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Recipient of the 2014 IETS Pioneer Award: William W. (Bill) Thatcher, MS, PhD

Dr William W. Thatcher is a native of Baltimore-Perry Hall, Maryland. He developed a love for livestock when he spent part of his summers as a boy on his grandfather's dairy farm. Dr Thatcher received his BS degree in Animal Husbandry from the University of Maryland in 1963, the MS degree from the University of Maryland under the direction of C. A. Kiddy in 1965, and the PhD degree in 1968 from Michigan State University under the mentorship of H. A. Tucker. Thatcher joined the Dairy Science Department of the University of Florida in 1969, held the appointment of Graduate Research Professor since 1988, and in 2004 transitioned to Graduate Research Professor Emeritus in the Department of Animal Sciences. Additional training was received through sabbaticals at the Physiology of Reproduction Laboratory, Institut National de la Recherche Agronomique at Nouzilly, France from 1977 to 1978 and 1985.

The foundation of his research and teaching program is an interdisciplinary graduate education program. He has served as a mentor for 73 graduate students, postdoctoral fellows, and sabbatical-leave scientists. People in his laboratory have gone on to faculty and industry positions in 30 countries. His philosophy of graduate education is captured in a paper he wrote as recipient of the L.E. Casida Award for Excellence in Graduate Training from the American Society of Animal Science (ASAS) (http://jas.fass.org/content/76/suppl_3/76.full.pdf+html).

During his career, Thatcher has published 360 refereed journal articles and 51 book chapters (http://www.thatcherteam.com). Through the research represented in these publications, Dr Thatcher has changed the way dairy managers and research scientists think about dairy cattle reproduction. His ability to formulate and implement experimental designs to reach significant conclusions is documented by the number of times his research has been cited (12 739; H index of 67), and the numerous invitations to present his research at national and international meetings. He has presented seven invited symposia presentations to the Annual Conference of the IETS. He also has affected the management of dairy cattle on a global scale through a prodigious and world-wide extension effort that has brought him to 49 countries.

Dr Thatcher has led research that has defined major advances towards improving the reproductive function of the lactating dairy cow. Thatcher's groundbreaking basic and applied research has provided tools to reverse the historical decline in fertility. Several of the pioneering and significant advancements accomplished by Dr Thatcher, his students, and colleagues in the areas of basic and applied reproductive biology of dairy cattle are as follows:

Control of ovarian function

Dr Thatcher was a member of the team who developed prostaglandin $F_{2\alpha}$ (PGF) as an oestrus synchronisation tool. Since then, Dr Thatcher, his students, and colleagues have made a rigorous study of the control of folliculogenesis with the goal of better regulating oestrus synchronisation, timed artificial insemination (TAI), superovulation, and treatment of ovarian cysts. Work from several laboratories, including his, demonstrated that a single dominant follicle regulates the growth of other, smaller follicles on both ovaries. Dr Thatcher and his colleague K. L. Macmillan were quick to recognise the importance of this finding and to develop creative procedures utilising GnRH analogues to regulate growth of the dominant follicle. He developed the idea that optimal success in oestrus synchronisation depends on synchronising both the corpus luteum and follicular growth (Schmitt *et al.* 1996). His work using GnRH is the basis for new systems of oestrus synchronisation that synchronise follicle development, CL regression, and AI at a fixed time without oestrous detection. Moreover, Dr Thatcher and colleagues were the first to apply principles of ovulation control to allow for fixed timed embryo transfer.

Further refinement of timed insemination programs

Dr Thatcher recognised that implementation of the Ovsynch program for TAI at certain stages of the oestrous cycle (i.e. days 1–4 and days 13–17) resulted in reduced fertility. This led to the development of the Pre-Synch/Ovsynch Program in which the Ovsynch program is initiated 12 to 14 days after the second PGF injection of a pre-synchronisation. This reproductive program has increased pregnancy rates to the Ovsynch program by ~13%

and has been readily adopted by the dairy industry and in a modified way by the beef industry (Moreira *et al.* 2001). Working cooperatively with Jose Santos at the University of Florida, current systems of TAI are allowing commercial dairies with high-producing lactating dairy cows to achieve pregnancy rates of 40% to 50%. These reproductive management systems, which are optimised physiologically and endocrinologically, are indeed fertility programs and not simply ovulation synchronisation programs.

Understanding embryo/conceptus interactions to enhance fertility

Based on his discoveries regarding mechanisms controlling embryo/conceptus development throughout pregnancy, Dr Thatcher and his students have developed approaches to improving herd fertility. His early studies with Peter J. Hansen and Fuller W. Bazer indicated that a conceptus-produced protein identified as bovine trophoblast protein-1 was immunologically related to ovine trophoblast protein-1 (Helmer *et al.* 1987), and that recombinant interferon-τ extended corpus luteum lifespan and reduced uterine secretion of PGF (Meyer *et al.* 1995). Beneficial effects of human chorionic gonadotropin on pregnancy rate have been identified based on its ability to induce an accessory CL and stimulate plasma progesterone. Injection of recombinant bovine somatotropin (bST) at the time of insemination of a Pre-Synch/Ovsynch program increases pregnancy rates by ~10% in lactating dairy cows. Additional basic research indicated that bST stimulates embryo development. Indeed bST treatment at AI and 11 days later has altered gene expression of *IGF2* and the luteolytic control system in the endometrium in a manner that benefits embryo survival (Bilby *et al.* 2006). His most recent research effort has dealt with the impact of lactational status on the uterine and conceptus transcriptome in dairy cattle (Cerri *et al.* 2012). This research is documenting an atlas of molecular pathways critical for early and late embryonic development that differs between lactating and non-lactating dairy cows. Identifying gene clusters altered by lactation provides valuable insight into novel strategies to rectify or circumvent conceptus losses during early pregnancy. His pioneering investigations examining the peri-parturient and postpartum endocrine changes of conceptus and maternal units in Jersey cows selected for milk yield (Eley *et al.* 1981) and Holstein heifers bred to genetically-different service sires (Guilbault *et al.* 1985) set the stage for management of the transition period in current studies of nutraceutical and endocrine regulation of the postpartum period and reproductive programming of the developing female calf.

Heat stress and reproductive performance

The early pioneering studies of Dr Thatcher and his students, working in cooperation with Maarten Drost, transcended the investigations of biological windows impacted by environmental heat stress. These included analysis of data from embryo transfer practitioners (Putney *et al.* 1988) dealing with effectiveness of embryo transfer in summer, recovery of embryos following periods of controlled thermal stress that indicated heat stress at day 0, or day 1 to 7 after breeding reduces embryo survival, and implementation of timed embryo transfer to bypass the thermosensitive periods of the oocyte and early embryo to increase occurrence of pregnancy (Ambrose *et al.* 1999). Such reproductive management techniques coupled with practical heat abatement systems have improved reproductive performance of lactating dairy cows in periods of heat stress.

Nutraceutical regulation of reproduction

In collaboration with Charles R. Staples and Jose E. P. Santos, Dr Thatcher has integrated systems of reproductive and nutritional management. The polyunsaturated fatty acids (i.e. linoleic acid, EPA, and DHA) have been shown to have distinct reproductive and immunological effects in lactating dairy cows. These findings have led to field experiments demonstrating that calcium salts of EPA, DHA, and linoleic acid can be utilised as nutraceutical supplements to improve postpartum health, immune function and subsequent reproductive performance of lactating dairy cows (Silvestre *et al.* 2011).

Awards

Dr Thatcher has been well recognised by his peers during his 50 years in academia. Among his awards are the Research Award from the Society for the Study of Reproduction (1994), the Upjohn Physiology Award (1981), Borden Award (1985), and Merial Dairy Management Research Award (2002) from the American Dairy Science Assoc. (1981); the Animal Physiology and Endocrinology Award, L.E. Casida Award for Excellence in Graduate Training (1997), and Morrison Award (2006) from ASAS; the National Association of Animal Breeders Research Award (2000); and the Hetzel Award for lifetime achievement from the Hungarian Society for Animal Production (2008). He is an Honorary Member of the American College of Theriogenologists (2003) and is a Fellow of the American Dairy Science Association (2007) and ASAS (2011).

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