The Journey to Success in Experimental Surgery

“Success is a journey, not at destination. It requires constant effort, vigilance and reevaluation.” - Mark Twain

The 33rd Annual Academy of Surgical Research Meeting will include new, novel and refined models, methods and materials in the arts and sciences of experimental surgery. Every new idea or refinement comes with challenges and stories along the way-- so let’s listen and share our experiences with each other, as we can continue to journey together to advance the field of surgery in all aspects of research, education and the development of products for clinical applications.

Learn about surgical research and surgical challenges in areas including:

- Anesthesia and Pain Management
- Suturing
- Cardiac Surgical Models
- Neurological surgical models
- General Surgery
- Telemetry
- Infusion and Ports
- Refinement, Replacement and Reduction Innovations
- Ethics and Welfare
- Model development
- Medical devices

Meeting attendees will have the opportunity to network with speakers and presenters, colleagues and friends. The meeting will offer diverse scientific content that will promote and encourage the advancement of the field of experimental surgery.
Academy of Surgical Research

Thank You to the following Corporate Partners for their generous contributions:

**Platinum Level**

![Envigo](envigo.png)  ![Pfizer](pfizer.png)

**Gold Level**

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**Silver Level**

![Bristol-Myers Squibb](bms.png)  

**Bronze Level**

![Vetequip](vetequip.png)
Welcome

Welcome to Las Vegas, the Miracle in the Desert! Known as the City of Entertainment, there is certainly something for everyone in this unique location including the 33rd Annual Meeting of the Academy of Surgical Research!

The Academy continues to grow each year and last year in New Orleans we set a record for the largest attendance in the Academy’s history! I sincerely expect we will continue this path of growth and I will work very hard to achieve this as I serve as your President in 2017 and 2018.

This year’s program is top notch with some very exciting wet labs, dry labs, and presentations planned for your benefit. We have a unique opportunity this year to present our wet labs at the Oquendo Center, a state of the art facility in the heart of Las Vegas. This facility affords us the ability to offer major, complicated procedures in multiple species including sheep. I am very excited to hear feedback from the students who take advantage of this unique setting in which to learn from some very talented surgeons.

I would like to recognize and thank this year’s Program Chair, Tracy Ziegelhofer, for the endless hours of hard work that she devoted to planning a program such as this. I would also like to thank all of the members of the Program Committee, the wet and dry lab instructors and all the presenters for volunteering their time to help make this meeting a success.

I would like to extend a special welcome to new members of the Academy and those individuals attending the annual meeting for the first time! I can tell you from personal experience there is not a better venue in our industry in which to learn from your peers. We focus on refinements of ‘routine” procedures and sharing our successes and failures in developing new surgical and anesthetic models.

The Academy is a small organization when compared with others in the industry such as AALAS but you will soon realize that this is what makes this organization so great! It affords you the opportunity for significant networking and sharing of ideas among your peers. You will make life-long friends and colleagues who quickly develop into a network of supporters. You will find this network ready to assist you with onboarding new models, trouble shooting current issues and sharing your own innovations and ideas with current members.

An additional advantage the annual meeting brings to the membership is an intimate setting in which to meet our exhibitors and vendors and to discuss your current needs with them. This setting provides an opportunity for direct networking with these individuals and to spend as much time with them as you need, instead of being pushed along like a herd of cattle as we so often encounter at other venues.

These exhibitors and corporate sponsors are a major arm of the Academy. Their continued support of the Academy, year after year, is a catalyst to our growth and to our ability to offer more and more to our membership. Please take some time to visit with each one of them and to thank them for their support!

Good luck to all those members sitting for a certification this year! I commend you for taking on this major challenge and I guarantee you will grow significantly from doing so.

It is with great pleasure and excitement that I once again welcome you to Las Vegas and our 33rd annual meeting!!

Jon Ehrmann
Jon Ehrmann, BS, SRS, SRA, LATg

Technical Operations Manager, Bristol Myers Squibb
Department of Veterinary Sciences
Veterinary Care and Research Support

Jon Ehrmann is the Technical Operations manager for the Veterinary Care and Research Support Group at Bristol Myers Squibb (BMS). He manages a specialized group within BMS providing surgical models and advanced study support to multiple therapeutic areas across several BMS sites. Additionally, his group supports the clinical research programs for the central New Jersey BMS facilities.

Jon has over 18 years of experience in preclinical and surgical research with a focus on cardiovascular, neurological, gastrointestinal and vascular surgery.

He is certified by ASR as a Surgical Research Specialist and a Surgical Research Anesthetist, having received the Barry Sauer Award for each certification exam. Jon joined ASR in 2004 and served on the certification committee for 6 years.

Jon has served on the Board of Directors since 2013 and is currently the President for 2017 and 2018.

He has coauthored several peer reviewed publications and is a frequent presenter at national conferences.

Jon earned a Bachelor’s of Science degree in Zoology from Michigan State University.
Welcome

Welcome to Fabulous Las Vegas, Nevada!

Las Vegas is an ever-changing city, always making way for the “next best thing”—a fitting gathering place for us to discuss the ever-evolving work we do!

I hope the saying “What Happens in Vegas, Stays in Vegas” doesn’t hold true for the 33rd Annual Academy of Surgical Research Meeting! The Program Committee has done a wonderful job assembling an exciting program for you. We hope you take every experience, idea, success and failure shared at this meeting and use them as catalysts for new surgical discoveries.

Over the next few days, you will have the opportunity to meet with some great exhibitors. Please make sure to take the time to meet with these vendors whom have been so generous in supporting this meeting. We also have some amazing instructors teaching 4 wet labs and 4 dry labs. A special thanks to them for putting in the time and effort to plan, organize and execute these labs. Lastly, you will hear two days of informative presentations which cover a broad range of topics.

I would like to thank our very generous sponsors, participating exhibitors, key note speakers and all the volunteer Program Committee members for supporting this year’s meeting and helping to ensure ASR’s success.

Tracy Ziegelhoffer
2017 Program Chair
Tracy Ziegelhofer, BS, SRS, RLATg
Manager, Surgical Services and Safety Pharmacology
Envigo

Tracy joined Envigo in 2001 after receiving her Bachelors of Science degree and advanced to Group Leader of the Surgical Services and Infusion Toxicology group by 2003. Tracy has 16 years of preclinical experience in specialty toxicology, including surgical services, infusion toxicology and cardiovascular safety pharmacology studies in multiple species.

Tracy is currently the Manager of Surgical Services, Infusion Toxicology and Safety Pharmacology at Envigo CR5 in New Jersey. She is responsible for expanding the capabilities of the Surgical Services and Infusion Toxicology group by researching and developing new surgical models and investigating and implementing surgical refinements. Tracy is also actively involved with the IACUC committee and is a member of National AALAS and Tribrach AALAS.

Tracy has been an active member of the Academy since 2003 and received the Andreas von Recum Award in 2016 in recognition of outstanding contribution to the Academy. She is passionate about learning, enjoys new challenges and is honored to have been nominated for a board position.

Program Committee

Jon Ehrmann BS, SRS, SRA, LATg
Bristol Myers Squibb

Leslie J. Stoll, SRS, LATg, LVT, AS
Charles River Laboratories

Heather Bogie, CVT, SRS, RLATg
Data Sciences International (DSI)

Margi Baldwin, MS, SRS, LATg, RVT
University of South Florida

Melanie Graham, MPH, PhD
University of Minnesota

Susan Fleming
Colonial Medical Supply

Brad Gien, BSc
Envigo

Scott Stoll, Pre-Press Technician
Fort Dearborn Inc.
# Board of Directors & Committee Chairs

## Board of Directors

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<th>Position</th>
<th>Name</th>
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<tr>
<td>President</td>
<td>Jon Ehrmann</td>
<td>SRS, SRA, LATg, BS</td>
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<tr>
<td>President-Elect</td>
<td>Jennifer Sheehan</td>
<td>SRS, LATg, BS</td>
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<tr>
<td>Secretary/Treasurer</td>
<td>Tracie Rindfield</td>
<td>SRS, RLAT</td>
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<td>Immediate Past President</td>
<td>Lisa Johnson</td>
<td>SRS, RLATg, BA</td>
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<td>Directors at Large (2014-2017)</td>
<td>Tim Edwards</td>
<td>SRS, BS, RLATg</td>
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<td>Leslie Stoll</td>
<td>SRS, LATg, LVT, AS</td>
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<td>Directors at Large (2015-2018)</td>
<td>Melanie Graham</td>
<td>MPH, PhD</td>
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<td>Marlo Volberg</td>
<td>SRS</td>
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<td>Directors at Large (2016-2019)</td>
<td>Heather Bodie</td>
<td>SRS, RLATg, CVT</td>
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<td>Tracy Ziegelhofer</td>
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## Committee Chairs

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<tr>
<th>Committee</th>
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<tr>
<td>By-laws Committee</td>
<td>Kul dip Mirakhur</td>
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<td>Certifications Committee</td>
<td>Lisa Johnson</td>
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<td>Exhibitors Committee</td>
<td>Susan Fleming</td>
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<td>Membership Committee</td>
<td>Timothy R. Edwards</td>
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<td>Lisa Johnson</td>
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<td>Tracy Ziegelhofer</td>
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<td>Publications Committee</td>
<td>Dr. Marc Basson</td>
<td>MD, PhD, MBA</td>
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<td>Strategic Planning Committee</td>
<td>Jennifer Sheehan</td>
<td>SRS, LATg, BS</td>
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<td>Journal Editor</td>
<td>Dr. Marc Basson</td>
<td>MD, PhD, MBA</td>
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**33rd Annual Meeting | Academy of Surgical Research**
Jim Manke, CAE

Association Solutions, Inc. (ASI)

Jim Manke is owner and founder of Association Solutions, Inc. (ASI) since 1998. ASI is headquartered in Minneapolis and has a client portfolio of seven associations. Jim started in the association business in 1977. He served for 14 years as Executive Director of the Minnesota Association of REALTORS, a 12,000 member association.

In 1996 he was selected by the National Association of REALTOR, the largest trade association in the country, to serve as their Chairman of the Executive Officers Committee. That role led him to working with numerous REALTOR associations around the country on developing strategic plans to boost their value propositions to the membership. It eventually culminated in his working with the startup of the Russian REALTORS Guild to introduce free market thinking and processes into their members’ business operations.

Back in 2002, Association Solutions Inc., became the management arm of the Academy of Surgical Research.

Kathi Schlieff

Association Solutions, Inc. (ASI)

Kathi serves as senior account manager at ASI. She has supported ASR since 2004. She is responsible for all aspects of the Annual Meeting, the Certification Program and responding to membership questions.

Prior to that she worked 15 years with the Minnesota Independent Insurance Agents and Brokers Association as their Director of Education.

In that role, Kathi was responsible for all aspects of the CIC certification Program. During her tenure, the CIC program achieved an all time high in participation and profitability.

Jim and Kathi are married and have five daughters.
Genevieve Andrews-Kelly is the Animal Care and Use Coordinator and Primate Behaviorist at Envigo in East Millstone, NJ. In her role as Primate Behaviorist, Genevieve has direct responsibility for the oversight of nonhuman primate positive reinforcement training program, and directs the implementation of enrichment procedures. Throughout her career, Genevieve’s main interest has been laboratory animal welfare and enrichment.

In 2013, Genevieve earned certification as a Pet Loss Counselor through the Association for Pet Loss and Bereavement (APLB) and completed certification as a Compassion Fatigue Educator through Regent University in 2016. Genevieve uses these skills to aid fellow laboratory animal professionals address the emotional impact of working with research animals. It is Genevieve’s goal to open the dialogue about compassion fatigue and grief in the laboratory animal community, to share resources needed to navigate the emotional bonds we create through our work, and support lab animal staff in the prevention and management of compassion fatigue.

Genevieve has facilitated workshops and presented on environmental enrichment, positive reinforcement training, the human/animal bond and compassion fatigue at various conferences and has authored and co-authored articles on laboratory animal enrichment. Genevieve is a board member of the Enrichment Record website (enrichmentrecord.com).
Melanie L. Graham, MPH, PhD
Preclinical Research Center, Department of Surgery, University of Minnesota, Saint Paul, USA

Dr. Graham is an Associate Professor in the Departments of Surgery and Veterinary Population Medicine. Dr. Graham is also the Director of the Preclinical Research Center (PCRC) at the University of Minnesota. She earned her M.P.H in Epidemiology from the University of Minnesota and her Ph.D from Utrecht University for her doctoral thesis entitled, ‘Working on the 3Rs: Utilization of refinement to enhance the value of translational research in nonhuman primates’. Her research is centered on the development of cell-based therapies for the treatment of diabetes, specifically extrahepatic delivery of islets. Dr. Graham is also widely recognized for her expertise in the characterization and refinement of animal models of chronic disease to improve animal wellbeing and enhance translation to the clinic. This work proved pivotal to the first demonstration of successful long-term diabetes reversal after adult pig islet xenotransplant in nonhuman primates. Dr. Graham is serving on the North American 3Rs Consortium steering committee, the NIAID Nonhuman Primate Transplantation Tolerance Cooperative, and NIAID Immunobiology of Xenotransplantation Cooperative Research Program. Her research is supported by the State of Minnesota, JDRF, and NIH.
Patrick Sharp, DVM, MRCVS, DACLAM

CEO, Animal Resources Authority
Perth, Western Australia

Dr. Sharp is the Chief Executive Officer of Western Australia’s non-regulatory, statutory authority, the Animal Resources Authority. He received his Doctor of Veterinary Medicine (DVM) degree from Purdue University. He completed his postdoctoral fellowship at the Washington University School of Medicine in St. Louis and is a Diplomate of the American College of Laboratory Animal Medicine (ACLAM). He is a Member of the Royal College of Veterinary Surgeons.

Dr. Sharp serves as a private consultant for various organizations providing various services including facility planning/design and AAALAC accreditation preparation. Dr. Sharp has worked in government, industry, and has held domestic and international academic appointments and positions at the David Geffen School of Medicine at UCLA (Los Angeles, California, USA), University of Florida (Gainesville, Florida, USA), the National University of Singapore (Singapore), and the Fundação Champalimaud’s Centre for the Unknown (Lisboa, Portugal). Dr. Sharp has served as an AAALAC ad hoc consultant specialist.

Dr. Sharp has supported Comparative Medicine training, including both ACLAM-approved training programs and international training opportunities for laboratory animal graduate veterinarians and veterinary students. He has strived to increase the quality of animal care through personnel education at all animal care levels and through the design and construction of better vivaria and research support facilities.
Brian Smith
Owner, Funny Farm Mustangs with Rio

Being an amateur western history buff, Brian always had the desire to move out West, but more importantly, to see the wild horse in its natural environment on the open range. Brian first became acquainted with wild horses while stationed in the Army at Fort Bragg, NC, whereby on several occasions, he would go to the coast of NC and view the beautiful Schakelford Banks Wild Horses, the incredible Corolla Wild Horses at the Outer Banks of NC and the Ocracoke Island Banker Wild Horses, on Ocracoke Island, NC. Retiring from the Army in 2003, Brian was hired by the federal government as a Federal Terrorism Officer, which in 2005, led to an opportunity to establish and direct the Nellis Air Force base Anti-terrorism programs, policies and procedures, here in Las Vegas, NV. In 2006, Brian was afforded the opportunity to adopt his first Mustang, named Rio, which triggered the establishment of Funny Farm Mustangs. This is a 501c3 non profit national public charity whose sole purpose is to perpetuate the adoption of mustangs and their cousins, the wild burro, through education and collaboration with the public and agencies, federal, state and local alike. Brian was recruited to the Las Vegas Metropolitan Police Department (LVMPD) in late 2006, and is part of the LVMPD Mounted Unit Collateral Rider Program; Brian is the only approved trainer in Las Vegas for the Mustang Heritage Foundation’sTIP program, the only approved wild burro gentle for the Humane Society’s Platero Project, and a senior member of the Horse Council of Nevada. Funny Farm Mustangs, with the great help of family and volunteers, conducts several events throughout the valley and outside counties such as educational clinics with the BLM’s wild horse and burro specialist at schools and gentles wild horses and burros throughout the year for the sole purpose of adoption, all out of pocket. Funny Farm Mustangs does not charge for the gentling of our country’s incredible, beautiful and majestic national horses and burros.
Venue
# Meeting Overview

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<td><strong>Wednesday, October 4</strong></td>
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<td><strong>Thursday, October 5</strong></td>
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## Meeting Overview

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<th>Time</th>
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<tr>
<td>8:00 AM – 9:00 AM</td>
<td>Continental Breakfast - Sponsored by TSE Systems</td>
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<td>El Dorado Ballroom</td>
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<td>9:00 AM – 9:15 AM</td>
<td>Opening Remarks - ASR President Jon Erhmann - El Dorado Ballroom</td>
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<tr>
<td>10:15 AM - 10:30 AM</td>
<td>Break</td>
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<tr>
<td>10:30 AM - 12:00 PM</td>
<td>Track 1 and 2 Scientific Sessions</td>
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<tr>
<td>12:00 PM - 2:00 PM</td>
<td>Business Lunch/ASR Awards Presentations - Brian Smith “Americas Wild Horses... Living Legend or Faded Legacy” - El Dorado Ballroom</td>
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<tr>
<td>2:00 PM – 03:00 PM</td>
<td>Track 1 Scientific Sessions</td>
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<td>2:00 PM - 3:00 PM</td>
<td>Surgical Writing Workshop - Carson City 1 &amp; 2</td>
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<td>3:00 PM</td>
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<tr>
<td>3:00 PM - 5:00 PM</td>
<td>Board of Directors Meeting - Conference Suite A</td>
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</tbody>
</table>
Lab Descriptions

Wet Lab Instructors

Heather Deloid, DVM
Wake Forest Innovations

Eric Adams, M.S., S.R.S.
Andy Carlson, BS, SRS
Northern Biomedical Research, Inc.

Jody Janecek, BS
Luke Mutch, AAS
Mickey Dunning, BS
Melanie Graham, MPH, PhD
University of Minnesota

Brad Gien
Chelsey Gosman
Stefanie Smith
Envigo

Wet Lab Volunteers

Jon Ehrmann BS, SRS, SRA, LATg
Bristol-Myers Squibb

Leslie Stoll, SRS, LATG, LVT, AS
Charles River Laboratories

Jan Bernal, DVM
Steven Kreuser, RVT, LATg, SRA
Adam Murphy BS, CVT, LAT
Evan Pagano BS, LVT, LAT
Pfizer

Jennifer Sheehan BS, SRS, LATg
Envigo

Dry Lab Volunteers

Jan Bernal, DVM
Pfizer

Leslie Stoll, SRS, LATG, LVT, AS
Charles River Laboratories

Liane Pinkos, LVT, LATG, SRS
SAI Infusion Technologies

Dr Marc Basson, MB, PhD, MBA
University of North Dakota

Cholawat Pacharinsak, DVM, PhD, DACVAA
Stanford University

Thank you to the Oquendo Center for hosting our wet labs and all of your support!
Wet Labs

The Quenko Center
Wednesday, October 4th

8:30 a.m. - 12:30 p.m.
Anesthesia and Intrathcal Catheterization Technique in Sheep
Heather Deloid, DVM, Wake Forrest Innovations, Eric Adams, MS., SRS, Northern Biomedical Research, Inc.
This hands-on workshop will demonstrate and train participants in the anesthesia, surgical techniques, equipment and instruments needed to perform intrathecal catheterization in a sheep model. After observing the procedure, each participant will perform a hemilaminectomy and place an intrathecal catheter and access port. Participants will gain experience with the equipment, instruments and surgical techniques in a supportive setting. Care and management related to the procedures will be discussed with special emphasis on anesthesia, post-operative care and management of intrathecal access ports.

8:30 a.m. - 12:30 p.m.
Targeted Cell Delivery Techniques in the Mouse
Jody Janecek, BS: Luke Mutch, AAS: Mickey Dunning, BS, Melanie Graham, MPH, PhD, University of Minnesota
This hands-on workshop will demonstrate and train participants in the most common surgical approaches (renal subcapsular intra-abdominal fat pad and intraportal) for targeted cell delivery along with practicing techniques in routine injections often used as control sites. Participants will gain practice with micro-surgical tools, perform the surgical technique related to each approach and discuss the advantages and limitations associated with each site. After learning implant procedures, participants will also perform the associated explant technique where appropriate (nephrectomy, fat pad excision, lobectomy). Care and management related to the procedures will be discussed with special emphasis on anesthesia as well as pre and post-operative care.

MORNING SESSION 8:30 a.m. - 12:30 p.m., AFTERNOON SESSION 1:00 p.m. - 5:00 p.m.
Vascular Access Techniques and Successful Management in the Swine Model
Jody Janecek, BS: Luke Mutch, AAS: Mickey Dunning, BS, Melanie Graham, MPH, PhD, University of Minnesota
This hands-on workshop gives a chance to practice with surgical technique, tools and instrumentation for (peripheral, central and portal) venous cannulation (acute and chronic) in a swine model in a supportive setting. Beginners will gain a better anatomical understanding of various approaches and learn basic techniques. More experienced participants can refine their skills and have the opportunity to discuss past experiences, have immediate feedback, ask questions and work with trainers to enhance technique for improved outcomes. Care and management of chronic vascular access will also be discussed as well as opportunity to practice access techniques.

1:00 p.m. - 5:00 p.m.
Rat Closed Loop Bile Duct Catheterization
Brad Gein, Chelsey Gosman, Stefanie Smith, Envigo
This hands-on workshop gives a chance for participants to observe, learn and perform a closed loop bile duct surgery on a rat under the supervision of skilled rodent surgeons. Participants will learn and perform a less invasive surgical procedure after having the chance to observe and ask questions of the surgery demonstration team. Successful maintenance of a bile duct closed loop catheter will be discussed after the surgery portion of this workshop. Beginner surgeons will find the workshop useful to enhance their knowledge of the anatomy surrounding the bile duct and tips for successful abdominal surgery. Advanced surgeons may find this useful for technical improvements in their own surgery and tips for maintaining a successful bile duct surgery.
Wet Lab Sponsors

Access Technologies

ENVIGO

Marshall

BioResources

SAI Infusion Technologies

Jose Serrano
Dry Lab Opportunities

Thursday, October 5th - 2:00 PM – 3:00 PM

Monitoring During Anesthesia
Cholawat Pacharinsak DVM, PhD, DACVAA
Department of Comparative Medicine, Stanford University

Anesthetic monitoring is one of the key components for general anesthesia in laboratory animal research. Such monitoring provides an early warning system, the first step to alert anesthetists to take action before complications become irreversible. The anesthetic monitoring process will increase patient safety and assist the anesthetist’s decision-making regarding patient care throughout the anesthetic procedure. The monitoring techniques covered include anesthetic depth, ECG, blood pressure, %SpO2, ETCO2, and temperature for large animals.

Thursday, Oct 5th, 2:00 PM – 3:00 PM

Proper Technique for Accessing, Flushing & Locking Catheters and Implanted Devices
Liane Pinkos
SAI Infusion Technologies
Maximum # of participants: 10

One of the most overlooked aspects of catheter success comes after the surgery is complete. Proper technique in accessing the implanted device, as well as appropriate routines for flushing and locking are essential to the ongoing success of any catheter. In this workshop, we will focus on the post-surgical care of your catheter including discussion on locking solutions, recommended frequency of flushing, aseptic technique for accessing the catheter, and troubleshooting. In addition to the discussion, participants will have the opportunity to practice proper cleaning, flushing and locking procedures for both the catheter and for the vascular access harness using realistic rodent models. Participants will be introduced to several types of access devices, including harnesses, buttons, and VAPs and will understand the benefits and limitations of each. This session is ideal for anybody who is new to catheter implantation and maintenance, but can also serve as a great refresher and forum for discussion on the best techniques and new products that aid in catheter care and longevity.
Dry Lab Opportunities

Friday, October 6 - 11:00 am - 12:00 pm

Still Suturing with the “Oldies”
Jan Bernal, Pfizer and Leslie Stoll, CRL
Maximum # of Participants: 10, Cost: Free

The objective of this dry lab is to provide an opportunity to learn and improve one’s suturing skills. Using a skin simulator, participants practice various suturing techniques, including simple and straight lacerations, deep-layer closure, skin closures, and tying knots using hand and instrument ties. The dry lab offers a variety of common procedures performed in the primary care setting. Didactic information as well as a hands-on component will be available. This dry lab is geared toward those wishing to refresh their suturing skill, as well as those interested in practicing advanced suturing techniques under professional direction and guidance.

Friday, October 6th - 2:00 pm– 3:00 pm

Surgical Writing—From Protocol Development, Conception of the Research Hypothesis, Data Collection, Manuscript Preparation through Publication.

Dr. Marc Basson
University of North Dakota

An interactive workshop on surgical writing with the new Editor-in-Chief of the Journal of Investigative Surgery. The session will include an overview of the process from hypothesis and experimental design through manuscript writing and submission and handling peer review and interaction with journals. The most common reasons for rejection of manuscripts will be discussed. In addition to a Q&A session, there will be an opportunity to participate in guided peer review of your own manuscript or someone else’s manuscript.
# Program Schedule

## Tuesday, October 3rd

<table>
<thead>
<tr>
<th>Time</th>
<th>Event Description</th>
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<tbody>
<tr>
<td>2:00 PM - 5:00 PM</td>
<td>ASR Board of Directors Meeting - Conference Suite A</td>
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## Wednesday, October 4th

<table>
<thead>
<tr>
<th>Time</th>
<th>Event Description</th>
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</thead>
</table>
| 07:00 AM - 08:00 AM | Registration for Test Takers  
Light Continental Breakfast for Test Takers and Wet Lab Attendees |
| 07:00 AM - 7:30 AM   | Registration for Wet Lab Participants                                               |
| 08:00 AM - 12:00 PM | Certification Exams - Carson City 1                                                |
| 08:30 AM - 05:00 PM | Wet Labs - The Oquendo Center                                                      |
| 04:00 PM - 07:00 PM | Welcome Reception with Exhibitors - *Sponsored by Instech Laboratories*  
Laughlin Room |
# Thursday, October 5th

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
<th>Location</th>
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<tbody>
<tr>
<td>08:00 – 09:00 AM</td>
<td>Continental Breakfast – <strong>Sponsored by Hilltop Lab Animals, Inc.</strong> El Dorado Ballroom</td>
<td></td>
</tr>
<tr>
<td>08:00 – 09:00 AM</td>
<td>Poster Setup – Laughlin Room</td>
<td></td>
</tr>
<tr>
<td>09:00 - 09:15 AM</td>
<td>Opening Remarks – ASR President Jon Ehrmann- El Dorado Ballroom</td>
<td></td>
</tr>
<tr>
<td>09:15 - 10:00 AM</td>
<td>Keynote – Genny Andrews Kelly &quot;Prevention and Management of Compassion Fatigue&quot; El Dorado Ballroom</td>
<td></td>
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## TRACK 1 – El Dorado Ballroom

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
<th>Moderator(s)</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>10:00 – 10:30 AM</td>
<td>Break with Exhibitors – Laughlin Room</td>
<td>Kathryn Nichols</td>
<td>Laughlin Room</td>
</tr>
<tr>
<td>10:30 - 11:00 AM</td>
<td>Rat Myocardial Infarction</td>
<td>Brad Gien</td>
<td>El Dorado Ballroom</td>
</tr>
<tr>
<td>11:00 - 11:30 AM</td>
<td>New Model for the Assessment of Transcatheter Aortic Valve Replacement Devices in Sheep - Experimental</td>
<td>John P Carney</td>
<td>El Dorado Ballroom</td>
</tr>
<tr>
<td>11:30 - 12:00 PM</td>
<td>Surgical Tips and Tricks</td>
<td>Kimberly White</td>
<td>El Dorado Ballroom</td>
</tr>
<tr>
<td>12:00 – 01:00 PM</td>
<td>Lunch with Exhibitors – <strong>Sponsored by emka TECHNOLOGIES</strong> - Laughlin Room</td>
<td></td>
<td>Laughlin Room</td>
</tr>
<tr>
<td>01:00 – 02:00 PM</td>
<td>Keynote – Melanie L. Graham &quot;Practical Application of Harm-Benefit Analysis in Research Using Animals: Protecting Animal Welfare and Advancing Science&quot; El Dorado Ballroom</td>
<td>Kimberly White</td>
<td>El Dorado Ballroom</td>
</tr>
<tr>
<td>02:00 – 02:30 PM</td>
<td>Craniol Access for the Delivery of Biotinylated Dextran Amine (BDA) Neural Tracers into the Motor Cortex following a T10 Hemicompression of the Spinal Cord Injury (SCI), in the Caribbean Green Monkey</td>
<td>David Moddrelle</td>
<td>El Dorado Ballroom</td>
</tr>
<tr>
<td>02:30 - 03:00 PM</td>
<td>Incisional Hepatic Biopsy Collection in the Non-Human Primate</td>
<td>Leslie Stoll</td>
<td>El Dorado Ballroom</td>
</tr>
<tr>
<td>03:00 – 03:30 PM</td>
<td>Break with Exhibitors –Laughlin Room</td>
<td>Kimberly Swearingen</td>
<td>Laughlin Room</td>
</tr>
<tr>
<td>03:30 – 04:00 PM</td>
<td>The Benefits of RFID in Surgical Procedures – Improving Efficiency, Quality and the 3R's During Surgery to Provide Better Animals Models for Researchers</td>
<td>Brad Gien</td>
<td>El Dorado Ballroom</td>
</tr>
<tr>
<td>04:00 – 04:30 PM</td>
<td>Poster Session - Laughlin Room</td>
<td></td>
<td>Laughlin Room</td>
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<tr>
<td>04:30 PM - 05:30 PM</td>
<td>Poster Judging – Laughlin Room</td>
<td></td>
<td>Laughlin Room</td>
</tr>
<tr>
<td>05:00 PM - 07:00 PM</td>
<td>Reception / Foundation Auction – <strong>Sponsored by Data Sciences International (DSI) and Lomir Biomedical, Inc.</strong> - Garden View Terrace</td>
<td></td>
<td>Garden View Terrace</td>
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</table>
### Thursday, October 5th

<table>
<thead>
<tr>
<th>Time</th>
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<tbody>
<tr>
<td>08:00 – 09:00 AM</td>
<td>Continental Breakfast – <strong>Sponsored by Hilltop Lab Animals, Inc.</strong> El Dorado Ballroom</td>
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<td>08:00 – 09:00 AM</td>
<td>Poster Setup – Laughlin Room</td>
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<tr>
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<td>Opening Remarks – ASR President Jon Ehrmann- El Dorado Ballroom</td>
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<tr>
<td>09:15 - 10:00 AM</td>
<td>Keynote – Genny Andrews Kelly “Prevention and Management of Compassion Fatigue” El Dorado Ballroom</td>
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<tr>
<td></td>
<td><strong>TRACK 2 – Carson City 1 &amp; 2</strong></td>
<td></td>
</tr>
<tr>
<td>10:00 – 10:30 AM</td>
<td>Break with Exhibitors – Laughlin Room</td>
<td></td>
</tr>
<tr>
<td>MODERATOR</td>
<td>Jon Ehrmann</td>
<td></td>
</tr>
<tr>
<td>10:30 - 11:00 AM</td>
<td>Lumbar Intrathecal Catheterization for the Chronic Collection of CSF in the Primate</td>
<td>Jon Ehrmann</td>
</tr>
<tr>
<td>11:00 - 11:30 AM</td>
<td>Intragastric Infusion of the Vacuolating Cytotoxin of Helicobacter pylori</td>
<td>Heidi Phillips</td>
</tr>
<tr>
<td>11:30 - 12:00 PM</td>
<td>A Novel Surgical Approach : Abdominal Wall Reconstruction Utilizing Pfannenstiel Abdominoplasty, Component Separation, Biological</td>
<td>Paul W Cartwright</td>
</tr>
<tr>
<td>12:00 – 01:00 PM</td>
<td>Lunch with Exhibitors – <strong>Sponsored by emka TECHNOLOGIES</strong> - Laughlin Room</td>
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</tr>
<tr>
<td>01:00 – 02:00 PM</td>
<td>Keynote – Melanie L. Graham “Practical Application of Harm-Benefit Analysis in Research Using Animals: Protecting Animal Welfare and Advancing Science” – El Dorado Ballroom</td>
<td></td>
</tr>
<tr>
<td>02:00 - 03:00 PM</td>
<td>Anesthesia Dry Lab</td>
<td>Cholawat Pacharinsak</td>
</tr>
<tr>
<td>03:00 – 03:30 PM</td>
<td>Break with Exhibitors – Laughlin Room</td>
<td></td>
</tr>
<tr>
<td>MODERATOR</td>
<td>Leslie Stoll</td>
<td></td>
</tr>
<tr>
<td>03:30 – 04:30 PM</td>
<td>“Dealers Choice” Technician Roundtable</td>
<td>Lisa Johnson, Leslie Stoll, Heather Bogie</td>
</tr>
<tr>
<td>04:30 PM - 05:30 PM</td>
<td>Poster Judging – Laughlin Room</td>
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</tr>
<tr>
<td>05:00 PM - 07:00 PM</td>
<td>Reception / Foundation Auction – <strong>Sponsored by Data Sciences International (DSI) and Lomir Biomedical, Inc.</strong> - Garden View Terrace</td>
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### Friday, October 6th

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<tr>
<th>Time</th>
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<th>Location</th>
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<tbody>
<tr>
<td>08:00 – 09:00 AM</td>
<td>Continental Breakfast - <strong>Sponsored by TSE Systems</strong> - El Dorado Ballroom</td>
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<tr>
<td>09:00 – 09:15 AM</td>
<td>Opening Remarks – ASR President Jon Ehrmann - El Dorado Ballroom</td>
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<tr>
<td>09:15 – 10:15 AM</td>
<td>Keynote - Patrick Sharp “Surgical Research: An International Perspective” El Dorado Ballroom</td>
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<tr>
<td><strong>Track 1 – El Dorado Ballroom</strong></td>
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<tr>
<td>10:15 - 10:30 AM</td>
<td>Break</td>
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</tr>
<tr>
<td><strong>MODERATOR</strong></td>
<td>Melanie Graham</td>
<td></td>
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<tr>
<td>10:30 - 11:00 AM</td>
<td>Renal Induced Hypertension Model with Cardiovascular Telemetry in the Primate</td>
<td>Jon Ehrmann</td>
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<tr>
<td>11:00 - 11:30 PM</td>
<td>Shipping Stress in Rodent Surgical Models</td>
<td>Steven Kreuser, Jan Bernal</td>
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<tr>
<td>11:30 - 12:00 PM</td>
<td>Challenges Faced in Performing a Surgical Study with Immunocompromised Rats</td>
<td>Lisa Johnson</td>
</tr>
<tr>
<td>12:00 – 2:00 PM</td>
<td>Business Lunch/ASR Awards Presentations - Brian Smith “Americas Wild Horses....Living Legends or Faded Legacy” - <strong>Sponsored By Colonial Medical</strong> - El Dorado Ballroom</td>
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<tr>
<td><strong>MODERATOR</strong></td>
<td>Marlo Volberg</td>
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<tr>
<td>02:00 – 02:30 PM</td>
<td>Short-term Clinical and Oncological Outcomes After Transumbilical Single Incision Laparoscopic Total Mesorectal Excision for Rectal Cancer : A Retrospective Analysis From One Center</td>
<td>Zhao Ren</td>
</tr>
<tr>
<td>02:30 – 03:00 PM</td>
<td>Intraoperative Carbon Nanoparticles Imaging in Secondary Total Thyroidectomy for Recurrent Thyroid of a 5-Criterion Case-match Study Nodules : Results of a 5-Criterion Case-match Study</td>
<td>Qiu Weihua</td>
</tr>
<tr>
<td>03:00 – 05:00 PM</td>
<td>Board of Directors Meeting – Conference Suite A</td>
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<tr>
<td>Time</td>
<td>Event</td>
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<tr>
<td>10:15 - 10:30 AM</td>
<td>Break</td>
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<tr>
<td>MODERATOR</td>
<td>Mike Horsmann</td>
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<tr>
<td>10:30 - 11:00 AM</td>
<td>Refinements in Aeration Techniques to Reduce Potential Exposure to Ethylene Oxide (EtO) Post Sterilization</td>
<td>Adam J. Murphy</td>
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<tr>
<td>11:00 - 11:30 AM</td>
<td>Practical Aspects of Bleeding Time Assessments in the Non-Human Primate</td>
<td>Jennifer Sheehan</td>
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<tr>
<td>11:30 - 12:00 PM</td>
<td>Rodent Glucose Surgery</td>
<td>Jennifer Sheehan</td>
</tr>
<tr>
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<td>Business Lunch/ASR Awards Presentations – <strong>Brian Smith “Americas Wild Horses....Living Legends or Faded Legacy”</strong> - <strong>Sponsored By Colonial Medical</strong> - El Dorado Ballroom</td>
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<tr>
<td>02:00 – 03:00 PM</td>
<td>Surgical Writing Workshop</td>
<td>Marc Basson</td>
</tr>
<tr>
<td>03:00 – 05:00 PM</td>
<td>Board of Directors Meeting – Conference Suite A</td>
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<td>Access Technologies</td>
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<tr>
<td>Advanced Anesthesia</td>
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<tr>
<td>AVA Biomedical</td>
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<tr>
<td>Clear H2O</td>
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<tr>
<td>Colonial Medical Supply</td>
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<tr>
<td>Data Sci</td>
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<tr>
<td>DRE Scientific</td>
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<td>Emka Tech</td>
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<tr>
<td>Envigo</td>
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<td>Hilltop Lab Animals, Inc.</td>
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<td>Instech Laboratories</td>
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<tr>
<td>Kent Scientific Corporation</td>
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<td>Lomir Biomedical Inc.</td>
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<td>Marshall BioResources</td>
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<tr>
<td>Medline Industries, Inc.</td>
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<tr>
<td>Patterson Scientific</td>
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<td>PMI PreClinical</td>
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<tr>
<td>ReCathCo</td>
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<tr>
<td>SAI Infusion Technologies</td>
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<tr>
<td>SOMNI Scientific</td>
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<td>Stoelting Co.</td>
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<td>Taylor &amp; Francis</td>
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<tr>
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<tbody>
<tr>
<td>TSE Systems</td>
<td>8</td>
</tr>
<tr>
<td>UID Identification Solutions</td>
<td>11</td>
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</tbody>
</table>
Exhibitor Directory
Access Technologies
www.norfolkaccess.com
For over 35 years Access Technologies has been the world leader in the design and manufacture of implanted access and infusion systems in support of Pre-Clinical research. The acquisition of Solomon Scientific has allowed Access Technologies to offer a more complete line of infusion devices for all species to the research community. Access Technologies prides itself on offering high quality products and superior technical and customer support. Custom design and prototyping is our specialty. To learn more visit us at www.norfolkaccess.com, email pwolf@norfolkmedical.com or call us 847-674-7131

DarvallVet
ajustice@darvallvet.com
DarvallVet, a division of Advanced Anesthesia Specialists, LLC is owned by veterinary anesthesia specialists who are dedicated to educational outreach and continue to engineer sensible, efficient and easy to use equipment. We are a global leader in the design and manufacture of veterinary anesthesia and critical care equipment and supplies. We focus on innovations in anesthesia delivery and patient warming that protect patients, reduce pollution and save veterinarians money.

AVA Biomedical, Inc.
www.avabio.com
AVA Biomedical, Inc. Advanced Infusion Systems AVA Biomedical, Inc. is a leading manufacturer of cutting-edge infusion devices. We provide complete, customized infusion systems for all species. AVA Biomedical provides researchers with unique variety of infusion products including: New Conventional Ports for all species, Cath-In-Cath2 Port systems the gold standard for long-term access, the FastTether2 modular rodent infusion system and state of the art infusion pump systems for tethered or ambulatory applications. Come see what makes us different.

ClearH2O
www.clearh2o.com
ClearH2O is a life science company meeting the needs of leading industry researchers and breeders with products that hydrate, nourish and enrich animals’ lives. A strategic partnership with nutrition and food science allows us to provide cost-effective solutions to address unmet demands, while saving time and labor. Our products are always consistent, eliminating nutrition and hydration variables. HydroGel® is the #1 choice of breeders worldwide, for hydrating research animals in transit. DietGel® products are the #1 soft dietary supplement for compromised or special needs animals. MediGel® and MediDrop® products are fast becoming the preferred medication delivery method while LabGels® and FiberBites® continue to offer enrichment for non-human primates.
Colonial Medical Supply
susan@colmedsupply.com

For 40 years Colonial Medical Supply has been dedicated to delivering the highest standard in medical equipment, personalized customer service and on-site anesthesia machine maintenance to the animal health community. We take pride in the equipment we sell, support and service to run as smoothly as possible every day.

DRE Scientific
www.dreveterinary.com/scientific

DRE Scientific, a Division of DRE Veterinary, is your source for new and professionally refurbished medical equipment. Our product line encompasses anesthesia (including rodent and MRI-compatible), ventilators, monitoring (telemetry), tables, lighting, electrocautery, and more. We offer calibration services of anesthesia machines and vaporizers along with biomedical field service preventive maintenance programs, performance verification, and parts.

Data Sciences International
www.datasci.com

DSI is a pioneering biomedical research company focused on systems physiology and pharmacology. The recognized global leader in physiologic monitoring, DSI offers telemetry, instrumentation, and software and services that help advance science. DSI serves many industries including: Pharmaceuticals, Academia, Contract Research Organizations, Biological and Chemical Defense, the Medical Device Industry, Government, and Biotechnology companies. We offer solutions that are tailored specifically to meet the unique research needs of our customers.

emka TECHNOLOGIES Inc.
www.emkatech.com

emka TECHNOLOGIES and SCIREQ offer in-vivo and ex-vivo research instruments & telemetry hardware for physiology, pharmacology, and toxicology. Our solutions provide unparalleled accuracy and reproducibility for cardiovascular, respiratory and neurology studies, as cited in over 1,000 scientific publications. Visit our booth to discuss your research application!

Envigo
www.envigo.com

Envigo provides essential research services, models and products for biopharmaceutical, crop protection, and chemical companies as well as universities, governments, and other research organizations. Our business is founded on a dedication to customer service and the expertise and experience of our 3,800 people. With over 50 locations worldwide we are committed to helping customers realize the full potential of their research and products as we work together to build a healthier and safer world.
Hilltop Lab Animals, Inc.
www.Hilltoplabs.com

Hilltop Lab Animals, Inc. produces research animals including rats, mice and guinea pigs. Hilltop also provides: contract housing including aged animals, precisely time-mated animals, tissues, blood products, and wide variety surgical procedures including catheter (vascular, bile duct, intra-gastric, urinary bladder) implants. For more information call customer service at 724-887-8480.

Instech Laboratories Inc.
www.instechlabs.com

Instech designs and manufactures products for rodent infusion, sampling and oral gavage, including: catheters, tethers, swivels, infusion pumps, automated blood samplers and flexible animal feeding tubes. Highlighted at ASR: OrchestTA pumps and software for automating GLP infusion studies, external ports for mice and rats that allow group housing.

Kent Scientific Corporation
www.kentscientific.com

Kent Scientific Corporation serves medical and research scientists as a worldwide provider of integrated solutions for pre-clinical research. As a leader in non-invasive blood pressure, physiological monitoring and anesthesia products for mice and rats, we enable our customers to achieve results that are fast, consistent and exceedingly accurate.

Lomir Biomedical Inc.
www.lomir.com

Lomir is the world’s largest manufacturer of animal jackets, infusion products and restrainers. Currently celebrating our 25th Anniversary our mission has been to manufacture equipment that is reliable, durable and easy to use. In depth knowledge enables Lomir to design and manufacture equipment with the exact precision to meet your scientific requirements. New products made using innovative materials enable researchers to consider new applications, often reducing labor while improving comfort and well-being of the subjects. Visit our booth to find out how working with the manufacturer can help you achieve your objectives.
Marshall BioResources
www.marshallbio.com

Marshall BioResources is a global provider of purpose bred animals for biomedical research and related services. We provide Marshall Beagles from our harmonized breeding facilities in both the United States and China. We also provide ferrets, mongrels and hounds, and Gottingen Minipigs from our AAALAC accredited facilities in the United States. Rodents and additional services are available via our facilities in the United Kingdom. For over 75 years our animals have been recognized as standard research models, known for their good health, genetic consistency, gentle temperament and uniformity.

Medline Industries, Inc.
www.medline.com

Medline is a global manufacturer and distributor serving the healthcare industry with medical supplies and clinical solutions that help customers achieve both clinical and financial success. Headquartered in Northfield, Ill., the company offers 350,000+ medical devices and support services through more than 1,400 direct sales representatives who are dedicated points of contact for customers across the continuum of care. For more information on Medline, go to www.medline.com/science or http://www.medline.com/social-media to connect with Medline on its social media channels.

Patterson Scientific
www.pattersonscientific.com

We are the industry leader in the manufacture and sale of premier veterinary and research inhalant anesthesia systems and accessories. We base the development and manufacture of our products on proven technology and testing procedures. We are committed to educating and providing researchers and veterinarians worldwide with our high quality, safe, reliable, effective and user-friendly products for every research application.

PMI
www.pmipreclinical.com

PMI is a preclinical CRO specializing in medical device R&D testing, GLP and non-GLP studies and physician/sales force training. Our AAALAC-accredited research facility is built specifically to help clients get from research to clinical application efficiently. With almost 30 years of experience, we have a reputation for excellent science, strong surgical skills and customized timely services. PMI has 4 surgical suites. Our imaging equipment includes: cath lab, c-arms, ultrasounds, laparoscopic and endoscopic towers, IVUS and access to MRI. We take a collaborative approach with our clients as we understand the complexities of research and the unique needs of individual companies.
ReCathCo
www.recathco.com

ReCathCo small animal research catheters. Rat and Mouse catheters, jugular, carotid artery, femoral vein & artery, bile duct, portal ‘T’ and customer specific designs. Our expertise using high technology bonding and fusion, tipping, drilling, slitting, banding and printing. In-house capabilities are with state of the art equipment and materials used in medical device manufacturing settings. ReCathCo’s extrusion capabilities for micro-bore tubing includes polyethylene (PE), polyurethane (PU), polypropylene (PP), silicone, Pebax, including ReCathCo Low Friction PU & ReCathCo PEBA soft flexible and chemical resistant tubing. All production in cleanroom environment and sterilization available to customer required configurations. ISO 13485 company.

SAI Infusion Technologies
www.sai-infusion.com

SAI Infusion Technologies www.sai-infusion.com SAI doesn't just make great infusion products, we make them work for you. SAI creates components for preclinical infusion and sampling. We provide technical support for all our products, including on-site surgical training and services. Improve surgical outcomes with customizable catheters, skin buttons, locking solutions, and a variety of surgical supplies, like introducers, drapes, and anesthesia machines. Our focus is on helping animal researchers get work done faster and better so your focus stays where it belongs- improving human and animal lives. We know the challenges you face in animal research and we'll put that knowledge to work for you.

SOMNI Scientific
www.somniscientific.com

SOMNI Scientific specializes in the design of inhalant anesthesia systems that assure compliance with animal welfare and workplace safety. Our expertise in developing specialized equipment, following ISO standards, for research and imaging applications extends into service and support of existing systems in the field. SOMNI Scientific builds confidence through quality.

Stoelting Co.
www.stoeltingco.com

Stoelting Co. (www.stoeltingco.com) has been an innovator in producing neuroscience research equipment since 1886; we offer a wide variety of stereotaxic instruments used in laboratories all over the world. Moreover, we also offer a complete line of gas anesthesia products, using gas anesthesia during stereotaxic surgery. In addition, a new rodent warming system is built right into the base plate allowing the user to maintain the temperature of the animal during surgery. At Stoelting, we have a strong commitment to support scientific research. We offer only high quality, reliable instruments, including prompt, educated customer service from science professionals.
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Keynote Speakers
Compassion Fatigue has recently become a growing concern within Laboratory Animal Community. Many of us in the lab animal profession, regardless of our job description, became involved in the field because of the desire to work with animals. Forming bonds with research animals is common. This bond is the motivation for the high quality of care that we offer to our animals and ultimately forms the foundation of good animal welfare. However, compassion fatigue, also known as the “cost of caring”, can be a consequence of the drive to meet the constant demands of caring for others. Compassion fatigue can manifest in many ways—symptoms include: irritability, depression, depersonalization, decreased job satisfaction, and ultimately may lead to a lessening of compassion over time. Once acknowledged, compassion fatigue is preventable and manageable. An introduction to methods for prevention, reduction and management compassion fatigue will be presented in this forum.

Attendees will learn about the causes and symptoms of compassion fatigue, how to encourage the human/animal bond in research, and strategies for the management and prevention of compassion fatigue. The intended audience will be all ASR members.
Biomedical research is the foundation for medical progress with animal models playing a pivotal role in advancing lifesaving therapies. The use of animals requires special consideration, their phylogenetic closeness to humans is exactly the reason why they are used, and this similarity is also the basis for concern regarding the impact of disease, clinical management, and necessary safety and efficacy monitoring on their well-being. When decreased quality of life is associated with the disease of interest in humans, it’s logical to likewise assume there is a substantial burden on animals. Routine care can be intensive and the experimental situation often introduces additional stressors like complex drug administration regimens, routine blood collection, advanced imaging studies, and surgical interventions. It has been shown that stress can introduce bias in resulting data that may underestimate therapeutic value. Stress can also prompt changes in appetite, gastrointestinal distress (e.g. nausea, vomiting, diarrhea), and depress typical immune function. This contributes to an inability to distinguish model-induced adverse events from those related to the investigational product resulting in potential overestimation of risk, lowering the predictive value of the model, which could prematurely end development of a useful therapeutic. These problems should be addressed in the design and execution of preclinical studies using best practices in animal modeling that are based on the concept of Refinement. At its most basic level Refinement is a tool that can be used to reduce stressors, but the more progressive interpretation seeks to also increase positive experiences for the animal to flourish and enhance the scientific aims by addressing aspects of validity. Refinement can be used to limit model induced confounding and to reduce disparity by introducing ‘clinical trial-like’ features. Adoption of the 3Rs benefits animal well-being and maximizes the likelihood of accurate prediction to the clinical situation positively shifting the harm-benefit profile.
Surgical Research: An International Perspective
Patrick Sharp; DVM, MRCVS, DACLAM
American Resources Authority

The presentation will cover overseas surgical research experiences highlighting surgical infrastructure, training and developing programs to an international standard.

NOTES
Americas' Wild Horses.....Living Legends or Faded Legacy
Brian Smith
Owner, Funny Farm Mustangs

The topics to be discussed include a review of the indigenous horses to North America, a brief history of the Mustang, the Congressional Free Roaming Wild Horse and Burro Act of 1971 and its’ purpose. How we utilize the Mustang, programs and organizations that manage, care and arrange adoptions.

NOTES
Thursday, Track 1

Rat Myocardial Infarction

Presenter: Brad Gien BSc
Envigo

Background: To learn, train and become proficient with a rat surgical model of myocardial infarction.

Purpose: The purpose of this project was to become proficient and improve the surgical outcome on a rat permanent ligation myocardial infarction model while looking for ways to improve the quality of the surgery.

Methods: This project was initiated when poor model quality and animal welfare concerns with the current surgery were observed. Data was gathered from the previous year’s studies, involving rats with permanent ligation myocardial infarction surgery. The percent of animals that met study acceptance criteria was an unacceptable 51%. The standard deviations of the infarct size and ejection fraction measurements were out of acceptable ranges. When necropsies were completed on the animals in the study, it was observed that the surgery had caused moderate to severe adhesions of the pericardium, lung, heart and chest wall as well as lung damage. Our goal was to achieve 80% or greater study enrollment and little to no adhesions or lung damage in any animal. Since the model originated from papers around 1954 we started the surgery training and improvement project using published papers. Once we identified the potential weaknesses in the current surgical protocol we redesigned and wrote an updated protocol. Identified and purchased the required surgery instruments and began training with surgery technicians who had several years of experience in this particular surgical model. After spending a week working with the more experienced surgeons for this model we returned to our lab and began practicing on our own. We monitored progress and technique through pictures, videos, echocardiography and necropsies.

Results and Discussion: After three months of working with the new surgical protocol, we achieved all of the goals set for this surgery project. Initially we had several issues with lung damage, adhesions and a variable infarct size. As our technique improved, with increased experience and practice, we observed a decrease in adhesion and lung damage. Our animal survival post-surgery increased from 60% to over 85%. We continued to practice and our standard deviation for infarct size and ejection fraction stabilized. Currently we have an average ejection fraction measurement of 31% with a standard deviation of 1.5%. Our adhesions have been minimal and lung damage has been eliminated on all surgeries. Our surgery time per animal has decreased as well which has improved recovery times from 5-7 days to 3-5 days with most animals showing normal behavior after 72 hours post-surgery.

Conclusion: Regular review of surgery procedures before beginning training or development can reduce the time to successfully complete training on a new model. It helped us identify faults in the current surgery protocol and to develop the model faster without making the same errors that others have already made. This was a very exciting project because we were able to collaborate with a surgical team from another company demonstrating that best practice surgery training, development, expertise, and information sharing can benefit research model development.

NOTES
New Model for the Assessment of Transcatheter Aortic Valve Replacement Devices in Sheep

Presenter: John P Carney
Experimental Surgical Services, University of Minnesota

Background: Transcatheter aortic valve replacement (TAVR) technology recently emerged as a treatment for patients with symptomatic aortic stenosis (AS), leading to numerous novel or modified TAVR devices. Prior to clinical use, these devices must be assessed in animal models for preclinical safety and efficacy. In the clinical setting, the AS disease state is used to anchor TAVR devices in place. However, large animal models lack a stenotic or calcific aortic annulus, thus preventing secure attachment of the TAVR device, and TAVR devices deployed within a healthy aorta often migrate into the left ventricle, causing animal death. Since current animal models do not mimic human AS patients, a critical impediment exists to long-term preclinical evaluation of TAVR devices. Therefore, our goals included creating a consistent, reproducible model of AS using a modified aortic annuloplasty (MAA) procedure in sheep, followed by deployment and anchoring of a TAVR device within the novel AS sheep model to evaluate device effectiveness and long-term performance.

Purpose: Five adult sheep were sedated, anesthetized, and prepared for sterile surgery. A left thoracotomy was performed to access the heart, and cardiopulmonary bypass (CPB) was initiated using standard techniques. The aortic valve was accessed and MAA performed with a novel annuloplasty ring of our laboratory’s design. Animals were weaned from CPB, closed and recovered. Transthoracic echo (TTE) was used to identify changes to the aortic annulus and ring in the postoperative period. Two of these sheep were euthanized 45 days after MAA for gross observation of the aortic annulus. The remaining three sheep were anesthetized and surgically prepared for TAVR deployment. Small cut-down incisions were performed to access the carotid artery and femoral artery and vein. A next generation Portico™ (St. Jude Medical, Inc.) was deployed within the aortic annulus via carotid artery access. Deployment was visualized under fluoroscopy and intracardiac echo (ICE) via femoral access. Vascular access was repaired and incisions closed. Sheep were recovered and transferred to postoperative care housing until scheduled sacrifice, approximately 90 days post-TAVR deployment. A pathologist performed a full necropsy, focusing on the successful simulation of a stenotic or calcific aortic annulus and adequate TAVR attachment.

Methods: All five sheep underwent MAA without complication and recovered normally. After 45 days, in the two sheep with MAA exclusively, the implanted ring segments had formed hard, fibrous, bulbous protrusions into the lumen of the left ventricle outflow tract and aortic annulus. In the remaining three sheep, a next generation Portico™ TAVR device was successfully deployed and anchored. These animals recovered uneventfully and survived the designated study period of 90 days without device migration.

Conclusions: We found that MAA performed in sheep creates stenotic segments effectively modeling AS observed in human patients. Additionally, we demonstrated these segments provide adequate rigidity within the aortic annulus for deployment, anchorage, and long-term evaluation of a next generation Portico™ TAVR device.

Citations: Our results indicate the novel sheep AS model we developed is clinically applicable for the assessment of new or modified TAVR devices.

NOTES
Surgical Tips & Tricks

Presenter: Kimberly Holliday-White BS, SRS
Data Sciences International

Continual improvement is critical for success in surgeries and in animal welfare. Several techniques have been developed to make surgeries more successful. Determining the best insertion location for placing the left ventricular catheter in the rat can be difficult but can become easier with this technique. Understanding how positioning of the catheter in the left ventricle affects the outcome of the data can help in troubleshooting and refinement in subsequent animals. In addition to pressure measurements many researchers also collect ECG data. Our recent development of new biopotential lead techniques has been helpful in preventing irritation to the animal and preventing potential wound contamination. Another challenge for surgeons can be transitioning to a new animal model. Working with a new species does not mean that the established technique for other species will be successful in the new one.
Cranial Access for the Delivery of Biotinylated Dextran Amine (BDA) Neural Tracers into the Motor Cortex Following a T10 Hemicompression of the Spinal Cord to Produce a Spinal Cord Injury (SCI), in the Caribbean Green Monkey

Presenter: David Moddrelle SR5
RxGen / St. Kitts Biomedical Research Foundation

Background: The Caribbean vervet (Chlorocebus Sabaeus), an Old World nonhuman primate sharing similar anatomic, physiologic, immunologic and genetic homology to humans as cynomolgus and rhesus monkeys, has been widely used in biomedical research. Their use and value in modeling and understanding neurodegenerative diseases such as Parkinson’s and Alzheimer’s is particularly well documented.

Purpose: The benefits of using this species and Old World nonhuman primates more broadly in spinal cord injury (SCI) research has been highlighted previously, guiding our development of an experimental model of SCI based on hemicompression of the cord at T9-10. This model limits post-injury deficits to minimize pain, distress and discomfort to animals. Biotinylated dextran amines (BDA) are organic compounds used as anterograde and retrograde neuroanatomical tracers. They can be used for labeling the source as well as the point of termination of neural connections and therefore, to study neural pathways, and have been used extensively in various species including the primate.

In this presentation we will explore several different techniques for opening the calvera (use of drills, trephines, various drill bits, etc.), dural opening and closure, replacing the bone flap (MRI compatible loops vs screws and plates), dental adhesives and their use. The presentation will follow each step of the procedure (pre, intra, and post-operatively) with all anesthetic, analgesic and antibiotic therapies employed and discuss the pitfalls associated. Application of these techniques for BDA injection into the motor cortex following SCI will be discussed.

Methods: After completion of the craniotomy and with the use of a stereotaxic frame, manipulator arm and a micro-injector the tracers were injected into the motor cortex tracking along the central sulcus and the superior sagittal sinus. The injections varied as to depth with some sites receiving 3 injections (6mm, 4mm and 2mm), some receiving 2 injections (4mm and 2mm) and some receiving 1 injection at 2mm. Up to 44 injections were performed along the tract. All injections were delivered over a 1 minute period with a 2 minute period in between each dose. Animals were euthanized approximately 11 weeks after BDA injections, allowing sufficient time for the tracer to reach and potentially extend beyond the SCI defect. Histology analysis of this project is not yet complete but will be presented during the presentation.

Conclusions: The successful conclusion of this 3 month study exhibited no post-operative problems associated with either the procedure or the BDA injections and shows that Chlorocebus sabaeus is a viable primate species for projects involving major cranial procedures.

NOTES
Incisional Hepatic Biopsy Collection in the Non-Human Primate

Presenter: Leslie Stoll SRS, LATg, RVT
Charles River Laboratories

Background: This abstract describes a surgical procedure for obtaining liver samples by direct visualization at single or multiple time points.

Purpose: This technique was developed to allow direct visualization of the liver and excisional biopsy vs. core needle biopsy to increase sample size for evaluation and improved safety for animals.

Methods: One hundred eleven biopsy samples were obtained using this method over a four month period of time. Multiple samples were collected from designated animals during the course of the studies. The animals were allowed to recover and heal for a minimum of 2 weeks between collections. Four in-life collections were approved by our IACUC with the 5th collection being performed at necropsy. The procedure was conducted under general Isoflurane anesthesia. Animals were anesthetized with Ketamine IM, induced with Ketamine/Diazepam IV to effect for intubation. Intravenous fluids were administered at 9ml/kg/hr and the animals were monitored for heart rate, in-direct blood pressure, temperature, CO2 saturation and SPO2. Buprenorphine 0.03mg/kg was administered pre-surgically for analgesia. Bupivicaine 0.20ml administered as an incisional block. The cranial abdomen under the rib cage was clipped and surgically prepared with warmed Chlorhexadine scrub. The animals were placed in dorsal recumbency, on a slight incline using a rolled up towel under the upper back, a final prep of ChlorPrep applied and surgical site draped. Procedure: A small stab incision, approximately 1-2cm in length was made with entry into the abdominal cavity. Forceps and hemostats were used to isolate the edge of a liver lobe. The lobe was grasped and lifted to the abdominal incision. A scalpel blade was used to excise the tissue. The liver lobe was ligated with absorbable monofilament suture to assure hemostasis and replaced into the abdomen. After hemostasis was confirmed, the abdominal incision was closed in two layers with absorbable monofilament suture. Tissue adhesive was applied. Animals were transferred to a recovery table, placed on O2 and monitoring continued. In-direct blood pressure was monitored continuously for approximately 10 minutes, to observe downward trends in blood pressure that would indicate internal hemorrhaging. In addition, mucous membrane color and heart rate were monitored. Once the animals were stable, they were removed from O2 and monitored visually and manually until extubated. When animals were able to sit upright unaided, they were returned to their home cages. Post-operatively animals received observations SID for 3 days and Rimadyl 4mg/ kg SQ SID for 2 days. The liver samples collected were weighed, placed in epindorph containers, flash frozen in liquid nitrogen and placed on dry ice.

Conclusion: Analysis of organ sample weights comparing needle biopsy method with this excisional technique revealed an average sample weight of 16mg for core needle biopsy and 124mg for the excisional method. Our experience with liver biopsy collection whether single or multiple times has helped confirm that the excisional method is safer for the animal due to less risk of sampling incorrect tissue and less trauma. Hemorrhage can be directly observed with the excisional method. The excisional technique also provides a better sample size for analysis.

NOTES
The Benefits of RFID in Surgical Procedures – Improving Efficiency, Quality and the 3R’s During Surgery to Provide Better Animals Models for Researchers

Presenter: Brad Gien BSc
Envigo

Background: Introduction: Monitoring surgery outcomes is an important part of a surgery lab. Documenting and working on improvement, surgery model, procedures or surgeon, is key to maintaining the 3 R’s, reduction, refinement and replacement. We complete over sixty thousand surgeries per year so monitoring quality and efficiency in a paper-based system leaves us with a lot of extra data entry and delays recognition of issues. We looked for an easy to use program that could monitor individual animal, surgical procedures, surgeon success/failure, and surgeon efficiency.

Purpose: At first we were looking to advance efficiency, quality, and the 3R’s, while providing a better model to the researcher. As the project progressed, we realized it would allow identification of any surgeon training deficiencies as well as surgical models that required improvement.

Methods: We contacted an RFID microchip supply company who had years of experience with lab animal surgery and knowledge of the industry. Initially we purchased RFID microchips, readers and tried to use excel and self-created databases for electronic data collection. Because of the unique nature of our business and the volume of surgery completed, this option did not prove to be more efficient than what we were currently doing using pen and paper. Working with the chip supplier, we provided to them all the information we would like to collect. We wanted to monitor the animal from the time it entered surgery until the time it left surgery, keeping track of everything that happened to that animal including weights, analgesic given, anesthesia, length of anesthesia, length of surgery procedure, recovery, health checks and monitoring and which staff member completed them. Another unique challenge was making it easy enough for surgery and support technicians to use and comply with, as well as working in an aseptic environment. To help with ease of use we were able to automate the weighing of animals as well as make large icons on a medical touch screen monitor. The surgeons could record all the data from the surgery procedure using receivers that did not require them to break from the aseptic surgery field and wristbands under their surgery gowns with their own personal identification microchip. This data was collected in a database and we were able to pull data hourly, daily, weekly or at any interval.

Conclusions: Using this new surgery application we have been able to increase efficiency, monitor and identify surgeon success and retraining needs. We have been able to provide a complete history on what the animal received for analgesics, anesthetics and when they received them. We can also monitor animal checks, when they occurred and any recurring issues that appear post-surgery. With all of this data, we have improved training, efficiency, identification of surgery issues and procedural problems. We can also identify highly successful surgeons and use them to train our new staff as well as staff that may be having issues with certain surgeries.

NOTES
Thursday, Track 2

Lumbar Intrathecal Catheterization in the Nonhuman Primate

Jon Ehrmann BS, SRS, SRA, LATg
Bristol Myers Squibb

Background: Alzheimer’s disease (AD) is a progressive neurodegenerative disorder characterized by an excessive production of extracellular amyloid plaques and intracellular neurofibrillary tangles in the brain. It is estimated to affect 5.3 million people and is the 6th leading cause of death in the United States. In an effort to support the investigation of specialized cerebral spinal fluid (CSF) biomarkers, a reliable and reproducible chronic system was developed to collect lumbar CSF from conscious nonhuman primates.

Materials and Methods

Several non-surgical and surgical procedures have been published for accessing lumbar CSF. We investigated the use of a lumbar catheter with a vascular access port to chronically collect lumbar CSF. A five cm dorsal (posterior) midline incision was made, centered over the L3 - L5 vertebral segment. The muscles were retracted to expose the dorsal spinous processes and the left side of the L4 vertebral body itself. A four millimeter hemilaminectomy was made into the left lateral aspect of the L4 vertebral body to expose the dura mater. A purse-string suture was placed within the dura to secure the catheter at its exit site. A small incision was made in the dura mater/arachnoid membrane in the area within the purse-string suture. The intrathecal catheter was then inserted into the intrathecal space. Confirmation of placement of the catheter within the intrathecal space was determined by passive flow of CSF through the catheter or by manually aspirating CSF. A MINI vascular access port (VAP) was tacked to the lumbodorsal fascia on the opposite side of where the hemilaminectomy was created. The other end of the catheter was cut to fit and attached to the VAP, leaving it full of CSF. This procedure was approved by the site governing IACUC.

Results

This procedure was originally presented at the 2013 ASR annual meeting and since then has been published in the Journal of Investigative Surgery. Within this time frame our experience with this model has increased significantly including the development of several refinements to the surgical procedure and the overall maintenance of the model. Once the model is established in the animal for several months we have found that the majority of them remain patent indefinitely. If patency was lost, a minor repair procedure was developed to restore patency. In regards to maintenance of the model, our experience suggests the less maintenance/flushing the better. Since CSF does not contain clotting factors, the need to flush a catheter routinely is not necessary. That being said, animals planned for study were accessed monthly to ensure they remained patent however stock animals would go several months without maintenance and still maintain patency. Additionally, allowing the system to passively drip CSF versus manual aspiration of CSF significantly improved the patency of the catheter.

Conclusion

Lumbar intrathecal catheterization for the chronic collection of CSF has become a routine and predictable model due to the experienced gained over the past five years. This presentation will discuss the surgical techniques necessary to create this model as well as several refinements developed over the years which significantly improve the patency of the catheter.

NOTES
Intragastric infusion of the Vacuolating Cytotoxin of Helicobacter pylori

Presenter: Heidi Phillips VMD, DACVS
University of Illinois College of Veterinary Medicine

Background: Pathogenic microorganisms colonize a host body and initiate infection via production of pathogenic effectors and toxins. The human gastric pathogen Helicobacter pylori chronically infects humans by colonizing the stomach at the epithelial barrier. A major pathogenic effector of H. pylori is the vacuolating cytotoxin (VacA), a secreted toxin that contacts gastric epithelial cells and localizes to mitochondria inducing dysfunction. The effects VacA induces on gastric cells in vivo remain poorly understood. We hypothesized that VacA functions in vivo to facilitate persistence of H. pylori within the gastric environment and report an intragastric infusion model for evaluating the effects of this bacterial toxin in vivo.

Purpose: Animals populations were composed of C57BL/6J mice (Jackson Laboratory, Bar Harbor ME) bred in-house. Using this mouse model, we surgically implanted an intragastric catheter connected to a peristaltic pump. A polyurethane intragastric catheter was custom designed by Norfolk Medical (Access Technologies). The catheter had a 0.6 mm inner diameter with 1.0 mm outer diameter and was 8 cm in length. Infusion tubing was attached to the catheter near the cervical area. The peristaltic pump was controlled locally by a laptop computer with custom-written software. The pump maintained a stomach volume of ~95% VacA for up to 3 days, or ~50% VacA for up to 30 days.

Methods: Histologically, we detected collapse of the apical gastric mucosa and recruitment of submucosal immune cells in VacA infused stomachs. Furthermore, loss of gastric mucus production was observed, and detectable anti-VacA sera antibody titers was observed. VacA was detected within the gastric lumen and was associated with gastric tissue with no apparent disruption to the proximal intestine. VacA induced gastric cell dysfunction while also generating an immune response.

Conclusions: In order to evaluate the physiological importance an individual effector, genetically mutant pathogens incapable of secreting the effector are often used. However, this approach provides insight into the functionality of a pathogen in the absence of an effector, but does not elucidate the direct effects of the factor. Administration of a pure pathogenic effector is technically challenging depending on the natural colonization site and route of exposure. Administration interventions are often invasive and most host organs often clear exogenously received material. There is therefore a need to develop direct and continuous methods to administer a pure pathogenic effector in order to evaluate the role an effector fulfills in a pathogenic infection process. We evaluated an intragastric infusion model using a murine model, and detected evidence that VacA functions in vivo to facilitate persistence of H. pylori within the gastric environment.

Citations: We report the successful development of a long-term intragastric infusion model in mice. As VacA internalizes into early endocytic compartments and ultimately localizes to the mitochondria where it induces mitochondrial dysfunction, our histopathological and immunoassay findings are supportive of our hypothesis. VacA appears to function in vivo to facilitate persistence of H. pylori within the gastric environment.

NOTES
A Novel Surgical Approach: Abdominal Wall Reconstruction Utilizing Pfannenstiel Abdominoplasty, Component Separation, Biological Mesh Underlay, and Biosynthetic Mesh Overlay.

Presenter: Paul W. Cartwright MS IV
Trinity School of Medicine

Background: Abdominal midline incisions in patients with multiple comorbidities often result in large, complex ventral hernias. Recent literature states that up to 40-60% of such patients will eventually develop, in some shape or form, a ventral hernia. Our novel reconstruction focuses to improve such defects by restoring the anatomy and functionality of the abdominal wall. We aim to provide structural support via implantable meshes while optimizing cosmesis and tension forces via abdominoplasty and component separation.

Purpose: This preliminary study followed 11 patients between 2014 - 2017. The surgical technique was comprised of (1) a Pfannenstiel incision and abdominoplasty, instead of the standard midline incision, (2) the implementation of component separation, and (3) the application of Rives-Stoppa technique to implant a retro-rectus biologic mesh in conjunction with an overlay biosynthetic mesh.

Methods: The multi-disciplinary technique was performed successfully in 7 female patients and 4 males with a mean BMI of 37.5. The average follow-up time was 7.5 months without recurrence or mesh infection. The average length of recovery was 3.33 months with high satisfaction rates reported in both general appearance and functionality.

Conclusions: Our primary surgical goal was to decrease post-operative complication and recurrence rates as a means to provide better patient outcomes and satisfaction. We believe by using component separation for adequate fascial approximation, utilizing appropriate underlay and overlay meshes for strength and support, and eliminating excess pannus tissue with a Pfannenstiel abdominoplasty, this dynamic abdominal wall reconstruction may become the mainstay of treatment in such complicated cases.

Citations: In review of six patients with significant comorbidities, our surgical technique has shown no recurrence with minimal post-operative complications. This is an ongoing study with new patient enrollment and continued follow-up as we attempt to understand the long-term sequela and efficacy of this novel procedure.

NOTES
Renal Induced Hypertension with Cardiovascular Telemetry in the Nonhuman Primate

Jon Ehrmann BS, SRS, SRA, LATG
Bristol Myers Squibb

Background: Hypertension affects over 85 million people in the United States alone. If left untreated, hypertension can lead to a heart attack, stroke or other cardiovascular problems. In an effort to study anti-hypertensive compounds, a renal hypertension animal model was developed in the cynomolgus macaque.

Materials and Methods

Hypertension was produced in eight cynomolgus macaques by reducing blood flow to the left kidney by 60% via renal artery stenosis utilizing a Goldblatt clamp. The model was produced by surgically implanting a Goldblatt clamp on the left renal artery. A renal flow probe was then placed in front of the clamp, once a stable reading of blood flow was noted the clamp was tightened to reduce blood flow to the kidney by 60%. The renal flow probe was then removed. During the same surgical procedure, a cardiovascular telemetry device was implanted to allow for continuous monitoring of these animals while on study. The telemetry unit was placed within a pocket on the right side of the abdomen between the transversus abdominus and the internal abdominal oblique muscles. A systemic blood pressure transducer was placed in the abdominal aorta via the femoral artery. A ventricular pressure transducer was placed in the apex of left ventricle of the heart. Additionally, electrocardiogram leads were sutured to the myocardium of the left ventricle and the right side of the pericardium near the base of the heart. This procedure was approved by the site governing Institutional Animal Care and Use Committee.

Results

The procedures discussed above were completed in two groups of four monkeys. In the first group, three of the four monkeys developed hypertension within four weeks of surgery and maintained hypertension for eight months. Several anti-hypertensive compounds were successfully screened using this model. The second group of four monkeys recently underwent surgery. Surgery was successful, and all four recovered well with minor to no post-operative complications.

Conclusion

Renal induced hypertension via a Goldblatt clamp is a well-established and published animal model in several species including the nonhuman primate. The planned presentation will focus on the surgical techniques necessary to create renal hypertension and discuss the implantation of a cardiovascular telemetry device.

NOTES
Shipping Stress in Rodent Surgical Models

Presenter: Jan Bernal DVM
University of North Carolina Charlotte

Background: Pfizer currently outsources the production of many rodent surgical models to vendors for delivery to Pfizer locations. At this time, the only approved method for shipment is by ground courier due to concerns about the impact of shipping stress on the animals. Though every effort is made to limit the animal’s transit time from vendor to Pfizer, it can sometimes take up to four days from origin to destination. Given there is limited published information based upon collection of physiological stress indicators during the shipment, the objective of this study was to evaluate stress in rodents following surgery in relation to time of shipment, mode of shipping, acclimation period evaluation and to assist in establishing guidelines for humane shipping post operatively.

Purpose: Starr_Oddi DST micro-HRT telemetry devices were purchased to evaluate heart rate and temperature in rodents from the time of surgery to delivery and acclimation. Charles River Laboratory preformed the surgeries. Twelve male, 8-10 week, variable weight, CRL CD Sprague Dawley rats were used. Group A (n=6) control data logger implants only. Group B (n=6) had both jugular catheter and data logger implantation. Surgery took place on day 0. Immediately following surgery, daily clinical and behavior assessments were completed. On day 3, a physical exam was preformed and a body weight assessment. The rats were packaged, and shipped from CRL, Raleigh, NC, to Groton, CT. On day 4 the rats were delivered to the Groton site where they were unpacked, physical exam and a body weight assessment, and placed in home cages. Daily log entry was completed to record significant events as well as behavioral observations within the assigned housing room. Body weights were collected at the time of surgery, prior to shipment, and receipt in Groton and on days 7 and 14. On day 14 rats were observed, euthanized, and data loggers were collected.

Methods: The time points evaluated for changes in heart rate and temperature as an indicator of stress were prior to shipment, shipment, arrival and acclimation. In all time points the heart rate of the surgical group (B) were significantly elevated compared to the control group (A). However, the level of increase during shipment was consistent between group A and B; rate of change from baseline was similar for each group respectively. Ambient temperature, crate temperature and animal body temperature were also monitored and analyzed with no significant differences between group A and B at all evaluated time points. Individual animal body temperatures did reflect and correspond to dramatic ambient temperature changes. In addition, behavioral observations (eyes, movement, posture, behavior, body condition, coat condition, respiration, appetite and fecal output, and incision sites) were evaluated daily post operatively and upon arrival at destination facility through the completion of the study. No abnormalities or significant changes were observed or documented between Group A and Group B.

Conclusions: The results of the changes in heart rate during the time points evaluated indicate that the surgical status of the rats did not influence the heart rate during shipping. This study utilized a novel method to collect data during the transportation (shipment) and acclimation period which can be used as a foundation for additional studies to continue to evaluate and refine current shipping practices with regards to rodent surgical models.

Citations: The surgically altered rats displayed an elevation in heart rate during shipment that was identical with the non-surgically altered animals. The response to shipping exhibited was independent of the surgical status.

NOTES
Challenges Faced in Performing a Surgical Study with Immunocompromised Rats

Presenter: Lisa Johnson BA, SR5, RLATg
University of Illinois College of Veterinary Medicine

Background: Due to the requirements for a specific study, we were required to perform a calvarial defect surgery on RNU rats. This posed several challenges stemming from their immunocompromised status, ranging from the need to sterilize the anesthesia equipment to dealing with their smaller size to having to perform a major surgery. This presentation will cover a brief overview of the strain of rat, the challenges we faced, and how we dealt with them. We will also discuss outcomes and welcome any suggestions from the audience.
Short-term Clinical and Oncological Outcomes After Transumbilical Single Incision Laparoscopic Total Mesorectal Excision for Rectal Cancer: A Retrospective Analysis From One Center

Presenter: Zhao Ren MD & PHD
Department of General Surgery, Ruijin Hospital, Shanghai Jiaotong University School of Medicine, Shanghai

Background: We present the largest case number of transumbilical single incision laparoscopic total mesorectal excision for rectal cancer, while assessing its safety and efficacy through reporting postoperative data. Importantly, we analyzed the short-term clinical and oncological outcome, including overall and disease-free survival at a median follow-up of 14 months.

Purpose: From September 2013 to December 2016, 95 rectal cancer patients who underwent transumbilical single incision laparoscopic total mesorectal excision surgery were recruited in the current study. Short-term perioperative clinical parameters and oncological outcomes were observed and all patients were followed up after surgery. Then summarize the preliminary application results.

Methods: 87 operations were accomplished successfully with single incision laparoscopy, 7 patients were converted to multiport approach, and 1 was converted to laparotomy, no diverting ileostomy was performed. The average operative time was 128.5 ± 43.6 min, with an average blood loss of (75.5 - 121.7) ml, the median hospital stay was 10.3 ± 2.1 days. All patients received a RO resection and the surgical margins were confirmed negative in all 87 cases, the median number of harvested lymph node is (18.4 ± 8.9), the specimens met the requirement of total mesorectal excision (TME). There were 3 post-operative complications, no operation-related mortality or postoperative anastomotic leakage was observed. No patient appeared recurrent in a median follow up of 14 months.

Conclusions: Advanced instrumentation and surgical experience had pushed the boundaries of conventional laparoscopic surgery to search for further innovative and minimally invasive procedures in the hope of improving short-term outcomes. In this article, we reported a large retrospective case series of single incision laparoscopic TME. Our experience revealed that SILS TME has similar short-term clinical outcomes when compared to similar single incision laparoscopic rectal surgery, and our results also show satisfactory oncological outcomes of single incision laparoscopic TME surgery.

Citations: In conclusion, this study showed that performing single incision laparoscopic total mesorectal excision surgery for rectal cancer is a feasible and safe procedure. Rectal cancer patients received TME through SILS approach is still new, and should be performed in selected patients by experienced colorectal surgeons.

NOTES
Intraoperative Carbon Nanoparticles Imaging in Secondary Total Thyroidectomy for Recurrent Thyroid Nodules: Results of a 5-Criterion Case-Match Study

Presenter: Qiu Wei
Rui Jin Hospital, Shanghai Jiao Tong University School of Medicine, Shanghai, China, 200025

Background: Due to the existed various extents of adhesion in the remnants of the thyroid and neck muscles, in addition to anatomical variations between the thyroid glands and RLN (recurrent laryngeal nerve) and parathyroid glands, secondary total thyroidectomy for recurrent multinodular goiter is considered as a complicated and high-risk procedure. To evaluate techniques of secondary total thyroidectomy with intraoperative carbon nanoparticles (Cns) imaging regards to safety and efficacy in patients with recurrent multinodular goiter after primary subtotal thyroidectomy.

Purpose: A case-matched analysis of a prospectively maintained database to compare perioperative outcomes in primary total thyroidectomy versus secondary total thyroidectomy with intraoperative Cns imaging was performed. Criteria included disease process, operative procedure, RLN/the parathyroid glands exploration, pathological results, and complications. 42 cases exact matches for all criteria were found between 159 primary total thyroidectomies and 32 secondary total thyroidectomies. These patients underwent secondary total thyroidectomy after a former subtotal thyroidectomy due to the recurrence of thyroid nodules or suspicious malignancy. With intraoperative Cns imaging, the residual glands were initially located by separating the gap between the anterior side of sternocleidomastoids and the lateral side of sternohyoids. Not all the residual glands should be completely exposed at the first exploration, and trace revelation of thyroid gland was enough for whole residual glands imaging. Partial exposure would be safer and easier by avoiding unnecessary dissection of RLN, the parathyroid glands and other important tissues. Even still in adhesion, the residual glands, surrounding lymph tissue, and level VI of lymph nodes could be fully imaged black. The parathyroid glands were then visibly different from the thyroid gland and lymph nodes. With intraoperative Cns imaging, RLNs and the parathyroid glands could be easily protected by meticulous dissection around the thyroid gland.

Methods: 18 patients enrolled in the current study possessed thyroid cancer. The RLNs were successfully identified in all patients. Partial fibers of the RLN were accidentally injured in two cases at the plane where the RLN enter the larynx, but there was no permanent vocal cord dysfunction. Three patients presented with transient hypocalcemia but had total recovery shortly after oral or venous calcium supply. One patient with parathyroid auto-transplantation received a long-term oral calcium replacement and the symptoms gradually remitted after one year.

Conclusions: There was longer mean operation time in secondary total thyroidectomy. There were statistically significant differences in complications, such as transient hoarseness and transient hypocalcemia, between primary and secondary total thyroidectomy.

Citations: The intraoperative CNs imaging, adequate understanding of the jugular anatomy and careful manipulation during surgery will minimize the incidence of complications like RLN palsy and hypoparathyroidism.

NOTES
Refinements in Aeration Techniques to Reduce Potential Exposure to Ethylene Oxide (EtO) Post Sterilization

Presenter: Adam J. Murphy BS, CVT, LAT
Pfizer

Background: The following details methods used to maintain employee exposure to EtO far below applicable OSHA limits during unloading of sterilized supplies. This is valuable in helping to reduce unnecessary employee EtO exposure during the conduct of EtO sterilization.

Purpose: This abstract communicates refinements implemented to reduce potential employee exposure to EtO. A literature search failed to reveal new safety recommendations despite technological advancements. The EtO sterilizer is maintained and used in accordance with manufacturer directions, state and local codes and per IACUC guidelines. Supplies sterilized via this method are used in animal related procedures. We used an EtO sterilizer, Passive Diffusion Monitors and an AIHA accredited testing laboratory. Monitors were placed at different intervals and locations during the sterilization process to monitor EtO levels.

Methods: The EtO sterilizer manufacturer recommended that aeration guidelines should originate from the manufacturer of the item(s) being sterilized. This is based upon the material’s composition. Upon completion of the initial aeration, we found there remained the potential for the user to unload supplies and still be exposed to residual EtO not been completely aerated or ventilated. Items could be theoretically removed in as soon as 2.75 hours on a warm cycle (55 degree Celsius). Per OSHA guidelines, EtO exposure may not exceed 1 ppm (parts per million) measured as an 8-hour time weighted average (TWA). Similarly, EtO exposure may not exceed 5 ppm EtO typically measured over a 15-minute sampling period (STEL-Short Term Exposure Limit). By increasing the recommended aeration time to 16 hours with additional 60-minute local exhaust aeration prior to unloading, employee exposures were decreased up to 80% and airborne levels lowered by at least 50%. These levels are at or near the detection limit of the analyses. While employee exposure is far below the applicable OSHA limits, we strive to maintain this additional level of control to reduce potential unnecessary exposure as EtO is an identified carcinogen.

Conclusions: With current parameters, continually adjusted as necessary, we have significantly reduced potential unnecessary employee EtO exposures and airborne levels present during the unloading of a completed sterilization cycle. Working with site Environmental Health and Safety and engineering groups, we maintain a higher room hourly air change than other procedure rooms and a strict EtO monitoring and control policy. We conduct personal and area EtO monitoring after routine service, in the event of a machine malfunction, or after the response to an unusual monitoring result. Increased aeration times have improved on original manufacturer control recommendations for the sterilizer operation.

Citations: With efficient process time management, we can sterilize supplies while maintaining EtO exposures and airborne levels at or near analytical detection limits, far below occupational health limits. We schedule sterilization cycles to accommodate study timelines and adhere to internally developed recommended aeration times to maintain staff safety.

NOTES
Practical Aspects of Bleeding Time Assessments

Presenter: Jennifer Sheehan
Envigo

Background: Bleeding time (BT) assessments are often used to determine the potential of novel anticoagulants to cause bleeding prolongation. This is done in an effort to assess their liability to cause major bleeding events in the clinic. There are many methods described in literature, but surprisingly few papers deal with the methodology for BT assessment in the non-human primate (NHP). This presentation will describe the development and validation of a BT assessment model in NHPs using both skin template BT as well as internal organ injuries.

NOTES
Glucose Telemetry Surgery in Rodents

Kathryn Nichols, MS, SR5
Data Sciences International

Our team has developed an optimized surgical approach for a fully implantable chemical sensor that provides continuous intravascular glucose measurements in rodents. While we have extensive experience with the placement of intravascular pressure-sensing catheters, the use of a chemical sensor was novel to our team. Our objective was to develop a successful surgical technique that provided continuous glucose measurements, was accessible by trained rodent surgeons, and caused minimal complications. Goals included protecting the sensor from damage, maintaining vascular patency and avoiding damage to the vessel and eliminating negative sequelae. The constraints included a fixed sensor length, an intravascular sensor with less flexibility than a pressure catheter with a connector piece to a flexible lead, and the presence of a separate reference electrode in the rat module. The final recommended surgical procedures for both rats and mice will be detailed.

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A Novel Surgical Approach: Abdominal Wall Reconstruction Utilizing Pfannenstiel Abdominoplasty, Component Separation, Biological Mesh Underlay, and Biosynthetic Mesh Overlay.

Presenter: Paul W Cartwright MS IV
Trinity School of Medicine

Background: Abdominal midline incisions in patients with multiple comorbidities often result in large, complex ventral hernias. Recent literature states that up to 40-60% of such patients will eventually develop, in some shape or form, a ventral hernia. Our novel reconstruction focuses to improve such defects by restoring the anatomy and functionality of the abdominal wall. We aim to provide structural support via implantable meshes while optimizing cosmesis and tension forces via abdominoplasty and component separation.

Purpose: This preliminary study followed 11 patients between 2014-2017. The surgical technique was comprised of (1) a Pfannenstiel incision and abdominoplasty, instead of the standard midline incision, (2) the implementation of component separation and (3) the application of Rives-Stoppa technique to implant a retro-rectus biologic mesh in conjunction with an overlay biosynthetic mesh.

Methods: The multi-disciplinary technique was performed successfully in 7 female patients and 4 males with a mean BMI of 37.5. The average follow-up time was 7.5 months without recurrence or mesh infection. The average length of recovery was 3.33 months with high satisfaction rates reported in both general appearance and functionality.

Conclusions: Our primary surgical goal was to decrease post-operative complication and recurrence rates as a means to provide better patient outcomes and satisfaction. We believe by using component separation for adequate fascial approximation, utilizing appropriate underlay and overlay meshes for strength and support, and eliminating excess pannus tissue with a Pfannenstiel abdominoplasty, this dynamic abdominal wall reconstruction may become the mainstay of treatment in such complicated cases.

Citations: In review of six patients with significant comorbidities, our surgical technique has shown no recurrence with minimal post-operative complications. This is an ongoing study with new patient enrollment and continued follow-up as we attempt to understand the long-term sequela and efficacy of this novel procedure.
Rat Myocardial Infarction

Presenter: Brad Gien BSc  
Envigo

Background: To learn, train and become proficient with a rat surgical model of myocardial infarction.

Purpose: The purpose of this project was to become proficient and improve the surgical outcome on a rat permanent ligation myocardial infarction model while looking for ways to improve the quality of the surgery.

Methods: This project was initiated when poor model quality and animal welfare concerns with the current surgery were observed. Data was gathered from the previous year’s studies, involving rats with permanent ligation myocardial infarction surgery. The percent of animals that met study acceptance criteria was an unacceptable 51%. The standard deviations of the infarct size and ejection fraction measurements were out of acceptable ranges. When necropsies were completed on the animals in the study, it was observed that the surgery had caused moderate to severe adhesions of the pericardium, lung, heart and chest wall as well as lung damage. Our goal was to achieve 80% or greater study enrollment and little to no adhesions or lung damage in any animal. Since the model originated from papers around 1954 we started the surgery training and improvement project using published papers. Once we identified the potential weaknesses in the current surgical protocol we redesigned and wrote an updated protocol. Identified and purchased the required surgery instruments and began training with surgery technicians who had several years of experience in this particular surgical model. After spending a week working with the more experienced surgeons for this model we returned to our lab and began practicing on our own. We monitored progress and technique through pictures, videos, echocardiography and necropsies.

Results and Discussion: After three months of working with the new surgical protocol, we achieved all of the goals set for this surgery project. Initially we had several issues with lung damage, adhesions and a variable infarct size. As our technique improved, with increased experience and practice, we observed a decrease in adhesion and lung damage. Our animal survival post-surgery increased from 60% to over 85%. We continued to practice and our standard deviation for infarct size and ejection fraction stabilized. Currently we have an average ejection fraction measurement of 31% with a standard deviation of 1.5%. Our adhesions have been minimal and lung damage has been eliminated on all surgeries. Our surgery time per animal has decreased as well which has improved recovery times from 5-7 days to 3-5 days with most animals showing normal behavior after 72 hours post-surgery.

Conclusion: Regular review of surgery procedures before beginning training or development can reduce the time to successfully complete training on a new model. It helped us identify faults in the current surgery protocol and to develop the model faster without making the same errors that others have already made. This was a very exciting project because we were able to collaborate with a surgical team from another company demonstrating that best practice surgery training, development, expertise, and information sharing can benefit research model development.
The Efficacy of Radiofrequency Ablation in the Management of Liver Tumors

Presenter: Ahmed Najjar - Medical Student
King’s College London

Background: Objectives Hepatocellular carcinoma (HCC) is currently the 2nd most prevalent cause of death from cancer worldwide, with prognosis for HCC generally remaining very poor. In addition, the efficaciousness of Radiofrequency Ablation (RFA) versus resection for HCC are relatively unclear.

Purpose: Primary objectives of this review were to assess 1-, 3- and 5-year overall and recurrence free survival in studies looking at the efficacy of RFA versus other accepted therapeutic modalities for the treatment of HCC. New evidence has also emerged regarding the efficacy of RFA in comparison with Percutaneous Cryoablation (PCA), Laser Ablation (LA) and Percutaneous Ethanol Injection (PEI), which are explored in this review.

Methods: A review was assembled in accord with the guidelines presented by the Cochrane handbook for systematic reviews of interventions and the PRISMA statement. Included in this review are 16 trials, with 2602 participants included. Comparative studies assessing RFA with Surgical resection, Microwave ablation (MWA), PEI and PCA that fulfilled the inclusion criteria were selected.

Results: A total of 16 studies matched the inclusion criteria, with 2602 participants. Four Randomized Control Trials (RCT’s) were identified comparing resection and RFA, generally study outcome homogeneity was observed in stating that RFA is similar to standard surgical resection in terms of efficacy and long-term survival, however resection remains the most preferable option. Six RCT’s were found comparing RFA and PEI (and Percutaneous Acetic Acid Injection (PAI), all 6 trials presented evidence supporting the superiority of RFA, with improved overall survival.

Conclusion: Currently EASL and EORTC guidelines indicate that the therapeutic of choice in patients unsuitable for resection is RFA, and if RFA is not feasible than PEI is the next most preferred therapeutic. No evidence found in this review poses any serious challenges to the current guidelines, however evidence supporting PEI as a great alternative for RFA has developed.
Intravenous Fentanyl Citrate Exposure in Telemetered Rabbits

Presenter: Michael S Horsmon MS SRS
US Army Edgewood Chemical Biological Center

Background: Available literature in reference to common opioid compounds typically report therapeutic dose ranges since doses above this are of no clinical value. However, with the increased incidence of opioid abuse in the general population, knowledge as to the precise systemic effects of high doses of opioid compounds is valuable. The establishment of an animal model to evaluate novel therapeutics for opioid intoxication is similarly important. The present study describes a range finding investigation resulting in derivation of an intravenous LD50 for fentanyl citrate from a modified up and down dosing paradigm in telemetered rabbits.

Purpose: Six New Zealand White rabbits (2.8-3.6kg) were implanted with a single telemetry device capable of monitoring electrocardiogram, blood pressure, respiratory rate and volume, body temperature and overall activity. Three of these 6 rabbits received a second implant which was utilized to monitor electroencephalogram (EEG) with two electrodes. Blood pressure, respiratory parameters, body temperature and animal activity were analyzed with the Ponemah Physiology Platform (v 5.2). Electroencephalograms were analyzed with Neuroscore (v 2.1), electrocardiograms were analyzed with Rhythm Express AE1010 (v 1.6.39.14). Since this study was assessing the toxicity associated with opioid exposure, opioid pain management was not an option pre or post-surgery. Rather, NSAID pain management (meloxicam) was utilized post surgically, and found to be sufficient.

Methods: Intravenous (marginal ear vein) doses of fentanyl citrate ranged from 0.03 - 1.59 mg/kg and the calculated LD50 was 0.63mg/kg. Lower doses (0.03, 0.06, and 0.16 mg/kg) resulted in mild to moderate physiologic signs of intoxication including moderate respiratory depression, decreased EEG activity with initially increased spike detection followed by suppression, bradycardia and delayed mild hypotension. Most of these signs resolved within 15-30 minutes. Higher doses (0.32, 0.80, and 1.59mg/kg) resulted in profound respiratory depression, EEG depression and bradycardia, resulting in severe hypotension and death.

Conclusions: Given that ultra-potent opioids of the fentanyl class are becoming more common in the general population an evaluation of risk for users and first responders should be conducted. The relevant route of exposure for users is typically IV, however first responders may be exposed through dermal and inhalation routes. The present model has established a relevant baseline of physiologic responses to high dose opioid intoxication. Since the toxicological sequela is likely to be different with respect to route of administration, a comprehensive model such as this is key to better understanding risk and defining an appropriate treatment for incidental and intention exposure. A point of concern for this model was the inability to use opioid pain management following surgery as it may have confounded our results due to potential development of tolerance. We found that animals recovering from these surgical procedures and maintained on NSAID therapy score similarly on post-surgical monitoring records as do animals receiving transdermal fentanyl for 72 hours post- surgery.

Citations: The present study demonstrates the utility of obtaining multiple physiologic endpoints from a single animal and serves as a baseline for comparison with investigations involving similar opioid compounds.
The Benefits of RFID in Surgical Procedures – Improving Efficiency, Quality and the 3R’s During Surgery to Provide Better Animals Models for Researchers.

Presenter: Brad Gien BSc
Envigo

Background: Monitoring surgery outcomes is an important part of a surgery lab. Documenting and working on improvement, surgery model, procedures or surgeon, is key to maintaining the 3 R’s, reduction, refinement and replacement. We complete over sixty thousand surgeries per year so monitoring quality and efficiency in a paper-based system leaves us with a lot of extra data entry and delays recognition of issues. We looked for an easy to use program that could monitor individual animal, surgical procedures, surgeon success/failure, and surgeon efficiency.

Purpose: At first we were looking to advance efficiency, quality, and the 3R’s, while providing a better model to the researcher. As the project progressed, we realized it would allow identification of any surgeon training deficiencies as well as surgical models that required improvement.

Methods: We contacted an RFID microchip supply company who had years of experience with lab animal surgery and knowledge of the industry. Initially we purchased RFID microchips, readers and tried to use excel and self-created databases for electronic data collection. Because of the unique nature of our business and the volume of surgery completed, this option did not prove to be more efficient than what we were currently doing using pen and paper. Working with the chip supplier, we provided to them all the information we would like to collect. We wanted to monitor the animal from the time it entered surgery until the time it left surgery, keeping track of everything that happened to that animal including weights, analgesic given, anesthesia, length of anesthesia, length of surgery procedure, recovery, health checks and monitoring and which staff member completed them. Another unique challenge was making it easy enough for surgery and support technicians to use and comply with, as well as working in an aseptic environment. To help with ease of use we were able to automate the weighing of animals as well as make large icons on a medical touch screen monitor. The surgeons could record all the data from the surgery procedure using receivers that did not require them to break from the aseptic surgery field and wristbands under their surgery gowns with their own personal identification microchip. This data was collected in a database and we were able to pull data hourly, daily, weekly or at any interval.

Conclusions: Using this new surgery application we have been able to increase efficiency, monitor and identify surgeon success and retraining needs. We have been able to provide a complete history on what the animal received for analgesics, anesthetics and when they received them. We can also monitor animal checks, when they occurred and any recurring issues that appear post-surgery. With all of this data, we have improved training, efficiency, identification of surgery issues and procedural problems. We can also identify highly successful surgeons and use them to train our new staff as well as staff that may be having issues with certain surgeries.
Evaluation of Two Surgical Models of Renal Failure in the Mouse: 3/4 and 5/6 Nephrectomy

Presenter: Andree Lapierre BS, CMAR, SR5
The Jackson Laboratory

Background: An established surgical model of renal failure in the mouse is the 5/6 nephrectomy. To reduce morbidity and mortality this model requires a mouse to undergo two surgical procedures, a unilateral nephrectomy with a subsequent 2/3 nephrectomy of the contralateral kidney. Typically the two procedures are separated by a one-week recovery period. A potential refinement to this renal failure model is a 3/4 reduction in renal mass conducted as a single surgical procedure. The use of a 3/4 nephrectomy mouse model has been reported in the literature as well tolerated however direct comparison of renal function with the 5/6 nephrectomy model is lacking. The objective of this study was to evaluate these two surgical models of kidney failure. Five groups (n=12) of C57BL/6J male, mice at 4 and 8 weeks post-surgery were evaluated. The groups consisted of Group A: 3/4 nephrectomy surgery in one setting; Groups B: 5/6 nephrectomy surgery in two procedures (nephrectomy followed by partial nephrectomy); Group C: 5/6 nephrectomy surgery in two procedures (partial nephrectomy followed by nephrectomy); Group D: sham surgery in two procedures; and Group E: no surgery. Mice were anesthetized with isoflurane gas anesthesia and analgesics were administered (carprofen subcutaneously and bupivacaine topically). Mice undergoing two surgical procedures had a one-week recovery period between the procedures. For the partial nephrectomy procedure both poles of the kidney were excised leaving a 4 mm remnant for the 3/4 model and a 3 mm remnant for the 5/6 nephrectomy. Body weight, kidney weight, blood and urine samples were collected pre-operatively and at 4 and 8 weeks post-operatively. Data from this study demonstrate that mice in the 3/4 nephrectomy group had lower blood urea nitrogen and serum creatinine with a higher urine creatinine and kidney to body weight ratio than mice in the 5/6 nephrectomy groups. These results are consistent with a more severe compromise to renal function in the 5/6 nephrectomy surgical model of renal failure.
Post-Surgical Self-Mutilation in Rabbits Associated with Intermingling of Unfamiliar Conspecifics

Presenter: Chelsea Kotlowski RLATg
Exct Inc.

Background: Post-Surgical Self-Mutilation in Rabbits Associated with Intermingling of Unfamiliar Conspecifics
Kotlowski, C., Williams, C., Roe, S., Metcalf Pate, K., Feasel, M., Horsmon, M.

Purpose: Following abdominal surgery, self-mutilation was observed in the form of opening the midline skin incision in 33% of rabbits undergoing telemetry implantation surgery. Rabbits were housed in one of two ways: only with animals from the same shipment, or with animals from two separate shipments. This behavior has not been observed in previous studies. Following extensive review of surgical and pain management procedures, we hypothesized that the intermingling of conspecifics from different shipments led to elevated social stress in rabbits during recovery from surgery. Retrospective analysis revealed that co-mingling animals from separate shipments is associated with increased post-surgical self-mutilation.

Methods: Naïve male New Zealand White rabbits (O. cuniculus), aged 5-6 months, were housed in a room containing rabbits that arrived in the same shipment (group A; n=9) or intermingled with rabbits from other shipments (group B; n=15) during the surgical recovery period. Anesthesia were induced via intramuscular injection of ketamine (45mg/kg) and xylazine (6mg/kg). After induction, cefazolin (20mg/kg) was administered via intravenous injection and buprenorphine (0.05mg/kg) was administered via subcutaneous (SQ) injection. Laparotomies were performed to install telemetry units to collect electrocardiogram and blood pressure measurements. All muscle and skin incisions were closed using absorbable suture and the midline incision was splash-blocked with 0.5% bupivacaine prior to closure. Post-operative pain management was achieved using meloxicam (0.2mg/kg) administered SQ once a day for up to three days.

Results/ Discussion: In group A, self-mutilation occurred in 1 of 9 animals during the post-operative recovery period; however, in group B, self-mutilation was observed in 7 of 15 animals. After careful scrutiny of variables such as surgical and aseptic techniques, animal handling, and post-operative pain management, no changes or abnormalities in these procedures were identified between the two outcome groups.

Conclusion: These data suggest that a primary factor contributing to the marked increase in post-surgical self-mutilation may be the presence of unfamiliar conspecifics. Additionally a review of previous studies, involving similar surgical procedures, reviled self-mutilation in less than 10% of cases. In all of those cases co-mingling of shipments did not occur. It is likely that a substantial reduction in self-mutilation may be achieved by housing shipments of rabbits separately from other shipments.
Increase in Plasma Cardiac Troponin I Following Intravenous Administration of Fentanyl at a Recommended Therapeutic Dose in Gottingen Minipigs

Presenter: Nicole Vincelli MS, LATg
US Army, Edgewood Chemical Biological Center

Background: Fentanyl is commonly used to provide analgesia and may also be used as an adjunct to anesthesia in surgical protocols in swine. We recently conducted a study in which fentanyl citrate was administered at a recommended therapeutic dose of 50 µg/kg intravenously (IV) and found that this dose resulted in an increase in plasma cardiac troponin I (cTnI) above the average baseline range for this breed. This increase in plasma cTnI was not observed when fentanyl citrate was antagonized by naloxone.

Methods: Six intact male Gottingen swine were surgically instrumented with D70-CCTP telemetry units. To facilitate dosing and blood collections, an indwelling jugular vein catheter (12Fr dual-lumen) was placed in the right exterior jugular vein and exteriorized at the dorsal aspect of the neck, cranial to the scapulæ. D70-CCTP units were placed in a subcutaneous pocket on the left side of the neck, between the jaw and shoulder. The pressure catheter was utilized to acquire blood pressure from the left exterior carotid artery. Two biopotential leads were utilized to acquire an electroencephalogram and two biopotential leads were placed in a Lead II configuration to acquire an electrocardiogram. Body temperature and overall activity were also acquired. Three animals were administered fentanyl citrate at 50µg/kg centrally via the indwelling JVC and 3 animals were administered the same dosage peripherally via an auricular vein. Blood was collected at 8 time-points following IV administration and analyzed using cTnI iStat cartridges. Additionally, a group of 4 animals were prophylactically administered naloxone IV followed by fentanyl citrate.

Results: Baseline plasma cTnI values were 0.00 – 0.02 ng/mL for all 6 animals with 5 animals showing an increase in plasma cTnI levels above the average baseline upper limit (0.079 ng/mL, 99th percentile) by 240 minutes post administration, independent of administration route. Histopathology analysis of the cardiac tissue from these animals indicated an infiltration of mixed cells for 2 of the 6 animals. A separate group of 4 animals were administered a prophylactic dose of naloxone and did not have an increase in plasma cTnI above baseline values following IV fentanyl administration.

Conclusion: Cardiac troponins have become the method of choice in clinical practice for serving as the most reliable and translatable clinical measurement of myocardial injury. While the primary objective of this study was not to investigate the cardiac effect of therapeutic fentanyl administration, it was an interesting, unanticipated finding. Further research is recommended to determine if a clinical cardiac risk is associated with this dosage in swine.
Surgical Refinement of a Long Term Telemetry Model for Electroencephalogram (EEG) in the Non-human Primate.

Presenter: Ashleigh Bone
Merck & Co. Inc., Kenilworth, NJ, USA

Background: Telemetry devices have been used for years to collect physiological data from conscious animals. As technology has improved for data collection, improvements to the surgical model merit evaluation. We investigated an approach to refining the surgical procedure without compromising the signal quality by evaluating the length of screws used to secure the lead wires in the skull.

Purpose: In our 14 year history with this model we have placed the screws so they penetrate into the skull cavity and touch the dura. This is an invasive procedure that can result in complications such as infection, localized osteodystrophy with loose screws, and traumatic injury to the brain. Additionally, it is considered a major surgery and the number of holes drilled is limited by the IACUC protocol. In an effort to assess the feasibility of effectively minimizing the degree of invasiveness, we designed a pilot surgery using two different stainless steel screw types (McMaster-Carr 2-56 and Plastics One 0-80) and three different screw lengths (6.3mm, 4.8mm and 1.6mm). These three lengths give three options: penetration through the skull touching the dura, just to the depth of the inside of the skull and into the bone of the skull not penetrating the cavity. One Rhesus macaque was implanted with a Data Science International D-70 telemetry device and the three sets of paired leads were each placed on one type of screw. The screws were placed using stereotaxic coordinates in two triangular patterns (one in front and one behind bregma) so the vectors across the leads would be similar. The ground lead was placed caudal and lateral to the leads using the Plastics One 0-80 4.8mm screw.

Methods: After post-operative recovery period the signals were evaluated using custom software to visualize changes in raw amplitude and in frequency power spectral density. There was not a remarkable difference in signal quality from the depth of the screw.

Conclusions: The significance of this finding is that the skull cavity doesn’t need to be penetrated for signal quality so the brain is not disturbed, this mitigates the risk of surgical complications and the surgery is considered minor.

Citations: The future implication would be the potential to place more leads on the skull to read more EEG signals to provide a more robust and clinically translatable picture to the investigators.
Osseointegration with PEKK 3D Technology in an Ovine Bony Defect Model

Presenter: Rasa Zhukauskas MD
RTI Surgical Inc.

Background: A comparative study to better understand in vivo osseointegration with smooth surface PEKK, titanium-coated rough PEKK and PEKK 3D Technology (TETRAfuseTM) was performed in an ovine bony defect model. 3D printed PEKK implants were designed with nano/micro scale surface features to promote osseointegration.

Purpose: Surgical procedure was performed under general anesthesia and pre- operative dose of NSAIDs (Carprofen 4.4mg/kg IM injection), and antibiotics (Ceftiofur 1.1–2.2 mg/kg) following an IACUC approved protocol (T3 Labs). After surgical preparation, a 3-4 cm skin incision was made perpendicular to and centered on the medial aspect of the distal femoral condyle. The soft tissues adjacent to the medial collateral ligament (MCL) were carefully dissected to allow visualization of the MCL. Defects were created using a custom made drilling guide. Total of six cylinder shaped (6 x 30 mm) implants per group (3 for push out and 3 for histomorphometry), per time point, were randomly placed into distal femora of six sheep bilaterally for 8 and 16 weeks. After irrigation, soft tissues were closed using 2-0 absorbable suture and sealed using liquid cyanoacrylate glue, followed by application of antibacterial ointment (e.g. Nitrofurazone). Implant placement was verified using fluoroscopy. Micro CT, CT and MRI were performed. Periprosthetic Bone Area (% PBA), Appositional Bone Index (ABI), fibrosis and immune response were evaluated using Scanning Electron and light microscopy. Peak force (N) values were obtained from push-out test.

Methods: All animals survived to the end points. Minor complications of eye infection and non-infectious swelling over the implants were treated with antibiotic ointment and NSAIDs respectively. During necropsy subdermal fibrosis was noted over the implants at 8 weeks and one implant extruded above surrounding bone. Microscopy demonstrated new viable bone surrounding all implants. Bone area increased by 8 weeks and stabilized thereafter. Bone apposition significantly increased to 3D PEKK and ti-coated PEKK but decreased to smooth PEKK implants by 8 weeks. Excellent osseointegration was achieved with 3D PEKK and ti-coated PEKK implants. Smooth PEEK showed “spot welding” osseointegration with limited mechanical interlock due to interposing fibrosis. 3D printed topography of PEKK implants allowed for progressive bone growth beyond 8 weeks. Push-out strength significantly increased with 3D PEKK (1600%) and ti-coated PEEK (2100%) on average (p<0.05, ANOVA) by 16 weeks when smooth PEEK showed no overtime increase.

Conclusions: This study was able to demonstrate differences between materials and surface topographies. 3D PEKK and ti-coated PEEK implants showed superior osteoconductivity and overtime osseointegration when compared to smooth PEEK. 3D PEKK surface allowed for bony ingrowth instead of bone apposition as with other two surfaces. However, the average peak force was higher with ti-coated PEEK than 3D PEKK. For better understanding of push-out outcome more investigation is needed.

Citations: Osteoconductive properties of 3D PEKK and rough titanium coating were similar but superior to smooth PEEK. Although periprosthetic repair was similar with three types of implants, superior osseointegration occurred with rough or 3D printed surfaces. 3D printed surface allowed deeper bony ingrowth over the rough surface.
Novel, Minimally Invasive, Pericardial Toxin Administration for the Development of Heart Failure in Swine

Presenter: Jay Budrewicz ScM, LATg, SRT CBSET

Background: Due to the growing population of adult cancer survivors, there is a dramatically increasing patient population developing heart failure (HF) as a result of the cardiotoxic effects of chemotherapy, such as the anthracycline-based regimen.

Purpose: A simple and reliable large animal cardiotoxicity HF model created through clinically relevant cardiotoxic mechanisms is necessary for testing novel pharmacologic, cell/tissue-based, and device therapies. Specifically, size and anatomy of the large animal cardiovascular system is ideal for the purpose of testing interventional cardiology medical devices. Current large animal models of toxin based HF have resulted in systemic toxicity or require invasive surgical procedures. Here we describe a minimally invasive approach for local administration of anthracycline chemotherapy into the pericardial cavity for developing a cardiac specific, toxin-based HF model in swine.

Methods: Two juvenile Yorkshire swine were administered different doses per body mass (30mg/m2 and 3mg/m2) of a doxorubicin hydrogel. The toxin was serially delivered, percutaneously through the sub-xiphoid region, into the pericardial cavity. The doxorubicin hydrogel was formulated to be aqueous during delivery and viscous at body temperature to remain in the pericardial cavity following weekly administrations. Sheath insertion, catheter placement and hydrogel mixed with contrast solution delivery were performed percutaneously under fluoroscopy, to confirm placement and delivery within the pericardial cavity. Transesophageal echocardiography, histological data and general health data were collected to evaluate the effects of the toxin.

Results and Discussion: The use of fluoroscopy was successful in confirming the delivery of the hydrogel to the pericardial cavity during all serial administrations. The animal that received the 30mg/m2 dose acutely displayed clinical observations (dyspnea, wet cough, poor appetite and reduced activity) that prevented it from surviving for more than two administrations or reaching the intended 42 day time point. Left ventricular ejection fraction decreased from 56 to 23% over the duration of the treatments. At necropsy gross observations of pericardial effusion was observed. Histological observations of the left atrium showed evidence of fibrous exudates in the pericardium. The myocardium of the left atrium there was a zone of superficial myocardial pallor-degeneration. The animal that received the 3mg/m2 dose did not exhibit any signs of doxorubicin induced HF and survived to its scheduled time point without evidence of heart failure.

Conclusion: A minimally invasive approach for local administration of doxorubicin into the pericardial cavity was developed as a means to generate a chronic model of toxin based HF in swine. The results indicate the model shows promise; however, the dosing regimen requires further optimization. The 30mg/m2 dose resulted in off target cardiotoxicity, described as pericarditis/epicarditis combined with pericardial effusion resulting in right sided heart failure. Histological findings of myocardial degeneration were similar to those seen in previously described large animal anthracycline cardiotoxicity models, although degeneration was limited to the outermost portion of the myocardium. The 3mg/m2 dose did not result in significant cardiotoxicity.
Benecol® as a Component of Liquid Diet in Swine

Presenter: Misty Williams-Fritze DVM, MS, DACLAM
CBSET, Inc.

Background: Swine are commonly utilized in research of the gastrointestinal tract (GIT), where unobstructed access to the upper or lower GIT is necessary for biomedical device evaluation. Studies may require the target area in the GIT be devoid of ingesta or that the animals receive nutrition via feeding tubes directly into the stomach rather than consumed per os. We regularly use a liquid diet developed by our facility, however, recent introduction of models to our institution studying the upper GIT has necessitated modifications to the liquid diet. Nestlé Benecol® is a low volume, high protein, calorie-dense, soluble supplement intended for people in need of concentrated nutrition. Our aims were threefold: (1) decrease the total volume of liquid diet fed to swine (intended to be administered via percutaneous endoscopic gastrostomy (PEG) tube), while maintaining caloric and nutritional requirements for growing animals; (2) provide a diet that was palatable, yet clear in color; and (3) remain cost-effective and efficient in terms of technician time for diet preparation and feeding.

Purpose: Animals were sedated with Telazol (2.2 mg/kg IM) and maintained on isoflurane anesthesia (1-5%) for one of three procedures (esophageal implant, colon resection and anastomosis, or Nissan fundoplication). Liquid diet formulated to contain Benecol® was utilized in 3 different studies (2 evaluating the upper GIT and 1 looking at the lower GIT; n=11 swine). Duration on diet ranged from 3 to 8 weeks, depending on the type of surgical procedure the animals underwent. Liquid diet was prepared in-house using commercially available ingredients, readily consumed by animals, and cost-effective for our institution in feeding large, growing animals long-term.

Methods: Animals on all 3 studies maintained or gained weight compared with their own baseline body weights and against growth charts provided by the animal vendors from which they were acquired.

Conclusions: Animals on all 3 studies maintained or gained weight compared with their own baseline body weights and against growth charts provided by the animal vendors from which they were acquired.

Citations: The use of Benecol® as a component of a liquid diet has significantly improved our ability to offer a calorie-dense diet in liquid form, and thus maintain positive animal welfare and nutritional status of growing swine, while ensuring study goals are met.
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