. “Mammalian Sperm Decapacitating Supplement.” Invention Disclosure No. 18UMC071. Submitted 2018. Patent pending.
2. “Mammalian Sperm Fertility Capacity Test.” Invention Disclosure No. 18UMC072. Submitted 2018. Patent pending.

Iowa State University

3. “Deep learning boar sperm auto morphology scoring of image-based flow cytometry samples.” Submitted January 4, 2021.
4. “Deep learning, label-free detection of infertile boar spermatozoa trained by lectin PNA.” Submitted January 4, 2021.

C. Publications:

1. Zuidema D, **Kerns K**, Sutovsky P. 2021. An Exploration of Current and Perspective Semen Analysis and Sperm Selection for Livestock Artificial Insemination. *Animals*. DOI: 10.3390/ani11123563.
2. Chen P, Redel B, **Kerns K**, Spate L, Prather R. 2021. Challenges and Considerations during In Vitro Production of Porcine Embryos. *Cells*. DOI:10.3390/cells10102770
3. Momal S, **Kerns K**, Sutovsky P, Bovin N, Miller D. 2021. Progesterone Induces Porcine Sperm Release from Oviduct Glycans in a Proteasome-dependent Manner. *Reproduction*. DOI:10.1530/REP-20-0474
4. **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
5. **Kerns K**, Jankovitz J, Robinson J, Minton A, Kuster C, Sutovsky P. 2020. Relationship between the length of sperm tail mitochondrial sheath and fertility traits in boars used for artificial insemination. *Antioxidants*. 9(11), 1033, DOI:10.3390/antiox9111033
6. 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.
7. Kelsey KM, Zigo M, Thompson WE, **Kerns K**, Manandhar G, Sutovsky M, Sutovsky P. 2020. Reciprocal Surface Expression of Arylsulfatase A and Ubiquitin in Normal and Defective Mammalian Spermatozoa. *Cell Tissue Res*. 379, 561-576. DOI: 10.1007/s00441-019-03144-1
8. 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
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. 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
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. **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

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14. **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
15. 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
16. Walters EM, **Kerns K**, Burlak C. 2017. Xenotransplantation literature update, May/June 2017. *Xenotransplantation* 24(4): e12323. DOI: 10.1111/xen.12323
17. **Kerns K**, Hua A, Burlak C. 2017. Xenotransplantation literature update, January/February 2017. *Xenotransplantation* 24(2): e12304. DOI: 10.1111/xen.12304
18. **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
19. Burlak C and **Kerns KC**. 2015. Xenotransplantation literature update, January-February 2015. *Xenotransplantation* 22(2): 155-157. DOI: 10.1111/xen.12168
20. 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:

21. Costello K, **Kerns K**, Sutovsky P, Timms K. Paternal Development Exposure to Endometriosis Causes Negative Transgenerational Impacts on Male Fertility. Ready to submit.
22. Nogueira E, **Kerns K**, Wiley G, Sutovsky P. Bull fertility predictive model using a biomarker approach. In late stage preparation.
23. Sliva CS, Costa-e-Silva EV, Dode MAN, Cunha ATM, Garcia WR, Sampaio BFB, Borges Silva JC, Ferreira MGCR, **Kerns K**, Sutovsky P, Nogueira E. Semen quality of Nellore and Angus bulls classified by fertility indexes and relations with field fertility in fixed time artificial insemination. In preparation.
24. 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.