BIOGRAPHICAL SKETCH
Senior Trainer.

NAME: John J Parrish

eRA COMMONS USER NAME: jjparrish

POSITION TITLE: Professor

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable. Add/delete rows as necessary.)*

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	Completion Date MM/YYYY	FIELD OF STUDY
California State University, Fresno, CA	B.S.	05/1977	Animal Science
Cornell University, Ithaca, NY	Ph.D.	10/1983	Animal Science & Physiology
University of Wisconsin, Madison, WI	Post-Doc	11/1983-10/1988	Reproductive Physiology

A. Personal Statement

I have been a faculty member for 28.5 years at the University of Wisconsin and during that time have supervised 10 MS and 7 PhD students. Beginning in my post-doctoral research and continuing on in my current position my research first began with in vitro fertilization and capacitation of sperm in the bovine along with the roles of glycosaminoglycans. Two publications on in vitro fertilization in the bovine are among the most frequent cited in reproduction:

1. Parrish, J. J., J. L. Susko-Parrish, M. A. Winer and N. L. First. 1988. Capacitation of bovine sperm by heparin. Biol. Reprod. 38:1171-1180. (1369 citations in Google Scholar as of 5/1/17)
2. Parrish, J. J., J. L. Susko-Parrish, M. L. Leibfried-Rutledge, E. S. Critser, W. H. Eyestone and N. L. First. 1986. Bovine in vitro fertilization with frozen-thawed semen. Theriogenology 25:591-600. (1133 citations in Google Scholar as of 5/1/17)

Over my career, there are and additional 2 publications with > 300 citations, 3 with >200 citations and 11 with greater than 100 citations, although these publications may be on other topics of reproduction in the male, embryo, or fish.

I have focused on the reasons for differences in fertility among males and have used humans, cattle, sheep, rabbits, hamsters, guinea pigs, swine, horses and fish as experimental models. As shown above the work began with fertilization and sperm capacitation but has expanded to include novel methods of accessing semen quality through measurement of sperm nuclear shape that has even resulted in a patent. The work has more recently involved heat stress to the testis using a scrotal insulation and whole animal exposure model in the bull and boar.

- Parrish JJ, Ostermeier C, Schindler J, Willenburg K, Enwall L, Kaya A. 2014. Quantifying sperm nuclear shape with Fourier harmonic analysis and relationship to spermatogenesis and fertility. Association for Applied Animal Andrology 2014 meeting. p30 – 49. In. International Veterinary Information Service, http://www.ivis.org/proceedings/aaaa/2014/3.pdf

Patent: PREDICITION OF FERTILITY IN MALES, Parrish, P130280US01 USSN: 61/856828, 2013

B. Positions and Honors

- Member Society for the Study of Reproduction, 1990-2009
- College of Agriculture and Life Sciences Teaching Excellence Award, 1992, UW-Madison.
- College of Agriculture and Life Sciences Pound Research Award, 1996, UW-Madison
- Sabbatical Leave, UW-Madison: 1996, 2008

- Member of American Society of Animal Sciences, 1998-present (Co-chair 2008 ASAS meeting Teaching Symposium)
- USDA-NRI Reproductive Efficiency Panel Member, 1998, 1999, 2003, 2004, 2005
- NIH Review Panel, U54 Center on Male Fertility, 2002
- NIH Review Panel, Contraceptive Network Centers, 2006
- NIH Review Panel, Reproduction, Andrology and Gynecology Study section, 2006, 2008
- Scientific Advisor to National Association of Animal Breeders, 1998, 2006, 2016.
- Local Arrangement Co-Chair of Society for the Study of Reproduction meeting in Madison, WI. July, 2000.
- University of Wisconsin System Teaching Scholar, 2001-2002
- College of Agriculture and Life Sciences, Jung Teaching Award, 2003
- USDA-NCR57-Committee on Reproduction-President, 1992, 2008, 2015
- Appointed the University of Wisconsin-Madison Teaching Academy, 2009
- Teaching academy summer institute UW-Madison, Facilitator and organizer, 2011, 2012, 2013, 2014, 2015, 2016
- College of Agriculture and Life Sciences Excellence in International Activities Award, 2014
- Chancellor's Distinguished Teaching Award - 2015

C. Contributions to Science

In vitro Fertilization (IVF) and Capacitation of Bovine Sperm – At the beginning of this work in 1983, there had been 1 report of successful IVF in the bovine. I identified that capacitation of bovine sperm was easily done using heparin but required the absence of glucose. Using in vitro bovine oocyte maturation procedures developed in the lab of NL First it was then demonstrated that bovine fresh, cooled and cryopreserved sperm could be capacitated with heparin and fertilize in vitro matured bovine oocyte and result in the birth of a calf. My lab later went on to demonstrate the role heparin had in impacting intracellular pH regulation, cAMP levels and intracellular calcium levels in bovine sperm during capaciation. The IVF technology developed now produces between 400,000 – 500,000 calves each year around the world. My role was the conceptual development and implementation of the heparin approach and how to use it for IVF in the bovine. Mathematical modeling I developed was also applied to intracellular pH and calcium levels in sperm.

1. **Parrish, J. J.,** J. L. Susko-Parrish, M. L. Leibfried-Rutledge, E. S. Critser, W. H. Eyestone and N. L. First. 1986. Bovine in vitro fertilization with frozen-thawed semen. Theriogenology 25:591-600. (1133 citations in Google Scholar as of 5/1/17)
2. **Parrish, J. J.,** J. L. Susko-Parrish, M. A. Winer and N. L. First. 1988. Capacitation of bovine sperm by heparin. Biol. Reprod. 38:1171-1180. (1369 citations in Google Scholar as of 5/1/17)
3. Uguz, C., W.L. Vredenburgh and **J.J. Parrish.** 1994. Heparin-induced capacitation but not intracellular alkalinization of bovine sperm is inhibited by Rp-Adenosine-3'5'-cyclic monophosphorothioate. Biol. Reprod. 51:1031-1039.
4. **Parrish, J.J.,** J.L. Susko-Parrish and J.K. Graham. 1999. In vitro capacitation of bovine spermatozoa: Role of intracellular calcium. Theriogenology 51:461-472.

Causes for male differences in fertility – Using IVF technology and success of artificial insemination in the bovine we first described how fertility differed among males in vitro and in vivo. We could trace low fertility males back to impacts on the first S-phase of bovine embryo development. There was a delay in entry into that S-phase but all embryos exited S-phase at approximate the same time. The result was that low fertility bulls had a delay into S-phase and a shorter overall S-phase. In the zygote this is suggestive of DNA damage in sperm sent us on a many year development of methods to detect small changes to DNA. This led to the development of Fourier Harmonic analysis of sperm nuclear shape using novel DNA staining and mathematical modeling of sperm nuclei. Methodology has shown that small changes in sperm nuclear shape are associated with reduction in male fertility in vivo and sperm chromatin packaging. My role has been in the evaluation of both in vivo and in vitro fertility and statistical evaluation, development of the mathematical approaches for shape analysis, development of image acquisition and evaluation software (now in ImageJ) and novel methods to statistically evaluate the data.

1. Eid, L.N., S.P. Lorton and **J.J. Parrish**. 1994. Paternal influence of S-phase in the first cell cycle of the bovine embryo. Biol. Reprod. 51:1232-1237.
2. Ostermeier,G.C., G. A. Sargeant, B.S. Yandell, D.P. Evenson, and **J.J. Parrish**. 2001. The relationship of bull fertility to sperm nuclear shape. J Androl. 22(4):595-603.
3. Ostermeier,G.C., G. A. Sargeant, B. S. Yandell, and **J. J. Parrish**. 2001. The measurement of bovine sperm nuclear shape using Fourier harmonic amplitudes. J. Androl. 22(4):584-94.
4. Sule Dogan, Peter Vargovic, Rodrigo Oliveira, Lauren E. Belser, Abdullah Kaya, Arlindo Moura, Peter Sutovsky, **John Parrish**, Einko Topper, Erdoğan Memili. 2015. Sperm protamine-status correlates to the fertility of breeding bulls. Biol. Reprod. 94(4):92, 1-9.

Impact of heat stress on the testis – During the most recent period of time my lab has focused on the impact of heat stress in the bovine and porcine. In these models, we have first used scrotal insulation and demonstrated that 48 hr heat stress of scrotal insulation induces damage to both bovine and porcine sperm that impacts mainly primary and early round spermatids. Further the impact is seen in ejaculated sperm 3 – 5 weeks post heat stress and is associated with both ejaculated sperm with apoptotic markers, impaired mitochondrial function and sperm chromatin damage as seen via changes to sperm nuclear shape. My role is in the development of software, statistical analysis and overall data interpretation. This is the first to expand on observation of testicular heat stress in rodents to domestic species and show that similar effects on the testes occur.

1. **Parrish JJ**, Ostermeier C, Schindler J, Willenburg K, Enwall L, Kaya A. 2014. Quantifying sperm nuclear shape with Fourier harmonic analysis and relationship to spermatogenesis and fertility. Association for Applied Animal Andrology 2014 meeting. p30 – 49. In. International Veterinary Information Service, http://www.ivis.org/proceedings/aaaa/2014/3.pdf

D. Additional Information: Research Support and/or Scholastic Performance

Ongoing Research:

- **USDA HATCH grant:Heat Stress and male fertility in swine, 2015-2018** – This is an ongoing project for which I am the PI. The goal is to understand how heat stress, via scrotal insulation, impacts the testes of the boar. Specific approaches will examine the role of heat stress on the blood testis barrier with emphasis on tight junctions, adherens junctions, gap juctions and ectoplasmic specializations. We have demonstrated that there is a breakdown of the tight junctions and likely is the cause of primary spermatocyte and round spermatid loss following scrotal insulation. We are also examining how whole body heat impacts the testis of boars as well.

Completed Research

- **USDA HATCH grant: Understanding and Improving Male Fertility in Swine, 2012-2015** – This grant looked at how scrotal insulation impacted ejaculated sperm post insulation and histological changes in the testis due to scrotal insulation. In this research, we first developed a model for scrotal insulation in the boar, demonstrated the loss of primary spermatocytes and round sperm spermatids following scrotal insulation and in particular the appearance of debris from these cells in the lumen of the seminiferous tubules. The timing of abnormal sperm in the ejaculate post scrotal insulation corresponded with when damaged cells that did not undergo apoptosis would be ejaculated.

Patent:

PREDICITION OF FERTILITY IN MALES, Parrish, P130280US01 USSN: 61/856828, 2013