Honoring the Past, Imagining the Future

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Honoring the Past

Whom do you thank when you are presented with such a prestigious honor as the Bartlett Award? I give thanks to God who has already blessed me in so many ways, all my life. God works through people, family, friends, and even strangers. There is a sign at Disney World that reads: “No matter what you have achieved, someone was there to help you.” I have many people to thank and will acknowledge many along the way in this presentation.

First and foremost I want to thank my wife Joan. We were married right after I received my DVM degree from Iowa State University. With her and through her I thank our four children and their families for the joy and support they have given us. Categorically I thank my students; between the University of California and the University of Florida, there have been roughly 3700. Finally, my colleagues, my clients, and the cows whose lives I entered.

Allow me to retrace some steps that ultimately led me to become a theriogenologist. I was born in Holland in a small village, Aalten, not far from the German border, several years before the onset of World War II. My father was a minister in the Dutch Reformed church. He was called to progressively larger congregations and so we ended up in The Hague, in the middle of the war. Food was scarce and rationed in the big cities. As a result the three oldest boys were sent back to the rural area where we were born. For three months each summer we lived and worked on farms where there was plenty to eat. It is there that I developed an interest in working with farm animals, plowing with the horse, milking the cows by hand, and cleaning the pigpens on Saturdays. I recall one particular incident that may have directed me towards veterinary medicine. The local veterinarian came out for a dystocia. After checking the presentation, position and posture and whether the calf was alive, he asked me if I wanted to feel the calf in there. Sure! It sucked my finger, Wow! About ten years later I wanted to study veterinary medicine in Utrecht, but with a family of seven children my father could not afford it. This led to my decision to emigrate to **America, the Land of Opportunity**.

Fast forward to my student days at Iowa State University. Dr Mac Emmerson taught us obstetrics and radiology. That was a strange combination then. Today, theriogenologists routinely use diagnostic imaging, especially ultrasonography. Dr Emmerson took me under his wing. I lived in the OB lab. In return for our room in the hayloft, my roommate and I had to clean up after the obstetrics classes and milk the palpation cows on the weekends.

Parenthetically, Dr Emmerson was the first one to diagnose trichomoniasis in cattle in North America; in Pennsylvania in 1932.

After two years in the USAR Veterinary Corps and two years in private large animal practice in the Santa Clara Valley of California, I accepted a position as a "Laboratory Animal Veterinarian" at UC Davis on a major NIH grant. My duties were to take care of a herd of about 25 Holstein cows that were heterozygous for the recessive Prolonged Gestation gene, and to do fetal adrenalectomies in sheep. Complete bilateral adrenalectomy of the lamb led to prolonged gestation in the ewe (1). I also did some crude! hypophysectomies by decapitating fetuses in utero. Amazingly, the bodies survived and those ewes also experienced prolonged gestation. Subsequently, chronic fetal cannulations and concurrent monitoring of fetal and maternal plasma cortisol concentrations illustrated the independent rise in the fetus as an endogenous trigger for the initiation of labor and parturition in the sheep (2). At about the same time, Dr WM Adams reported that you could mimic the fetal trigger in the advanced pregnant cow by injecting her with a potent synthetic glucocorticoid such as dexamethasone (3). As I reflect on my career as a theriogenologist, I must conclude that we are all scientific pioneers.

Relating these and other personal experiences to the students during their basic reproductive systems course made the material more relevant and real. Lest you think I boast by stating that I was the first one in the world to do successful fetal adrenalectomies in sheep, I must add that the original idea and hypothesis were not mine. I was a member of the **team** that produced the results. I also remind **you** that each paper **you** have published in a refereed journal, has contributed a bit/byte of original information to the world literature.

In 1968 Dr John W Kendrick, a charter diplomate, invited me to join him and Dr John P Hughes in his newly formed Department of Reproduction. That same summer Dr George H Stabenfeldt became the fourth member of the group. He was a basic scientist and endocrinologist. John Kendrick had developed a **blueprint** for this fledgling department that was to be the first Department of Reproduction per se in the country. We were unable to find a small animal reproductive specialist at the time. This led us to accept Dr Victor M Shille directly out of his private small animal practice into a PhD program in 1972, with the intent to train him to become our specialist in this area. We were unable to fill the andrologist position.

Dr Kendrick had a major influence on my career. He encouraged me in 1972 to spend a year at Cornell University to fill the gap left between Dr Stephen J Roberts who had just retired to practice with his brother in Vermont, and Dr Ingemar Settergren from Sweden. I was to teach veterinary reproduction to the junior and sophomore students, a daunting task in the wake of the great master Dr Roberts. His big red book "Obstetrics and Genital Diseases" (4) was the fulcrum of his courses. I still have the almost terse little note of instructions he left me: "Drs Drost and Wright. First term juniors - Obstetrics, Infertility of Male Animals – 2 wks, p604-725 in my text. Rest of term, 12-13 weeks, p36-337 in my text. Use Junior Surgery room for OB exercises" signed: SJ

Roberts. What an awesome opportunity. Dr Ken McEntee in pathology, and Drs Robert H Foote and William Hansel in the Department of Animal Sciences allowed me to interact with their respective graduate students. I anastomosed some ovarian veins with the external mammary veins, and did some Leersum Loops in Dr Hansel's experimental ewes to create ready external access to ovarian blood and carotid blood respectively. Dr Foote asked me to help him with the surgical recovery of embryos from superovulated heifers, as an early means of validating sexed bull semen, ready for marketing if the sexing procedure worked (in 1973).

In the teaching hospital Dr Ken Braun and Dr Robert Hillman provided me with interesting cases, including a Holstein cow with a rupture prepubic tendon that carried live term quadruplets (5). Dr Joseph M Wright Jr, a graduate student of Dr Roberts, and I induced parturition with dexamethasone in an Ayrshire cow with hydrallantois. In the classroom, I barely stayed one lecture ahead of the students. I truly believe in the saying that "To Teach is to Learn Twice". At the end of the academic year I was all set to sit for the Theriogenology Boards at New Bolton Center.

Even before I returned to UC Davis, Dr Perry T Cupps of the Department of Animal Sciences had asked me to help him start his embryo transfer program. All surgical embryo recovery was done under general anesthesia and all transfers were done surgically as well. It was exciting teamwork between animal science and veterinary medicine. With help of Dr Gary B Anderson, we flew 34 Day4 embryos collected on campus, in a Piper Cub to a private ranch 300mi to the North for a field trial (6). Residents and students were already there and had lined up the recipients. It made for a long day but we achieved a pregnancy rate of 56%, which was very good in 1975.

All this was excellent experience to prepare me for a faculty exchange with Utrecht University. I worked with Dr Arie Brand on the development of a method of nonsurgical embryo recovery that year. We succeeded and submitted our manuscript to Theriogenology. Amazingly, two other teams independently and unknowingly submitted manuscripts of their methods of nonsurgical embryo recovery in the cow at virtually the same time. Dr Kendrick, the founding editor of the still relatively new international journal made a Solomon-like decision by publishing all three manuscripts in the same September 1976 issue (7,8,9). No-one could claim to be the first to have published this breakthrough.

While on a faculty exchange at the Uithof at Utrecht University in the huge obstetrical clinic, I shared an office with Dr Les Ball for 6 months. Our obstetrical training received a whole new twist from Dr Gerrit Schuijt. Dr CJ Bierschwal had been there a couple of years earlier. The booklet "Fetotomy in Large Animals" (10) Bush and Professor CHW de Bois published was a welcome guide for disciples like Les Ball and myself upon our return to the US.

In 1977, my palpating arm was twisted for another major opportunity. Dr Wy Cripe enticed me to move to the University of Florida to start up a brand new Department of Reproduction. To help found a new college of veterinary medicine was tempting. I succumbed. With Dr Kendrick's blessing I submitted his California **blueprint**

as a condition for accepting the position in Florida. Two future department members were already there, Dr Paul Cardeilhac, an expert in fish reproduction and later an expert in alligator reproduction, and Dr CL Chen, an endocrinologist. Dr Woody Asbury joined me from the start as a founding faculty member and expert in equine reproduction. In the following two years we continued to fill the slots on the chart, Dr Victor M Shille, small animal reproduction, Dr Rolf E Larsen, andrology, and as a bonus we attracted Dr Michelle M LeBlanc, initially as a Jaqueline of All Species and ultimately as a leading equine expert. All of these colleagues stayed at UF for 20 or more years. We were later joined by Dr Peter J Hansen, reproductive physiologist (currently professor of Animal Sciences), Dr Louis F Archbald, Dr Maria Eugenia Cadario, Dr Margo Macpherson, Dr Mats Troedsson, Dr Malgorzata Pozor, and just this Spring Dr John Verstegen. The list of residents is illustrious and long and nearly all of them are diplomates in the American College of Theriogenologists today (see Appendix).

The concept of **teamwork** has prevailed at the University of Florida, even when the Department of Reproduction was converted into a section in clinical sciences. All our theriogenology courses during each of the four years of the curriculum are team-taught. The Theriogenology Group is an active component of the Interdisciplinary Reproductive Biology Group on campus, with members of the departments of animal science, obstetrics and gynecology, biochemistry and zoology. Collaboration with friends and colleagues in the department of animal sciences has been vital to my career. I credit Dr William W Thatcher with legitimizing the scientific aspects of my curriculum vitae. Dr Thatcher is a graduate research professor in the field of dairy science at UF. He is a global expert in reproductive physiology in dairy cows. He has been my PI, my Principal Instigator. He helped me become a **clinician-scholar**. Without him my CV would be a mere pamphlet, at best a travelogue. We share many publications, **many firsts**, especially in the areas of heat stress, cycle control and Timed AI. Together we built a bridge between animal science and veterinary medicine. I like the hybrid vigor. I have served on the committees of many of his graduate students. Last year at the meeting in Columbus OH **we** were honored when he and his friend and colleague Dr Fuller Bazer became honorary diplomates in our American College of Theriogenologists.

One notable first with Dr Thatcher, again not my original idea, came when Bill asked me if I would hysterectomize some Holstein cows for him. Wow! I shook my head, I vacillated, I hesitated and finally said, that uterus it going to be pretty hard to reach in those big Holsteins. When do you want to do it? Thinking may be next week or in a couple of weeks. I want you to do it right after they have calved. You got to be kidding. That uterus is going to be huge, she will go into shock or bleed to death. I shook my head some more. Then, really more thinking out loud, I said maybe we could electively prolapse the uterus at that time and amputate it. Well, as usual I ended up doing it, in this case with our resident Dr Steve Hopkins. Sure enough the prostaglandin metabolite concentrations in those cows plummeted (11). It was a classical target organ ablation study. But, Bill always wanted to go one step further. So he mused, does the prostaglandin come from the caruncles or from the intercaruncular endometrium? Let's remove the caruncles. Let US remove? I had to remove the caruncles, all 120 of them one by one. So we did that too, and indeed the prostaglandin does come from the

caruncles at that time. I am sure those were the first total carunculectomies in the cow.

I suspect there had been a hidden agenda by some in getting me to come to Florida. I was asked if I could transfer some water buffalo embryos to cattle recipients. I suggested that maybe we should first try to see if we could make embryo transfer work within Bubalus bubalis. With the help with Dr Joe Wright from Castroville TX we struck oil on first try. The world's first water buffalo ET calf was born in March of 1983 (12). That feat has given me more travel miles than any other project.

Imag(in)ing the Future

I am interested in the future because I am going to spend the rest of my life there. If the past is the prologue to the future, what have the foregoing experiences taught me for the future? To be sure, I made plenty of mistakes along the way, from which, I admit, I learned a great deal. I am convinced that: **The cow is a classic model for the study of reproduction**. Bovogenology is what I called my elective course in advanced bovine reproduction. The cow is a nonseasonal breeder, she cycles regularly every 21 days, she is bi-sexual, you can do a direct digital examination of the entire reproductive tract, you can correct abnormal presentations, positions and posture by reaching all the way into her uterus with your whole arm(s), and you can do a cesarean section while she stands there and chews her cud. If cows were not bi-sexual by nature, the use of AI would not have been adopted as readily 50 years ago. It certainly facilitated heat detection. Can you imagine if farmers had to tease them all one by one every day, or if we had to monitor their progesterone concentrations on a daily basis? Nonsurgical embryo transfer became a commercial endeavor in less than a decade in the 1970s, and it evolved into other commercial forms of ART (Assisted Reproductive Technology) such as In-Vitro Fertilization. Even cloning is done on a limited commercial basis today. The production of transgenic calves is not far behind. The cow is my heroine. I am addicted to her.

We are living in an era of social revolution (13), a time of rapid cultural, political, economic, societal, and communicational changes. Many of these changes are profoundly affecting the veterinary profession. When veterinary colleges educated veterinarians to address important contemporary needs of society, the profession flourished, but when they have not, veterinarians were held in low esteem and the profession and veterinary education were neglected (14). Because of the exponential increase in information, and sometimes knowledge, the overcrowded curriculum and the many clinical skills to be acquired, students find it difficult to learn and become competent and confident at graduation.

The Pew Report on Future Directions for Veterinary Medicine recommended that professional education be structured to emphasize a core of instruction and that an in-depth clinical experience in some veterinary practice setting, either in private or public sectors, be required (15). Our own diplomate, Dr Shirley D Johnston, Dean of the College of Veterinary Medicine of the Western University of Health Sciences in Pomona CA is a pioneer in this arena.

Each college of veterinary medicine in North America includes theriogenology in its curriculum. The emphasis varies, the number of instructors varies, and there is geographical uniqueness. Ultimately, all graduating seniors need to take the National Board Examination in the US. I do not propose that we teach just for the examination. How I despise the question “Is it going to be on the exam?” We need to advance the quality of education. Computer assisted instruction can help us. The ACT could develop a series of basic on-line lectures for use around the country. **The** big advantage of e-lectures is that they can be updated by the experts every year, or instantly for that matter. This is in contrast with conventional textbooks that have an “inter-estrous” interval of 5 to 10 years. I envision that the course coordinator would view the lectures with the students, and would be there to answer questions. The laboratory exercises can then be designed to complement the lecture material. With e-texts there is no page limit, hence no limit to the number of illustrations, including videos, that can be included. While **we** may not be comfortable with this approach, the students who have grown up with computers will be. For the latter we can also lower the cost of education when they do not have to purchase so many textbooks. Enthusiasm is central to effective teaching. Enthusiasm must be based on thorough knowledge of the subject matter, and should be imparted in the students. For the students learning should be an interactive process that requires motivation. Motivation is tied to teaching as well as learning. Students learn what they care about and remember what they understand. The latter requires that the teacher be well prepared and patient. As teachers we are facilitators of learning.

The continuing information explosion calls for more effective and efficient methods of transmission of information to students. The old “adage” a picture is worth a thousand words” still holds true. With current computer assisted image control, images contributed by experts in the field can be shared in a retrievable manner via the internet. I would like to show you a project that I have been working on for the last five years, a Visual Guide to Animal Reproduction, URL: **drostproject.vetmed.ufl.edu/bovine**. In essence it is a web atlas.

The genesis of the project lay in the question, what am I going to do with all my teaching slides when I retire? Some images were unique like Dr Robert’s slide of a case of diphallus in the bull. Images per se, without an individual description and a way in which to find a particular illustration like one would in a traditional atlas, are relatively useless. Images (kodachromes, photographs) restored and documented are timeless. When readily retrievable they are a priceless, perpetual resource. The nucleus of my current collection stems from three filing cabinet drawers full of randomly stored slides of Dr Stephen J Roberts at Cornell University, including many slides from Dr Ken McEntee. I was given access to this valuable resource when serving as a temporary replacement for Dr Roberts upon his retirement. Dr Roberts generously allowed me to keep any duplicates and gave me permission to copy any or all of the remaining slides. During my sabattical leave at the Faculty of Veterinary Medicine of Utrecht University in The Netherlands, a large number of slides was added to the collection. Permission to include all of them in the visual guide was granted by Dr Roberts, Dr McEntee and Dr Bert van der Weijden in 1999. Each image is referenced to its contributor. Corporate

financial support by Pharmacia Animal Health enabled the start of this project.

The beauty of a web atlas is that it is a dynamic educational instrument. It can be updated at a moment's notice. Images can be added at virtually any time and there is no limit to the size of the collection. Conventional atlases are very expensive and are infrequently revised (16,17). As a university based collection the visual guide is accessible to anyone with access to the Internet and it is free of charge. The on-line Visual Guide transcends state, regional, national and international boundaries. While English is the leading scientific language in the world today, there is no reason the annotations of the images could not be translated at some time in the future.

At this time the infrastructure of the Visual Guide is in place and the Bovine Chapter is complete. The layout of the bovine chapter can serve as a template for other species. I wish to acknowledge Dr Gwen Cornwell as my collaborator. She is the hard drive of the project. Dr Cornwell is the owner of a private computer business in Gainesville FL. She earned her PhD degree in Animal Sciences at the University of Florida. I was a member of her graduate committee. The title of her dissertation, presented in 1989, was A Study of Estrus Synchronization with PGF2a in Brahman Heifers: Proposal of a New System. She has maintained an abiding interest in cattle production. Dr Cornwell serves as the computer consultant for the project.

In closing I express the hope that some of you may wish to preserve some of your own unique images in this virtual atlas. I see it as an opportunity to centralize all teaching slide collections of colleagues who change direction in their career or who retire. The American College of Theriogenologists and/or the Society for Theriogenology may well wish to become the custodian(s) of the Visual Guide some day.

References

1. Drost M, Holm LW. Prolonged gestation in ewes following foetal adrenalectomy. Journal of Endocrinology 1968; 40:293-296.
2. Drost M, Kumagai LF, Guzman Margaret. Sequential foetal-maternal plasma cortisol levels in sheep. Journal of Endocrinology 1973; 56:483-492.
3. Adams WM. The elective induction of labor and parturition in cattle. Journal of the American Veterinary Medical Association 1969; 154:261-265.
4. Veterinary Obstetrics and Genital Diseases. Stephen J Roberts (ed). Distributed by Edwards Brothers, Inc. Ann Arbor MI; 1971.
5. Drost M, Dunn HO, Stormont C. Clinical Item. Bovine Quadruplets - A clinical and cytogenetic report of two cases. Theriogenology 1974; 1(1):35-37.
6. Drost Maarten, Anderson Gary B, Cupps Perry T, Horton Mary B, Warner Peter V, Wright, Raymond W. A field study on embryo transfer in cattle. Journal of the American Veterinary Medical Association 1975; 166(12): 1176-1179.
7. Drost M, Brand A, Aarts MH. A device for nonsurgical recovery of bovine embryos. Theriogenology 1976; 6(5): 503-507.
8. Elsden RP, Hasler JF, Seidel GE Jr. Non-surgical recovery of bovine eggs. Theriogenology 1976; 6(5): 523-532.

9. Rowe RF, Del Campo MR, Eilts CL, French LR, Winch RP, Ginther OJ. A single cannula technique for nonsurgical collection of ova from cattle. Theriogenology 1976; 6 (5): 471-483.
10. The Technique of Fetotomy in Large Animals. Bierschwal CJ and deBois CHW (eds). Published by VM Publishing Inc, Bonner Springs KS; 1970.
11. Guilbault LA, Thatcher WW, Drost M, Hopkins SM. Source of F series prostaglandins during the early postpartum period in cattle. Biology of Reproduction 1984; 31: 879-887.
12. Drost M, Wright JM Jr, Cripe WS, Richter AR. Embryo transfer in water buffalo (Bubalus bubalis). Theriogenology 1983; 20(5): 579-584.
13. Shille VM. Bartlett Address. Courage to change the things that should be changed. Proceedings of the Society for Theriogenology. San Antonio TX; 1992.
14. Pritchard WR. Some implications of structural change in veterinary medicine and its impact on veterinary education. Journal of the American Veterinary Medical Association 1993); 201: 361-364.
15. Pritchard WR. Future Directions for Veterinary Medicine. Pew National Veterinary Education Program. North Carolina: Duke University;1988. 189pp.
16. Color Atlas of Diseases and Disorders of Cattle. RW Blowey and AD Weaver (eds). Iowa State University Press, Ames IA; 1991.
17. Color Atlas of Reproductive Pathology of Domestic Animals. Claus D Buergelt (ed) Mosby, St Louis MO; 1997.

Appendix

Chronological list of residents in theriogenology at the University of Florida.

Ernest L Bliss	1977-1979	Ruth E Massey	1989-1991
Jean-Pierre Held	1978-1980	Pascale Chavatte	1990-1992
Steven M Hopkins	1979-1981	Stephen B Constant	1991-1993
Jeffrey B Grimmett	1980-1982	Maria E Cadario	1992-1994
George K Haibel	1981-1983	Karen E Wolfsdorf	1993-1995
Barry A Ball	1982-1984	Dorraine Waldo	1994-1996
Eleazar Soto-Belloso	1982-1983	Dragan Momcilovic	1995-1997
John M Martin	1983-1985	Peter R Morresey	1996-1997
Alan G Rathwell	1984-1986	Marcela vonReitzenstein	1997-1999
Dale L Paccamonti	1985-1987	Audrey A Kelleman	1998-2000
Antonio Garcia G	1985-1986	Peter C Sheerin	1999-2001
Scott T Norman	1986-1988	Shannon L Luznar	2000-2002
Sara K Lyle	1987-1989	Rodrigo J Velasco	2001-2003
Phillip GA Thomas	1988-1990	Tracy A Murchie	2002-2004

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