

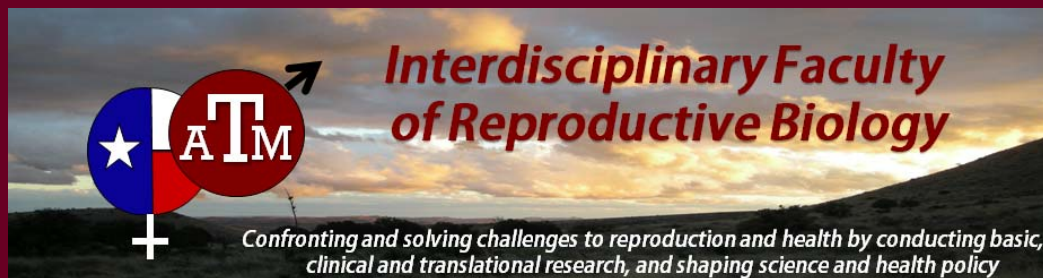
## IFRB 2012

### POINTS OF INTEREST:

- The IFRB was organized in 1992 and is one of the largest Reproductive Biology Programs 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, 22 year old IFRB Repro Forum Seminar Series, Texas Forum on Reproductive Sciences, Annual IFRB Retreat

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2012, ISSUE 2

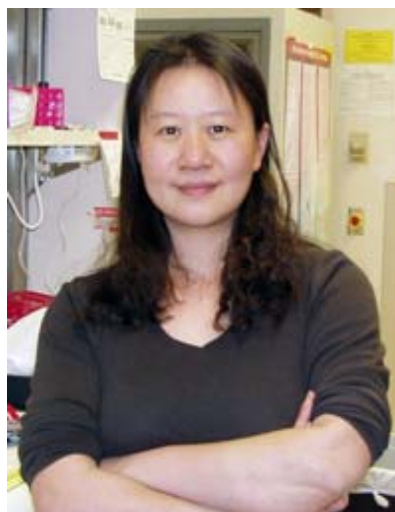
FALL, 2012

## New IFRB Faculty Spotlight



The newest full member of the TAMU IFRB is **Beiyan Zhou, Ph.D.**, Assistant Professor in the Department of Veterinary Physiology & Pharmacology. Dr. Zhou was recruited in the Fall of 2009 following the completion of a prestigious post-doctoral fellowship at the Whitehead Institute for Biomedical Research at the Massachusetts Institute of Technology (MIT). She worked under the direction of Dr. Harvey Lodish, a pioneer in the field of stem cell biology and a fellow of the American Association for the Advancement of Science, a member of the National Academy of Sciences, and a fellow of the American Academy of Arts and Sciences.

As an Assistant Professor, Dr. Zhou has continued to expand her interests in stem cell biology by devel-

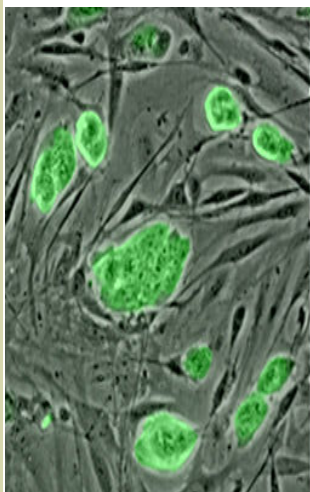


oping an independent research program designed to understand the systemic network governed by epigenetic factors in hematopoietic stem cells (HSCs). Four main lines of research are being carried out in her laboratory including: 1) the regulation of microRNAs ([miRNAs] which are small RNA molecules of about 22 nucleotides that function in the regulation of gene expression) in hematopoietic stem cell function; 2) how miRNAs act as oncogenes or tumor suppressors in leukemogenesis and its progression; 3) rheostatic regulation of miRNAs in lymphocyte formation and function; and 4) mechanisms of action of miRNAs in macrophage activation and obesity. In this latter area of research she has recently been collaborating with the laboratories of a number of other IFRB members including **Drs.**

**Fuller Bazer, Stephen Safe and Guoyao Wu** along with **Drs. Chaodong Wu and Robb Chapkin** in the Department of Nutrition and Food Sciences.

(continued on page 2)

## Grand Challenges: Regenerative Medicine



GFP-tagged embryonic stem cells

### Regenerative Medicine: Repair, Replace, Restore

Regenerative medicine is the process of harnessing natural healing processes to improve upon tissue repair for a more functional healed tissue. Muscle, tendon, cartilage, and bone are efficiently and appropriately built during embryonic development. During this time, injury to fetal tendon will result in complete healing and a fully functional structure that cannot be distinguished from uninjured tissue. Unfortunately, postnatal healing of musculoskeletal tissues is not as efficient or precise. The holy grail of regenerative medicine would be to recapitulate fetal development, resulting in healed tissues that cannot be distinguished from uninjured tissue.

**Dr. Ashlee E. Watts**, in the College of Veterinary Medicine, is a recently recruited equine surgeon with research interests in investigating the use regenerative therapies for lameness and orthopedic disease, arthroscopic surgery, and fracture repair in equine orthopedics. The potential to substantially improve outcomes for orthopedic disease with regenerative techniques is considerable. One of the tools for regenerative medicine in orthopedics is the use of stem cells, which are self-renewing, highly proliferative cells, capable of multi-lineage differentiation.

The ultimate stem cell is made at conception: the zygote. In the first few days after fertilization, the embryo consists of totipotent stem cells that are able to form all 3 germ layers as well as

(continued on page 8)

## In Memoriam: Timothy A. Cudd



**Professor  
Timothy Cudd,  
Texas A&M University**

**Timothy A. Cudd, DVM, PhD**, valued colleague and member of the IFRB, passed away on Aug. 26, 2012. Dr. Cudd was Professor of Veterinary Physiology & Pharmacology, a superb scientist, teacher, surgeon, as well as a friend and mentor.

His lifelong interest in horses led him to the University of Tennessee where he earned the DVM in 1982. He practiced veterinary medicine in Lexington, Kentucky, where he developed the first private practice neonatal foal clinic in the U.S. Due to a growing interest in research, he later moved on to the University of Florida where he earned a Ph.D. in Physiology, specializing in endocrinology of the maternal-fetal interaction controlling parturition. In 1994, he joined the faculty at Texas A&M. Although he left clinical practice, he remained a horse enthusiast and actively trained and competed dressage horses.

Dr. Cudd was internationally known for his innovative research on Fetal Alcohol Spectrum Disorders (FASD) and his use and refine-

ment of the sheep as a translational model for FASD studies. His work on fetal physiology, nutrition and the endocrine consequences of maternal alcohol consumption has had a significant impact on the understanding of the etiology and treatment of FASD. He was a contributing member of CIFASD, an international and multidisciplinary consortium that aims to accelerate the clinical translation of new capabilities in FASD recognition, intervention and prevention by fostering collaboration between basic, clinical, and translational research. His research provided a unique opportunity to bridge the basic science and clinical arms of the consortium.

Dr. Cudd had extensive instructional activities in the professional veterinary program and was a beloved mentor. He coordinated the physiology course for first year veterinary students and worked tirelessly to improve teaching methods and the curriculum. He has had an enormous and long lasting impact on the field of research not only through his own research contributions, but also

through his mentorship, training and support of a new generation of researchers and by his willingness to provide collaborative support to numerous investigators.

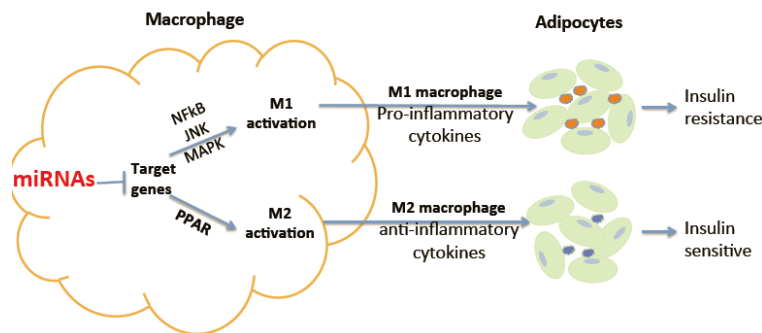
### **A memorial scholarship fund in Dr. Cudd's name has been created.**

Contributions may be made by check payable to the Texas A&M Foundation and mailed to: Texas A&M University, College of Veterinary Medicine, Office of Development, 4461 TAMU, College Station, TX 77843-4461. Please include a note that the check is for the Dr. Tim Cudd Scholarship Fund. For online contributions, <http://giving.tamu.edu>. The Foundation Office will make sure that his family is notified of your donation. Questions may be directed to: Dr. Guy Sheppard, Director of Development, Texas A&M College of Veterinary Medicine, [g-sheppard@tamu.edu](mailto:g-sheppard@tamu.edu), 979-845-9043

**Cartoon depicting alternative activation status pathways of infiltrating adipose tissue macrophage (ATMs). The classic pro-inflammatory response of ATMs (M1) depends on Toll-like receptors and activation of nuclear factor kappa B (NFκB)/c-Jun N-terminal kinase 1 (JNK1), leading to the production of inflammatory cytokines, leading to adipose tissue inflammation and insulin resistance. In contrast, M2 activation recruits PPARγ, PPARδ, or Stat6, leading to alternative, anti-inflammatory activation (M2) of ATMs.**

**The IFRB is pleased to welcome Dr. Zhou as our newest full member.**

## New IFRB Faculty (cont'd from page 1)



Adipose tissue inflammation is an important contributor to the pathogenesis of obesity-associated diseases, including type 2 diabetes and cardiovascular diseases, the two leading causes of morbidity and mortality in the United States and worldwide. Chronic excess of nutrient intake lead to a pathological expansion of adipose tissue, characterized by increased immune cell infiltration. Accumulation of infiltrating inflammatory adipose tissue macrophages (ATMs) leads to elevated inflammatory cytokine production, impaired adipose tissue function, and the development of systemic insulin resistance. ATMs display pri-

marily alternative activation (anti-inflammatory) status (M2) in lean adipose tissue that makes fat cells insulin sensitive. Upon excess nutrient stimulation, ATMs undergo a phenotypic switch towards pro-inflammatory (M1) activation that causes fat cells to be insulin resistant that can lead to development of cardiovascular diseases and type 2 diabetes. The two different pathways result from differences in polarization of macrophages. Dr. Zhou and collaborators have made the novel discovery that miRNAs serve as essential and potent regulators of ATM polarization and that

miR-223 regulates ATM activation and protects against excess nutrient intake that induces adipose tissue inflammation. Results were recently reported in the journal *Circulation* that was accompanied by an Editorial highlighting the significance of the work which may ultimately provide the basis for using microRNA analogs or chemicals to effect changes in microRNA regulated genes to treat insulin resistance-related diseases.

In other collaborations with Dr. Bazer, she has shown that interferon tau is a potent regulator of inflammatory responses, by specifically guiding ATMs to differentiate into an anti-inflammatory M2 phenotype. Other studies involve investigation of the role of uteroferrin as a regulator of red blood cell formation during fetal hematopoiesis and the role of miR-150 in regulating B cell functions including insulin sensitivity by controlling antibody production. IFRB graduate student **Wei (Eddie) Ying** has been actively involved in carrying out the latter studies. Additional collaborations with Dr. Safe include investigations on drugs that inactivate orphan nuclear hormone receptors, NR4A1 and NR4A2 in leukemia cells and thereby inhibit their growth and survival.



# IFRB Faculty Member Spotlight: Dr. Greg Johnson



**There is a precisely orchestrated communication between the conceptus trophoderm/placenta and uterine endometrium that influences establishment and maintenance of pregnancy.**

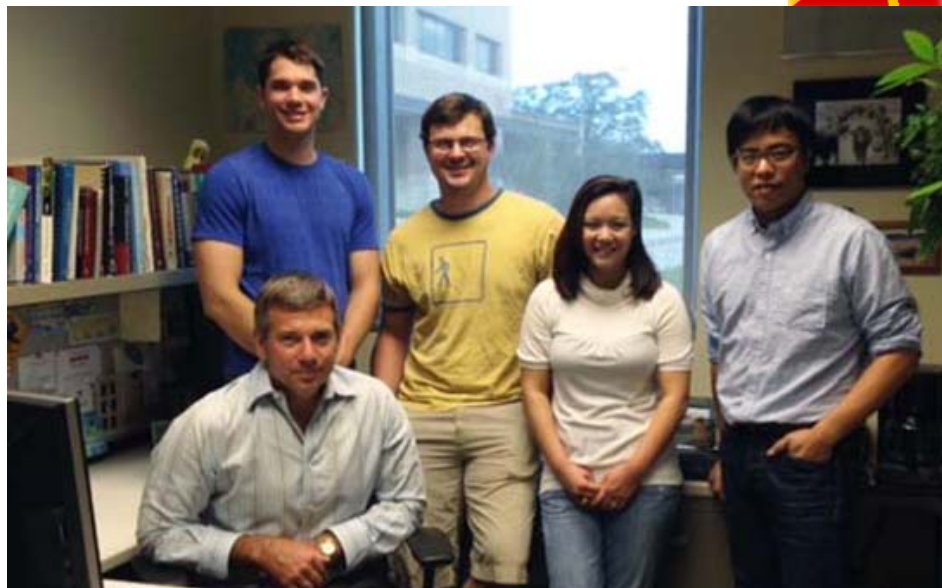
This communication is mediated by autocrine, paracrine, endocrine and physical interactions that regulate uterine and/or placental expression of genes and morphological development that supports an embryotrophic environment. The complex nature of these interactions is reflected by high embryonic mortality across species.

**Dr. Gregory A. Johnson** is an Associate Professor within the Department of Veterinary Integrative Biosciences. His laboratory utilizes pigs, sheep and mice to investigate the molecular, cellular and physiological interactions between the embryo/fetus and uterus during pregnancy recognition, implantation and placental development – with the ultimate goal of applying new knowledge towards clinical strategies to prevent pregnancy loss in women, livestock, and companion animals.

Greg is a native of Wyoming where he earned a B.S. in Zoology, an M.S. in Microbiology and a Ph.D. in Animal Science from the University of Wyoming. After postdoctoral work in the laboratory of **Dr. Fuller W. Bazer** at Texas A&M University, Greg was faculty for 2 years in the Department of Animal Science at the University of Idaho before returning to Texas A&M University “because the atmosphere of collaboration, camaraderie and talent amongst the scientists who study pregnancy at A&M provides a unique, exciting and fun environment in which to do investigative science. I just didn’t want to miss out on the opportunity to work closely with these people.”

Current USDA- and NIH-funded projects in the laboratory involve collaborations with other IFRB members including **Drs. Fuller W. Bazer, Robert C. Burghardt, Guoyao Wu and Kayla J. Bayless** to: 1) study cell-cell communication between endothelial progenitor cells (EPCs) and vascular endothelial cells and shed light on how EPCs incorporate into established vascular networks within the pig placenta (see *Schematic illustration at right*).

The ability of gap, tight or adherens junctions to direct EPC incorporation into newly-forming vessels induced by angiogenic factors is being investigated using in vitro studies, and the ability of EPCs to incorporate into newly

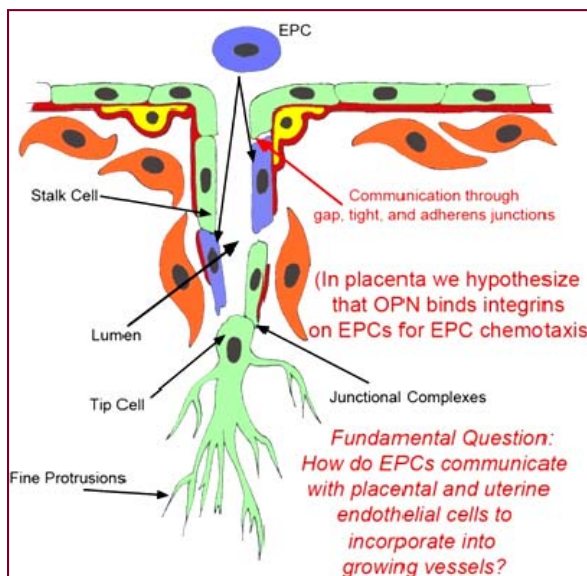


**Dr. Johnson (seated) is shown here with trainees (from left to right), Andrew Naeger, Will Frank, Grace Chang and Ted Wing**

forming vasculature during pregnancy is being tracked through the injection of fluorescently labeled EPCs into the placental veins of pigs; 2) to define the signals downstream of the conserved lysophospholipid, sphingosine-1-phosphate (S1P), that drive development of,

and angiogenesis in, the ruminant placenta. Pregnant sheep have been administered a S1P receptor antagonist, and effects on placental angiogenesis, placental and fetal development and changes in gene expression in response to S1P are being examined; 3) to investigate the importance of integrins  $\alpha v \beta 3$  and  $\alpha 5 \beta 1$  in mediating adhesion of the conceptus to uterine LE during implantation in sheep.

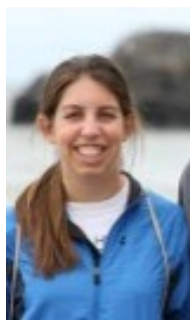
In vivo studies in which morpholino antisense oligonucleotides (MAOs), designed to inhibit translation of mRNAs for integrins  $\alpha v \beta 3$  and  $\alpha 5 \beta 1$ , are being infused into the uterine lumen of Day 12 pregnant sheep to perform loss of function for these conceptus-expressed integrins, and observe effects on conceptus implantation; and 4) to understand mechanisms whereby specific components of histotroph, e.g., glucose, leucine, arginine, glutamine and osteopontin activate nutrient sensing pathways in cells of the conceptus. These pathways include phosphatidylinositol 3-kinase, proto-oncogenic protein kinase I, mammalian target of rapamycin or mTOR, and ribosomal protein S6 kinase, as well as (mitogen-activated protein kinases 14 (p38 MAPK), 3 and 1 (ERK1/ERK2).



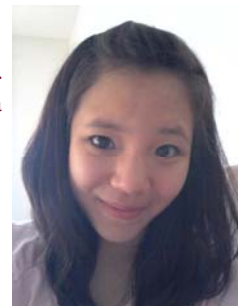
**Schematic illustrating sprouting angiogenesis that includes incorporation of endothelial progenitor cells (EPCs) into sites of neovascularization. Adapted from Bayless and Johnson, Vascular Research, 2011.**

## IFRB Trainee News

**Michelle Bedenbaugh** recently joined the laboratory of Dr. Marcel Amstalden. Michelle has a B.S. in Animal Science from Texas A&M and graduated in May 2012 with Summa Cum Laude honors and the Texas A&M University Undergraduate Research Fellow recognition. Michelle received the 2012 College of Agriculture and Life Sciences Dean's Award for Outstanding Undergraduate Research conducted under the supervision of Dr. Amstalden. Michelle started the M.S. program in Physiology of Reproduction in Fall 2012.



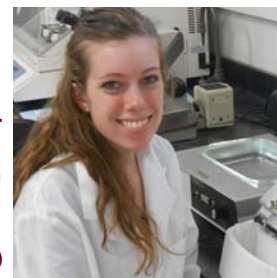
and their roles in protein and nutrient transport during pregnancy in pigs. She is also studying the expression and role of a facilitated glucose transporter in implantation and conceptus development in pigs and sheep. A preliminary report of this work was presented at the 2011 Annual Meeting for the Society for the Study of Reproduction in Portland, Oregon.



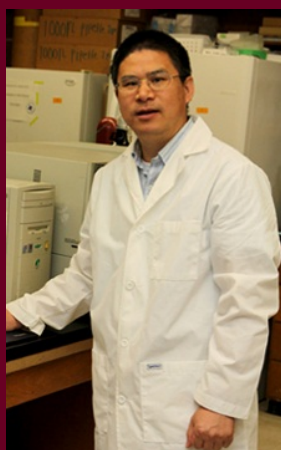
**Hannah DelCurto** is the newest member of the laboratories of Drs.

**Kathrin Dunlap and Carley Satterfield** within the Physiology of Reproduction Section of the Department of Animal Science.

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**Immunofluorescence (IF) detection of the integrin  $\alpha 2 \beta 1$  at the uterine-placental interface of a Day 60 pregnant pig.**  
- immunostaining prepared by Grace Chang



**Dr. Wu was also elected as Fellow of the American Association for the Advancement of Science. (the world's largest general scientific society). He was recognized for discovery of novel pathways of amino acid nutrition and metabolism affecting intestine, cardiovascular and reproductive tissues impacting health and development of animals and humans.**

**Grace Chang** joined the laboratory of Dr. Greg Johnson in August, 2012 to begin work on a M.S. degree in Biomedical Science. She participated in undergraduate research in Dr. Johnson's lab and graduated in 2011 with a B.S. in Biomedical Science. She is currently studying the expression of  $\alpha 2 \beta 1$  and claudin-4 proteins

## IFRB's Newest Distinguished Professor

**Dr. Guoyao Wu, Professor of Animal Science and long-standing member of the IFRB was named a University Distinguished Professor effective September, 2012.** This ranking is awarded to professors whose work has caused a substantial intellectual leap forward in their discipline, are considered pre-eminent in their field and have made major impacts.

Dr. Wu has been responsible for elucidation of basic metabolic pathways for amino acid utilization in animals including glutamine, arginine, cysteine, leucine and proline; and he has used this knowledge to develop the concept of functional amino acids that regulate key metabolic pathways impacting physiological processes such as cell survival, growth, development and reproduction in pigs and sheep. As a consequence, Dr. Wu and colleagues have developed novel applications involving dietary supplementation with functional amino acids to enhance spermatogenesis in boars, improve fetal survival, increase litter size and enhance growth performance, muscle gain and meat quality in young pigs. His discoveries are transforming the practice of swine nutrition as the result of mechanistic studies that have refined our understanding of nutrient requirements of swine. The commercial development of two feed-grade glutamine and arginine supplements (AminoGut and Progenos) are being used to enhance reproductive and growth performance in piglets throughout the world.

Intrauterine growth restriction/retardation (IUGR) is a common diagnosis in human obstetrics and carries an increased risk of perinatal morbidity and mortality. Interestingly, pigs exhibit the most severe IUGR among livestock species which is further exacerbated by lack of

understanding of the importance of functional amino acids. Dr. Wu and colleagues have shown that dietary supplementation of glutamine or L-arginine can mitigate the impact of IUGR and enhance placental growth and fetal survival and growth in sheep and pigs. While many different factors can give rise to IUGR in humans, Dr. Wu's findings offer promise of mitigating fetal complications of this condition which affect about 5% of general obstetric population.

As most of his collaborators know, Dr. Wu is among the very small percentage of scientists whose curiosity-driven research interests are combined with an ability to routinely "think outside of the box" which, in part, accounts for the paradigm shifting discoveries related to the understanding and utilization amino acids to improve animal nutrition and reproductive performance. During the last 20 years, Dr. Wu, as PI or Co-PI, has obtained more than \$15 million in grant funds from United States Department of Agriculture, National Institutes of Health, American Heart Association, Juvenile Diabetes Research Foundation, National Science Foundation of China, The Chinese Academy of Sciences, Feed Industry, and other agencies. He published over 350 peer-reviewed journal articles and 50 book chapters and has served as chair or co-chair of committees for 27 graduate students, committee member for 44 graduate students and mentor for 26 postdoctoral fellows and visiting scholars. He has received numerous recognitions and awards. Few scientists have had such an impact on the field of animal nutrition as a visionary researcher and mentor.



# IFRB Seminar Series, Fall 2012

The IFRB Seminar Series, Reproductive Biology Forum, has been held weekly during the Fall and Spring Semesters since 1990. The 2012 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:

September 7 **Dr. Robert Burghardt**, Chair IFRB, IFRB General Business Meeting.

September 14 **Dr. Andre Pires-daSilva**, University of Texas Arlington, "Evolution of mating systems and aging." Hosted by **Dr. Marcel Amstalden**.

September 21 **Rodolfo Cardoso**, Animal Science, TAMU College Station, "Accelerated body weight gain during the juvenile period as a model to assess NPY control of puberty in heifers." Hosted by **Dr. Gary Williams**. **Kirthiram Sivakumar**, Veterinary Integrative Biosciences, TAMU College Station. "Postnatal exposure to hexavalent chromium through mother's milk accelerates follicular atresia in F1 offspring through oxidative stress." Hosted by **Dr. Sakhila Banu**.

September 28 **Dr. Fuller Bazer**, Animal Science, TAMU College Station, "Uterine environment and conceptus development." Hosted by **Dr. Marcel Amstalden**.

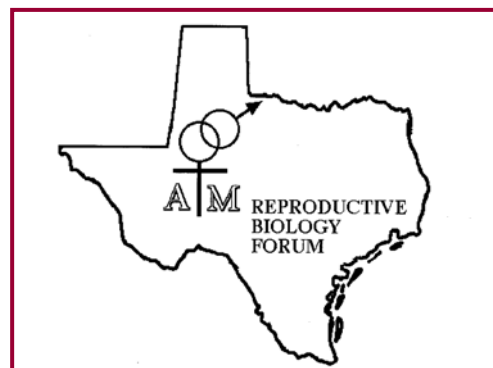
October 5 **Dr. George Smith**, Michigan State University, "Embryotrophic actions of follistatin: potential mechanisms and translational relevance." Hosted by **Dr. Qinglei Li**.

October 12 **Dr. Chung Park**, North Dakota State University, "Maternal methyl diet and epigenetic imprint of mammary carcinogenesis in offspring." Hosted by **Dr. Gary Williams**.

October 19 **Wei (Eddie) Ying**, Animal Science, TAMU College Station, "Arginine decarboxylase/agnatinase: an alternative pathway for synthesis of polyamines in ovine conceptus and uterus." **Xiaoqiu (Churchill) Wang**, Animal Science, TAMU College Station, "In vivo translational knockdown of arginine-associated gene transcripts in conceptus trophectoderm differentially compromise growth, development and gene expression by ovine conceptuses." Hosted by **Dr. Fuller Bazer**.

October 26 **Reproductive Biology Retreat** (Coordinator: **Dr. Joe Arosh**) Minisymposium speakers: **Dr. Greg A. Johnson**, Veterinary Integrative Biosciences, "Osteopontin, a key player in placentation;" **Dr. Mark Westhusin**, Veterinary Physiology and Pharmacology, "GM farm animals: When can I order green eggs and ham?" **Dr. Jone Stanley**, "Gestational exposure to chromium predisposes F1 females to pregnancy failures and affects fetal growth and development;" **Dr. Alison Kiser**, "Sperm quality following 4 days of cooled storage: Impact on fertility;" and **Wei "Eddie" Ying**, A novel paradigm of microRNA regulated B cell functions on insulin resistance: mir-150 regulates insulin sensitivity through controlling antibody production."

**R.O. Berry Memorial Lecture** (Coordinator: **Dr. Fuller Bazer**). **Dr. Peter Parham**, Department of Structural Biology, Stanford University, "The extraordinary



immunogenetics of natural killer cells and their influence on reproduction."

November 2 **Dr. Melissa Pepling**, Syracuse University, NY, "Uncovering mechanisms regulating mammalian oocyte development." Hosted by **Dr. Sakhila Banu**.

November 9 **Dr. Jules Puschett**, Medicine and Neuroscience and Experimental Therapeutics, TAMHSC, "Involvement of the cardiotonic steroids in hypertensive and neurologic disorders: a tale of two syndromes." **This seminar was cancelled and rescheduled for the Spring Semester, 2013**

November 16 **Dr. Pam Plotkin**, Director, Sea Grant Program, TAMU, "Sea turtle nesting gone wild: The alternative reproductive behavior of the Olive Ridley sea turtle (*Lepidochelys olivacea*)." Hosted by **Dr. Duncan MacKenzie**.

November 30 **Dr. Stan Hileman**, West Virginia University Health Sciences Center, "Regulation of luteinizing hormone release in the ewe by neurokinin-B", Hosted by **Dr. Marcel Amstalden**.

December 7 **Dr. Eric Asselin**, Title: "Regulation of cell survival in the endometrium". Hosted by **Dr. Joe Arosh**.

## IFRB Hot Papers, Fall 2012

Carlson DF, Tan W, Lillico SG, Stverakova D, Proudfoot C, Christian M, Voytas DF, **Long CR**, Whitelaw CB, Fahrenkrug SC. Efficient TALEN-mediated gene knock-out in livestock. *Proc Natl Acad Sci U S A* 2012 109:17382-17387.

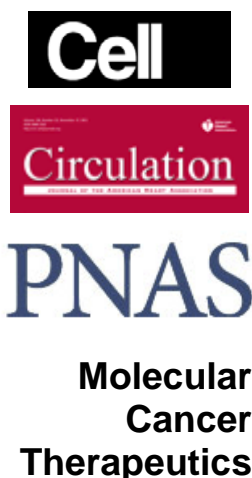
Matzuk MM, McKeown MR, Filippakopoulos P, **Li Q**, Ma L, Agno JE, Lemieux ME, Picaud S, Yu RN, Qi J, Knapp S, Bradner JE. Small-molecule inhibition of BRDT for male contraception. *Cell* 2012 150:673-684.

**Kim K, Chadalapaka G, Pathi SS**, Jin UH, Lee JS, Park YY, Cho SG, **Chintharlapalli S, Safe S**. Induction of the Transcriptional Repressor ZBTB4 in Prostate Cancer Cells by Drug-Induced Targeting of MicroRNA-17-92/106b-25 Clusters. *Mol Cancer Ther* 2012 11:1852-1862.

**Kim J, Song G, Wu G, Bazer FW**. Functional roles of fructose. *Proc Natl Acad Sci U S A* 2012

109:E1619-E1628.

Zhuang G, Meng C (equal contribution), Guo X, Cheruku PS, Shi L, Xu H, Li H, Wang G, Evans AR, **Safe S**, Wu C, **Zhou B**. A novel regulator of macrophage activation: miR-223 in obesity-associated adipose tissue inflammation. *Circulation*. 2012 125(23):2892-2903.





## Trainee Spotlight: Bruna Alves, DVM



**Bruna Alves, DVM**, doctoral candidate in Physiology of Reproduction, investigates the influence of nutrition during the juvenile period in programming the onset of puberty in heifers. For optimal lifetime productivity, it is essential that heifers become pregnant early during their first breeding season and calve the first time by approximately 24 months of age. Therefore, practices that promote adequate growth of replacement heifers are critical for maximizing productivity and profitability of beef cows. Although it has been known that nutrition during the prepubertal period influences the timing of onset of puberty in heifers, recent studies have indicated that the period between 4 and 7 months of age is particularly critical. Early weaning calves at three to four months of age and feeding high-concentrate diets that promote high rates of body weight gains can reduce markedly the age at puberty in heifers.

Studies conducted by Bruna and colleagues investigating the mechanisms by which nutrition promotes

early onset of puberty in heifers have indicated that increased rate of body weight gain during the juvenile period leads to structural and functional alterations in neurons located in the hypothalamus, a region of the brain involved in the control of food intake, energy expenditure and reproductive function. Alterations include differential expression of the genes encoding neuropeptide Y (NPY) and kisspeptin, neuropeptides involved in the control of gonadotropin-releasing hormone (GnRH) secretion. In addition, Bruna also observed considerable plasticity in NPY and kisspeptin neuronal projections. In heifers that were weaned at 4 months of age and fed diets high in concentrate to promote elevated body weight gain, the proportion of GnRH neurons in close proximity to NPY-containing neuronal fibers was reduced at eight months of age. In contrast, the proportion of GnRH neurons in close proximity to kisspeptin-containing neuronal fibers was increased at that time. Because NPY inhibits, and kisspeptin stimulates, the release of

(continued on page 14)

## 44th Annual Meeting, Society for the Study of Reproduction

The 45th Annual Meeting of the Society for the Study of Reproduction was held at Penn State University in State College, PA Aug 12-15. IFRB was well represented at the meeting with reports involving 18 faculty members and 23 trainees.

Faculty from TAMU contributing to papers presented included **Drs. Marcel Amstalden, Joe Arosh, Sakhila Banu, Kayla J. Bayless, Fuller W. Bazer, Robert C. Burghardt, Kathrin A. Dunlap, John Edwards, Michael Golding, Greg A. Johnson, Qinglei Li, Charles Long, Penny Riggs, M. Carey Satterfield, Luis O. Tedeschi, Thomas H. Welsh, Jr., Gary L. Williams, and Guoyao Wu.**

Trainee participants included **Bruna R.C. Alves, Rodolfo C. Cardoso, Grace Chang, James W. Frank, Sorin M. Greff, Ashley Keith, Yang Gao, JeHoon Lee, Thamizh K. Nithy, JeHoon Lee, Xilong Li, Ligia D. Presotto,**

**Irene Ruiz-Gonzalez, Sarah Sharpton, Janessa Short, Kirthiram K Sivakumar, Jone A. Stanley, Sam D. Stephen, Jennifer F. Thorson, Xiaoqi (Churchill) Wang, Bryan G. White, Theodore Wing, and Wei Ying.**

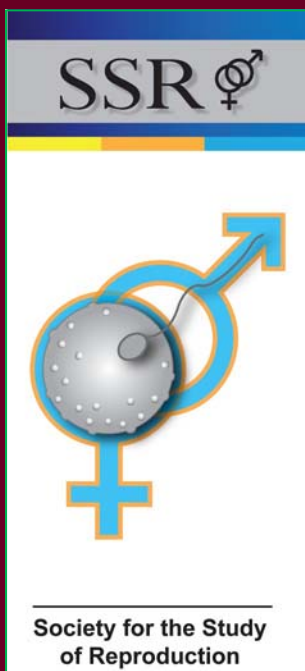
**IFRB trainees were recipients of major SSR awards.** Recipients of the 2012 Animal Research in Reproduction Fellowships from the USDA included **Bruna R.C. Alves**, (Platform), **Rodolfo Cardoso**, (Poster), and **Bryan White** (Platform). Recipients of the Larry Ewing Memorial Trainee Travel Fund Awards (LEMTTF), administered by the Trainee Affairs Committee were **Bruna Alves, Rodolfo Cardoso, Yang Gao, Ashley Keith, Xiaoqi (Churchill) Wang, and Wei Ying.**

Additional travel awards to attend the SSR meeting were provided by the IFRB with funding provided by the Texas A&M University Division of Research and Deans of the Colleges of Agriculture and Life Sciences and Veterinary Medicine & Biomedical Sciences. Trainees

supported included **Bruna R.C. Alves, Rodolfo Cardoso, James Will Frank, Yang Gao, Ashley Keith, Jennifer F. Thorson, Xiaoqi (Churchill) Wang, Ted Wing, Wei (Eddie) Ying, Kurthiram Sivakumar.** Two other trainees received travel awards to attend the American Dairy Science Association (ADSA), American Society of Animal Science (ASAS), Canadian Society of Animal Science, Asociacion Mexicana de Produccion Animal (AMPA), and Western Section American Society of Animal Science 012 Joint Annual Meeting (JAM) in Phoenix, Arizona, July 15 - 19, 2012, including **Deborah Price** and **Jennifer Rosenberg.**

IFRB members are reminded to renew SSR membership which provides the following benefits:

- Free access to the Society's journal, *Biology of Reproduction* (BOR);
- Discounts on annual meeting registration - for trainees, discount is greater than total membership cost;
- The Annual Meeting - an opportunity to interact with leading reproductive biologists and gain international recognition for your work;
- Representation and resources on policy issues, e.g., research funding, stem cell research, and animal use.



# A Snapshot of IFRB Research

**The IFRB is recognized as one of the most productive interdisciplinary research and education programs in reproductive biology in the U.S. The following "snapshot" of research productivity illustrates the multiple investigator research activities of the IFRB involving extensive participation of trainees during the 4 month period July 1 to November 1, 2012:**

- Albarzanchi AM, Sayes CM, Ridha Albarzanchi MT, Fajt VR, Dees WL, Kraemer DC. Cilostazol blocks pregnancy in naturally cycling mice. *Contraception*. 2012 Oct 18. pii: S0010-7824 (12)00818-9. doi 10.1016/contraception.2012.09.008. [Epub ahead of print]
- Allen CC, Alves BR, Li X, Tedeschi LO, Zhou H, Paschal JC, Riggs PK, Braga-Neto UM, Keisler DH, Williams GL, Amstalden M. Gene expression in the arcuate nucleus of heifers is affected by controlled intake of high- and low-concentrate diets. *J Anim Sci* 2012 90:2222-2232.
- Balaraman S, Winzer-Serhan UH, Miranda RC. Opposing actions of ethanol and nicotine on microRNAs are mediated by nicotinic acetylcholine receptors in fetal cerebral cortical-derived neural progenitor cells. *Alcohol Clin Exp Res* 2012 36:1669-1677.
- Banerjee N, Talcott S, Safe S, Mertens-Talcott SU. Cytotoxicity of pomegranate polyphenolics in breast cancer cells in vitro and vivo: potential role of miRNA-27a and miRNA-155 in cell survival and inflammation. *Breast Cancer Res Treat* 2012 136:21-34.
- Bazer FW. Fertility: role of repressor of estrogen receptor activity. *Endocrinology*. 2012 153:3555-3557.
- Bazer FW, Kim J, Ka H, Johnson GA, Wu G, Song G. Select nutrients in the uterine lumen of sheep and pigs affect conceptus development. *J Reprod Dev*. 2012; 58:180-188.
- Bazer FW, Kim J, Song G, Ka H, Tekwe CD, Wu G. Select nutrients, progesterone, and interferon tau affect conceptus metabolism and development. *Ann N Y Acad Sci* 2012 1271:88-96.
- Bazer FW, Song G, Kim J, Dunlap KA, Satterfield MC, Johnson GA, Burghardt RC, Wu G. Uterine biology in pigs and sheep. *J Anim Sci Biotechnol* 2012 16:3(1):23.
- Carlson DF, Tan W, Lillico SG, Stverakova D, Proudfoot C, Christian M, Voytas DF, Long CR, Whitelaw CB, Fahrenkrug SC. Efficient TALEN-mediated gene knockout in livestock. *Proc Natl Acad Sci U S A* 2012 109:17382-17387.
- Chadalapaka G, Jutooru I, Sreevalsan S, Pathi S, Kim K, Chen C, Crose L, Linardic C, Safe S. Inhibition of rhabdomyosarcoma cell and tumor growth by targeting specificity protein (Sp) transcription factors. *Int J Cancer*. 2012 Jul 19. doi: 10.1002/ijc.27730. [Epub ahead of print]
- Connor EE, Baldwin RL 6th, Blanton JR Jr, Johnson SE, Poulos S, Welsh TH Jr. Growth and Development Symposium: Understanding and mitigating the impacts of inflammation on animal growth and development. *J Anim Sci* 2012 90:1436-1437.
- Culumber ZW, Shepard DB, Coleman SW, Rosenthal GG, Tobler M. Physiological adaptation along environmental gradients and replicated hybrid zone structure in swordtails (Teleostei: Xiphophorus). *J Evol Biol* 2012 25:1800-1814.
- Dai ZL, Li XL, Xi PB, Zhang J, Wu G, Zhu WY. Regulatory role for L-arginine in the utilization of amino acids by pig small-intestinal bacteria. *Amino Acids* 2012 43:233-244.
- Dorniak P, Bazer FW, Spencer TE. Biological role of interferon tau in endometrial function and conceptus elongation. *J Anim Sci* 2012 Oct 24. [Epub ahead of print]
- Dorniak P, Bazer FW, Wu G, Spencer TE. Conceptus-derived prostaglandins regulate endometrial function in sheep. *Biol Reprod* 2012 87(1):9, 1-7.
- Gandhy SU, Kim K, Larsen L, Rosengren RJ, Safe S. Curcumin and synthetic analogs induce reactive oxygen species and decreases specificity protein (Sp) transcription factors by targeting MicroRNAs. *BMC Cancer*. 2012 Nov 30;12(1):564.
- Go GW, G Wu, DT Silvey, S Choi, XL Li, SB Smith. Lipid metabolism in pigs fed supplemental conjugated linoleic acid and/or dietary arginine. *Amino Acids* 2012 43:1713-1726.
- Gold JR, Cohen ND, Welsh TH Jr. Association of adrenocorticotrophin and cortisol concentrations with peripheral blood leukocyte cytokine gene expression in septic and non-septic neonatal foals. *J Vet Intern Med* 2012 26:654-661.
- González-Fernández L, Macías-García B, Velez IC, Varner DD, Hinrichs K. Calcium-calmodulin and pH regulate protein tyrosine phosphorylation in stallion sperm. *Reproduction* 2012 144:411-422.
- Hafila AN, Lancaster PA, Carstens GE, Forrest DW, Fox JT, Forbes TD, Davis ME, Randel RD, Holloway JW. Relationships between feed efficiency, scrotal circumference and semen-quality traits in yearling bulls. *J Anim Sci* 2012 Jun 4. [Epub ahead of print]
- Hayden SS, Blanchard TL, Brinsko SP, Varner DD, Hinrichs K, Love CC. Pregnancy rates in mares inseminated with 0.5 or 1 million sperm using hysteroscopic or transrectally guided deep-horn insemination techniques. *Theriogenology* 2012 78:914-920.
- Hinrichs K, Choi YH, Norris JD, Love LB, Bedford-Guaus SJ, Hartman DL, Velez IC. Evaluation of foal production following intracytoplasmic sperm injection and blastocyst culture of oocytes from ovaries collected immediately before euthanasia or after death of mares under field conditions. *J Am Vet Med Assoc* 2012 241:1070-1074.
- Hou YQ, L Wang, D Yi, BY Ding, ZG Yang, J Li, X Chen, YS Qiu, G Wu. N-Acetylcysteine reduces inflammation in the small intestine by regulating redox, EGF and TLR4 signaling. *Amino Acids* 2012 doi: 10.1007/s00726-012-1295-x
- Jeong W, Kim HS, Kim YB, Kim MA, Lim W, Kim J, Jang HJ, Suh DH, Kim K, Chung HH, Bazer FW, Song YS, Han JY, Song G. Paradoxical expression of AHCYL1 affecting ovarian carcinogenesis between chickens and women. *Exp Biol Med* 2012 237:758-767.
- Jin UH, Lee SO, Safe S. Aryl Hydrocarbon Receptor (AHR)-Active pharmaceuticals are selective Ahr modulators in MDA-MB-468 and BT474 breast cancer cells. *J Pharmacol Exp Ther* 2012 343:333-341.
- Jones AG, Bürger R, Arnold SJ, Hohenlohe PA, Uyeda JC. The effects of stochastic and episodic movement of the optimum on the evolution of the G-matrix and the response of the trait mean to selection. *J Evol Biol* 2012 Sep 7. doi:10.1111/j.1420-9101.2012.02598.x. [Epub ahead of print]
- Kim K, Chadalapaka G, Pathi SS, Jin UH, Lee JS, Park YY, Cho SG, Chintharlapalli S, Safe S. Induction of the Transcriptional Repressor ZBTB4 in Prostate Cancer Cells by Drug-Induced Targeting of MicroRNA-17-92/106b-25 Clusters. *Mol Cancer Ther* 2012 11:1852-1862.
- Kim J, Song G, Wu G, Bazer FW. Functional roles of fructose. *Proc Natl Acad Sci U S A* 2012 109:E1619-E1628.
- Kong XF, BE Tan, YL Yin, HJ Gao, XL Li, LA Jaeger, FW Bazer, G Wu. L-Arginine stimulates the mTOR signaling pathway and protein synthesis in porcine trophectoderm cells. *J Nutr Biochem* 2012. 23:1178-1183.
- Lei J, Feng D, Zhang Y, Dahanayaka S, Li X, Yao K, Wang J, Wu Z, Dai Z, Wu G. Hormonal regulation of leucine catabolism in mammary epithelial cells. *Amino Acids* 2012 Jun 17. [Epub ahead of print]
- Lei J, Feng D, Zhang Y, Dahanayaka S, Li X, Yao K, Wang J, Wu Z, Dai Z, Wu G. Regulation of leucine catabolism by metabolic fuels in mammary epithelial cells. *Amino Acids* 2012 43:2179-2189.

(continued on page 11)



## Regenerative Medicine, cont'd.

placental tissue. Once the embryo becomes a blastocyst, the inner cell mass consists of pluripotent stem cells that will give rise to all 3 germ layers — ectoderm, mesoderm, and endoderm — but can no longer form placental tissues. Further in development, the cells become either somatic cells (terminally differentiated) or stem cells committed to a specific lineage (multipotent stem cells). Importantly, local niches of lineage-committed multipotent stem cells remain in adult tissue throughout life, for normal tissue remodeling and repair.

In the United States, osteoarthritis is the most common joint disorder, affecting over one third of Americans older than 65 years of age. Of those with knee osteoarthritis, 40% report their health as “poor” or “fair,” related to their reduced mobility and the pain of osteoarthritis. One of the leading risk factors for development of osteoarthritis is previous joint injury. A mechanism for improved repair of joint injury, avoiding the sequelae of osteoarthritis, could improve the lives of millions. In laboratory animal models, stem cells with greater potency, such as embryonic stem cells, have an increased treatment effect compared to that for lineage-committed stem cells. Because of ethical considerations, embryonic stem cells have not been thoroughly investigated nor used in human musculoskeletal applications. The horse suffers similar musculoskeletal injuries to man in joints and tendons, and would be an excellent model system to ascertain whether embryonic stem cells improve musculoskeletal regeneration compared to adult-derived stem cells. Unfortunately, a verified pluripotent equine embryonic stem line cell has not been successfully isolated.

Induced modifications to stem cells are also being studied. One modification is a fetal-derived stem cell that has been manipulated in vitro to act more like an embryonic stem cell. An important benefit of this type of stem cell is its increased potency due to its pluripotent-like (embryonic-like) state. One such product has been developed and tested in the horse tendon with remarkable results, but is not yet clinically available, pending FDA approval. Another modification is the induced pluripotent stem (iPS) cell, where in vitro manipulations are applied to adult somatic cells, such as skin fibroblasts, to de-differentiate them and induce a stem-cell-like state. This type of cell may achieve the benefit of improved potency without the ethical considerations of embryonic stem cells.

Because of the current limitations with embryonic stem cells and modified stem cells, much attention has been focused on adult-derived mesenchymal stem cells (**MSCs, see Schematic**). These are considered to be an excellent stem cell source for musculoskeletal regenerative therapies because they are of mesodermal lineage, are readily harvested from adult tissues and are immune-privileged, thus avoiding host vs. graft rejection. The immune privilege of MSCs may be in part due to lack of MHC class II molecules and most of the classical co-stimulatory molecules of antigen-presenting cells. In addition to being immune-privileged, MSCs are immune-modulatory, through secretion of chemo-attractants followed by regulation of

immune cell activation (T and B cells). Finally, MSCs may also be anti-inflammatory through inhibition of IFN- $\gamma$  and TNF- $\alpha$  and stimulation of metalloproteinase inhibitors and anti-inflammatory interleukins, such as IL-10.

To date, bone marrow-derived MSCs have been the most thoroughly studied stem cells in both horse and human, and have the most evidence for ability to contribute to cartilage, tendon, and bone repair as well as to modulate inflammation and soft tissue repair within the joint. In the horse, there is good clinical evidence that stem cell therapy improves repair in tendon injury. In a report of 105 racehorses treated for tendon injury with over 2 years of follow-up, there was a lower recurrence rate of bowed tendon in tendons treated with MSCs (~25%), compared with traditional therapies (approximately 55%; historical controls). Unfortunately, experimental models in the horse and other model species have been unable to demonstrate the mechanisms of improved repair

from the adult-derived stem cells. Of great interest, treatment with fetal-derived embryonic-like stem cells with enhanced potency showed faster injury resolution than did treatment with MSCs, and formed a normal hypocellular matrix in an equine model of tendon injury.

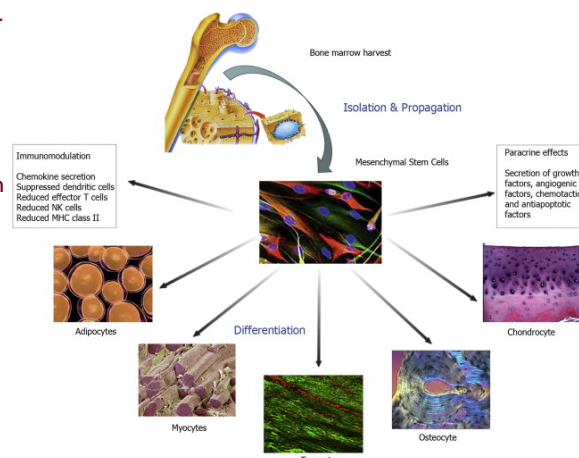
For the treatment of joint injury, intra-articular stem cell injection as well as direct arthroscopic implantation into joint defects have been used in horses and people (FDA-approved clinical trials) for the treatment of acute articular injuries and minimization of osteoarthritis progression. Several animal models of osteoarthritis have shown promising results across several different research groups with reduced cartilage degeneration and osteoarthritis progression and improved soft tissue healing after MSC injection.

Because of their broad overlap with other cell populations, MSCs cannot yet be sorted accurately by cell surface markers. Therefore, many labs select and isolate MSCs by using their

plastic-adherent properties. Efforts to better define the MSC by reproductive biologists, stem cell biologists and immunologists are ongoing.

There is still much to learn about the optimal treatment paradigm in regenerative therapies for musculoskeletal conditions. The initial enthusiasm for stem cells in regenerative medicine was based on the concept of tissue-specific differentiation, in that stem cells implanted to a cartilage lesion would engraft, become chondrocytes, and produce cartilage matrix. As both basic science and clinical data accumulates, it appears that stem cell therapy may also work, largely or in part, via local production of bioactive molecules and immune modulation, rather than via tissue specific differentiation and long term engraftment. What treatment effects stem cells actually impart is an important question. The answers will likely change current thinking about which conditions are treated with stem cells and by which stem cell source, when they are applied, by which route, how often they are administered, and the dose of

(continued on page 14)



*Isolation of MSCs can be from many connective tissues but is most common from bone marrow. The effect of MSCs can be through differentiation toward target cell lineage but is more likely to involve trophic modulation by paracrine and autocrine activity; secretion major histocompatibility complex (MHC) of angiogenic, chemoattractant, and antiapoptotic factors; and specific anti-inflammatory effects through reduced T-cell activity and MHC suppression.*

- Nixon, Watts and Schnabel (2012) J Shoulder Elbow Surg.



# 18th Annual Dr. Raymond O. Berry Memorial

**The Eighteenth Annual Dr. Raymond O. Berry Memorial Lecture was held at the Veranda, Bryan, TX on October 26, 2012.** The Annual Raymond O. Berry Lecture series is held in honor of Dr. Raymond O. Berry, a member of the faculty of the Agricultural and Mechanical College of Texas from 1931 to 1960 who contributed significantly to establishment of the discipline of Reproductive Immunology through his pioneering studies involving embryo transfer to evaluate genetic factors affecting reproduction.

Dr. Berry made many contributions to the fields of Reproductive Biology and Genetics. Pioneering work of Dr. Berry and his colleagues involved embryo transfer to study sheep/goat hybrids. Dr. Berry and colleagues made the first successful intra-species transfer of a goat embryo in 1932 and a successful intra-species sheep embryo transfer in 1933. Until that time, embryo transfer had been limited to rats and rabbits. Dr. Berry's research produced pregnancies from interspecies transfer of embryos between sheep and goats, but none was carried to term. Through these results, he was perhaps the first to demonstrate that the uterus is not an immunologically privileged site. Pregnancy failure does result because the uterus of the goat rejects fetal-placental tissues of sheep and vice versa. Since that time scientists have determined that the trophoblast (placenta) associated with an embryo must be immunologically compatible with the mother. Therefore, a goat embryo will develop to term in a ewe if the early embryo is manipulated to insure that it has sheep trophoblast (placenta) and sheep/goat chimeras will develop successfully to term so long as the trophoblast (placenta) is immunologically compatible with the recipient female. 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.**



**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. Peter Parham, Professor in the Departments of Structural Biology and Microbiology & Immunology at the Stanford University School of Medicine, was selected by a vote of IFRB faculty.** He presented an excellent lecture entitled, "The extraordinary immunogenetics of natural killer cells and their influence on reproduction" which generated considerable discussion.

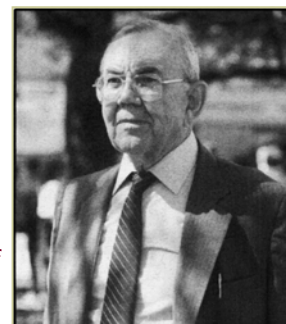
Dr. Parham was born in Stanmore, Middlesex, England and received a B.A. and M.A. in Natural Sciences from the University of Cambridge and Ph.D. in Biochemistry and Molecular Biology from Harvard University. He then conducted research at the Genetics Laboratory, University of Oxford, with Sir Walter F. Bodmer and the Harvard Biological Laboratories and Sidney Farber Cancer Center where he was a Junior Fellow, Society of Fellows, Harvard University. In 1980, Dr. Parham was appointed Assistant Professor of Structural Biology and he is now Professor of Structural Biology, Microbiology & Immunology at Stanford University. He has re-

ceived numerous honors and awards that include being named: Agnes Axtell Moule Faculty Scholar, Stanford University; Searle Scholar, Chicago Community Trust; Fellow of the Leukemia Society of America; Stohman Award, Leukemia Society of America; The Rose Payne Distinguished Scientist Award, American Society for Histocompatibility and Immunogenetics; Ceppellini Lecturer, European Foundation for Immunogenetics; Peter Gorer Lecturer, British Society for Immunology; Tyrrell Lecturer, University of Alberta; Freidheim Lecturer, Rockefeller University; Fellow of the Royal Society; Hilliard Festenstein Lecturer, British Society for Histocompatibility and Immunogenetics; Lord Harris Visiting Professorship, Harris Manchester College, University of Oxford; NIH lecturer, International Federation of Placenta Associations, Geilo, Norway; and the Edmond Goidl Lecturer, University of Maryland, Baltimore.

Dr. Parham has served as a member of the: Allergy and Immunology Study Section, NIH; Council of the American Society for Histocompatibility & Immunogenetics; Councillor of the International Histocompatibility Workshop; American Cancer Society, Study Section Personnel B; National Marrow Donor Program, Histocompatibility Committee; Harold C. Simmons Arthritis Center, University of Texas Southwestern Medical Center at Dallas, Scientific Advisory Committee; Liver Center, University of California at San Francisco, Scientific Advisory Committee; and the Searle Scholars Program, Scientific Advisory Board. He has also served as Subject Editor for *FEBS Journal* and *Open Biology*, Associate Editor of *Tissue Antigens*, Advisory Editor of the *Journal of Experimental Medicine*, and Editor-in-Chief of *Immunological Reviews*, as well as a member of the editorial boards of many other journals related to immunology.

Dr. Parham has made contributions to a number of books, including his authorship of 'The Immune System', for which three editions have been published in several languages. He has also published some 300 papers in refereed scientific journals, and 146 scientific review articles. His research has been supported by grants from the National Institute of Allergy and Infectious Disease continuously since 1981; he has also received research grants from the National Science Foundation, the American Cancer Society, the Leukemia Society of America and the Cancer Research Institute. Some 80 postdoctoral fellows and 10 graduate students have worked in Dr. Parham's research group, many of whom are now principal investigators in academia or the biomedical technology industry.

**Dr. Peter Parham is presented with a memorial plaque by Dr. Fuller W. Bazer recognizing his contribution as the 18th Lecturer in the Raymond O. Berry Memorial Lecture Series.**



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

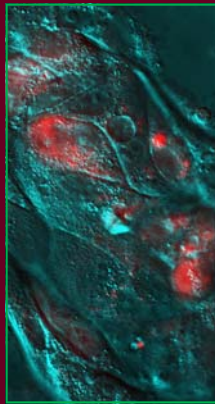
**-Fuller W. Bazer**



## Trainee News (cont'd from page 4)



**H&E staining illustrating the accumulation of histotroph in the uterine glands and placental areolae of a Day 70 pregnant pig.** - Images above and below provided by Greg Johnson



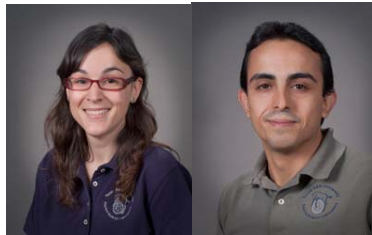
**In vitro assessment of rhodamine-labeled morpholino antisense oligonucleotide (MAO) uptake designed to inhibit translation of mRNAs for integrin  $\alpha v \beta 3$  in porcine uterine epithelial cells. Differential interference contrast (DIC) and fluorescence microscopy.**

She is originally from Cove, Oregon and recently earned a bachelors degree in Animal Science from Kansas State University. Hannah is a recipient of a Texas A&M University COALS Excellence Fellowship and her current studies focus on the effects of maternal under-nutrition on placental development and maternal-fetal nutrient transfer.

**J. Will Frank** was awarded a USDA, National Institute of Food and Agriculture Pre-doctoral Fellowship Award for the period of 08/15/2012 to 8/15/2014 for his graduate research project entitled, "Integrin Receptors ITGA $\nu$ B3 and ITGA5B1 are Necessary for the Proper Implantation of the Conceptus in Sheep." Will is a graduate student in the laboratory of **Drs. Greg A. Johnson** and **Kayla J. Bayless**



**Beatriz Macías García, DVM, Ph.D.,** and **Lauro Gonzalez Fernández, Ph.D.,** former postdoctoral fellows in the laboratory of **Dr. Katrin Hinrichs** recently received competitive postdoctoral grant for research in Portugal: Bolsas Individuais de Pós-Doutoramento Fundação para a Ciência e a Tecnologia.



**Gang Lin**, a Ph.D. student in Animal Nutrition at China Agricultural University, came to TAMU September 2012. He is currently a visiting student doing a research project on nutrient signaling in porcine placental cells in the laboratories of **Drs. Fuller Bazer** and **Guoyao Wu**.



**Andrew Naeger** is a graduate student in the laboratory of **Dr. Greg Johnson**. He is investigating the involvement of the SIP signaling pathway in angiogenesis during pregnancy in sheep. Efforts are underway to analyze structural changes in placentome structure due to antagonism of the SIP receptor using the inhibitory analog FTY720. He currently assists Dr. Johnson as a Teaching Assistant in VIBS 343/602 - Histology. Following graduation, Andrew will begin dental school at the UT Health Science Center, San Antonio.



**Irene Ruiz-Gonzalez, DVM, PhD**, is a postdoctoral fellow in the laboratory of **Dr. Fuller Bazer** and being funded by a Fellowship for Graduate Courses in Universities and Colleges granted by Caja Madrid Foundation (Spain). She obtained her DVM degree in 2007 by the Complutense University of Madrid (Spain) and entered the PhD program in the Pathology Department of the same University in 2008, funded by a Fellowship from the Spanish Ministry of Education, Culture and Sports. During her PhD program she visited Dr Bazer's laboratory for 14 weeks to work on the expression of Toll-Like receptors (TLRs) in ovine uteri during estrous cycle and early pregnancy. She obtained her PhD in Veterinary Sciences this past June 2012 and she has now re-joined the lab to continue with her research on the involvement of TLRs during ovine pregnancy establishment and conceptus early development.



**Isabel Catalina Velez, DVM, MS**, Research Assistant in the Equine Embryo Lab, working with **Dr. Katrin Hinrichs**, passed the certifying examination for the American College of Theriogenologists and is now a Diplomate of the College.



**Weiwei Wang**, a Ph.D. student in Animal Nutrition at China Agricultural University, came to Texas A&M in August 2012. She is currently a visiting student doing a research project on glycine nutrition in neonatal pigs in the laboratory of **Dr. Guoyao Wu**.



**Jing (Jean) Xu** is a graduate student who joined **Dr. Fuller Bazer's** laboratory in September, 2012 after completing her M.S. in Animal Reproduction at China Agricultural University in 2012. She received her B.S. in Animal Science from Huazhong Agricultural University, China. Her research is focusing on the regulation of gene expression by prostaglandins in the trophectoderm of ovine conceptuses.





## Trainee News (cont'd from page 10)

**Xiaoling (Solin) Zhu**, a doctoral student at College of Animal Science and Veterinary Medicine, Jilin University, China is currently visiting the laboratory of **Dr. Fuller Bazer**. She is part of a Ph.D. joint training program funded by China Scholarship Council and will be a member of Dr. Bazer's laboratory for the next 20 months. She joined Dr. Bazer's lab in September, 2012. Her research focuses on phenotypic characteristics between pig trophectoderm and macrophages and the roles of interferons delta (IFND) and gamma (IFNG) in early pregnancy of pigs.

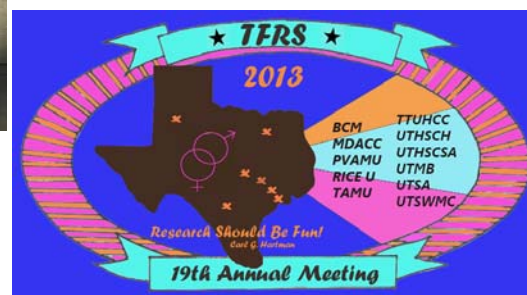


**Chelsie Burroughs**, attended the International Congress on Animal Reproduction in Vancouver, British Columbia, July 29-August 2, 2012, on a CVM Graduate Student Travel Grant and presented a poster entitled "TET gene family transcript profiles during bovine embryo pre-implantation stages." She will attend the International Embryo Transfer Society (IETS) annual meeting in Hannover, Germany January 19-22, 2013 as a Student Competition Finalist and present "Oxidative stress induced changes in epigenetic modifying gene mRNA in pre-implantation in vitro bovine embryos." Chelsie was also recently elected to the Board of Governors for the IETS student group. Chelsie is a doctoral student working in the lab of **Dr. Chuck Long**.



## TFRS, 2013

*The 19th Annual Meeting of the Texas Forum for Reproductive Sciences will be held April 18-19, 2013 at the Texas Pavillion for Women, Houston, TX.*



- Logo for the 19th Annual Meeting of the Texas Forum for Reproductive Sciences logo, prepared annually by Dr. Greg A. Johnson.

## 6th Annual IFRB Retreat, 2012

The **6th Annual IFRB Retreat** was held on October 26, 2012 in conjunction with the 17th Annual Dr. Raymond O. Berry Memorial Lecture. Over 75 IFRB faculty and trainees from the Colleges of Veterinary Medicine & Biomedical Sciences and Agriculture and Life Sciences and Prairie View A&M plus guests participated in the Retreat which was held at the Veranda in Bryan, TX. The organizer of the retreat was **Dr. Joe Arosh**, Associate Professor, Veterinary Integrative Biosciences.

Highlights of the Retreat included Minisymposia presentations by IFRB Faculty and Trainee members: **Dr. Greg A. Johnson**, Veterinary Integrative Biosciences, "Osteopontin, a key player in placentation;" **Dr. Mark Westhusin**, Veterinary Physiology and Pharmacology, "GM farm animals: When can I order green eggs and ham?" **Dr. Jane Stanley**, "Gestational exposure to chromium predisposes F1 females to pregnancy failures and affects fetal growth and development;" **Dr. Alison Kiser**, "Sperm quality following 4 days of cooled storage: Impact on fertility;" and **Wei "Eddie" Ying**, A

novel paradigm of microRNA regulated B cell functions on insulin resistance: miR-150 regulates insulin sensitivity through controlling antibody production."

There were also 20 posters were presented by trainees during the retreat. For the third year in a row, **Dr. Davey Griffin** and members of the Texas A&M Department of **Animal Science Meats Judging team** provided an excellent prime rib dinner.

**Support for the 6th Annual IFRB Retreat and Dr. Raymond O. Berry Memorial Lecture** was provided by **Dr. Alan Sams**, Executive Associate Dean, Agriculture and Life Sciences and Department Heads, **Drs. H. Russell Cross**, Animal Sciences, **Glenn A. Laine**, Veterinary Physiology & Pharmacology, **Evelyn-Tiffany-Castiglioni**, Veterinary Integrative Biosciences and **Allen Roussel**, Large Animal Clinical Sciences.



## Awards, etc.

### NEW

#### GRANTS:

**\*Greg Johnson and Kayla J. Bayless** recently received notice of R21 grant from the NIH for a project entitled, "Incorporation of Endothelial Progenitor Cells into Placental Vasculature."

**\*Qinglei Li** received notice of an R21 grant from NIH for a project entitled, "TGF-beta Signaling in Myometrial Development and Function. **Dr. Kayla J. Bayless** is a Collaborator on the grant.

#### AWARDS & HONORS:

**\* Drs. Marcel Amstalden, Tom Welsh and Nancy Ing** received funding from the TAMU Honors and Undergraduate Research office for conducting summer undergraduate research training. The project was entitled Integrative Physiology: a Tool to Enhance Undergraduate Research Experience in Animal Sciences. Five undergraduate students enrolled in ANSC and BIMS majors participated in the project."

**\*Dr. Kayla J. Bayless** was elected to the American Society for Matrix Biology (ASMB) Council and will attend to the joint ASMB meeting with Society for Glycobiology in San Diego November 10-14th.

**\*Dr. Nancy Ing** recently received the inaugural College of Agriculture and Life Sciences Deans Outstanding Achievement Award for Faculty Mentoring. Dr. Ing is the organizer of the Agriculture Women Excited to Share Opinions, Mentoring and Experience (also known as AWESOME).

**\*Dr. Ron Randel** was the recipient of the L. E. Casida Award for Graduate Education at the Triennial Reproduction Symposium held during the 2012 Annual Animal Science Meeting. The Award is given to recognize excellence in the education of graduate and/or post-doctoral students to conduct research in the area of reproductive physiology and endocrinology.

**\*Guoyao Wu**, was elected as Fellow of the American Association for the Advancement of Science. He was recognized for discovery of novel pathways of amino acid nutrition and metabolism affecting intestine, cardiovascular and reproductive tissues impacting health and development of animals and humans.

#### INTERNATIONAL ACTIVITIES:

##### **\*Dr. Fuller Bazer**

- "Pregnancy Recognition Signaling in Mammals," China Agricultural University, Beijing, June 17, 2012,
- "Hormonal Regulation of Uterine Functions for Transport of Select Nutrients Affecting Conceptus Development in Sheep and Pigs," Wuhan Polytech University, Wuhan, PRC, June 19, 2012.
- "Hormonal Regulation of Uterine Functions for Transport of Select Nutrients Affecting Conceptus Development in Sheep and Pigs," Chinese Swine Health Symposium, Changsha, PRC, June 21, 2012.
- "Comparative Aspects of Pregnancy Recognition Signaling Among Mammals," South China Agricultural University Guangdong Academy of Agricultural Science., June 23, 2012
- "Hormonal Regulation of Uterine Functions for Transport of Select Nutrients Affecting Conceptus Development in Sheep and Pigs," Guangdong Academy of Agricultural Science., June 23, 2012
- Two Plenary Lectures at the annual meeting of the Brazilian Society for Embryo Transfer:
- "Modulation of Uterine Function by Endocrine and Paracrine Factors in Ruminants"
- Uterine Environment and Conceptus Development in Ruminants", Foz do Iguaçu, Brazil, August 30 to September 2, 2012.

##### **\*Dr. Guoyao Wu**

- "Amino acid nutrition: the past, present, and future", China Animal Nutrition Annual Meeting, Changsha, China, October 23, 2012.
- "Arginine nutrition and reproductive performance in gestating sows", ASAS-Gentech China Swine Nutrition International Nutrition

Symposium, Shanghai, China, October 25, 2012.

- "Dietary requirements of nutritionally nonessential amino acids", ASAS-Gentech China Swine Nutrition International Nutrition Symposium, Shanghai, China, October 26, 2012.
- "Dietary requirements of amino acids for lactating sows", Gentech China Swine Nutrition Conference, Shanghai, China, October 26, 2012.
- "History of amino acid nutrition research", Inner Mongolia Academy of Agricultural Sciences, "October 29, 2012, "(Supported by the Foreign Experts Bureau of China)
- "Synthesis of glutamine and glutamate by lactating sows", Inner Mongolia Academy of Agricultural Sciences, October 29, 2012, (Supported by the Foreign Experts Bureau of China)

#### INVITED LECTURES

##### **\*Dr. Marcel Amstalden**

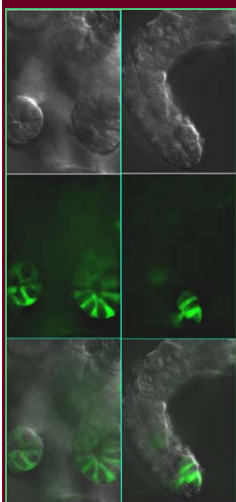
- "Nutritional regulation of the onset of puberty: Mechanisms and implications for developing replacement heifers. Academy of Veterinary Consultants Conference, Kansas City, MO; August, 2012.
- "Hypothalamic pathways mediating the nutritional control of the onset of puberty in ruminants. Nutrition Seminar, Texas A&M University; November, 2012.

##### **\*Dr. Greg Johnson**

- "Basic placental anatomy of pigs and ruminants" and "The matricellular protein Osteopontin and its integrin receptors physically and functionally modify the uterus and placenta to support pregnancy." 15th Frontiers in Reproduction (FIR 2012), Marine Biological Laboratories, Falmouth MA, April 29-June 9, 2012.

##### **\*Dr. Gary Williams**

- "Synchronization of Bos indicus-influenced cows for fixed-time artificial insemination,"
- "Nutritional programming of puberty in heifers," Roy A Wallace Memorial Symposium on Bovine Reproduction, Select Sires, Columbus, OH, October 18, 2012.



*Stem cells identified in isolated colon crypts of transgenic mice. In these mice, GFP is expressed under the control of the leucine-rich repeat-containing G-protein coupled receptor 5, an orphan receptor that serves as a stem cell marker of the intestinal epithelium. Isolated colon crypts were generated by the lab of Dr. Robb Chapkin. Images generated by differential interference contrast (DIC) and fluorescence microscopy and overlaid.*



- Matzuk MM, McKeown MR, Filippakopoulos P, Li Q, Ma L, Agno JE, Lemieux ME, Picaud S, Yu RN, Qi J, Knapp S, Bradner JE. Small-molecule inhibition of BRDT for male contraception. *Cell* 2012 150:673-684.
- Manjarin R, V Zamora, G Wu, J P Steibel, R N Kirkwood, N P Taylor, E Wils-Plotz, K Trifilo, and NL Trotter. Effect of amino acids supply in reduced crude protein diets on performance, efficiency of mammary uptake, and transporter gene expression in lactating sows. *J Anim Sci* 2012 90:3088-3100.
- Lim W, Kim HS, Jeong W, Ahn SE, Kim J, Kim YB, Kim MA, Kim MK, Chung HH, Song YS, Bazer FW, Han JY, Song G. SERPINB3 in the Chicken Model of Ovarian Cancer: A Prognostic Factor for Platinum Resistance and Survival in Patients with Epithelial Ovarian Cancer. *PLoS One*. 2012;7(11):e49869.
- Lim W, Jeong W, Kim J, Yoshimura Y, Bazer FW, Han JY, Song G. Expression and regulation of beta-defensin 11 in the oviduct in response to estrogen and in ovarian tumors of chickens. *Mol Cell Endocrinol*. 2012 Nov 16. doi:pii: S0303-7207(12)00494-7.
- Lim W, Jeong W, Kim J, Ka H, Bazer FW, Han JY, Song G. Differential expression of secreted phosphoprotein 1 in response to estradiol-17 $\beta$  and in ovarian tumors in chickens. *Biochem Biophys Res Commun* 2012 422:494-500.
- Lim CH, Jeong W, Lim W, Kim J, Song G, Bazer FW. Differential expression of select members of the SLC Family of genes and regulation of expression by microRNAs in the chicken oviduct. *Biol Reprod* 2012 Oct 24. [Epub ahead of print]
- Liu C, G Lin, XQ Wang, TJ Wang, G Wu, DF Li, JJ Wang. Intrauterine growth restriction alters the hepatic proteome in fetal pigs. *J Nutr Biochem* 2012 doi: 10.1016/j.jnutbio.2012.06.016
- Mawyer JD, Cavinder CA, Vogelsang MM, Sigler DH, Love CC, Brinsko SP, Blanchard TL, Varner DD, Arnold CE, Teague S, Gordon RK. Thermoregulation of the testicle in response to exercise and subsequent effects on semen characteristics of stallions. *J Anim Sci* 2012 90 (8):2532-2539.
- McCracken JA, Custer EE, Schreiber DT, Tsang PC, Keator CS, Arosh JA. A new in vivo model for luteolysis using systemic pulsatile infusions of PGF $_{2\alpha}$ . *Prostaglandins Other Lipid Mediat* 2012 97:90-96.
- McDonald TJ, G Wu, SL Jenkins, PW Nathanielsz, T Jansson. Effect of 30% nutrient restriction in the first half of gestation on maternal and fetal baboon serum amino acid concentration *Br J Nutr* 2012 doi: 10.1017/S0007114512003261
- Montano GA, Kraemer DC, Love CC, Robeck TR, O'Brien JK. Evaluation of motility, membrane status and DNA integrity of frozen-thawed bottlenose dolphin (*Tursiops truncatus*) spermatozoa after sex-sorting and cryopreservation. *Reproduction*. 2012 143:799-813.
- O'Brien JK, Steinman KJ, Montano GA, Love CC, Saiers RL, Robeck TR. Characteristics of high-quality Asian elephant (*Elephas maximus*) ejaculates and in vitro sperm quality after prolonged chilled storage and directional freezing. *Reprod Fertil Dev* 2012 Aug 15. doi: 10.1071/RD12129. [Epub ahead of print]
- Pathi S, Jutooru I, Chadalapaka G, Nair V, Lee SO, Safe S. Aspirin inhibits colon cancer cell and tumor growth and downregulates specificity protein (Sp) transcription factors. *PLoS One*. 2012;7(10):e48208.
- Rezaei R, DA Knabe, CD Tekwe, S Dahanayaka, MD Ficken, SE Fielder, SJ Eide, SL Lovering, G Wu. 2012. Dietary supplementation with monosodium glutamate is safe and improves growth performance in post-weaning pigs. *Amino Acids* doi: 10.1007/s00726-012-1420-x
- Ramirez-Carvajal L, Long CR. Down-regulation of viral replication by lentiviral-mediated expression of short-hairpin RNAs against vesicular stomatitis virus ribonuclear complex genes. *Antiviral Res* 2012 95:150-158.
- Randel RD. Casida Award Winner Response: philosophy for graduate education in reproductive physiology and endocrinology. *J Anim Sci* 2012 Oct 16. [Epub ahead of print]
- Randel RD, Welsh TH Jr. Interactions of feed efficiency with beef heifer reproductive development. *J Anim Sci* 2012 Oct 9. [Epub ahead of pr]
- Ren WK, W Luo, MM Wu, G Liu, XL Yu, F Jun, TJ Li, YL Yin, G Wu. Dietary L-glutamine supplementation improves pregnancy outcome in mice infected with type-2 porcine circovirus. *Amino Acids* 2012 doi: 10.1007/s00726-011-1134-5
- Rizal Y, ME Mahata, I Joli, G Wu. Improving the nutrient quality of juice wastes mixture through fermentation by using *Trichoderma viride* for poultry diet. *Pakistan J Nutr* 2012 11: 203-207
- Romano JE, Thompson JA, Kraemer DC, Westhusin ME, Tomaszewski MA, Forrest DW. Effects of early pregnancy diagnosis by palpation per rectum on pregnancy loss in dairy cattle. *J Am Vet Med Assoc* 2011 239:668-673.
- Safe S. Endocrine disruptors and falling sperm counts: lessons learned or not! *Asian J Androl* 2012 Sep 24. doi: 10.1038/aja.2012.87. [Epub ahead of print]
- Satterfield MC, Dunlap KA, Keisler DH, Bazer FW, Wu G. Arginine nutrition and fetal brown adipose tissue development in diet-induced obese sheep. *Amino Acids*. 2012 43:1593-1603.
- Shin JA, Jung JY, Ryu MH, Safe S, Cho SD. Mithramycin A inhibits myeloid cell leukemia-1 to induce apoptosis in oral squamous cell carcinomas and tumor xenograft through activation of bax and oligomerization. *Mol Pharmacol*. 2012 Sep 27. [Epub ahead of print]
- Shapiro-Reznik M, Jilg A, Lerner H, Earnest DJ, Zisapel N. Diurnal rhythms in neurexins transcripts and inhibitory/excitatory synapse scaffold proteins in the biological clock. *PLoS One* 2012 7(5):e37894.
- Sohrabji F, Selvamani A, Balden R. Revisiting the timing hypothesis: Biomarkers that define the therapeutic window of estrogen for stroke. *Horm Behav* 2012 Jun 19. [Epub ahead of print]
- Tan BE, XG Li, G Wu, XF Kong, ZQ Liu, TJ Li, and YL Yin. Dynamic changes in blood flow and oxygen consumption in the portal-drained viscera of growing pigs receiving acute administration of L-arginine. *Amino Acids* 2012 43:2481-2489
- Tolleson D, Carstens G, Welsh T Jr, Teel P, Strey O, Longnecker M, Prince S, Banik K. Plane of nutrition by tick-burden interaction in cattle: Effect on growth and metabolism. *J Anim Sci* 2012 90:3442-3450.
- Velez IC, Pack JD, Porter MB, Sharp DC, Amstalden M, Williams GL. Secretion of luteinizing hormone into pituitary venous effluent of the follicular and luteal phase mare: novel acceleration of episodic release during constant infusion of gonadotropin-releasing hormone. *Domest Anim Endocrinol* 2012 42:121-128.
- Wang Y, Brahmakshatriya V, Lupiani B, Reddy SM, Soibam B, Benham AL, Gunaratne P, Liu HC, Trakooljul M, Ing N, Okimoto R, Zhou H. Integrated analysis of microRNA expression and mRNA transcriptome in lungs of avian influenza virus infected broilers. *BMC Genomics* 2012 13(1):278.
- Williams GL, Thorson JF, Prezotto LD, Velez IC, Cardoso RC, Amstalden M. Reproductive seasonality in the mare: neuroendocrine basis and pharmacologic control. *Dom Anim Endocrinol* 2012 43:103-115.
- Wu Z, Satterfield MC, Bazer FW, Wu G. Regulation of brown adipose tissue development and white fat reduction by L-arginine. *Curr Opin Clin Nutr Metab Care* 2012 15:529-538.
- Wu G, ZL Wu, ZL Dai, Y Yang, WW Wang, C Liu, B Wang, JJ Wang YL Yin. Dietary requirements of "nutritionally nonessential amino acids" by animals and humans. *Amino Acids* 2012 10.1007/s00726-012-1444-2
- Xi PB, ZY Jiang, ZL Dai, XL Li, K Yao, CT Zheng, YC Lin, JJ Wang, G Wu. Regulation of protein turnover by L-glutamine in porcine intestinal epithelial cells. *J Nutr Biochem* 2012 23:1012-1017.
- Yang H, F Li, X Kong, X Yuan, W Wang, R Huang, T Li, M Geng, G Wu, and Y Yin. Chemerin regulates proliferation and differentiation of myoblast cells via ERK1/2 and mTOR signaling pathways *Cytokine* 2012 60:646-652
- Yao K, Yin Y, Li X, Xi P, Wang J, Lei J, Hou Y, Wu G. Alpha-ketoglutarate inhibits glutamine degradation and enhances protein synthesis in intestinal porcine epithelial cells. *Amino Acids*. 2012 42:2491-2500.
- Zeng X, X Mao, Z Huang, F Wang, G Wu, S Qiao. 2012. Arginine enhances embryo implantation in rats through PI3K/PKB/mTOR/NO signaling pathway during early pregnancy. *Reproduction* doi: 10.1530/

GnRH, results from Bruna's experiments are consistent with the hypothesis that maturation of the reproductive neuroendocrine system involves decreased inhibition of GnRH neurons by inhibitory inputs, and increased stimulation of GnRH neurons by excitatory inputs. Interestingly, elevated body weight gain during early juvenile development appears to advance this process. Bruna is now investigating potential cellular mechanisms that lead to those structural alterations.

Prior to joining the Texas A&M University as graduate student in January 2009, Bruna Alves was a Research Assistant at the Brazilian Agricultural Research Corporation (EMBRAPA) in Juiz de Fora, Brazil. Bruna received a D.V.M. degree from the School of Veterinary Medi-

cine at Federal University of Minas Gerais, Brazil, and a M.S. in Animal Science from the same institution. Bruna anticipates completing her doctoral program at Texas A&M University in May 2013 with a dissertation entitled "Nutritional Programming of Neuroendocrine Pathways Controlling the Onset of Puberty in Heifers". During her program at Texas A&M University, Bruna has authored or co-authored 6 abstracts presented in national and international scientific meetings, has co-authored two scientific articles, and is preparing three manuscripts for submission in peer-reviewed scientific journals. Bruna Alves conducts her doctoral research under the supervision of **Drs. Marcel Amstalden** and **Gary Williams**.

## Global Challenges, cont'd from page 8

cells used. A clear gap in the stem cell knowledge base is the function of embryonic stem cells in musculoskeletal applications. Continued collaborative efforts from reproductive biologists, stem cell biologists and orthopedic clinicians may lead to provocative and exciting treatments to slow or even halt the progression of musculoskeletal injury to chronic tendinopathy and osteoarthritis.

The IFRB has a number of other scientists who are also conducting pioneering studies in the biology of stem cells, including research on the mechanisms determining stem cell identity, stem cell maintenance, and cell fate determination. For example, **Dr. Michael Golding** is using trophoblast and embryonic stem cells to investigate epigenetic processes that result in placental patterns of imprinted gene expression, to

better understand the role these genes play in development and disease. **Dr. Rajesh Miranda's** laboratory is interested in understanding the biological steps that transform uncommitted stem cells into neurons or glial cells. Also, as noted elsewhere in this issue, **Dr. Beiyan Zhou's** laboratory is studying the systemic network governed by epigenetic factors in stem cells with particular emphasis on the regulation of hematopoietic stem cell function. Regenerative medicine has been called the "next evolution of medical treatments," by the U.S. Department of Health and Human Services. With its potential to heal, this new field of science is expected to revolutionize health care.

- *IFRB thanks Dr. Ashlee Watts for preparing this Global Challenges report.*

## IFRB Committee\* Structure & Membership

\*The IFRB Nominating Committee is pleased to report that in recent IFRB elections, **Drs. Marcel Amstalden** and **Gary Williams** were elected to the Executive Committee (EC) along with **Rodolfo Cardoso**, as the Graduate Student Representative to the EC. By vote of the IFRB EC, **Dr. Marcel Amstalden** was chosen to serve as Chair. Congratulations to the newly elected IFRB EC members.

### Graduate Programs Committee

Duncan MacKenzie, Chair  
Joe Arosh  
Carey Satterfield  
Martha Voglesang

### Seminar Committee

Marcel Amstalden, Chair  
Robert Burghardt  
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### Executive Committee

Marcel Amstalden, Chair  
Robert Burghardt, Vice-Chair  
Rodolfo Cardoso, Grad Student Rep  
Fuller Bazer  
Greg Johnson  
Katrin Hinrichs  
Duncan MacKenzie  
Gary Williams

### Nominating Committee

Mike Golding, Chair  
Marcel Amstalden  
Clay Cavinder  
Joe Arosh  
Katrin Hinrichs

### Membership Committee

Tom Welsh, Chair  
Kathrin Dunlap  
Farida Sohrabji



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### 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.