Total Knee Replacement in the Dog
By Matthew J. Allen, Vet. M.B., Ph.D.

Total knee replacement (TKR) is a relatively new option for managing advanced degenerative joint disease (DJD) in the dog. The implants and instrumentation for canine TKR were developed by BioMedtrix, Inc. (biomedtrix.com), the same company that manufactures the total hip replacement implants that are used routinely at The Ohio State University. As in humans, the implants consist of a metal femoral component and a plastic tibial component that is attached to bone with cement. A cement-free option for canine TKR has recently been evaluated in a pilot study at Ohio State and a larger (30-dog) clinical trial is currently open for enrollment (vet.osu.edu/2743.htm).

The goal of total knee replacement is to eliminate joint pain and to restore mobility to affected joints. TKR, which is most often performed as the first surgical procedure on a hip with advanced DJD, is more challenging than TKR. Although prior surgery is not a problem per se, there is an increased risk of infection in joints that have had previous surgery and, since infection is an absolute contraindication for any form of total joint replacement procedure, it is our standard practice to rule out infection (via synovioscintesis or the collection of synovial biopsies) prior to recommending TKR.

The surgical procedure for TKR takes approximately two to three hours and dogs are kept in the hospital for a minimum of 48 hours. Although they will often toe-touch the morning after surgery, clinical recovery from TKR is slower than after THR and owners are cautioned to control their pet’s exercise for the first six weeks after surgery. Gentle exercise, with leash walks of increasing duration, can be instituted after six weeks and recovery is usually complete by 12 weeks. Approximately 220 dogs worldwide have undergone TKR to date. There have been a few problems reported post-operatively in these dogs, with the most significant complication (infection) being seen at a rate that is similar to that for other orthopedic procedures. All of the clinical cases are being followed in order to document and better understand the long-term results of canine TKR. As you read the other articles in this issue it will become evident that clinicians and scientists work together to continually advance clinical orthopedic procedures through cutting-edge research that has application to clinical veterinary practice.

BioMedtrix Canine TKR implants (left), consisting of a plastic tibial component and a metal femoral component. For dogs with advanced DJD secondary to the long-term effects of canine TKR. At Ohio State, we ask to see dogs at six and 12 months post-operatively and every year thereafter. This program of active surveillance is critically important as a means of identifying potential problems, refining the criteria for case selection and further improving the implants and instrumentation for TKR. We are committed to offering TKR as a routine surgical option that relieves pain and restores joint function (right).

Cells Can Be Engineered to Make Bone and Help Patients
By Aliisa L. Bernotte, DVM, Ph.D., DACVS

Sometimes bones may heal slowly or poorly in all species of animals, including humans. The body’s natural molecule that heals bone is Bone Morphogenetic Protein-2 (BMP2), one of the most potent bone growth factors known. One novel and naturally biological way to deliver this molecule to the bone injury site is by injecting cells that have been engineered to synthesize BMP2 in high quantities. This cell-mediated delivery of BMP2 has been shown to induce bone growth and promote acceleration and enhancement of healing in dogs and horses. Our Comparative Orthopedics Laboratory at The Ohio State University has published in Gene Therapy and Journal of Orthopedics (2010) on the proven efficacy of this cell therapy in horses. Many cell sources can be used including stem cells or skin cells. Because of the promising results from these studies, Ohio State has started a clinical trial in horses and other species to apply this cell-mediated molecular therapy for the treatment of clinical patients with various bone disorders, including poor healing fractures, bone cysts, or failed joint fusions. Some of the patients we have treated are listed below.

Case 1: A young llama with a comminuted fracture of the femoral condyle. The legs healing poorly, the owner brought the llama to our hospital to investigate the situation [Figure 1]. After stabilizing the fracture, the plateau was removed and bone regeneration was induced by injecting a patient-specific BMP2 gene-modified skin cell line. The results were excellent and the bone healed normally [Figure 2].

Case 2: A horse with a failed pastern arthrodesis required further bone bridging of the joint to provide stability and return to comfort. BMP2-skin cells, obtained from the horse, were injected into the biopsy spots at surgery and the plates and screws [Figure 2A and B] at surgery and the bone progressed to bony union and walking comfortably by 60 days.

Case 3: Several horses with bone cysts at the joint surface have been treated by injection of the cysts with BMP2-cells at surgery [Figure 3]. Drs. Elizabeth Santichi and Bretton are recruiting patients with these cysts for this treatment. Follow-up on these cases is still pending, but some have completely filled in with bone and early results are promising for some horses.

Comparative Orthopedics at the Ohio State Veterinary Medical Center
By Rustin Moore, DVM, Ph.D., DACVS

The Veterinary Medical Center’s three hospitals – Hospital for Companion Animals, Hospital for Farm Animals, and the Galbreath Equine Center – along with the College’s basic and translational research programs are integrally involved in our comprehensive comparative orthopedics program. As you read the other articles in this issue, it will become evident that clinicians and scientists work together to continually advance clinical veterinary orthopedics through cutting-edge research that has application to clinical veterinary practice whether companion animals, farm animals or horses.

The College has a long tradition and rich history of excellence in orthopedics, including pioneering work in the area of total hip replacement in dogs as well as fracture repair in large and small animals. More recently, scientists and clinicians have been working on modulating bone healing through cell-mediated molecular therapy using the patient’s cells that have been engineered to produce bone morphogenetic protein-2 (BMP2), one of the most potent bone growth factors known, to facilitate bone healing. This has been verifled experimentally and has been used successfully in horses and farm animals to facilitate healing of fractures, bone cysts and joint fusions. Clinical trials in horses and large animals are underway, and there are plans for similar studies in small animals.

Other cellular and molecular approaches for treatment of musculoskeletal and orthopedic injuries in horses and other animals, including the use of products derived from platelets are available. For example, platelet-rich plasma is used in the treatment of tendon and ligament injuries in horses. Additionally, there is currently a clinical trial evaluating use of intra-articular platelet concentrate to improve lameness in dogs with osteoarthritis. Similar exciting scientific investigations are underway in the area of regenerative medicine, including cartilage healing, and this offers hope in the future for animals with osteoarthritis.

Ohio State is well known for research and clinical work in the area of total hip replacement (THR) in dogs. Dr. Marc Olmstead helped pioneer THR in dogs and has completed more THR procedures on clinical patients than anyone worldwide, many of which were done at Ohio State. More recently Dr. Jon Dyce completed his 1000th THR on clinical patients, very few surgeons have this body of clinical experience with THR. Dr. Dyce works diligently with others to continually improve and advance the techniques and biomaterials used for this procedure. It is anticipated there will be ongoing THR clinical trials for dogs with THR. With our comprehensive gait analysis system to evaluate lameness, we are well positioned to be a trial center for the next generation of BioMedtrix THR titanium stems, which are expected to be more biocompatible. Visit our Clinical Trials webpage (vet.osu.edu/2743) for an ongoing list of trials for which we are currently recruiting and enrolling cases.

Continued on page 2
Comparative Orthopedics (continued from page 1)

Arthroscopy has been commonly used at Ohio State for diagnostic and therapeutic purposes in horses for years. For example, it is used diagnostically to evaluate joints and tendon sheaths for evidence of pathology. It is used more extensively therapeutically for removal of chymopapain and osteochondrosis lesions, curettage of subchondral bone cysts and areas of cartilage and subchondral bone damage; treatment of meniscal disease; removal of fibrin; purulent exudate and damaged synovium associated with septic joints or tendon sheaths; as well as treatment of various other joint and tendon sheath pathologies. Arthroscopy is also available and used in farm animals for similar conditions. As you will note from the article on arthroscopy in dogs, this is becoming much more commonplace in our companion animals, including some of the same indications as in large animals. Specifically it is useful for shoulder OCD, fragmented medial coronoid process of ulna, cranial cruciate ligament injuries with evaluation of menisci, among others.

The Canine Physical Rehabilitation program at the Ohio State Veterinary Medical Center began in 2008 courtesy of charitable gifts from grateful clients of the orthopedic service and has grown substantially since that time. The service includes a veterinarian and two registered veterinary technicians that have completed their certification in canine rehabilitation. The service offers a comprehensive approach to rehabilitation and has potential application for pre- and post-operative orthopedic surgical patients, dogs with osteoarthrosis; neurological and neurosurgical patients; geriatric or overweight patients; and agility, performance and service offers a comprehensive approach to rehabilitation and has potential application for arthritis or osteoarthrosis.

An area of the comparative orthopedic program that overlaps with another service (oncology) is the use of implants for limb-sparing in dogs with osteosarcoma. Recently Kelly, a large mixed-breed dog, was diagnosed with osteosarcoma of the left front leg and she was not a candidate for amputation because of severe osteosarcoma of her elbows. Thus, a titanium implant was used to bridge the area of resected bone. Kelly continues to do well. To learn more about this case view the video at abc6onyourside.com. Scroll down to News Features and click on Healthier World for Animals, then click on Titanium Implant. Dr. Lauren Pugliese is our current orthopedic fellow, supported in full by Dr. Noel Fitzpatrick, a UK veterinarian surgeon with Stanmore Orthopedics (UK) to develop novel limb-sparing implants and prosthetics as alternatives to amputation for limb trauma and musculoskeletal tumors.

The Ohio State Veterinary Medical Center’s comparative orthopedics program is committed to research, cutting edge and never satisfied with the status quo. Our clinicians and scientists work collaboratively to make new discoveries that are translated into clinical application to improve the health, well-being and lives of animals whether small or large. If you have a companion animal, farm animal or horse with a routine or complex orthopedic condition that might benefit from the expertise and innovative approaches of our comparative orthopedics clinicians, we welcome your inquiries. Referrals of small animal patients can be made through the Veterinary Medical Center’s referral coordinator (614-292-0950). For equine and farm animal patients, please call 614-292-6661.

The back surface of BioMedtrix’s TKR Femoral implant

The Ohio State Veterinary Medical Center’s Hospital for Companion Animals with a chronic forelimb lameness that localized to her left shoulder joint. Based on bone radiographs we were suspicious of osteochondrosis dissecans (OCD) of her caudal humeral head. Because Velvet’s main function would be agility and herding, our treatment goal was to evaluate the shoulder joint and treat a possibly OCD in the least invasive way possible. The arthroscopic approach required two small stab incisions through her skin into the joint to create a scope and an instrument portal. The arthroscope was used to examine the main structures of the joint including the origin of the biceps tendon, the medial collateral ligament and the cartilage of both the glenoid cavity and humeral head. A large cartilage flap was observed on the surface of the caudal humeral head (Fig. 1). The flap was freed and removed through the instrument portal using a 3-5 mm grasping forceps (Fig. 2). A bone curette was then used to debride the abnormal bone beneath the flap (Fig. 3) until healthy subchondral bone was exposed (Fig 4). The joint was thoroughly flushed with saline and in less than 10 minutes, the entire procedure was completed. While the OCD defect needs time to heal via fibrocartilage, Velvet recovered very quickly from the arthroscopic surgery. Since shoulder OCD generally carries an excellent prognosis with removal and debridement, we expect Velvet to do very well and return to her intended activity in the future!

Clinical Trials

The college’s Clinical Trials Office provides assistance in the design, execution and evaluation of veterinary clinical trials of client-owned animals. Results of clinical trials help to advance the health of animals, which will improve the quality of life for future patients and possibly lead to advances in human health. Clinical trials have helped us make great strides in medical and surgical treatments.

Current clinical trials related to orthopedics that are recruiting new patients are:

1. Cell-Mediated Bone Morphogenetic Protein Gene Therapy for Bone Healing in Horses
   - To demonstrate an efficacy and safety of cell-mediated molecular therapy for bone disorders and bone regeneration in horses with bone lesions

2. Does your dog have a history of osteoarthrosis?
   - To establish more data on the emerging C-PET treatment for osteoarthrosis

3. Pilot Clinical Trial on the Use of Intra-articular Platelet Concentrate to Improve Lameness in Dogs with Osteoarthrosis
   - To determine if a single intra-articular joint injection of autologous platelet concentrate processed using a filter-based platelet harvest device can improve lameness and joint pain

4. A Randomized Clinical Trial of Cemented versus Cementless Total Knee Replacement (TKR) in Dogs
   - To compare the effectiveness of cemented versus cementless canine total knee replacement

5. Evaluation of Novel Spinal and Orthopedic Devices in the Dog
   - To evaluate clinical function and evidence of bone healing after implantation of two new devices developed specifically for dogs

Learn more about the Clinical Trials Office at: vet.osu.edu/ClinicalTrials.htm

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Comparative Orthopedics (continued from page 1)

More recently Ohio State has entered into the area of total knee replacement (TKR) in dogs. Although a relatively new option for managing advanced degenerative joint disease in dogs, implants and instrumentation for canine TKR have been developed. Dr. Matthew Allen joined the Ohio State Veterinary Medical Center in 2008 to help advance our clinical and translational research related to orthopedics. Dr. Allen was instrumental in the development and evaluation of the TKR implants and procedure in dogs. Together, he and Dr. Dyce successfully completed the first TKR case at Ohio State in 2009. There is currently a clinical trial of cemented vs. cementless TKR in dogs.

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An area of the comparative orthopedic program that overlaps with another service (oncology) is the use of implants for limb-sparing in dogs with osteosarcoma. Recently Kelly, a large mixed-breed dog, was diagnosed with osteosarcoma of the left front leg and she was not a candidate for amputation because of severe osteosarcoma of her elbows. Thus, a titanium implant was used to bridge the area of resected bone. Kelly continues to do well. To learn more about this case view the video at abcsnewsyourside.com. Scroll down to News Features and click on Healthier World for Animals, then click on Titanium Implant. Dr. Lauren Pugliese is our current orthopedic fellow, supported in full by Dr. Noel Fitzpatrick, a UK veterinary surgeon working on Healthier World for Animals, then click on Titanium Implant. Dr. Lauren Pugliese is our current orthopedic fellow, supported in full by Dr. Noel Fitzpatrick, a UK veterinary surgeon working on Healthier World for Animals, then click on Titanium Implant.

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Arthroscopic Procedure Provides Diagnosis and Treatment

By Bianca Hettich, medvet, DACVS

Velvet, a 6-month-old Australian sheepdog, presented to the Ohio State Veterinary Medical Center's Hospital for Companion Animals with a chronic forelimb lameness that localized to her left shoulder joint. Based on her history and radiographs we were suspicious of osteochondrosis dissecans (OCD) of her caudal humeral head. Because Velvet's main function would be agility and herding, our treatment goal was to evaluate the shoulder joint and treat a possible OCD in the least invasive way possible. The arthroscopic approach required two small stab incisions through her skin into the joint to create a scope and an instrument portal. The arthroscope was used to examine the major structures of the joint including the origin of the biceps tendon, the medial collateral ligament and the cartilage of both the glenoid cavity and humeral head. A large cartilage flap was observed on the surface of the caudal humeral head (Fig 1). The flap was freed and removed through the instrument portal using small grasping forceps (Fig 2). A bone curette was then used to debride the abnormal bone underneath the flap (Fig 3) until healthy subchondral bone was exposed (Fig 4). The joint was thoroughly flushed and in less than 10 minutes, the entire procedure was completed. While the OCD defect needs time to heal via fibrocartilage, Velvet recovered very quickly from the arthroscopic surgery. Since shoulder OCD generally carries an excellent prognosis with removal and debridement, we expect Velvet to do very well and return to her intended athletic activity in the future!
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The goal of total knee replacement is to eliminate joint pain and to restore mobility to affected joints. In DJD, the most common indication for surgery is DJD secondary to rupture of the cranial cruciate ligament. The majority of dogs referred for TKR present with a history of at least one prior surgery on the affected joint. In this regard, TKR is very different than THR, which is most often performed as the first surgical procedure on a hip with advanced DJD. Although prior surgery is not a problem per se, there is an increased risk of infection in joints that have had previous surgery and, since infection is an absolute contraindication for any form of total joint replacement procedure, it is our standard practice to rule out infection (via synovioscintesis or the collection of synovial biopsies) prior to recommissining TKR.

The surgical procedure for TKR takes approximately two to three hours and dogs are kept in the hospital for a minimum of 48 hours. Although they will often toe-touch the morning after surgery, clinical recovery from TKR is slower than after THR and owners are cautioned to control their pet’s exercise for the first six weeks after surgery. Gentle exercise, with leash walks of increasing duration, can be instituted after six weeks and recovery is usually complete by 12 weeks.

Approximately 220 dogs worldwide have undergone TKR to date. There have been few problems reported post-operatively in these dogs, with the most significant complication (infection) being seen at a rate that is similar to that for other orthopedic procedures. All of the clinical cases are being followed in order to document and better understand the long-term results of canine TKR. At Ohio State, we ask to see dogs at six and 12 months post-operatively and every year thereafter. This program of active surveillance is critically important as a means to improve potential problems, refine the criteria for case selection and further improving the implants and instrumentation for TKR. We are committed to offering TKR as a routine surgical option for dogs. For inquiries (614-292-3551) or (allen.1243@osu.edu).

Cells Can Be Engineered to Make Bone and Help Patients
By Alissa L. Beronte, DVM, Ph.D., DACVS

Sometimes bones may heal slowly or poorly in all species of animals, including humans. The body’s natural molecule that heals bone is Bone Morphogenetic Protein-2 (BMP-2), one of the most potent bone growth factors known. One novel and naturally biological way to deliver this molecule to the bone injury site is by injecting cells that have been engineered to synthesize BMP-2 in high quantities. This cell-mediated delivery of BMP-2 has been shown to induce bone growth and promote acceleration and enhancement of healing in dogs and horses. Our Comparative Orthopedics Laboratory at The Ohio State University has published in Gene Therapy and Journal of Orthopedics (2010) on the proven efficacy of this cell therapy in horses. Many cell sources can be used including stem cells or skin cells. Because of the promising results from these studies, Ohio State has started a clinical trial in horses and other species to apply this cell-mediated molecular therapy for the treatment of clinical patients with various bone disorders, including poor healing fractures, bone cysts, or failed joint fusions. Some of the patients we have treated are listed below.

Case 1: A young Tama with a comminuted supracondylar fracture presented to Dr. Rebecca Pentecost at our Hospital for Farm Animals (Figure 1). The fracture was treated at the Veterinary Medical Center. Stabilization with plating failed to result in bony union and a non-union and lameness developed. Skin cells from the llamas were biopsied and grown in the lab, the BMP2 gene put into the cells, and the cells injected under radiographic control back into the fracture (Figure 1A and B). At 60 days after injection, the bone was healed and radiographs and the llama was walking. Continued follow-up by Dr. Patricia Balzer and her daughter, Kelly Balzer (DVM Class of 2012), have shown continued union.

Case 2: A horse with a failed lateral condylar osteotomy required further bone bracing of the joint to provide stability and return to comfort. BMP2-skin cells, obtained from the horse, were injected into the area of the plates and screws (Figure 2A and B) at surgery and the horse progressed to bony union and walking comfortably by 60 days.

Case 3: Several horses with bone cysts at the joint surface have been treated by injection of the cysts with BMP2-cells at surgery (Figure 3). Drs. Elizabeth Santucci and Benton are recruiting patients with these cysts for treatment. Follow-up on these cases is still pending, but some have completely filled in with bone and early results are promising for some horses.

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Other cellular and molecular approaches for treatment of musculoskeletal and orthopedic injuries in horses and other animals, including the use of products derived from platelets are available. For example, platelet-rich plasma is used in the treatment of tendon and ligament injuries in horses. Additionally, there is currently a clinical trial evaluating use of intra-articular platelet concentrate to improve lameness in dogs with osteoarthritis. Similar exciting scientific investigations are underway in the area of regenerative medicine, including cartilage healing, and this offers hope in the future for animals with osteoarthritis.

Ohio State is well known for research and clinical work in the area of total hip replacement (THR) in dogs. Dr. Marv Olmeda helped pioneer THR in dogs and has completed more THR procedures on clinical patients than anyone worldwide, many of which were done at Ohio State. More recently Dr. Jon Dyce completed his 1000th THR on clinical patients, very few surgeons have this body of clinical experience with THR. Dr. Dyce works diligently with others to continually improve and advance the techniques and biomaterials used for this procedure. It is anticipated there will be an upcoming clinical trial for dogs with THR. With our comprehensive gait analysis system to evaluate lameness, we are well positioned to be a trial center for the next generation of BioMedtrix THR titanium stems, which are expected to be more biocompatible. Visit our Clinical Trials webpage (vet.osu.edu/2743) for an ongoing list of trials for which we are currently recruiting and enrolling cases.

BioMedtrix Canine TKR implants (left), consisting of a plastic tibial component and a metal femoral component. For dogs with advanced DJD secondary to rupture of the cranial cruciate ligament (center), TKR provides an effective treatment that relieves pain and restores joint function (right).
Kristine McComis – A Legacy
May 2, 1968 – August 18, 2010

The month of August was a particularly emotional and sad time for us at the Veterinary Medical Center with the passing of Kristine McComis. Kristine first began working at the Ohio State Veterinary Hospital on March 19, 1993 and served as assistant to the director for four different hospital directors. She was heavily involved with communications, including playing an instrumental role in writing and preparing many of the articles in all of the past issues of this publication, the Veterinary Medical Center Update and preparing the monthly hospital newsletter.

She embodied the many attributes and values for which we aspire as individuals and as an organization. She was honest and humble; respected and trusted; kind and compassionate; collegial and professional; and gracious and gentle. Kristine always searched for the good in everyone, found the good in everyone, embraced the good in everyone, and focused on the good in everyone.

Kristine contributed so much to the Veterinary Medical Center and College of Veterinary Medicine through her commitment, hard work, and creativity. She was integrally involved with quality of life initiatives to optimize our learning and working environments. Kristine was the consummate ambassador for the hospital and college. She was so proud of the place she worked and wanted everyone to know about the Veterinary Medical Center and the great work done here. She also gave tours of the hospital to thousands of people.

Kristine was a well-deserving recipient of the 2009 College Distinguished Staff Award. Here are excerpts from her nomination letters: “There is no more loyal employee within the College. She has seen her job description modified and had her office moved and changed numerous times … all the while serving with dignity, class, loyalty and ever-efficient effectiveness. She is the type of employee that every employer hopes to hire….Kristine is truly a gem – quietly efficient, always accommodating and helpful, and known for getting the job done and done on time … all beyond anyone’s expectations and without any fanfare. She goes out of her way to make the work environment better for us all.”

Kristine will be greatly missed. She has left a rich legacy at the Veterinary Medical Center through positively and meaningfully touching the lives of so many people and animals for 17 years. She will be fondly remembered for her pride, commitment, passion and love of the place she worked. Kristine was many things to many people – a co-worker, colleague, friend, fellow book club member, role model … and most of all she was our family – the family away from home that she spoke and wrote about and cared for so deeply. We were all blessed by knowing Kristine and privileged to be part of her family.
In early August of 1976, veterinary orthopedic surgeon Dr. Bruce Hohn performed the first total hip replacement (THR) in a dog at The Ohio State University, using a Richards II cemented THR. In cemented THR, the implants are anchored to the bone of the pelvis and femur by acrylic cement. Later that month, Dr. Hohn and Dr. Marvin Olmstead collaborated on the next Ohio State THR. It took them five years to accumulate 221 cases, but after publication of the impressive results of this cohort of patients in a seminal paper on canine THR (JAVMA 1983), Ohio State became known as the preeminent veterinary hospital for THR, and the caseload increased dramatically.

In order to further improve the consistency of clinical outcome, Dr. Olmstead partnered with Chris Sidebotham (CEO of BioMedtrix, a New Jersey biomedical engineering company) in the fall of 1989. The result was new canine THR technology and radically improved surgical instrumentation, with extensive reference to our preferred clinical model – people with well-functioning THRs. Dr. Olmstead implanted the first BioMedtrix cemented hip in late 1989. From 1990 onward we have used exclusively BioMedtrix total hips at Ohio State. To date, more THRs have been performed in dogs at Ohio State than at any other institution. One key element of the program has been the commitment to surgical education. Workshops sponsored by BioMedtrix are held twice a year at Ohio State, under the leadership of Dr. Jonathan Dyce, and are recognized as the gold standard for training in total hip replacement surgery. Ohio State faculty surgeons have trained hundreds of surgeons worldwide to perform THR, and have partnered with private surgical referral practices and academic institutions to initiate international clinical programs in THR.

In the late 1990s, surgeons at North Carolina State University led by Dr. David DeYoung published excellent results of a clinical trial of a custom cementless THR. Many of the design features of this system were incorporated in the next generation of BioMedtrix THR and we now have six years of experience with this cementless implant. In cementless THR, the implants are initially secured by a press-fit, and long-term stability is provided by ingrowth of bone into the textured surface of the cup and femoral stem. The selection of cemented, cementless or hybrid (cementless cup, cemented femoral stem) THR in the individual case is dependent upon many factors including age, size, bone quality, and shape of the femur. Small through giant breed dogs can now benefit from THR. All dogs receiving THR at Ohio State are documented in an archive to allow ongoing review and optimization of this surgery. Ohio State orthopedic surgeons and residents continue to contribute significantly to the published literature, and thanks to a dedicated team of surgeons, technicians, anesthesiologists and radiologists, The Ohio State University Veterinary Medical Center remains squarely at the forefront of canine THR.