

IFRB 2010

POINTS OF INTEREST:

- The IFRB was organized in 1992 and is the 3rd largest Reproductive Biology Program in the US
- Membership includes 43 faculty from 5 departments, 3 colleges, 4 TAMUS components and 2 state agencies
- IFRB sponsored activities: Annual R.O. Berry Lecture, 18 year old IFRB Repro Forum Seminar Series, Texas Forum on Reproductive Sciences, Annual IFRB Retreat

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2010, ISSUE 1

FALL, 2010

New IFRB Faculty Spotlight



Mammalian development consists of a series of carefully orchestrated changes in gene expression that occur as stem or progenitor cells differentiate to form the tissues and organs making up the growing fetus. These dynamic changes in gene expression arise from cell specific alterations in the way in which the DNA encoding each gene becomes packaged within the nucleus. The mechanisms that control this gene packaging are heritable through cell division, and are referred to as epigenetic as they represent a level of regulation that is above or "epi" to genetics.

Dr. Michael Golding's research focuses on determining the nature of the biochemical marks and mechanisms that direct the ordered process of epigenetic modification during embryonic development and how environmental factors influence these processes. As a model, his lab examines the impact of environmental and nutritional factors on the transcriptional

control of endogenous retroviral elements within mammalian genomes and how the epigenetic control of these parasitic nucleic acids relate to the control of other developmentally critical transcriptional networks during development. Using a

stem cell model system his group focuses on discovering the nature of the molecular signature that a cell uses to discern "self" from "non-self" (viral) and what biochemical factors and mechanisms are recruited to silence the latter. Interestingly different tolerances and mechanisms for transcriptional silencing appear to exist between embryonic, extraembryonic and placental tissues. It has long been known that cells that give rise to the embryo

silence retroviruses given the necessity of preventing insertional mutagenesis that could arise from retroviral reactivation. Surprisingly, cells that give rise to the placenta do not appear to silence retroviruses whereas cells of the extraembryonic endoderm

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2010 IFRB Highlights

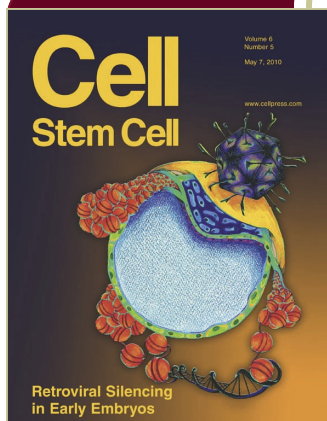
*** Trainee Travel Supported by the IFRB with funds provided by the Texas A&M University Division of Research and Graduate Studies and Deans of the Colleges of Agriculture and Life Sciences and Veterinary Medicine & Bomedical Sciences:** During the past year 18 trainees received financial support to attend national meetings and present their work. These include **Justyna Fliant** (Spencer) to attend a Re-

productive Tract Biology Gordon Conference; **JeHoon Lee**, **Sam Stephen** (Arosh), **Piotr Dorniak**, **Megan Minton** (Spencer), **Rodolfo Cardoso**, **Jennifer Thorson** (Williams), **James Frank** (Johnson) to attend the 43rd SSR Meeting, **Greg Burns** (Long), **Mike Peoples** (Westhusin) to attend the 36th International Embryo Transfer Society Meeting **Carol Dworaczek**, (Voglesang), **Shavahn Loux**, **Catalina**

Velez, (Hinrichs) to attend the 26th International Equine Reproduction Symposium, **Lisbeth Ramirez-Carvajal** (Long), to attend the 29th American Society for Virology Annual Meeting, **Thomas Miller** (MacKenzie) to attend the Society for Integrative and Comparative Biology Annual Meeting, and **Andrea Loyd**, **Shane Morgan** (Randel) to attend the American Society for Animal Science Annual meeting.

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New IFRB Faculty (cont'd from page 1)



Dr. Golding's work was highlighted on the May 7, 2010 cover of *Cell Stem Cell*.

"...daily treatment of pregnant sheep with Sildenafil citrate (Viagra) increases the delivery of nutrients to the fetus resulting in increased fetal growth."

- Satterfield et al.
(2010) J Nutr

that give rise to the yolk sac and amnion exhibit extremely aggressive retroviral extinction. Thus, with the very first differentiation event of mammalian development three different tolerances for retroviral activity and potentially three unique regulatory mechanisms exist. Using these models for early development, Dr. Golding and his team are trying to understand how environmental toxins and poor nutrition can alter the developmental program of the fetus and result in adult diseases like cancer, diabetes and obesity.

Dr. Golding's recent 2010 paper in *Cell Stem Cell* entitled "Multiple epigenetic modifiers induce aggressive viral extinction in extraembryonic endoderm stem cells," that was highlighted on the Journal cover, described the capacity of the three stem cell lineages of the mouse preimplantation embryo to epigenetically silence retroviral transcription. Using an RNA interference-based screen, Dr. Golding and his colleagues identified a number of enzyme factors that mediate integrated and endogenous retroviral silencing, including an Argonaute family member, suggesting that small noncoding RNAs may play a role in guiding this epigenetic process.



Dr. M. Carey Satterfield's lab is focused on the long-term consequences of maternal nutrition on fetal and postnatal growth and development using sheep as his primary animal model. A growing body of scientific evidence indicates that both maternal malnutrition and obesity during pregnancy increase the risk for development of disease in the adult offspring. These diseases include a predisposition to develop obesity, type-II diabetes, hypertension, and many others. In collaboration with others, Dr. Satterfield's laboratory strives to not only understand the cellular and molecular mechanisms result in adult onset disease but also to develop strategies to intervene during gestation to prevent these consequences. For example, Dr. Satterfield and colleagues recent

paper in the *Journal of Nutrition* entitled "Sildenafil citrate treatment enhances amino acid availability in the conceptus and fetal growth in an ovine model of intrauterine growth restriction" described the ability of daily treatment of pregnant sheep with Sildenafil citrate (Viagra) to increase the delivery of nutrients to the fetus resulting in increased fetal growth. The prevention of fetal growth restriction will likely result in reduced perinatal and adult morbidity.

In addition, Dr. Satterfield studies the role of nutraceuticals in fetal brown adipose tissue development and the ability of offspring to regulate their core body temperature during periods of cold stress. Maintenance of core body temperature is one of the first and most critical physiological processes that mammalian neonates must initiate to survive. In sheep, 40% of non-predator related perinatal losses are attributed to failed or insufficient initiation of this process. Ongoing studies in Dr. Satterfield's laboratory are investigating the ability of maternal arginine administration during late gestation, which increases development of key thermogenic tissues in the fetus, to improve postnatal response to cold.

IFRB Highlights 2010 (cont'd from page 1)

*** Faculty Recruiting:** A new IFRB Faculty Member was recruited by The Department of Veterinary Integrative Biosciences. **Dr. Quinglei Li** received post-doctoral training from Dr. Martin Matzuk's laboratory at Baylor College of Medicine. Dr. Li's work is focused on understanding mechanisms of oocyte maturation, ovulation, implantation and pregnancy maintenance. Growth differentiation factor 9 (GDF9) and bone morphogenetic protein 15 (BMP15) are two of the most important oocyte-derived factors that are critical to fertility in multiple mammalian species.

Dr. Li has recently produced and purified bioactive recombinant proteins of these oocyte-derived factors and will examine individual and synergistic effects of these proteins on oocyte maturation, fertilization, and embryo developmental potential along with signal transduction pathways involved. He will also study the role and regulation of several candidate receptors that might be key components of TGF β signaling machinery in multiple reproductive processes including fertilization and pregnancy maintenance. Dr. Li will join the department and the IFRB in January, 2011.

***Activities:** For the past 18 years, the IFRB has contributed to the teaching, research, service and outreach activities of the TAMU System. Our interdisciplinary research includes a rich mixture of curiosity-driven basic, clinical and translational research that involves extensive participation of trainees. Milestones in 2010 include:

- 18th year of Fall and Spring Reproductive Biology Forum Seminar series.
- 16th Annual Raymond O. Berry Lecture Series.
- 16th Annual Texas Forum for Reproductive Sciences.
- 4th Annual IFRB Retreat



Trainee Spotlight

Kim Paczolt is a graduate student in the Department of Biology working with **Dr. Adam Jones**. The focus of her dissertation research is postcopulatory sexual selection and sexual conflict in the evolution of syngnathid reproduction. Syngnathids include sea horses, pipefish, and sea dragons, fish species distinguished by exhibiting male pregnancy. They therefore serve as excellent models in which to test hypotheses about sexual selection and evolution. Some of her doctoral work was published in the March 18 edition of the journal **Nature** (see "Hot Papers" section) which examines offspring survivorship in pipefish. Kim is in her 5th year of study in Biology. She did her undergraduate work at the University of Illinois at Urbana-Champaign, where she worked in the lab of Carla Caceres and studied the ecology and evolution of *Daphnia* species in freshwater lakes. She expects to finish her Ph.D. work in



the spring of 2011. **Justyna Fliant** and **Piotr Dorniak** are new trainees who joined the laboratory of **Dr. Thomas Spencer** in 2009. They both completed M.S. degrees from the University of Warmia and Mazury in Poland in cooperation with the Polish Academy of Sciences under the direction of Dr. Adam Ziecik, an internationally known reproductive biologist. Justyna's research is focused on hormonal, cellular and molecular mechanisms regulating uterine morphogenesis. Piotr's research evaluates the role of 15-hydroxyprostaglandin dehydrogenase – the main enzyme of prostaglandin catabolism in porcine endometrium during the maternal recognition of pregnancy period. He is investigating how prostaglandins regulate endometrial functions important for conceptus survival, growth and development in sheep.



Dr. Bryan White is a Canadian post-doctoral research associate in the Department of Veterinary Integrative Biosciences.

Bryan and his wife Sarah moved to Texas earlier this year, when he started work on a USDA-funded project awarded to **Drs. Kayla J. Bayless** and **Greg A. Johnson** focused on the regulation of angiogenesis in the sheep uterus and placenta by sphingosine-1-phosphate during pregnancy. He completed his undergraduate and graduate studies in St. John's, Newfoundland, Canada at Memorial University of Newfoundland. After completing an undergraduate degree in Biochemistry, he began graduate work in the lab of Dr. Daniel MacPhee in the Faculty of Medicine. His Ph.D. research focused on mid-late pregnancy and labor in a rat model, and he investigated the regulation of small Heat Shock Protein 27 and its role in uterine contraction during this period.



16th Annual Raymond O. Berry Lecture

Dr. Raymond O. Berry, a member of the faculty of the Agricultural and Mechanical College of Texas from 1931 to 1960 contributed significantly to establishment of the discipline of Reproductive Immunology through his pioneering studies involving embryo transfer to evaluate genetic factors affecting reproduction. (The 58th Legislature of Texas, on August 23, 1963, changed the name of the Agricultural and Mechanical College of Texas to Texas A&M University). For his outstanding contributions, Texas A&M University recognizes the work of this distinguished scientist through the Raymond O. Berry Memorial Lecture which was established in 1994 by **Dr. Fuller W. Bazer**.

Over the past 16 years, Dr. Berry's daughters, Dorothy McLemore and

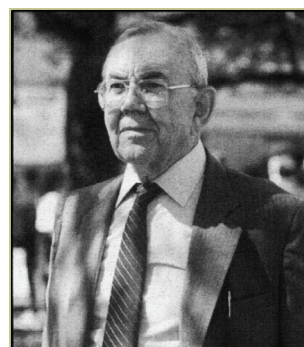
Margaret Thompson and their family members have attended the Lecture as guests. This years, Dorothy and her husband, Dr. Joe McLemore joined the IFRB for the Lecture, Social and Dinner that followed.

Dr. Duane C. Kraemer, Professor of Veterinary Physiology & Pharmacology and IFRB member worked with Dr. Berry during his early years as a graduate student. Dr. Kraemer led off the Lecture by providing an entertaining presentation that included memories of Dr. Berry.

Dr. Donald J. Dudley, Professor and Vice Chair for Research, Department of Ob/Gyn, UT Health Science Center at San Antonio presented the Raymond O. Berry Lecture entitled, "The Relevance of

Reproductive Immunology."

Dr. Dudley, who is a Fellow in the American College of Ob/Gyn and a member of multiple societies that focus on maternal-fetal medicine, was selected by a vote of the entire IFRB following an open nomination process. Dr. Dudley has served on key national committees that focus of perinatal medicine and children's health and received numerous awards from his research. His lecture, entitled "The Relevance of Reproductive Immunology," covered a variety of topics including regulation of lymphokine production by murine decidual lymphocytes, the role of interleukin 6 in preterm labor, immunology of preeclampsia, and cytokine networks at the maternal-fetal interface.



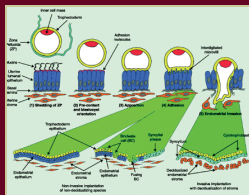
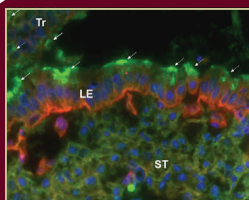
"Dr. Berry's pioneering studies contributed basic knowledge about maternal immune recognition of the fetal placental unit."

-Fuller W. Bazer

New Grants, Awards, Honors, etc.



TEXAS A&M
UNIVERSITY



Two of Dr. Bazer, Burghardt, Johnson, Spencer and Wu's papers in the journal *Reproduction* are highlighted on the Society for Reproduction and Fertility website <http://www.srf-reproduction.org/>



Amstalden et al. (2010) was featured on the cover of the *Journal of Neuroendocrinology*, January 2010

NEW GRANTS:

* **Marcel Amstalden**, NIH, NICHD, R03: Neuroendocrine Ontogeny of Accelerated Puberty," 7/1/10 to 5/31/12, \$146,500.

* **Fuller W. Bazer**, PI; Co-PI's, **Guoyao Wu**, **Greg A. Johnson**, USDA CSREES AFRI 2010-03220, "Arginine and Secreted Phosphoprotein I Mediate mTOR Cell Signaling for Conceptus Development and Survival," 12/1/10-11/30/14, \$500,000.

* Peter J. Hansen, PI; Co-PI's, **Todd Bilby** (Texas A&M University), Alan D Ealy (University of Florida), Albert De Vries (University of Florida), Charles R. Staples (University of Florida), Geoffrey E Dahl (University of Florida), Jeremy Block (University of Florida), John Fernandez van Cleve (University of Puerto Rico), John B Cole (USDA AIPL), Jose Eduardo Santos (University of Florida), Robert J. Collier (University of Arizona), USDA-NIFA award #2010-85122-20623. Improving fertility during heat stress in lactating dairy cows. Total \$1,000,000; Sub-award to Texas AgriLife Extension \$243,998.

* **Michael Golding**, PI, **Timothy Cudd**, Co-PI, NIH, R03AA020129-01 "Measuring the Impact of Prenatal Alcohol Exposure on the Fetal Epigenome," 9/1/10 to 8/31-12, \$138,822.

* **Adam Jones and Kimberly Paczolt**, Co-PI's, NSF, Dissertation Research: "Sex-specific Effects on Postcopulatory Sexual Selection and Sexual Conflict in a Sex-role Reversed Pipefish," 7/1/10-6/30/11, \$15,000.

* **Charles Long**, NIH R21, "Analysis of Epigenetic Regulation in Early Mammalian Embryos via RNA Interference," 7/1/10 to 6/30/2011, \$130,845.

* **Gil Rosenthal**, NSF, IOB, "Enabling Partnerships to Enable Science (TOOLS): anyFish: a User-friendly Software Package for Creating Realistic Animations for Animal Behavior", 9/1/10 to 8/30/12, \$300,000.

* **Stephen Safe**, PI, **Robert Burghardt**, Co-I, NIH, "Molecular Mechanisms and Applications of Ah Receptor-MicroRNA Interactions,"

7/1/10 to 5/31/15, \$1,609,735,

* **Stephen Safe**, DOD-Army Breast Cancer Research Program, "The Role of Novel Substituted Diindolylmethane Analogues in the Treatment of Triple-Negative and ErbB2-Positive Breast Cancer."

* **D. Forbes**, PI, **Thomas Welsh**, **Ron Randel**, **Gordon Carstens**, **F.M. Rouquette**, Co-PI's, USDA, "Beef Improvement Research, 4/1/10 to 3/30/11, \$349,000.

* **Mark E. Westhusin**, PI, Co-PI's **Charles Long**, **Michael Golding**, **Tom Spencer**, **Larry Dangott** and **Greg Hannon**, NIH R01 Grant, "Functional Analysis of the Embryonic Epigenome in a Non-Rodent Model," 4/14/10 to 2/28-2015, \$1,465,000.

* **Gary L. Williams**, PI, **Marcel Amstalden**, Co-PI, Link Endowment Equine Research, "RF-related Peptide-3 (RFRP-3) as a Regulator of Reproduction in the Mare," 9/1/10 to 8/30/12, \$60,000.

* **Shannon E. Wilson**, NIH, K08, "Mechanisms and Nutritional Intervention for Fetal Alcohol Spectrum Disorders," 3/20/2010 to 2/28/13, \$90,000/year. (**Timothy Cudd**, **Guoyao Wu**, Mentors)

* **Guoyao Wu**, American Heart Association, "Leucine and Vascular Insulin Resistance in Diet-induced Obese Rats," 7/1/10 to 6/30/12, \$140,000.

- National Science Foundation of China, "Regulation of N-acetylglutamate Synthase Gene Expression in the Pig Small Intestine," 1/1/10 to 12/30/11, \$30,000. Indonesia Government, Foreign Research Cooperation and International Publication Program "Improving nutrient quality of carrot and fruit juice waste mixture for poultry diet," 7/1/10 to 6/30/12, \$30,000 (PI: Dr. Yose Rizal, University of Andalas, Indonesia; Co-PI: G. Wu).

PATENTS AWARDED:

* **Joe A. Arosh**, **Sakhila Banu**, United States Patent Application 20100249125, September 30, 2010. "Inhibition of Prostaglandin E2 Receptors for the Treatment of Endometriosis," is a therapeutic approach that may provide a much

improved treatments for endometriosis.

INVITED LECTURES:

* **Marcel Amstalden**, Oct. 28, 2010, Neuroendocrine Regulation of Pulsatile Luteinizing Hormone Release: Role for Infundibular Neurons. Neuroscience Seminar Series, University of Wyoming, Laramie, WY.

* **Fuller W. Bazer**, June 6, 2010. "Interferon Tau, Secreted Phosphoprotein I (Spp1) And Nutrients Affect Conceptus Development Via The Mammalian Target Of Rapamycin (mTOR) Pathway." Germ Cell, Stem Cell and Reproductive Biology Symposium, Hyatt Hotel, Jeju Island, South Korea.

- Aug. 29, 2010, "Interferons and uterine receptivity," Aspen Perinatal Biology Conference, Aspen, CO - Nov. 11, 2010, Interferon Tau: Pregnancy Recognition and Beyond," University of Montreal, Montreal, Quebec, Canada.

* **Todd Bilby**, Oct. 7th- 8th, 2010. "Reproduction Strategies and Solutions During Heat Stress in Lactating Dairy Cows University of Autonoma, Mexicali, Mexico.

* **Robert C. Burghardt**, May 24-25, 2010, "Mechanobiology of Pregnancy," Center for Reproductive Biology and Health, Annual Retreat, Penn State University.

Steven Brinsko, July, 25-30, 2010, "Low dose/low volume insemination" 10th International Symposium on Equine Reproduction Lexington, KY.

* **Michael Golding**, Sept. 25, 2010 Epigenetic Control of Gene Expression in the Embryonic and Extraembryonic Lineages. Early Career Speaker - Perinatal Research Society Annual Meeting, Avon, CO.

* **Katrin Hinrichs**, July 26, 2010, "Use of intracytoplasmic sperm injection and in vitro culture to the blastocyst stage for clinical production of foals post mortem." 10th International Symposium on Equine Reproduction, Lexington, KY.

* **Nancy H. Ing**, Nov. 23, 2010, "The Dog as a Novel Animal Model for Leiomyoma Research," Advances in Uterine Leiomyoma Research: 3rd NIH International Congress, NIH, Bethesda, MD.

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IFRB Seminar Series, Fall 2010

The IFRB Seminar Series

(Reproductive Biology Forum) has been held weekly during the Fall and Spring Semesters since 1990. The 2010 Fall IFRB Seminar Series, coordinated by **Dr. Marcel Amstalden**, continues to provide an excellent combination of seminars from internationally recognized reproductive biologists from outside and inside the university along with advanced IFRB trainees:

Sep. 10 **Kim Paczolt**, Ph.D. student (Dr. Adam Jones), TAMU, Biology Dept.

Title: Post-copulatory sexual selection in the evolution of male pregnancy

Thomas Miller, Ph.D. student (Dr. Duncan MacKenzie), TAMU, Biology Dept.

Title: Glycoprotein hormone specificity of the goldfish thyrotropin receptor
Host: **Dr. Duncan MacKenzie**

Sep. 17 **IFRB General Business Meeting** – **Dr. Greg Johnson**, Past-Chair; **Dr. Robert Burghardt**, Chair IFRB

Sep. 24 **Reproductive Biology Retreat** (Coordinator: **Dr. Marcel Amstalden**)

R.O. Berry Memorial Lecture (Coordinator: **Dr. Fuller Bazer**)

Lecturer: **Dr. Donald Dudley**, UT Health Science Center at San Antonio. Title: The Relevance of Reproductive Immunology
Host: **Dr. Fuller Bazer**

Oct. 1 **Dr. T. John Wu**, Uniformed Services University of the Health Sciences, Bethesda. Title: A Biological Role for the Luteinizing Hormone-Releasing Hormone

(LHRH) Metabolite”

Hosts: **Drs. Paul Harms and Marcel Amstalden**

Oct. 8 **Dr. Jeffrey Vallet**, USDA-ARS Meat Animal Research Center, Clay Center
Title: “Factors Affecting the Number of Piglets Weaned.” Host: **Dr. Fuller Bazer**

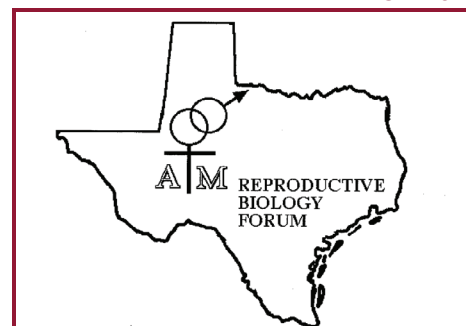
Oct. 15 **Dr. Akio Miyamoto**, Professor & VP (International Activity) Reproduction Science Group, Obihiro, Japan. Title: Regulation of the corpus luteum development and regression in the cow: the possible specific roles of vascular (angiogenic factors and luteal blood flow) and immune (Neutrophils) systems. Host: **Dr. Fuller Bazer**

Oct. 22 **Dr. Jon Oatley**, Penn State University. Title: Of Mice and Bulls: Study of Male Germline Stem Biology in Biomedical Sciences and Animal Agriculture
Host: **Drs. Greg Johnson and Bob Burghardt**

Oct. 29 **Justyna Filant**, Ph.D. student (Dr. Tom Spencer), TAMU. Title: Mechanisms Regulating Endometrial Gland Development in the Mouse

Piotr Dorniak, Ph.D. student (Dr. Tom Spencer), TAMU. Title: Prostaglandins Regulate Conceptus Elongation and Mediate Effects of Interferon Tau on the Endometrium
Host: **Dr. Thomas Spencer**

Nov. 05 **Dr. Frank (Skip) Bartol**, Auburn University. Title: Lactocrine Signaling and



Neonatal Reproductive Tract Development
Host: **Dr. Fuller Bazer**

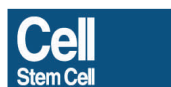
Nov. 11 **Special Seminar: Dr. Mark Miranda**, National Program Leader for the Animal Nutrition, Growth and Reproduction, Agriculture and Food Research Initiative, USDA National Institute of Food and Agriculture
Title: “Reorganization of the USDA National Institute of Food and Agriculture (NIFA): What it means for AFRI and other funding programs at NIFA.” Host: **Dr. Robert Burghardt**

Nov. 12 **Dr. Gail Cornwall**, Texas Tech University Health Science Center, Lubbock.
Title: “The Cystatin CRES: Amyloidogenic Properties and Reproductive Function” Host: **Dr. Fuller Bazer**

Nov. 19 **Dr. Gil Rosenthal**, Department of Biology TAMU, Title: “Sexual Communication and Natural Hybridization in Swordtail Fish.”
Host: **Dr. Marcel Amstalden**

Nov. 26 No Forum - **Thanksgiving**

Dec. 03 **Dr. Joe Arosh**, Department of Veterinary Integrative Biosciences
Title: “Molecular Control of Prostaglandin F2a Transport in Ruminant Reproduction.”



IFRB Hot Papers 2010

Amstalden M, LM Coolen, AM Hemmerle, HB Billings, JM Connors, RL Goodman, MN Lehman (2010) Neurokinin 3 receptor immunoreactivity in the septal region, preoptic area and hypothalamus of the female sheep: colocalization in neurokinin B cells of the arcuate nucleus but not in gonadotrophin-releasing hormone neurones. *J Neuroendocrinol* 22:1-12.

Black S, F Arnaud, RC Burghardt, MC Satterfield, JGW Fleming, C Long, C Hanna, L Murphy, R Biek, M Palmarini, TE Spencer

(2010) Viral particles of endogenous betaretroviruses (enJSRVs) are released in the sheep uterus and potentially infect the conceptus trophectoderm in a trans-species embryo transfer model. *J Virology* 84:9078-9085.

Golding MC, L Zhang, MR Mann (2010) Multiple epigenetic modifiers induce aggressive viral extinction in extraembryonic stem cells. *Cell Stem Cell* 6:1-11.

Kim J, DW Erikson, RC Burghardt, TE Spencer, G

Wu, KJ Bayless, GA Johnson, FW Bazer (2010) Secreted phosphoprotein 1 binds integrins to initiate multiple cell signaling pathways, including FRAP1/mTOR, to support attachment and force-generated migration of trophectoderm cells. *Matrix Biol* 29:369-382.

Paczolt KA, AG Jones (2010) Postcopulatory sexual selection and sexual conflict in the evolution of male pregnancy. *Nature* 464:401-404.

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Bazer FW, Wu G, Spencer TE, Johnson GA, Burghardt RC, Bayless K (2010) Novel pathways for implantation and establishment and maintenance of pregnancy in mammals. *Mol Hum Reprod* 16:135-152.

Theriogenology News

Theriogenology:
the branch of
veterinary medicine
concerned with
reproduction.



Texas A&M University has a world-class team of equine Theriogenologists, including 5 faculty who are board certified by the American College of Theriogenologists (ACT): **Drs. Terry Blanchard, Steve Brinsko, Katrin Hinrichs, Charles Love and Dickson Varner.**

The equine Theriogenology faculty focus on translational research in the areas of stallion fertility/infertility and equine assisted reproductive technologies. In addition, TAMU boasts ACT diplomates specializing in epidemiology (**Dr. James Thompson**) and small ruminant reproduction (**Dr. Juan Romano**). The clinical theriogenologists have joined forces with basic scientists at TAMU and other universities to address issues that impact the horse breeding industry.

Highlights:

Dr. Steve Brinsko was elected to a four-year term on the ACT Execu-

tive Committee, including current service as president-elect.

Tenth International Symposium on Equine Reproduction: Contributions from TAMU comprised 19 of 164 invited papers (13 of 52 stallion papers) at this prestigious meeting, held once every four years at locations around the world.

Recent innovations from members of this group include:

- Novel analytical approaches to study subfertility in stallions (see Das et al., 2010 in "Hot Papers" section);
- Establishment of methods for equine embryo biopsy for preimplantation genetic diagnosis (see Choi et al., 2010 in Hot Papers section).
- Development of a centrifugation technique to enhance semen quality, a process that is now being applied to several commercial stallions.

-Refinement of methods for assessment of sperm DNA quality, the results of which are currently being applied to clinical cases.

-Use of gene expression to evaluate the effect of exogenous dexamethasone on testicular function (with **Drs. Nancy Ing, David Forrest, and Thomas Welsh, Jr.**).

- Use of genotyping and sperm transcriptome analysis to study the effect of the genome on acrosomal dysfunction in Thoroughbred stallions (with **Drs. Terje Raudsepp, Pranab Das, Bhanu Chowdhary [TAMU] and Molly McCue and James Mickelson [University of Minnesota]**).

Theriogenologist of the Year:

Three of the theriogenologists at Texas A&M University have been voted "Theriogenologist of the Year" by the American College of Theriogenologists, a number which has not been matched by any other university.

16th Annual Texas Forum for Reproductive Sciences

The 16th Annual Meeting of the Texas Forum for Reproductive Sciences (TFRS) was held at the McMillian Auditorium, Baylor College of Medicine, Houston, TX on April 15-16, 2010. This year the TFRS honored Stanley R. Glasser, Ph.D., Professor Emeritus at Baylor College of Medicine. Dr. Glasser has had a long and productive career in Reproductive Biology and has made fundamental contributions to the investigations of Embryo Implantation and Uterine Biology. He is a founding member of the TFRS and has supported Reproductive Biology in Texas by his research, mentoring and insatiable curiosity. Participants at this year's annual meeting included faculty and trainees from 27 different institutions. The Thursday evening keynote speaker was Dr. David Zarkower, University of Minnesota who presented "Regulation of Testis Differentiation and the Mitosis/Meiosis Decision by a Mammalian Double-sex Homolog." The Friday Keynote

Speaker, Dr. Diego Castrillon, UT Southwestern Medical Center, presented "Lkb1 and Cancers of the Reproductive Tract." The IFRB was well represented with 17 faculty, 15 trainees and 3 former trainees contributing to poster or platform presentations. **Drs. Gary Newton, Greg Johnson and Tom Spencer** served on the Organizing Committee.

The TFRS is a unique regional organization that resulted from the vision of distinguished reproductive biologists working at multiple institutions in central Texas. In 1994, **Drs. Fuller Bazer** (Texas A&M) Barbara Sanborn & George Stancel (University of Texas Health Sciences Center Houston), JoAnne Richards and Stan Glasser, (Baylor College of Medicine), Dan Carson (MD Anderson Cancer Center Houston), Robert Garfield (University of Texas Medical Branch-Galveston) organized reproductive biologists from their



institutions that resulted in inter-institutional collaborations and the development an annual regional meeting that continues to expand as the TFRS. Additional participating institutions include faculty (and organizers) from the University of Texas at San Antonio (Dr. John McCarrey), the University of Texas Southwestern Medical Center at Dallas (Dr. Mala Mahendroo), the Texas Tech University Health Sciences Center (multiple investigators), Rice University (Dr. Daniel Carson), Texas A&M University – Kingsville (Drs. Michelle Garcia and Randy Stanko), and the Institute for Biosciences and Technology, Texas A&M System Health Sciences Center (**Dr. Stephen Safe**).

IFRB Papers Presented at the 43rd SSR Meeting, 2010

SPPI (Osteopontin) and SPARC (Osteonectin) May Interact Developmentally During Mouse Pregnancy.

DW Erikson, Y-H Hsieh, K Hayashi, RC Burghardt, KJ Bayless, P-L Chang, GA Johnson.

Recruitment and Modulation of Porcine Endothelial Progenitor Cells by Secreted Phosphoprotein 1 (SPPI, Osteopontin). KJ Bayless, DW Erikson, JW Frank, MM Joyce, RC Burghardt, FW Bazer, GA Johnson.

Endogenous Retroviruses: From Infectious Elements to Essential Genes. TE Spencer, M Palmarini.

Arginine Stimulates Migration of Ovine Trophoblast Cells Through the MTOR-RPS6-RPS6K Signaling Cascade and Synthesis of Nitric Oxide, Polyamines, and Interferon Tau. FW Bazer, J Kim, RC Burghardt, G Wu, GA Johnson, TE Spencer.

Potential Role of Wnt in Neonatal Uterine Development. K Hayashi, S Yoshioka, EB Rucker, TE Spencer, PS Cooke, FJ DeMayo, JP Lydon, JA MacLean.

Are Luteal PGF₂a Secretions Similar During Spontaneous and PGF₂a-Induced Luteolysis in Ewes? YS Weems, D Johnson, RD Randel, CW Weems.

Prostaglandin (PG) E₁ or E₂ (PGE₁, PGE₂) Intra-luteal Implants Alter mRNA for PG Receptors and mRNA for LH and Its Receptors to Prevent Luteolysis in Cows. C Weems, Y Weems, J Arreguin-Arevalo, T Nett, M Jeoung, P Bridges, R Vann, S Ford, D Neuendorff, A Lewis, T Welsh, R

Randel.

Interferon-tau Has Endocrine Action on the Ovine Corpus Luteum During Early Pregnancy That Is Independent of Its Paracrine Effect on Endometrial ESRI and OXTR. AQ Antoniazzi, RL Ashley, JF Oliveira, FW Bazer, TE Spencer, TR Hansen.

Blocking Ovarian Leptin Increases Abnormal Luteal Formation in the Caprine Species. MA Ramirez, F Xie, EA Benavides, RA Katchko, L Ayala, DH Keisler, RL Stanko, MR Garcia.

Selective Increased Luteal PG E₂ Compared to F₂ Alpha Biosynthesis and Signaling Are Critical for Luteal Protection and Resistance During Establishment of Pregnancy in Sheep. J Lee, SD Stephen, JA McCracken, S Banu, TK Nithy, JA Arosh.

Effects of Early Pregnancy and Estrous Cycle on Survival and Apoptotic Pathways Lead to Endurance or Death of Corpus Luteum in Sheep. SD Stephen, J Lee, S Banu, JA McCracken, TK Nithy, JA Arosh.

Selective Transport of PGF₂a and PGE₂ from Uterus to Ovary During Luteolysis and During the Establishment of Pregnancy in Sheep. JA McCracken, J Lee, SD Stephen, S Banu, TK Nithy, JA Arosh.

Conditional Ablation of Wnt7a after Birth Impacts Postnatal Uterine Morphogenesis. KA Dunlap, G Song, JM Deng, K Hayashi, E

Rucker, FJ DeMayo, JP Lydon, J-W Jeong, R Behringer, TE Spencer.

Gestational Exposure to Chromium (VI) Impairs Pregnancy Outcome and Fetal Development. SK Banu, JA Stanley, J Lee, TK Nithy, JA Arosh, PB Hoyer, MM Aruldas, RC Burghardt.

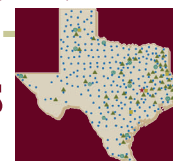
Glucose, Amino Acids, and Their Transporters in Pig Uteri, Conceptuses, and Placentae. GA Johnson, H Gao, X Li, ML Halvorsen, G Wu, RC Burghardt, FW Bazer. **Expression of SPPI (Osteopontin) and the Aggregation of Integrins into Focal Adhesions Is an Adaptation to Mechanical Forces at the Uterine-Placental Interface in Pigs.** JW Frank, X Li, DW Erikson, G Wu, FW Bazer, KJ Bayless, RC Burghardt, GA Johnson.

Progesterone Regulation of Endometrial Gene Expression in the Early Pregnant Ovine Uterus. MA Minton, MC Satterfield, FW Bazer, TE Spencer.

Hydroxysteroid (11-beta) Dehydrogenase (HSD11B) Activity in the Ovine Endometrium and Conceptus During Early Pregnancy. PL Dorniak, FW Bazer, TH Welsh, TE Spencer.

Characterization of Seminal Plasma Proteins from Dairy and Meat Goat Sires. D Rucker, K Baker, U Tress, L Nuti, GR Newton.

IFRB Members at Texas A&M AgriLIFE Research & Extension Centers



Reproductive biology research is conducted at multiple off-campus locations by IFRB members including 3 of the 14 Texas AgriLIFE Research and Extension Centers.

Dr. Gary Williams is Professor/Research Leader in the Animal Reproduction Laboratory, Texas AgriLIFE Research Station-Beeville and former Vice-Chair of the IFRB. His research group has 3 major ongoing projects: 1) Nutritional regulation of puberty in the heifer; objectives are to understand how early calf-hood nutrition influences neuroendocrine plasticity and gene expression in the timing of pubertal onset; 2) Neuroendocrine control of reproductive seasonality in the mare and development of pharmacological methodologies for accelerating onset of reproductive transition; 3) Optimization of pharmacological methodologies for synchronization of ovulation and fixed-time AI in *Bos indicus* influenced beef cattle. His program at Beeville is linked tightly with **Dr. Marcel Amstalden's** on the TAMU campus. Drs. Williams and Amstalden are Co-PI's on multiple grants and they co-mentor all of their graduate students. They currently have 3 Ph.D. and 1 M.S. students. Two M.S. students just completed degree requirements.

(see page 9).

Dr. Ron Randel is Senior AgriLife Faculty Fellow/Regents Fellow and Professor stationed at the AgriLife Research and Extension Center at Overton. He has served as the Physiology of Reproduction Section Leader in the Department of Animal Science. His research group has several ongoing projects: 1) Influence of residual feed intake on correlated production traits with emphasis on reproduction in beef cattle; 2) Influence of temperament on endocrine and immune function and resultant productivity of beef cattle; 3) Transportation stress impacts on subsequent endocrine and immune function as they influence health and productivity of beef cattle. His program at Overton is linked with **Dr. Tom Welsh's** program at TAMU. They are co-PIs on grants and co-mentor students. They are working collaboratively with former student **Dr. Jeff Carroll** at ARS Lubbock on stress physiology and immunology of beef cattle and with Dr. Rhonda Vann at Mississippi State University on temperament and related production traits of beef cattle. They currently mentor 2 PhD students and 5 MS students.

Dr. Todd Bilby is an Associate Professor and extension dairy specialist located at the

AgriLife Research and Extension Center in Stephenville. His research program is well funded (see "New Grants") and involves cattle management, reproduction, nutrition, and heat abatement. Special emphasis is given to designing strategies to maximize profit for dairy producers. This includes refining timed artificial insemination protocols, nutritional and cooling strategies to improve heat loss/abatement, and ways to improve fertility in the dairy cow. Dr. Bilby's extension duties include leadership and coordination of educational programs in dairy management via applied research, demonstrations and workshops. He provides expertise and training for clientele and organizations across Texas. He develops communication strategies with the Texas dairy industry through associations, boards, cooperatives and individual producers. Dr. Bilby advises 1 TAMU M.S. student, 1 Tarelton State M.S. student and 1 West Texas A&M Ph.D. student (where he is an adjunct professor) and a post-doc from the National Autonomous University, Mexico. Dr. Bilby's research program is also linked with **Dr. Tom Spencer's** on the TAMU

**"Reproductive
Biology is at
the epicenter of
life sciences."**

**von Willebrand fac-
tor staining of pro-
gesterone treated
ovariectomized
sheep. Image from
Bailey et al., Repro-
duction, 140:583-
594, 2010.**

New Grants, Awards, Honors, etc. (continued from page 4)

Invited Lectures, continued

* **Greg A. Johnson**, April 22, 2010. "Osteopontin and integrins attach uterus to placenta to stabilize the interface for transfer of nutrients from mother to fetus during pregnancy," Sigma Xi Spring Symposium.

* **Thomas E. Spencer**

- March 25, 2010, "The role of Wnt signaling in conceptus-endometrial Interactions." 57th Annual Meeting of the Society for Gynecologic Investigation, Orlando, FL.

- April 7, 2010, "Endogenous retroviruses: from infectious elements to essential genes". Asdell Lecturer, Department of Animal Science, Cornell University.

- July 1, 2010, "Maternal nutrition and programming of fetal development". Alltech Distinguished Lecturer, University of Kentucky, Lexington, KY.

- July 31, 2010, "Endogenous retroviruses: from infectious elements to essential genes," SSR Annual Meeting, Milwaukee, WI.

- Aug. 2010, "Wnt genes and uterine differentiation." Gordon Research Conference on Reproductive Tract Biology, Andover, NH.

- Sept. 3-7, 2010, "Endogenous retroviruses of sheep: a model system for understanding physiological adaptation to an evolving ruminant genome," 8th International Ruminant Reproduction Symposium, Anchorage, AK.

* **Guoyao Wu**, April 22, 2010, "Amino acid nutrition and fetal growth," Keynote speaker, Sigma Xi Spring Symposium.

- April 23, 2010, "Amino acid nutrition in fetal and neonatal growth: from animal studies to clinical applications." Experimental Biology, Symposium on Animal Models for Nutritional Research, Anaheim, CA.

- April 329, 2010, "Glutamate content in foods and utilization by the pig small intestine," International Glutamate Technical Committee, Santa Monica, CA.

- July 11, 2010, "Important roles for glutamine in swine nutrition and production," American Society of Animal Science Annual Meeting, Triennial Symposium on Animal Growth and Development, Denver

INTERNATIONAL:

Amstalden M, JS Redmond, GM Baez-Sandoval, KM Spel, TE Spencer, CA Lents, GL Williams,

"Kiss I gene expression in the arcuate nucleus increases during activation of pulsatile release of LH in maturing ewe lambs." International Congress of Neuroendocrinology July 11-15, Rouen, France.

* **Fuller W. Bazer**, WCU Professor in Biomodulation, Department of Agricultural Biotechnology, Seoul National University, 599 Gwanak-ro, Gwanak-gu, Seoul 151-921, Korea.

- March 2010, Distinguished Scientist Lecture: Pregnancy Recognition Signaling in Mammals, Seoul National University, Seoul, S. Korea.

- May 5, 2010. Invited Lecture: Mechanisms for Pregnancy Recognition Signaling Yonsei University, Wonju, S. Korea.

* **Katrin Hinrichs**, Oct. 29, 2010, "Assisted Reproductive Techniques – Clinics and Research" Buenos Aires Province Equine Embryo Transfer Veterinarians, Lincoln, Argentina.

- June 3, 2010, "In vitro production of equine embryos" Annual Meeting of the Asociación Española de Reproducción Animal (Spanish Association of Animal Reproduction), Cáceres, Spain.

* **Greg A. Johnson**, October 19-22, 2010, Invited presentation, "What can we learn from epitheliochorial placentae: Roles of osteopontin and integrins during pig implantation and placentation." International Federation of Placental Associations (IFPA) Meeting 2010 "Fetus and Placenta: A Perfect Harmony," Santiago, Chile.

* **Thomas E. Spencer**, May 8-12, 2010, "Comparative Aspects of Conceptus-Endometrial Interactions and Implantation." Frontiers in Periimplantation Biology Symposia of the First State Key Laboratory of Reproductive Biology, Beijing, China.

- May 14, 2010, "Endogenous Retroviruses: From Infectious Elements to Essential Genes." WCU Biomodulation Major Symposium, Seoul National University, Korea.

* **Guoyao Wu**, -Oct 12-14, 2010, "Intestinal amino acid metabolism:

thinking outside of the box, Genetech International Nutritional Symposium, Shanghai China.

AWARDS:

* **Fuller W. Bazer**, Pioneer Award, International Society for Ruminant Reproduction (2010)

- Doctor of Science degree by the University of Florida

- Distinguished Alumnus Award, North Carolina State University (October, 2010)

* **Robert C. Burghardt**, Distinguished Service Award, Society for the Study of Reproduction (2010).

* **Michael Golding**, Early Career Award, Perinatal Research Society (2010).

* **Guoyao Wu**, Thousand-People-Talent Award, The Central Government of China (2010).

OTHER ACTIVITIES:

* **Fuller W. Bazer**, - Associate Editor, Journal of Animal Science and Biotechnology (2010 -).

- Member, Scientific Advisory Board of TauMedix, 2010 -).

- Member, Scientific Advisory Board of Pregmama, 2010 -).

* **Steven Brinsko** is involved in numerous service activities that support the American College of Theriogenologists: -Vice President ('09-10), President-Elect ('10-11); Chair, Awards Nominating Committee; 40th Anniversary Celebration Committee; Theriogenology Foundation-Task Force for Research Grant Review.

* **Robert C. Burghardt** was elected Secretary, Society for the Study of Reproduction, 2010-2013.

* **Larry Johnson** was appointed Executive Director of the Texas A&M Chapter of Sigma Xi.

* **Thomas E. Spencer and Greg A. Johnson** contribute to a team taught course NIH Frontiers in Reproduction (FIR) course held each year at the Woods Hole Marine Biological Laboratory.

* **Thomas H Welsh, Jr.**, was elected President-Elect, Southern Section American Society of Animal Science (2010-2011).

Congratulations to Trainees!

GRADUATE STUDENTS:

Nicole Burdick, PhD, "The relationship amongst temperament, stress, and immune function in Brahman cattle." Co-Chairs, Thomas Welsh, Jr., and Jeff Carroll. In 2010, Nicole was the recipient of the U.S. Senator Phil Gramm doctoral award, the Dr. A.M "Tony" Sorenson Achievement Award and the Mauro Procknor Memorial Award, and the Ronnie L. Edwards Graduate Teaching Award. She is currently a postdoctoral fellow at the USDA-ARS in Lubbock. Recent paper: Burdick N, J Carroll, L Hulbert, J Dailey, M Ballou, R Randel, S Willard, R Vann, T Welsh (2010) Temperament influences endotoxin-induced changes in rectal temperature, sickness behavior, and plasma epinephrine concentrations in bulls. *Innate Immunity* doi:10.1177/17534259103791



Sarah Black, PhD, "Endogenous Betaretroviruses in the Ovine Uterus and Conceptus" Chair, Thomas E. Spencer. She is currently a postdoctoral fellow with Dr. Scott Dindot in the Department of Veterinary Pathobiology. Recent paper: Black SG, Arnaud F, Palmarini M, Spencer TE (2010) Endogenous retroviruses in trophoblast differentiation and placental development. *Am J Reprod Immunol* 64:255-264.



Jinyoung Kim, PhD, "Select Nutrients, Secreted Phosphoprotein 1 and Insulin-Like Growth Factor 2: Effects on Trophectoderm of Ovine Conceptuses." Chair, Fuller W. Bazer. She is currently a postdoctoral fellow in the Department of Agricultural Biotechnology, Seoul National University, Seoul, Korea. Recent paper: Kim JY, Burghardt RC, Wu G, Johnson GA, Spencer TE, Bazer FW (2010) Select nutrients in the ovine uterine lumen. VI and VII. *Biol Reprod* in press.



Carolyn Allen, MS "Influence of Nutrition During the Juvenile Period on Gene Expression Within the Hypothalamic Arcuate Nucleus and on Age at Puberty in Heifers." Co-Chairs, Gary Williams and Marcel Amstalden.



Mike Peoples MS "Identification and Utilization of Bovine Pol III Promoters to Express short-hairpin RNA" Chair: Mark Westhusin.



Jeremy Redmond MS, "KISS1 Gene Expression and the Effects of Kisspeptin During Pubertal Development in the Ewe Lamb" Chair: Marcel Amstalden.

POSTDOCTORAL FELLOW:

David Erickson, PhD completed three years of postdoctoral studies with **Drs. Greg A. Johnson and Kayla J. Bayless**. He recently moved to San Francisco to begin additional training in the Department of Obstetrics, Gynecology and Reproductive Sciences at the University of California San Francisco with Dr. Linda Guidice. Recent paper: Erikson DW, Burghardt RC, Bayless KJ, Johnson GA (2009) Secreted phosphoprotein 1 (SPPI, osteopontin) binds to integrin alpha v beta 6 on porcine trophectoderm cells and integrin alpha v beta 3 on uterine luminal epithelial cells, and promotes trophectoderm cell adhesion and migration. *Biol Reprod* 81:814-825.



Hot Papers - 2010 (continued from page 5)

Choi YH, A Gustafson-Seabury, IC Velez, DL Hartman, S Bliss, FL Riera JE Roldán, B Chowdhary, K Hinrichs (2010) Viability of equine embryos after puncture of the capsule and biopsy for preimplantation genetic diagnosis. *Reproduction*, 140:893-902.

Das PJ, N Paria, A Gustafson-Seabury, M Vishnoi, SP Chaki, CC Love, DD Varner, BP Chowdhary, T Raudsepp (2010) Total RNA isolation from stallion sperm and testis biopsies. *Theriogenology* 74:1099-1110.

Fisher HS, GG Rosenthal (2010) Relative abundance of *Xiphophorus* fishes and its effect on sexual communication. *Ethology* 116: 32-38.

Jutooru I, G Ghadalapaka, S Sreevlsan, P Lei, R Barhoumi, R Burghardt, S Safe (2010) Arsenic trioxide downregulation of specificity protein (Sp) transcription factors and inhibits bladder cancer cell and tumor

growth. *Exp Cell Res* 316:2174-2188.

Lassala A, FW Bazer, TA Cudd, S Datta, DH Keisler, MC Satterfield, TE Spencer, G Wu (2010) Parenteral administration of L-arginine prevents fetal growth restriction in undernourished ewes. *J Nutr* 140:1242-1248.

Lee J, JA McCracken, SK Banu, R Rodriguez, TK Nithy, JA Arosh (2010) Transport of prostaglandin F(2alpha) pulses from the uterus to the ovary at the time of luteolysis in ruminants is regulated by prostaglandin transporter-mediated mechanisms. *Endocrinology* 151:3326-3335.

Porada C, C Sanada, C Long, JA Wood, J Desai, N Frederick, L Millsap, C Bormann, SL Menges, C Hanna, G Flores-Foxworth, T Shin, M Westhusin, W Liu, H Glimp, E Zanjani, J Lozier, V Pliska, G Stranzinger, H Joerg, D Kraemer, G Almeida-Porada (2010) Clinical and molecular characterization of a re-established line of sheep exhibiting hemo-

philia A. *J Thromb Haemost* 8:276-285.

Satterfield MC, Bazer FW, Spencer TE, Wu G (2010) Sildenafil citrate treatment enhanced amino acid availability in the conceptus and fetal growth in an ovine model of intrauterine growth restriction. *J Nutrition* 140:251-258.

Su SC, SA Maxwell, KJ Bayless Annexin 2 regulates endothelial morphogenesis by controlling AKT activation and junctional integrity. *J Biol Chem* 2010 Oct 13. [Epub ahead of print] PMID: 20947498.

Wu G, FW Bazer, RC Burghardt, GA Johnson, SW Kim, XL Li, MC Satterfield, and TE Spencer (2010) Impacts of amino acid nutrition on pregnancy outcome in pigs: mechanisms and implications for swine production. *J Anim Sci* 88: E195-E204.

4th Annual IFRB Retreat, 2010



The 4th Annual IFRB Retreat was organized by **Dr. Marcel Amsdalden** with support from 5 departments in two colleges including the Department of Animal Science, College of Agriculture and Life Sciences and Departments of Veterinary Integrative Biosciences, Veterinary Large Animal Clinical Sciences, Veterinary Physiology & Pharmacology and Veterinary Pathobiology in the College of

Veterinary Medicine & Biomedical Sciences. Special thanks goes to **Drs. Gary Acuff, John August, Glen Laine, Evelyn Tiffany-Castiglioni, and William Moyer** for their sustained support of the trainee-focused activities of the IFRB.

The Retreat was held in conjunction with the 16th Annual Raymond O. Berry Memorial Lecture.

Following a short IFRB Business Meeting, **Drs. Katrin Hinrichs and Tom Spencer** presented Minisymposia in the morning session. After lunch, trainee platform "Data Blitz" highlighting research of **Sam Stephen** (VIBS), **Xilong Li** (Animal Science) and veterinary resident, **Dr. Shelby Hayden** (LACS, Theriogenology) were followed by poster sessions.



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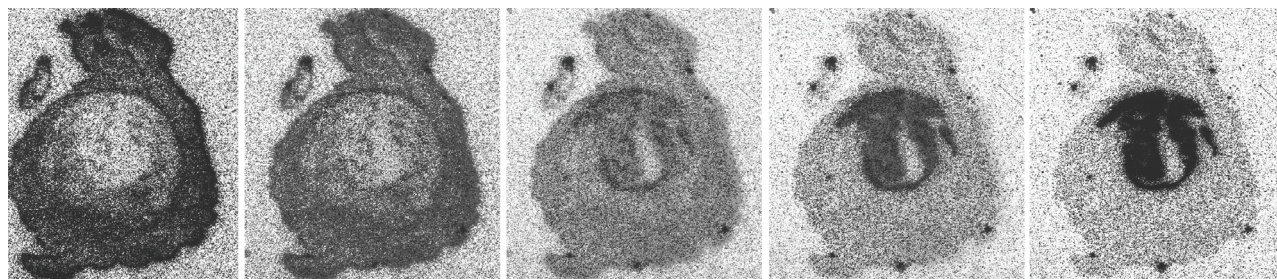
Email: ifrb@tamu.edu

IFRB Chair: Dr. Robert C. Burghardt

We acknowledge and thank donors who have supported the IFRB in the past. We welcome contributions at any level to support the following: graduate fellowships, pilot funds for promising research directions, capital equipment for imaging and biological analysis, and infrastructure upgrades for research laboratories. For more information on how to support the IFRB, contact Dr. Robert Burghardt at: rburghardt@cvm.tamu.edu

IFRB RESEARCH AND TRAINING MISSION:

Reproductive Biology is at the epicenter of the life sciences. Focal areas of research and graduate/postdoctoral training in the IFRB are interdisciplinary and cover both genders, encompass humans, domestic animals, laboratory animals and wildlife, and include: assisted reproductive techniques, biological clocks, cloning, conservation of endangered species, contraception, developmental biology, diseases of the reproductive tract, endocrinology, fertilization, fetal growth retardation, gametogenesis, gender-biased diseases and health issues, immunology, infertility, lactation, pregnancy and pregnancy-related disorders, premature labor, recovery of function, science and health policy, stem cell biology, systems biology and functional genomics, toxicology, and uterine biology. The outcomes of this research are impacting Texas, our nation and the world.



"A matricellular protein medley" -G Johnson, D Erikson, P-L Chang, R Burghardt