The 26th Annual Meeting
of the
Academy of Surgical Research

September 30 - October 2, 2010
Clearwater Beach, FL – Sandpearl Resort

The 26th Annual ASR Meeting will include presentations on new and refined methods and materials used in preclinical and clinical surgical investigations, as well as new procedures that will enhance the attendees’ fields of scientific and surgical research. Renowned academic and industry experts will share cutting-edge surgical concepts, research, and techniques, thereby fostering an interdisciplinary transfer of ideas and theories in experimental surgery.

Learn about surgical research and surgical challenges in areas including

- Organ transplant surgery
- Long-term vascular access/infusion
- Medical device implantation/surgical/orthopedic models
- Surgical techniques
- Surgical research
- Cardiovascular surgery
- Minimally invasive surgery (MIS)

Meeting attendees will have the opportunity to engage in dialogue with speakers and presenters, colleagues and friends. This meeting will offer diverse scientific content that will promote and encourage the advancement of the field of surgery.
### Annual Meeting Overview

#### Registration Hours

<table>
<thead>
<tr>
<th>Days</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thursday, September 30</td>
<td>7am - 5pm</td>
</tr>
<tr>
<td>Friday, October 1</td>
<td>7am - 5pm</td>
</tr>
<tr>
<td>Saturday, October 2</td>
<td>7am - 12pm</td>
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</tbody>
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#### Wednesday, September 29

<table>
<thead>
<tr>
<th>Time</th>
<th>Events</th>
</tr>
</thead>
<tbody>
<tr>
<td>2pm-5pm</td>
<td>ASR Board Meeting</td>
</tr>
</tbody>
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#### Thursday, September 30

<table>
<thead>
<tr>
<th>Time</th>
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</tr>
</thead>
<tbody>
<tr>
<td>7am</td>
<td>Busses depart hotel. Breakfast provided</td>
</tr>
<tr>
<td>8am-12pm</td>
<td>ASR Examinations</td>
</tr>
<tr>
<td>8am-12pm</td>
<td>Wet Labs</td>
</tr>
<tr>
<td>- Catheter-based Research Techniques in Swine</td>
<td></td>
</tr>
<tr>
<td>- Telemetry Techniques for Small Lab Animals: EEG in Rats</td>
<td></td>
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<tr>
<td>- Computer Assisted Surgery: the daVinci® Surgical System</td>
<td></td>
</tr>
<tr>
<td>12pm</td>
<td>Buses depart/return to Sandpearl Resort. Boxed lunch will be provided.</td>
</tr>
<tr>
<td>1pm-5pm</td>
<td>Wet Labs</td>
</tr>
<tr>
<td>- Laparoscopic Surgery in Rats</td>
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<td></td>
</tr>
<tr>
<td>5pm</td>
<td>Buses depart from USF to Sandpearl Resort</td>
</tr>
<tr>
<td>6:30pm</td>
<td>Welcome Reception</td>
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</tbody>
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#### Friday, October 1

<table>
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<tr>
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<tbody>
<tr>
<td>7am-8am</td>
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<tr>
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</tr>
<tr>
<td>8:20am-9:10am</td>
<td>Markowitz Award Recipient Presentation</td>
</tr>
<tr>
<td>Repairing the Injured Knee: The Science Behind the Surgery</td>
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</tr>
<tr>
<td>9:10am-10am</td>
<td>Keynote Presentation</td>
</tr>
<tr>
<td>Robotic Approaches To The Management Of The Common Gynecologic and Pelvic Floor Disorders In Women</td>
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<tr>
<td>7am-8am</td>
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<td>8am-8:40am</td>
<td>Featured Presentation</td>
</tr>
<tr>
<td>Innovation and Discovery in Surgery through Medical History</td>
<td></td>
</tr>
<tr>
<td>8:45am-10am</td>
<td>-Cardiovascular Surgery</td>
</tr>
<tr>
<td>-ASR Certification Prep</td>
<td></td>
</tr>
<tr>
<td>10am-10:20am</td>
<td>Break</td>
</tr>
<tr>
<td>10:20am-11:25am</td>
<td>-Cardiovascular Surgery</td>
</tr>
<tr>
<td>-ASR Certification Prep</td>
<td></td>
</tr>
<tr>
<td>11:30am-1:20pm</td>
<td>ASR Business Meeting/Awards Luncheon</td>
</tr>
<tr>
<td>1:20pm-3:15pm</td>
<td>-Minimally Invasive Surgery</td>
</tr>
<tr>
<td>-ASR Certification Prep</td>
<td></td>
</tr>
<tr>
<td>3:15pm-3:35pm</td>
<td>Break</td>
</tr>
<tr>
<td>3:35pm-4:35pm</td>
<td>-Surgical Writing and Regulations</td>
</tr>
<tr>
<td>-ASR Certification Prep</td>
<td></td>
</tr>
<tr>
<td>4:40pm-5pm</td>
<td>-ASR &amp; You: Q&amp;A with ASR Board</td>
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<td>-Closing Remarks</td>
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### Wednesday, September 29

- 2pm-5pm ASR Board Meeting

### Thursday, September 30

- 7am: Buses depart hotel. Breakfast provided
- 8am-12pm: ASR Examinations
- 8am-12pm: Wet Labs
  - Catheter-based Research Techniques in Swine
  - Telemetry Techniques for Small Lab Animals: EEG in Rats
  - Computer Assisted Surgery: the daVinci® Surgical System
- 12pm: Buses depart/return to Sandpearl Resort. Boxed lunch will be provided.
- 1pm-5pm: Wet Labs
  - Laparoscopic Surgery in Rats
  - Advanced Suturing Techniques in Swine
  - Telemetry Techniques for Large Lab Animals: DSI in Rabbits
  - Computer Assisted Surgery: the daVinci® Surgical System
- 5pm: Buses depart from USF to Sandpearl Resort
- 6:30pm: Welcome Reception

### Friday, October 1

- 7am-8am: Continental breakfast with exhibitors
- 8am-8:15am: Opening Remarks
- 8:20am-9:10am: Markowitz Award Recipient Presentation
  - Repairing the Injured Knee: The Science Behind the Surgery
- 9:10am-10am: Keynote Presentation
  - Robotic Approaches To The Management Of The Common Gynecologic and Pelvic Floor Disorders In Women

### Saturday, October 2

- 7am-8am: Continental breakfast with exhibitors
- 8am-8:40am: Featured Presentation
  - Innovation and Discovery in Surgery through Medical History
- 8:45am - 10am: Cardiovascular Surgery
  - ASR Certification Prep
- 10am - 10:20am: Break
- 10:20am - 11:25am: Cardiovascular Surgery
  - ASR Certification Prep
- 11:30am - 1:20pm: ASR Business Meeting/Awards Luncheon
- 1:20pm - 3:15pm: Minimally Invasive Surgery
  - ASR Certification Prep
- 3:15pm - 3:35pm: Break
- 3:35pm - 4:35pm: Surgical Writing and Regulations
  - ASR Certification Prep
- 4:40pm - 5pm: ASR & You: Q&A with ASR Board
  - Closing Remarks
Greetings Everyone,

I would like to take this opportunity to welcome all ASR members to our 26th annual meeting here in Clearwater.

This meeting is the result of hours of dedication by many volunteers and made possible by your participation, you are the meeting's success.

I believe this is one of the best programs ever thanks to the efforts of our program committee.

Thank you all for the honor of serving the society as president for the past year. Everyone should consider joining in and taking on a position in the society we need new blood for our continued success.

Sincerely,

Tom Long
President, ASR

Tom Long, PhD, is the founder of Lomir Biomedical Inc., and has served as President and CEO for the past 22 years. Tom is responsible for the unique design of all of Lomir's equipment and he currently holds the rights to several patents in conjunction with Pfizer/Upjohn, St. Jude's Children's Hospital, New England Exotics, and the like.

Tom received a BA from Sir George Williams University in 1970 and pursued a PhD in engineering at McGill University specializing in micro-hydraulics. In 1989 he returned to McGill University, Mcdonald College, specializing in animal sciences. Tom also holds certificates in power transmission and advanced hydraulic technology and occupied the post of General Manger, new product design with Richler Industries for a period of 14 years. He has been designing equipment for industrial and commercial, as well as biomedical, applications for more than 35 years.

He serves on the Board of Directors of Lomir Biomedical, Pro-Tek-Plus, Bonafind, and MD Industries. Tom has been a member of many professional organizations, such as, CALAS, AALAS, and Allied Trades for over 20 years. He is one of the three original vendor members of the Academy of Surgical Research (ASR). Tom is committed to supporting the work of biomedical researchers and participates in a number of outreach programs including local school boards and the AREA program at the National AALAS meeting. Tom has been on the ASR Board of Directors since 2003 and has acted as chair of the Strategic Planning Committee since 2005, he has also chaired the By-Laws committee and currently serves as the ASR President.
Board of Directors
& Committee Chairs

Board of Directors

President
Thomas Long

President-Elect
Jan E. Bernal, DVM

Secretary/Treasurer
Tracie Rindfield, RLAT, SRS

Immediate Past President
Kimberly J. Bayer, BS, CVT, LATG, SRS

Liaison Officer
Teresa R. Gleason, BS, LVT, LATG, SRS

Director at Large
John Long, DVM
Lisa Johnson, SRS, LATG, LAT, BA

Director at Large
Ken MacLeod
Erlinda L. Kirkman, SRS, DVM

Director at Large
Margi K. Baldwin, BS, LATG, SRS
Marcel I. Perret-Gentil, DVM, MS

Committees

By-Laws Committee
Jacob T. Kissinger, BS, SRS

Certification Committee
Lisa Johnson, SRS, LATG, LAT, BA

Membership Co-Committee
Steve Hachtman
Randy Pielemeier, SRS, LVT, LATG

Nominating Committee
Kimberly J. Bayer, BS, CVT, LATG, SRS

Program Committee
John C. Resendez, MS, RLATG, SRS, CMAR

Publications Committee
Nance Moran, SRS, RLATG

Strategic Planning Committee
Steve Hachtman

Journal Editor
Luis Toledo-Pereyra
2010 Program Chair

John Cody Resendez, MS, RLATG, SRS, CMAR, is the Director of Infusion Toxicology and Senior Study Director at MPI Research. Prior to joining MPI Research, Mr. Resendez was a Research Scientist at Charles River Laboratories - Preclinical Services, for more than nine years. He obtained a BS in biology from Texas A&M University and a MS in animal science from the University of Nevada. Mr. Resendez has more than 14 years of experience in preclinical and surgical research, with a specific focus in infusion toxicology. He has performed many GLP and non-GLP studies in multiple species. His areas of expertise include cardiovascular physiology, infusion toxicology, and vascular surgery. Mr. Resendez continues to be very active in the infusion toxicology arena, delivering presentations and posters through various national and international venues, and has authored/co-authored many peer reviewed scientific abstracts and publications. He is also an active member of AALAS, the Academy of Surgical Research, the Society of Toxicology, and the Safety Pharmacology Society.

Program Committee

Scott Adrian, DVM  
*MPI Research*

Margaret Baldwin, RVT, RLATG, SRS, MS  
*University of South Florida*

Jennifer DeVries, LATG, SRS  
*MPI Research*

Tim Edwards, BS, RLATG, SRS  
*WIL Research*

Steve Hachtman  
*DSI*

Randy Pielemeier, LVT, SRS, BS, LATG  
*MPI Research*

Luis Toledo, MD, PhD  
*Michigan State University*
2010 Markowitz Award Recipient

Steve Arnoczky, DVM, is the Director of Laboratory for Comparative Orthopaedic Research, Professor of Orthopaedic Surgery, and Professor of Surgery at Michigan State University, in Lansing, Michigan. Dr. Arnoczky was appointed as the first Wade O. Brinker Professor of Veterinary Surgery at MSU in 1992.

Dr. Arnoczky's research is centered around the injury and repair of ligaments, tendons, and cartilage in humans and animals. His research in comparative orthopaedics has resulted in numerous awards and honors from both the human and veterinary medical community. He has been recognized for outstanding research by the American Academy of Orthopaedic Surgeons and The American Orthopaedic Society for Sports Medicine. In addition, he has been the recipient of the Purina Small Animal Research Award and the SmithKline Beecham Award for Research Excellence.

Dr. Arnoczky received his DVM from the College of Veterinary Medicine at The Ohio State University. He has published over 300 scientific papers and has received more than 2 million dollars in research support. Dr. Arnoczky’s current research includes the investigation of overuse injuries in tendons, development of tissue engineered tendons and menisci, and the evaluation of various synthetic bone grafts.

Keynote Speaker

Lennox Hoyte, MD, is the Director of the Division of Urogynecology and Reconstructive Surgery at the University of South Florida in Tampa. He is an attending Obstetrician Gynecologist at the Tampa General Hospital, and maintains an active clinical practice specializing in all types of female pelvic floor disorders, including genital prolapse, urinary and fecal incontinence, overactive bladder syndromes, childbirth related pelvic floor injury, and pelvic muscle dysfunction. He is also the Chief Medical Information Officer for USFPG and the Director of the USF Robotic Simulation Center.

Dr. Hoyte received his Master's degree in electrical engineering and computer science from MIT, his MD degree from Stanford Medical School, and completed four years of residency training in Obstetrics and Gynecology at Harvard. He completed formal fellowship training in Female Pelvic Medicine and Reconstructive Surgery at Loyola University Medical Center in Maywood, Illinois. He is currently a board certified Obstetrician/Gynecologist, a Fellow of the American College of Obstetrics and Gynecology, and an elected member of the Society of Gynecologic Surgeons. He is the recipient of the 3rd annual June Allyson Award for research from the American Urogynecologic Society, and serves on editorial review boards of several peer reviewed medical journals. Dr. Hoyte has been invited to speak nationally and internationally on varied topics, including MR-based 3D female pelvic anatomy and biomechanics, overactive bladder syndromes, management of pelvic organ prolapse, and incontinence.

Dr. Hoyte is also an active clinical researcher. In his research, he is seeking to better understand why some women develop pelvic floor dysfunction after childbirth and others do not. His research tools include pelvic imaging, imaging based 3D reconstruction, and computer based simulation of pelvic floor behavior under different conditions. He has developed videos and images of his MR-based 3D reconstructions to demonstrate normal and abnormal pelvic anatomy.
Guest Speakers

Cindy L. Farber moved to Florida three years ago, after graduating from Carroll College, to pursue her dream of working with marine mammals. Cindy has a Bachelor’s degree in Psychology with an emphasis on Biology and Animal Behavior. After working with dolphins at The Dolphin Research Center in Grassy Key, FL as part of a Career Series Course known as Dolphin Lab, she became fascinated with dolphin training and fell in love with the idea of working with these amazing animals further. In pursuit of her career, Cindy went on to work with bottlenose dolphins (Tursiops truncatus) and North American river otters (Lontra canadensis) as an intern at Clearwater Marine Aquarium in 2007. Upon completion of the internship, Cindy stayed on site as a volunteer. In 2009, she was offered a full-time position on staff as a trainer. Cindy now holds the title of Marine Mammal Trainer and Presentation Coordinator at CMA and works closely with the head trainer for all training and daily operations required by a facility that focuses on rescue, rehabilitation, and release.

Danielle O’Neil started working in the marine animal rehabilitation field in 1994. She graduated with her undergraduate degree in Biology from UC Santa Cruz and has her Masters degree in Marine Biology with an emphasis on neonatal pinniped endocrinology and immunology from the University of Alaska, Fairbanks. She also is a certified veterinary technician licensed through the State of Massachusetts. She has been lucky enough in her career to work with over eight species of seals and sea lions, sea otters, dolphins, porpoises, sea turtles, black bears, moose and a host of other terrestrial wildlife in rehabilitation hospitals. She has been the manager of Sea Turtle Programs at the Clearwater Marine Aquarium for over two years and is thrilled to be a part of the stranding team and medical team that works with Florida’s marine wildlife.
Sandpearl Resort

Adorning 700 feet of Clearwater’s pristine beachfront, Sandpearl Resort offers the highest caliber of guest experience, quality of appointments and meeting and conference facilities on the Gulf Coast. The first new resort to be built on Clearwater Beach in 25 years, the Sandpearl Resort has been recognized by Expedia Insiders’ Select ranking of top hotels in the world. Sandpearl was rated #8 in the world in the 2009 Insiders’ Select ranking based on customer satisfaction and value for the dollar. Sandpearl seamlessly blends refined amenities and nature’s splendor to create moments that enrich the spirit well beyond your stay.
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Clearwater Beach, FL – Sandpearl Resort
**Wednesday, September 29, 2010**

2pm-5pm  
ASR Board Meeting  

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**Thursday, September 30, 2010**

*(Meeting registration hours, 7am-5pm)*

7am  
Buses depart from Sandpearl Resort to University of South Florida (USF). Breakfast will be provided.  
*Sponsored by MPI Research*

8am-12pm  
ASR Examinations  

8am-12pm  
Wet Lab #1 - “Catheter-based Research Techniques in Swine”  
Wet Lab #2 - “Telemetry Techniques for Small Lab Animals: EEG in Rats”  
Wet Lab #3 - “Computer Assisted Surgery: the daVinci® Surgical System”  
  Hands-on demo and introduction to robotic training

12pm  
Buses depart/return to Sandpearl Resort. Boxed lunch will be provided.  
*Sponsored by MPI Research*

1pm-5pm  
Wet Lab #4 - “Laparoscopic Surgery in Rats”  
  Lecture and wet lab  
Wet Lab #5 - “Advanced Suturing Techniques in Swine”  
Wet Lab #6 - “Telemetry Techniques for Large Lab Animals: DSI in Rabbits”  
  Including intubation and anesthesia care  
Wet Lab #7 - “Computer Assisted Surgery: the daVinci® Surgical System”  
  Hands-on demo and introduction to robotic training

5pm  
Buses depart from USF to Sandpearl Resort

6:30pm-8:15pm  
Welcome Reception  
*Sponsored by VetQuip, Inc.*
Interventional Radiology – Swine Cath-lab (Wet Lab #1)
Instructor: Jennifer DeVries, SRS, LATG
Minimally invasive and ‘least invasive’ procedures continue to be developed in lieu of more invasive, open cavity procedures. One rapidly developing area of least invasive procedures includes interventional radiology procedures in which guide wires and catheters are used to gain access to various organs. Familiarity with various guide wires and catheters is necessary for safe and effective access to areas such as the kidney, liver, pancreas, intestine, heart and peripheral vessels. This hands-on workshop will provide basic knowledge of various guide wires and catheter types that can be used in these procedures. In addition, the workshop will include a discussion and demonstration of various devices used for interventional treatment and model development such as angioplasty balloons, intravascular stents and embolization coils.

Advanced Telemetry Techniques (Wet Labs #2 & #6)
Instructors: Heather Bogie, RLAT, CVT; Dan Huetteman (Rodent)
Teresa Gleason, BS, LVT, SRS, RLATG (Rabbit)
The teaching goals for this workshop are to increase knowledge and awareness of telemetry and the surgical procedures associated with telemetry. Instruction will be provided for the proper techniques necessary to conduct scientific studies with a focus on the reduction in animal numbers and a more humane way of monitoring and collecting vital data. Students will be learning techniques they can employ in their own facility.
- Rodent – EEG implant
- Rabbit – Blood Pressure/ECG/Temp implant (Intubation, pre-/peri-/post anesthesia monitoring covered)

Computer Assisted Surgery: Getting a Grip on Robotic Surgery (Wet Labs #3 & #7)
Instructor: USF Health da Vinci® Center for Computer Assisted Surgery
This didactic and laboratory session will demonstrate intra-operative robotic surgical techniques. This workshop is designed to expose participants to the da Vinci® Surgical System. Each participant will engage in hands-on experience necessary to obtain a firm understanding of the aspects involved in using the da Vinci® Surgical system. The workshop will introduce the da Vinci® System and address, OR Set-up, positioning of equipment, port placement, manipulation skills, dissection, and suturing techniques (non-animal workshop).

Minimally Invasive Surgery – Laparoscopic Surgery In Rodents (Wet Lab #4)
Instructors: Marcel Perret-Gentil, DVM; Szczepan Baran, VMD
This workshop is designed for scientists, veterinary technicians, veterinarians, and technical support staff who wish to learn the basic principles of rat laparoscopy. Information presented in this workshop will introduce participants to skills necessary to perform rodent laparoscopic biopsy and injection procedures. Instrument handling and all techniques from patient preparation to patient abdominal closure, will be demonstrated and participants will have an opportunity to handle rodent appropriate laparoscopic instrumentation and equipment, and learn intra-abdominal organ biopsy and injection techniques while working with anesthetized rats.

Advanced Suture Techniques Laboratory (Wet Lab #5)
Instructors: Jan Bernal, DVM; Vince Mendenhall, DVM, PhD
The aim of this workshop is to demonstrate and allow practice of, more complex suturing techniques.
The following types of suture techniques will be performed in swine:
- Hand ties (one handed)
- Hand ties (two handed)
- Inverting suture patterns - hollow organs (Cushing vs. Connell)
- Oversew patterns (Lembert, Halsted and Parker- Kerr)
- Purse-string (circular version of Lembert)
- Tension sutures – Muscle (horizontal, vertical mattress)
- Tension sutures – Tendons (interlocking loop and three loop pulley)
- Deep hand ties in the thoracic and abdominal cavity
### Program

**Friday, October 1**

<table>
<thead>
<tr>
<th>Time</th>
<th>Session A - Harbor A</th>
<th>Session B - Harbor B&amp;C</th>
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<td>7am-8am</td>
<td>Continental breakfast with exhibitors Sponsored by Colonial Medical Supply Company</td>
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<td>Opening Remarks: ASR President, Tom Long, PhD</td>
<td>Harrow Ballroom</td>
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| 8:20am-9:10am | **Markowitz Award Recipient:** Steven Arnoczky, DVM  
Repairing the Injured Knee: The Science Behind the Surgery | Harrow Ballroom                                                                       |
| 9:10am-10:00am| **Keynote Speaker:** Lennox Hoyte, MD  
Robotic Approaches To The Management Of The Common  
Gynecologic and Pelvic Floor Disorders In Women | Harrow Ballroom                                                                       |
| 10am-10:20am  | Break Sponsored by Access Technologies                                               |                                                                                      |

#### Organ Transplant Surgery

**Moderator:** Luis Toledo

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<th>Topic</th>
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| 10:20am-11:50am| **Vince Mendenhall**, DVM, PhD  
Wake Forest University, Baptist Medical Center | "Working" versus "Non-working" Heterotopic Heart Transplantation | **Moderator:** Luis Toledo                                                                                           |
| 11:05am-11:50am| **Matthias Heuer**, MD  
University Hospital of Essen | Lessons Learned During Implementation of an  
Experimental Model of Liver Transplantation | **Moderator:** Luis Toledo                                                                                           |

#### Long-Term Vascular Access/Infusion

**Moderator:** Teresa Gleason

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| 1:10pm-2:40pm | **Melanie Graham**, MPH  
University of Minnesota | Refined Method of Vascular Access Port  
Placement in Nonhuman Primates for Cell Transplantation | **Moderator:** Teresa Gleason                                                                                           |
| 1:40pm-2:10pm | **Oscar Bermeo**, DVM  
Battelle Memorial Institute | Experiences With the DSI™ D70-PCTP  
Radiotelemetry Transmitter in the Rabbit  
Model for the Evaluation of Respiratory, Core Temperature and Cardiovascular Parameters | **Moderator:** Teresa Gleason                                                                                           |
| 2:10pm-2:40pm | **Bonnie Lyons**, DVM  
The Jackson Laboratory | Jugular Vein and Carotid Artery Catheterization in the Mouse | **Moderator:** Teresa Gleason                                                                                           |

#### Surgical Techniques and Surgical Research

**Moderator:** Mike Talcott

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| 10:20am-10:50am| **Michael Dard**, DDS, PhD  
Institut Straumann | The Respective Places of Minipig And Dog Models in Oral Bone Regeneration Research | **Moderator:** Mike Talcott                                                                                           |
| 10:50am-11:20am| **George Kopchok**, SRS, BS  
Abbott Laboratories | Ovine Aortic Aneurysm Model for Endoluminal Graft Evaluations | **Moderator:** Mike Talcott                                                                                           |
| 11:20am-11:50am| **Kuldip Mirakhur**, DVM, MVSc, PhD  
Abbott Laboratories | Intestinal Surgical Models - an Appraisal in Large Animals and Poultry | **Moderator:** Mike Talcott                                                                                           |

#### Surgical Techniques and Surgical Research

**Moderator:** Jan Bernal

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<td>1:10pm-1:40pm</td>
<td><strong>Michael Duggan</strong>, Massachusetts General Hospital</td>
<td>Development of a Clinically Relevant Survival Model of Polytrauma and Hemorrhagic Shock in Swine</td>
<td><strong>Moderator:</strong> Jan Bernal</td>
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| 1:40pm-2:10pm | **Justin Prater**, SRA, LATG, BS  
MPI Research | Using Thromboelastography as a Surgical Diagnostic and Research Tool | **Moderator:** Jan Bernal                                                                                           |
| 2:10pm-2:40pm | **Scott Adrian**, DVM  
MPI Research | Anesthetic and Physiologic Management of Swine Throughout a Malignant Hyperthermic Crisis | **Moderator:** Jan Bernal                                                                                           |
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<td>3:00pm-4:00pm</td>
<td>Long-Term Vascular Access/Infusion</td>
<td>Surgical Techniques and Surgical Research</td>
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<td>Moderator:</td>
<td>John Cody Resendez</td>
<td>Vince Mendenhall</td>
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<td>3:00pm-3:30pm</td>
<td>April Pruett, BS</td>
<td>3:00pm-3:30pm Weihua Qiu, MD, PhD</td>
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<td>Laboratories, Inc.</td>
<td>Rodent Catheter Options and Surgical Services</td>
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<td>3:30pm-4:00pm</td>
<td>David Rehagen, DVM</td>
<td>3:30pm-4:00pm Experiences in Total Thyroidectomy for Recurrent Thyroid Nodules</td>
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<td>4:05pm-5pm</td>
<td>Medical Device Implantation/Surgical/Orthopedic Models</td>
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<td>Moderator:</td>
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<td>4:05pm-4:35pm</td>
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<td>The Human Proxy: Preclinical Medical Device Surgical Models</td>
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<td>4:35pm-5pm</td>
<td>Layne Norlund, DVM</td>
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<td>IMDS Discovery Research</td>
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<td>Optimizing Animal Models for Medical Device Research and Development: Three Case Studies</td>
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<td>5pm-6pm</td>
<td>Poster Judging</td>
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<td>6:30pm-9:30pm</td>
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<td>Sponsored by DSI and Lomir Biomedical Inc.</td>
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<td>Gulf Lawn</td>
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Program
Saturday, October 2

7am-8am  Continental breakfast with exhibitors
Sponsored by AVA Biomedical, Inc.
Cove Meeting Room/ Cove Foyer

8am-8:40am  Featured Presentation: Luis Toledo, MD, PhD
Michigan State University - Kalamazoo Center For Medical Studies
Innovation and Discovery in Surgery through Medical History
Harbor Ballroom

Session A - Harbor A
Cardiovascular Surgery
Moderator: Steve Hachtman

8:45am-9:10am
John Schomburg
University of Minnesota Medical School
Internal Aortic Annuloplasty: A Novel Model and Valve-Sparing Surgical Repair of Valvular Insufficiency

9:10am-9:35am
David Moddrelle, SRS
MPI Research
A Left Thoracotomy Approach for Consistent Epicardial P Wave Acquisition via Telemetry in the Primate

9:35am-10am
Heather Bogie, RLAT, CVT
Data Sciences International (DSI)
Recommended Surgical Technique for Placement of a Pressure Sensing Catheter to Record Chronic Left Ventricular Pressure in Rodents

ASR Certification Prep
8:45am-10am
Lisa Johnson, SRS, BS
Pfizer
Distribution of Questions Exams and Test Taking Tips Analgesia and Pain Assessment

10am-10:20am  Break  Sponsored by DRE Veterinary Equipment

Session B - Harbor B
Cardiovascular Surgery
Moderator: Steve Hachtman

10:20am-10:50am
Leslie Stoll, SRS
Charles River Laboratories
Novel Method for Surgical Placement of Respiratory Impedance Leads for the DSI D70- Pctr Telemetry Device In Nonhuman Primates

10:50am-11:25am
Oscar Bermeo, DVM, RLATG
Battelle Memorial Institute
Experience With a Novel Implanted Vascular Access Port and Catheter for Continuous Infusion in Nonhuman Primates

ASR Certification Prep
10:20am-10:50am
Jen Sweet, SRS, BS, LATG
MPI Research
Anesthesia

10:50am-11:25am
Kim Bayer, SRS, BS, CVT, LATG
Pre-, Peri-, and Post-Operative Care
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<td>ASR Business Meeting/Awards Luncheon</td>
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<td>11:30am-1:20pm</td>
<td><strong>Minimally Invasive Surgery</strong></td>
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<td>Moderator: Marcel Perret-Gentil</td>
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<td>1:20pm-1:50pm</td>
<td><strong>Szczepe Baran</strong>, VMD, MS</td>
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<td>Rat Laparoscopic Biopsies Lead to Decreased</td>
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<td>1:50pm-2:45pm</td>
<td><strong>Gregory Voronin</strong>, DVM</td>
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<td>Minimally Invasive Surgical Techniques: Single Port</td>
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<td>Laparoscopic Liver Biopsy in the Dog</td>
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<td>Nonhuman Primate and Laparoscopic Assisted</td>
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<td>Ovariohysterectomy in the Dog</td>
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<td>Rat Laparoscopy – Refinement for Rat Model</td>
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<td>Development, Renal, Testicular, and Hepatic</td>
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<td>Laparoscopic Implantation of Neoplastic Cells</td>
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<td><strong>Surgical Writing and Regulations</strong></td>
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<td><strong>Luis Toldeo</strong>, MD, PhD</td>
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<td>Basic Elements of Successful Surgical Writing</td>
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<td><strong>Mike Talcott</strong>, DVM</td>
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<td>Washington University School of Medicine</td>
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<td>Review of the 2010 Update to the Guide for the Care and Use of Laboratory Animals; Review of Changes that Could Impact Surgical Research</td>
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<td>4:40pm-5pm</td>
<td><strong>ASR and You: Q&amp;A with ASR Board</strong></td>
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The 26th Annual Meeting of the Academy of Surgical Research
September 30 - October 2, 2010
Clearwater Beach, FL – Sandpearl Resort

Alphabetically listed by Author. Underline indicates presenting Author.
Malignant Hyperthermia (MH) is a potentially lethal peri-anesthetic syndrome of individuals with a genetic predisposition in both humans and swine. Caused by a hypermetabolic state within the skeletal muscle induced during the administration of volatile inhalation anesthetics and depolarizing muscle relaxants; it is characterized by severe states of pyrexia, hypercapnia, lactacidemia, acidosis, tachycardia, hyperkalemia, and muscle rigidity. Clinically in humans MH has an approximate incidence of 1:15,000 in children and 1:100,000 in adult humans receiving anesthesia. Prior to 1979 and the introduction of dantrolene sodium, the primary treatment, mortality rates were estimated to be as high as 85%. Currently as a result of increased awareness, at-risk patient screening, better patient monitoring, and aggressive treatment measures including the use of dantrolene sodium, mortality has been reduced to less than about 10%.

Using veterinary and IACUC approved study protocols, we refined a test model of MH in swine to examine the efficacy and success of various treatments including dantrolene sodium. During the development and conduct of these studies we encountered and overcame many challenges presented by these unique animals and the chaotic nature of the MH crisis. This presentation plans to discuss these challenges, provide an explanation and overview of the interesting physiology that occurs during such a crisis, and illustrate the details of the version of this model that we conducted for this study. With the growing popularity of newer generation anesthetic agents (i.e. sevoflurane and desflurane), the use of many other anesthetic drugs capable of triggering an event in swine, and the continued (often hidden) presence of genetically susceptible animals, Malignant Hyperthermia (aka Porcine Stress Syndrome) continues to be a potential challenge for the veterinary clinician and surgical researcher utilizing swine. It is the hope of the speaker to provide the necessary awareness and knowledge to manage this adverse event and potentially related or similar physiologic abnormalities.
RAT LAPAROSCOPIC BIOPSIES LEAD TO DECREASED POST-OPERATIVE PAIN

Szczepan Baran, VMD, MS
Veterinary Bioscience Institute

The refinement of current surgical techniques represents a key opportunity to improve the welfare of laboratory rodents, while meeting legal and ethical obligations. Minimally invasive surgery such as laparoscopy is considered the gold standard for many human abdominal procedures. Laparoscopy results in decreased pain, decreased tissue trauma and more rapid post surgical recovery. Compared to laparotomy, laparoscopy preserves immune function when equivalent procedures are performed. Many of these benefits have been demonstrated in rodents with the exception of pain management. A pilot study was conducted using three groups; rats that had undergone laparoscopic liver biopsy via laparoscopy, rats that had undergone liver biopsy via laparotomy, and rats exposed to inhalant anesthesia alone. Preliminary data, which included quantitative behavior analysis of assessing post-operative pain, demonstrated that laparoscopic procedures lead to less post surgical pain than laparotomy. Additional studies are required, but this initial data suggest that laparoscopy in rodents might represent a significant surgical refinement for the reduction of post-operative pain.
RAT LAPAROSCOPY – REFINEMENT FOR RAT MODEL DEVELOPMENT OF RENAL, TESTICULAR AND HEPATIC
LAPAROSCOPIC IMPLANTATION OF NEOPLASTIC CELLS

Szczepan Baran, VMD, MS
Veterinary Bioscience Institute

Rodent tumor models are becoming more complex with the widespread adoption of genetically modified mice and rats. These models are commonly developed by implanting neoplastic cells subcutaneously or under the renal capsule. Orthotopic xenograft models have become rather common. These models reproduce the host and tumor cellular interactions more accurately and thereby support the study of human disease progression in rodent models with higher dependability. These models allow for in vivo testing of potential drug compounds on a wide range of human tumors and are often a good predictor of clinical efficacy. Such orthotopic models are typically more invasive than subcutaneous implantations and require a higher degree of surgical skill and experience. Because of these challenges, tumors are often implanted at more accessible locations, which do not provide the local native tumor environment and limit the predictive value of these pre-clinical rodent data sets. An alternative to the performance of invasive abdominal surgeries was the development of ultrasound guided-injections of tumor cells into abdominal organs under indirect visualization. However, this approach introduced experimental bias and confounding effects of inadvertent dissemination of tumor cells, depending upon the user’s skill. Advances in non-invasive bioluminescent and fluorescent imaging allow longitudinal assessment of the growth and metastatic dissemination of orthotopic tumors but are limited by the inability to collect serial tumor samples. Laparoscopy allows for direct visualization of implantation of neoplastic cells, provide direct observation and assessment of gross as well very tiny morphology due to the magnification provided by the laparoscope. In addition, laparoscopy facilitates collection of tissue samples with high precision through direct visualization of target organs. Most importantly, the scientific community has an ethical and legal responsibility to develop and implement methods that refine experimental models, and minimize potential pain and distress, while providing quality data that meets study objectives. Here we describe in detail renal, testicular and hepatic laparoscopic implantation of neoplastic cells in rats.
EXPERIENCES WITH THE DSI™ D70-PCTP RADIOTELEMETRY TRANSMITTER IN THE RABBIT MODEL FOR THE EVALUATION OF RESPIRATORY, CORE TEMPERATURE AND CARDIOVASCULAR PARAMETERS

Oscar A Bermeo, DVM, RLATG
Battelle Memorial Institute

Implantable telemetry is considered a refinement method since animals can be remotely monitored without interaction with humans. The use of implantable telemetry is judged, at present, the best available alternative method. It considerable lowers the stress that would result from the use of more conventional cardiovascular or respiratory analysis methods capable of continually collecting data from an unanesthetized model. This presentation will illustrate our experiences pre-operative, operative and post-operative up to 4 weeks with 4 male New Zealand White rabbits implanted with D70-PCTP radiotelemetry transmitters from DSI™ (St. Paul MN), used primarily to collect cardiovascular, respiratory and core temperature data for further safety evaluations.
EXPERIENCE WITH A NOVEL IMPLANTED VASCULAR ACCESS PORT AND CATHETER FOR CONTINUOUS INFUSION IN NONHUMAN PRIMATES

Oscar A Bermeo, DVM, RLATG
Battelle Memorial Institute

The implanted subcutaneous access port with indwelling intravascular catheter is an established tool of laboratory animal researchers. Large and small animal research models require these devices for studies needing repeated access to the vascular system for infusion of test articles, blood sampling, and blood pressure recording. Benefits of the implanted port catheter systems over externalized catheters include reduced infection and reduced catheter dislodgement and damage. When used in protracted vascular access applications in large animals (i.e., infusions lasting several minutes to hours or days) complications from port use arise, namely Huber point needles periodically become dislodged after inserted percutaneously into the port. Our laboratory has utilized the novel PortHold™ vascular access port from Solomon Scientific in nonhuman primates with 100% success rate for infusion studies in our BL3 facility in which safety and accurate dose administration are critical. Over a one-year period 154 NHPs were implanted with these devices without dislodgement or study disruption.

NOTES
Cardiac function has become an increasingly studied area as new drugs with diverse and specific mechanisms of action are being brought through the development pathway. Cardiac contractility has recently been more often included in the battery of tests conducted in safety assessment of these new cardiovascular active drugs. Cardiac contractility traditionally has only been assessed in larger animals in later stages of testing. Canines and non-human primates are accordingly the traditional safety models. Recent advances in the miniaturization of telemetric devices have enabled the development of a dual pressure rodent sized transmitter. This new device now supports accurate and chronic assessment of left ventricular pressure (LVP) in rats and other smaller laboratory models. The new transmitter design and its surgical approaches for use in rodents have been developed and validated for successful outcomes. The surgical procedure for LVP measurement with an implanted pressure sensing catheter requires advanced skill, additional preparation and recovery planning. This presentation will discuss the surgical technique and the requirements needed to ensure a successful outcome.
THE RESPECTIVE PLACES OF MINIPIG AND DOG MODELS IN ORAL BONE REGENERATION RESEARCH

Michel Dard, Marcel Obrecht
Institut Straumann

For historical reasons dog models are largely used and extensively documented in the field of periodontology research. Their advantages for bone regeneration investigations remain questionable due to their sensitivity to infection and periodontitis. Minipigs are widely accepted as non-rodent models in pharmacology and toxicology and a reliable documentation about their involvement in surgical research is available. Although their bone metabolism and morphology is well known, they are still not fully established as a model in oral surgery. The aim was to develop, document and compare under different aspects (ethics, clinics, imaging, microscopy) intra-oral surgical models in minipigs and dogs.

All surgical procedures were conducted in operations suites under aseptic conditions. In order to facilitate an intra-oral access the Göttingen minipigs ® (Ellegaard, Denmark) are anesthetized without intubation by an intra-muscular injection of ketamine /midazolam. The mongrel dogs (Marshall BioResources, NY, USA) are maintained in anesthesia by isoflurane inhalation. Teeth extractions are performed after elevating a full thickness flap and removing bilaterally the lower premolars and the first molar. After a healing period of 3 months, flaps are elevated in edentulous area of each hemi-mandible and different osteotomy procedures (cylindrical, semi-saddle or saddle defects, standardized dehiscences) can be conducted depending on the purpose of the study protocol. Chronic or acute defects creation and/or implantations are performed bilaterally according to a split-mouth design and by help of a guided surgery instrumentation if necessary. The post-surgical analysis includes observations and measurements based on Xrays, computed tomography, micro-computed tomography, biomechanical tests (removal torque), histology-histomorphometry.

This minipig and dog models were successfully applied in surgical research studies on dental implant design (so-called bone level design with non-matching abutment), metal surfaces (i.e. hydrophilic) assessment, investigations on metal alloyed (comparison between titanium and zircon alloyed titanium) and ceramic materials, bone regeneration with absorbable scaffolds (polyethylene glycol hydrogels, biphasic calcium phosphate blocks).

The minipig model demonstrated its usefulness, versatility and reliability in oral surgical research when bone regeneration issues are addressed, the dog model should be reserved for perio-implantology research purposes.

NOTES
DEVELOPMENT OF A CLINICALLY RELEVANT SURVIVAL MODEL OF POLYTRAUMA AND HEMORRHAGIC SHOCK IN SWINE

Michael J. Duggan  
Massachusetts General Hospital

Various swine models of polytrauma and hemorrhagic shock have previously been described for non-survival studies. However, due to the nature of injuries, these animals can’t be kept alive to evaluate the long-term consequences of treatments, and to monitor for delayed complications. To fill this gap, we have developed a clinically relevant survival model of polytrauma and hemorrhagic shock in swine.

Female Yorkshire swine (40-50kgs) were subjected to an experimental protocol that simulated different phases of trauma care, including: 1) "Pre-hospital phase"- controlled hemorrhage (50% blood volume, mean arterial pressure 30-35 mmHg), 30 minutes of shock, and infusion of 154mM NaCl equal to 3x hemorrhage volume. Multiorgan injury was created by sharp partial resection of the left median liver lobe, multiple complete splenic lacerations, and a rib fracture. There was uncontrolled bleeding for 30 mins simulating transport time to the hospital, which resulted in development of severe coagulopathy, acidosis, and hypothermia. Treatment with test agents was performed during this period. 2) "Operative phase"- Hemorrhage was controlled through hepatic repair and partial splenectomy. 3) "Critical care/resuscitative phase"- One hour after beginning repair, animals were fully resuscitated with blood products to correct anemia (hemoglobin returned to within 10% of baseline) and reverse acidosis. 4) "Recovery/monitoring phase". All but the external jugular catheter were removed, surgical incisions repaired, and animals recovered from anesthesia. Over the next seven days animals were monitored for organ function, and any post-operative complications, before being sacrificed for collection of tissues.

This was a highly lethal model of shock as only 25% (2/8) animals resuscitated with 6% hetastarch solution survived. However, this could be completely reversed by adequate treatment, and all of the animals (7/7) treated with fresh whole blood survived. All the animals that survived to the recovery phase had uneventful post-operative course.

It is possible to develop a very severe, highly lethal, poly-trauma large animal model that is suitable for survival studies. The reversibility of the lethality makes it suitable for testing promising treatment options. This model incorporates the key components of traumatic coagulopathy, including multiple injuries, coagulopathy, shock, hypothermia, acidemia and inflammation. Survivability is important to the clinical relevance of this model and allows for further assessment of organ injury post recovery.

NOTES
Islet transplantation is a promising treatment for type 1 diabetes. Nonhuman primates are utilized in preclinical transplant studies because of the biological complexity and close similarity of e.g. their immune system to that of humans, hence a high predictive value of results to the situation in a patient. Islet transplantation is generally performed in the liver, which in nonhuman primates requires an open laparotomy. Anesthesia and surgical injury alter immune reactivity and thus confound the outcome of detailed immune mechanistic studies. Also retransplants are problematic as these require multiple major survival surgical procedures. We therefore established a method for chronic vascular access to the hepatic portal vein using a port with the catheter tip located in the splenic vein. This procedure was conducted in 16 cynomolgus and 9 rhesus macaques, part of which underwent islet cell transplantation. Controls (n=17) received the transplant via open midline laparotomy. These groups did not differ in operation time (median about 60 min). However, controls showed significantly higher liver enzyme concentrations than animals transplanted via the access port, and also had significantly lower blood hemoglobin values. The port could be used for administration of biologics and also for blood sampling. In all cases the port remained patent for infusion (median follow-up 336 days, range 62-485 days). Patency for blood sampling was maintained in about half of the animals: the 50% survival was 255 days. This difference between infusion and sampling patency is most likely due to the location of the catheter tip in the splenic vein, with occlusion caused by the small vessel to catheter ratio. We conclude that hepatic vascular access enables long-term frequent administration of cells, medication or other products. This avoids repeat open surgical procedures, hence contributes to a higher level of animal well-being and reduces model induced confounding.
VESSEL CASTING YIELDS THREE-DIMENSIONAL STRUCTURE OF THE LOWER EXTREMITY ARTERIES IN THE LABORATORY PRIMATE

Daniel A. Huetteman  
*Data Sciences International*

Anatomy texts are a great reference for anatomical structure but they are ineffectually two-dimensional and quite often exaggerate the dimensions of the structures they illustrate. A recent collaborative study prompted us to research the three dimensional configuration of the arterial system of the lower extremities of the laboratory primate. There is very little information on branching patterns and vessel diameters in the literature so we were forced to rely on traditional experimental methods to find the information. Two Cynomolgus monkeys scheduled for termination (1 male, 4.6 kg and one female, 2.4 kg), were anesthetized and prepared for necropsy. The experimental procedure involved exposure of the abdominal aorta via a midline laparotomy. The aorta was isolated just cranial to the iliac bifurcation and cannulated with a 14 G syringe needle connected to an infusion apparatus. The monkeys were bled out under anesthesia and the lower extremities were flushed with heparinized saline (heparin 100 units/ml). A fast-curing silicone elastomer material was injected through the infusion apparatus and allowed to flow through the arterial system. The silicone was allowed to set (10-15 minutes); the flexible silicone cast was removed from the animal; and the artery walls were dissected away. The resulting three dimensional casts showed remarkable detail of the branching structure of the arteries and accurate measurements of the lengths of the individual branches could be made. Unfortunately, the silicone infusion pressure was not carefully controlled which resulted in a non-physiologic distention of the vessel diameters in one animal. Consequently, the vessel diameters could not be directly compared between animals. Follow up studies may be performed to accurately determine luminal diameter of the different arterial branches in laboratory primates.
A model of orthotopic liver transplantation in swine was developed to investigate an advanced preservation solution. The commonly in the experimental setting used veno-venous bypass during the recipient operation was disclaimed. Challenges for surgery and anaesthesiology, which occur during establishing an experimental model of transplantation, will be focused.

15 female swine of the German Landrace breed were used. Donor, median 32.5 kg (29.0-34.5), and recipient, median 32.0 kg (30.5-35.5), were matched for body weight. Liver transplantations were performed without using veno-venous bypass. All anastomosis were performed in an end-to-end fashion. The sequence of the upper, lower caval and portal vein anastomosis was changed in the first period of the investigation. After 5 transplantations the time of cold storage was decreased from 12 to 5 hours to allow a follow-up of 7 days.

All animals in the first period died within 48 hours due to liver failure after transplantation and cold storage of 10-12 hours. In the beginning of the second period two swine died on the table presumptively due to cardiac arrest and bleeding. The following transplantations were carried out after a median cold ischemic time of 307.5 minutes (295-340). Median warm ischemic time in these cases was 25 minutes (20-32), respectively. The median total anesthetic time from intubation to extubation was 360 minutes (234-467) in those cases in which the complete surgical procedure was performed. The associated median total operative time was 210 minutes (172-307). Therefore 8 of 10 swine in the second period survived more than 48 hours after operation.

Orthotopic liver transplantations in the recipient swine are feasible even without using veno-venous bypass. If, portal venous recirculation time is about 25 minutes transplantation can be performed safely with a less technical and time consuming procedure. After a first period of disappointig results due to methological and technical problems in the second period of the study promising results were achieved after establishing of this model of liver transplantation in swine.

NOTES
OVINE AORTIC ANEURYSM MODEL FOR ENDOLUMINAL GRAFT EVALUATIONS

George Kopchok, BS, Carlos Donayre, MD, Arash Keyhani, MD, Tony Fang, MD, Tien Nguyen, MD, Catalina Guerra, DVM, Rodney White, MD
Harbor UCLA Medical Center

Purpose: To describe creation of large abdominal aortic aneurysms (AAA) in adult ovine for evaluation of endoluminal grafts (ELG). Models are required to evaluate device deployment, AAA exclusion, and to verify long term performance of the prosthesis.

Using standard sterile technique, a mid line incision was made over the abdomen and the aorta surgically isolated and controlled. Heparin was administered and the aorta was clamped below the renal arteries and above the aortic bifurcation. A 4.0 cm arteriotomy was made and “T” at both ends to increase overall length to 5cm. To allow distal perfusion, large-bore shunt was inserted, and controlled with tourniquets, clamps were then removed. Aneurysm was created utilizing a series of dacron panels (6 x 1.5 cm) sutured along opposite sides of the arteriotomy. The ends of the patch were sutured together and a football-shaped panel was sutured on top of both side panels. Prior to closing the top panel, the shunt was removed and the graftotomy was controlled with a side-biting vascular clamp to maintain hemostasis. After completion of the aneurysm model the incision was closed in standard fashion. This work was done under a protocol approved by our Institutional Animal Care and Use Committee.

Eighteen (18) animals with a mean weight of 78.4 (± 11.3) kg have been used for this study. Four (4) animals died or were euthanized prior to device deployment. Only one episode of hind limb paralysis occurred (5.5%). The remaining 14 animals were used for ELG device evaluation.

This is a novel approach to aneurysm creation as the patch model can be used to create aneurysm of various sizes, as per the need of the device. The use of a large bore aortic shunt helps to minimize the risk of hind limb paralysis that occurs with temporary aortic flow interruption.

NOTES
JUGULAR VEIN CATHETERIZATION IN THE MOUSE

Bonnie L. Lyons, DVM
The Jackson Laboratory

In biomedical research chronic catheterization of large vessels is routinely carried out on many laboratory animal species for pharmacokinetic studies and compound administration. Because of their small size placing indwelling vascular catheters in mice presents a significant challenge. We have developed a technique for jugular vein catheterization of mice that consistently results in long-term patency. The right jugular vein is accessed for catheter placement. The mouse is anesthetized with tribromoethanol (400mg/kg IP), buprenorphine (0.05mg/kg SQ) is administered for analgesia and the surgical site is prepared. The mouse is placed in dorsal recumbency with the head adjacent to the surgeon and a sterile drape is placed at the proposed incision site. A skin incision is made over the right jugular vein and a section of the vein is exposed. A ligature is placed on the cranial aspect of the vein and a second ligature is loosely tied at the caudal aspect. A small transverse incision is made and a saline filled catheter is inserted into the lumen. Patency of the catheter is verified and the caudal ligature is tied to secure the catheter. The free end of the catheter is tunneled subcutaneously and is externalized through an interscapular incision. The skin incision over the jugular vein is closed with suture. The catheter is flushed with saline and then filled with a heparin and glycerol lock solution. The end of the catheter is plugged with a sterile blunted ball pin and the pin is secured to the skin with a wound clip. To maintain patency the catheter is flushed with saline and refilled with fresh lock solution every 3 days.

NOTES
"WORKING" VERSUS "NON-WORKING" HETEROTOPIC HEART TRANSPLANTATION

Vince Mendenhall, DVM, PhD
Wake Forrest University Babtist Medical Center

Background: When studying possible methods to help prevent heart transplant rejection and/or improve graft function, heterotopic placement is preferred over orthotopic placement, since rejection or insufficient function of the graft does not result in the recipient's death. Sequential examination of the tissue over time aids in determining the pathophysiology of the rejection process (if it occurs). Heterotopic heart transplants may also be implanted as either "non-working" or "working". Although technically easier, a direct correlation between graft rejection and cardiac contractile function cannot be obtained in the heterotopic non-working heart model in terms of left ventricular work, as well as being difficult to obtain hemodynamic data in situ. Thus, the "non-working" heart model is used in early development of anti-rejection methods, and the "working" heart model is used to determine actual function in the absence of rejection, prior to performing definitive orthotopic implantation procedures.

"Non-working" model: The heart is prepared for implantation by ligation of the atrial incisions and dissection of the adventitial tissue between the ascending aorta and the main pulmonary artery. End-to-side anastomosis is performed between the donor ascending aorta and the recipient infrarenal abdominal aorta. End-to-side anastomosis is then performed between the donor main pulmonary artery and the inferior vena cava. The right atrial incision is then ligated.

Working Model: The main pulmonary is doubly ligated, and the right atrial appendage is opened to a diameter of about 2 cm. The fossa ovale is then excised to create an atrial septal defect about 1 cm in diameter. The tricuspid valve is then rendered incompetent by division of its chordae. End-to-side anastomosis is performed between the donor ascending aorta and the recipient infrarenal abdominal aorta. End-to-side anastomosis is then performed between the right atrium and the inferior vena cava.
AN APPRAISAL OF INTESTINAL SURGICAL MODELS

Kuldip Mirakhur, DVM, MVSc, PhD
Abbott Laboratories

Surgical models on the gut are being used to aid in the study of regional absorption for new compounds, genomics and immune response to antigens, peptides and adjuvant, as well as in vivo colonization of microorganisms. Surgical techniques, complications and outcome of various models, viz. intestinal access port in dogs, gut loops in sheep, calves and pigs, and in utero fetal sheep will be presented.

Intestinal access catheters are implanted for the delivery in jejunum, ileum and colon through a mid line ventral abdominal incision extending cranially about 3-4 inches from the umbilicus. Intestinal catheter implantation has been previously described in the literature and will be reviewed here, as well as highlighting some minor modifications to help improve the longevity of the model. In general, the catheters are introduced into the lumen on the anti-mesenteric border and secured by a purse string suture and Dacron disc secured to the catheter. Additionally, the catheter is secured to the gut wall by three interrupted sutures around Dacron beads on the catheter parallel to the gut wall. Through a stab incision, the catheters exit through the abdominal wall and are tunneled subcutaneously to a dorso-lateral skin incision and coupled to the access ports sutured to the musculature. Complications have included migration of the intestinal catheters into the lumen which have occasionally resulted in intestinal obstruction and/or intussusceptions and infection of the port areas or the catheter tracts. The various steps used to deal with these complications and the refinements to minimize their causes and reduce their incidence will be addressed.

A gut loop model will be described that involves isolation of Peyer’s patches in jejunum and ileum for the purpose of studying the local and systemic immune response to the antigens, peptides, adjuvant etc. to help in the mucosal and neonatal vaccine studies. Surgical technique involves the exteriorization of the intestine through a laparotomy and identifying a part that has the requisite number of Peyer’s patches. An intestinal segment that has the required number of Peyer’s patches is transected while maintaining its mesenteric blood, lymph and nerve supply and a blind loop is created upon closing both ends. An end-to-end anastomosis is performed to restore the patency of the jejunum or ileum. Before returning abdominal contents into the peritoneal cavity, the gut loop is injected with the test substance to be later retrieved ex-vivo for the purpose of RNA studies and immunochemistry. The abdomen is closed in a routine manner and the animal is recovered. This technique has been carried out in sheep, cattle, pigs as well as in utero sheep fetus. Complications seen most commonly are the suppuration of the loop in cattle only.

NOTES
A LEFT THORACOTOMY APPROACH FOR CONSISTENT EPICARDIAL P WAVE ACQUISITION VIA TELEMETRY, IN THE PRIMATE

David Moddrelle, SRS, Jen Ward, Kyle O'Donahue, BS, Theodore Baird, PhD
MPI Research

Epicardial placement of telemetry bio-potential leads has become widely accepted as the standard for high quality, noise free recording of electrocardiograms (ECG). This particular placement technique allows recording a base apex ECG by placing a positive bio-potential lead on the lateral aspect of the left ventricular apex and a negative bio-potential lead along the mediastinal aspect of the base of the left ventricle. In multiple species it has been shown that a complete ECG (PQRST) can be acquired via this method with R wave amplitudes ranging from 5 - to over 10 millivolts. The ventral species, such as the canine and swine, have consistent detectable P waves when utilizing the base/apex ECG approach. This is due to their heart orientations tending to be sternal or right side dominate. However, in the primate, its cardiac orientation tends to be left side dominate, which may not allow for the base/apex approach to be 100% successful in acquiring a detectable P wave. Other thoracic anatomy of the primate, such as the thymus and or fat pads that reside on the pericardium, also add challenges to base/apex P wave detection. Recently, a study was presented to our surgical and safety pharmacology groups where we were tasked to provide 31 telemeterized primates with epicardial leads for the detection of potential AV block. This required that all animals have a detectable P wave via a Ponemah recording system. With IACUC approval, the animals under went an off midline laparotomy for placement of the transmitter and pressure catheter and a left thoracotomy for placement of the epicardial leads. The base/apex approach yielded a success of 65.1% (21/31) with 34.9% (10/31) of the animals experiencing either visually non-detectable P waves or exhibiting such low P wave amplitudes as to be non detectable by a Ponemah recording system. P wave quality was accessed by comparing the total number of ECG waveforms (TW) against the number of good waves (GW) and the number of P waves detected by the ponemah system (Pct) in a 5 second bin. This comparison showed a 20 -25% difference between the number of counted ECG waveforms and the number of counted good waves and counted P waves in base/apex configuration that exhibited weak P waves. Surgical modification of the epicardial placement was performed by dissection of the thymus and or fat pads off the pericardium, without disruption of the mediastinum, until the right atrium could be visualized through the pericardium. The negative lead was then placed in several locals in this area until the ECG exhibited a visual P wave that could be consistently detected by the Ponemah system and then anchored into place, generally over the area of the right atrium. This modification allowed for a 100% improvement on P wave quality with the numbers for TW, GW and Pct virtually the same. These numbers remained the same through out the in-life phase of the study. All animals were recovered normal, post-surgically, with no complications noted. It is our belief that if a complete epicardial ECG complex is required in the primate then a surgical modification of the placement of the negative epicardial lead is essential.

NOTES
OPTIMIZING ANIMAL MODELS FOR MEDICAL DEVICE RESEARCH AND DEVELOPMENT: THREE CASE STUDIES

L. Layne Norlund, DVM
IMDS Discovery Research

Well designed animal models for biomedical research enhance translational prospects for animal study findings to the corresponding human medical/surgical treatment of interest. Well designed animal models and studies also maximize the benefit-to-cost ratio for study sponsors and enhance a test facility’s reputation. Poorly designed animal models/studies accomplish the exact opposite, and may quash a treatment or device with significant beneficial potential in humans, promote an ineffective product, or worse yet, promote a potentially dangerous product. Well designed animal models for biomedical research incorporate most appropriate comparative animal anatomy/physiology for animal species selection, knowledge of and proficiency with current state of the profession best practices and materials, and most relevant in-life and postmortem testing. Three medical device research and development case studies will be used to illustrate these principles. They will include animal models for rotator cuff reconstruction, digital flexor tendon repair, and breast reconstruction/augmentation.
THE HUMAN PROXY: PRECLINICAL MEDICAL DEVICE SURGICAL MODELS

Shawn O’Malley, BS
MPI Research

Preclinical surgical research is unique in that it frequently has direct application in the clinical setting. Many animal surgical models are a scaled down version of the human methodologies. Discussed are the human diseases and conditions that require surgical intervention and some of the preclinical surgery models used to develop treatments; cardiovascular stent deployment, arterial-venous grafts, spinal implantation of stimulating electrodes, knee and hip arthroplasties, dental prosthetics, and stem cell administration in cardiovascular and neurological tissues. Models in both large and small animals will be covered, as well as the limitations of the animal analogue.
USING THROMBOELASTOGRAPHY AS A SURGICAL DIAGNOSTIC AND RESEARCH TOOL

Justin Prater BS, LATG, SRA, Randy Pielemeier, LVT, SRS, BS, LATG, Dr. Scott Adrian DVM, Dr. Adam Aulbach, Scotty Hall ALAT
MPI Research

Thromboelastography is a coagulopathic diagnostic tool which is quickly gaining popularity in the clinical setting to rapidly diagnose coagulopathic issues. This presentation will demonstrate the uses of this test as it relates to surgery for diagnosis of coagulopathic abnormalities. A background on thromboelastography will be presented, showing how it was developed and how it is used now. Clinical case studies will be presented, highlighting issues such as excess bleeding due to heparin administration, effects on clotting of excess fluid administration, drugs which are designed to affect clotting, clotting effects due to platelet abnormalities, and using thromboelastography to assist in diagnosing unknown bleeding causes. This presentation will be enlightening as it explores the expansive development of this rapid testing method and it's importance as a coagulopathic diagnostic tool as it relates to surgery.
RODENT CATHETER OPTIONS AND SURGICAL SERVICES

April Pruet, BS and Pam Wolf
Harlan Laboratories, Inc.

There are numerous variables to consider when selecting a cannulated animal model. The catheter properties such as the construction material, tip configuration and diameter are important variables to consider as well as catheter maintenance and surgical technique. All of these factors will contribute to the patency duration of the catheter. Furthermore, patency of the catheter can be extended by utilizing a rounded tip catheter configuration, while minimizing thrombosis and infection. Prior to selecting a commercial vendor for your surgically modified animal model, availability, research requirements, standard options and modifications, quality, consistency, service and animal welfare standards should be analyzed. A strategic balance of all these factors will facilitate good animal welfare practices and desirable research outcomes.

NOTES
A NEW AND MORE DANGEROUS VARIATION AT THE ENTRY OF THE RECURRENT LARYNGEAL NERVE INTO THE LARYNX: EXPERIENCE FROM 4,241 EXPLORATIONS

Tanglei Shao, Weiping Yang, Weihua Qiu, MD, PhD
Shanghai Jiao Tong University School of Medicine, Department of Surgery, Ruijin Hospital

Objectives We aimed to highlight a new anatomical variation of the recurrent laryngeal nerve (RLN), and to emphasize its implication for thyroid surgery. Methods A prospective study was carried out in a group of 3,078 consecutive thyroidectomies during the years 1998-2008. Total, near-total thyroidectomy, subtotal and partial thyroidectomy were performed for various thyroid diseases. The RLN was routinely identified and exposed its entire course until the entry into the larynx. The postoperative complications of patients with different variations were compared. Results 4,241 RLNs were successfully identified in all patients unilaterally or bilaterally. In addition to extralaryngeal branching and non-recurrent laryngeal nerves, an unreported variation was identified in 44 RLNs (1.04%) at their entries into the larynx. The variation happened at the truck or the branches of the RLN entering the larynx far from the posterior of cricothyroid joint, and the entry was higher than the superior comu of the thyroid cartilage and the arch of the cricoid. The median distance from the entry to the posterior of cricothyroid joint was > 5mm. Since the trunk or the branches had to travel along with the lateral edge of the upper 1/3 of the thyroid before entering the larynx, the incidence of RLN palsy was higher than that in extralaryngeal branching variations (p< 0.05). Conclusion This new discovered variation of the RLN is more vulnerable to be injured and should bring much more attention to the surgeons.
EXPERIENCES IN TOTAL THYROIDECTOMY FOR RECURRENT THYROID NODULES

Weiping Yang, Tanglei Shao, Tao Zhang, Weihua Qiu, MD, PhD  
Shanghai Jiao Tong University School of Medicine, Department of Surgery, Ruijin Hospital

Objectives To evaluate the techniques of total thyroidectomy with regard to safety and efficacy in patients with recurrent multinodular goiter after primary subtotal thyroidectomy. Methods 42 patients underwent total thyroidectomy after former subtotal thyroidectomy due to recurrence of thyroid nodules or suspicious malignancy during January 1995 and December 2008. The residual glands were exposed through the gap between the anterior side of sternocleidomastoids and the lateral side of sternohyoids. With a careful dissection of the tracheoesophageal groove, the bilateral recurrent laryngeal nerves (RLNs) were exposed and protected. The parathyroid glands were not deliberately dissected to protect their potential blood supply. Results Five patients enrolled in current study possessed thyroid cancer. The bilateral RLNs were successfully identified in all patients. However partial fibers of the right RLN were accidentally injured in two cases at the plane where the RLN enter larynx but there was no permanent vocal cord dysfunction. Six patients presented with transient hypocalcemia but got total recovery shortly after oral or venous calcium supply. The patient with parathyroid autotransplantation received a long-term oral calcium replacement and the symptoms gradually remitted after one year. Conclusion The correct exposure, adequate understanding of the jugular anatomy and careful manipulation during surgery will reduce the incidence of complications like permanent hypoparathyroidism and RLN palsy, to a minimum.
EFFECT OF SMALL-DIAMETER PROXIMAL SPLENORENAL SHUNT IN THE TREATMENT OF PORTAL HYPERTENSION: EXPERIENCE FROM 176 CASES

Weiping Yang, Yongliang Yao, Hao Chen, Weihua Qiu, MD, PhD
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Objective To investigate the effects of small-diameter proximal splenorenal shunt (PSRS) in the treatment of portal hypertension. Methods 176 cirrhotic patients enrolled in this study. 96 patients underwent splenectomies and PSRS with the shunt stoma size of 8mm in diameter. 80 who took splenectomies and gastroesophageal devascularizations were included as the control group. The hemodynamics of the portal venous system was detected using Doppler color flow imaging (DCFI). Pre-, post-splenectomy and post-shunting, free portal pressures (FPPs) were measured in all cases during the operation. Mortality and incidences of complications (especially encephalopathy, liver failure, and occlusion) were documented in 158 patients during the average follow-up period of 76.32 months (12-165 months). Results Mean diameter of shunt was 8.54 ± 0.81 mm (7-10 mm). FPPs reduced significantly from 42.4±5.85 cmH2O to 29.01±3.48 cmH2O after shunting (P<0.01), but less apparent change was observed in control group. The portal vein flow decreased significantly in both groups, but no difference between two groups. In spite of the negative early mortality, 6 and 12 patients had recurrent variceal hemorrhage in two groups, respectively. DCFI revealed the shunts to be patent in 74 cases and occluded in 18 (18.37%) cases. The incidence of hepatic encephalopathy was 3.37% in shunting group. The survival rate in shunting group of 1, 3, 5 and 10-year was 95.90%, 67.74%, 48.35% and 15.38%, respectively, which was statistically superior to those in control group. Conclusion Small-diameter PSRS affords durable potency and protection against variceal rebleeding with a favorable survival. The low incidence of encephalopathy may result from the maintenance of majority of hepatopetal flow from the portal vein.

NOTES
PATHOLOGY OF INTRAVENOUS CATHETERIZED RATS ON INFUSION STUDIES

David A. Rehagen, DVM, Diplomate ACVP
MPI Research

Interpreting infusion site pathology in rats with surgically-placed catheters from preclinical safety studies can be challenging. Pathologic vascular and perivascular tissue reactions may be influenced by catheter design, catheter placement, catheter maintenance techniques, duration of catheterization, dosing techniques, and other complications such as bacterial contamination. The study pathologist's role is to document and distinguish test article-related macroscopic and microscopic findings from background or procedural changes associated with catheterization. A brief review of common pathologic findings at infusion sites of catheterized rats will be presented.
INTERNAL AORTIC ANNULOPLASTY: A NOVEL MODEL AND VALVE-SPARING SURGICAL REPAIR OF VALVULAR INSUFFICIENCY

John L. Schomburg, Matthew T. Lahti, and Richard W. Bianco
University of Minnesota Medical School

The purpose of this study was to develop an experimental model and a reproducible surgical technique for the evaluation of safety and biocompatibility of a novel sub-valvular internal aortic annulus repair device. This novel device and technique to repair aortic insufficiency has not previously been attempted and required the development of a new experimental surgical model in order to meet regulatory requirements prior to clinical use. Six adult sheep underwent aortic annuloplasty using a orthotopically placed 19-mm aortic annuloplasty frame. Animals were sedated using 10 mg/kg ketamine IM, anesthesia was induced with 10-12 mg/kg sodium thiopental IV. Once intubated and positioned for surgery, oxygen was set at 4 L/min and isoflurane set between 1.0 and 3.0% to maintain a deep plain of anesthesia. Standard cardiopulmonary bypass techniques were followed, and no chronic anticoagulation was used. There was one death due to surgical complication. The five remaining sheep underwent echocardiographic evaluation prior to elective sacrifice and full necropsy. Four were sacrificed on postoperative day 30 and one was sacrificed on postoperative day 60, per study protocol. As the pilot arm of the pre-clinical trial, the results of this study are limited to six experiments. The results show that the model is appropriate and that the surgical technique is effective and reproducible. The next step is to move on to a full pre-clinical trial in a larger number of animals, to evaluate the device and technique for safety, biocompatibility, and efficacy before moving on to clinical trials.

NOTES
NOVEL METHOD FOR SURGICAL PLACEMENT OF RESPIRATORY IMPEDANCE LEADS FOR THE DSI D70- PCTR
TELEMETRY DEVICE IN NON-HUMAN PRIMATES

Leslie Stoll, SRS
Charles River Laboratory

Respiratory rate and other measures of respiratory function (e.g., tidal volume, minute volume, respiratory rate, inspiratory time) should and in some studies must be evaluated.

Clinical observation of animals is generally not an adequate or an efficient use of resources to evaluate respiratory function and thus these parameters should be quantified by using appropriate methodologies such as radio-telemetry monitoring including intercostal impedance lead placement for providing accurate assessment of these parameters.

Proper surgical and anatomical placement of these respiratory electrode impedance leads in imperative to the accuracy of the respiratory data.

Standard anesthesia and analgesics are used as for telemetry implant procedures

Horizontal incisions are placed bilaterally in the intercostal region allowing placement of the electrodes, one cranial and one caudal to the 7 rib and lateral to the zyphoid process. These measurements vary depending on each animal’s unique anatomy.

The (4) imedance leads are separated into two designated pairs, excite electrodes and the sense electrodes. Paired, measured and properly tied loops are implanted in small intermuscular pockets blunt dissected in the intercostal muscles.

Each loop end is placed in opposite directions with the tied base of the loops secured to the muscular pocket approximately 2 cm apart. This distance in critical in the placement.

An electronic verification of placement is performed prior to closure of the incisions. Xray may be used to verify correct loop direction and loop base measurement.

Feasibility study data between Charles River-Preclinical Nevada and DSI has shown the use of this particular placement of the PCTR respiratory leads to be an accurate and consistent method for respiratory data collection.

NOTES
INNOVATION AND DISCOVERY IN SURGERY THROUGH MEDICAL HISTORY

Luis H. Toledo-Pereyra, MD. PhD  
*Michigan State University / Kalamazoo Center for Medical Studies*

The history of medicine has been a trusted witness to great advances and discoveries in the annals of medicine and surgery. Our hypothesis assumes that the history of medicine would teach us a better way to participate in future developments if we utilize the examples gathered from the past to enrich our knowledge and opportunity for discovery. A critical analysis of the contributions of noted surgical personalities of modern surgery, such as Harvey Cushing (1869-1939) and C. Walton Lillehei (1918-1999), can be used as templates to identify their advances in relationship to the historical lessons and taught to future generation of surgeons.

Important questions would be: How can we become future innovators and discoverers? How can we encounter the necessary information to reach the level needed for medical and surgical discovery? Can innovation and discovery be taught through history by example? Is it possible to extrapolate virtues and characteristics from other great innovators like Cushing and Lillehei and apply them to our daily activities? The answer, although positive, requires a systematic and committed practice of all factors leading to innovation.

Harvey Cushing, for example, introduced blood pressure monitoring in surgery, improved methods of hemostasis in brain surgery, such as Bovie cauterization, advanced methods to remove brain tumors, and improved management of neurosurgery patients as some of his innovative developments. Walt Lillehei made open heart surgery accessible to all in the cardiovascular arena. Beginning with cross-circulation on the 1950’s, Lillehei completed the correction of most cardiac congenital anomalies. He introduced the use of myocardial electrodes to treat electrical blockade and the bubble oxygenator, as well as many cardiac valve innovations.

What, then, are the lessons learned from Cushing and Lillehei? There are many but mostly associated with accurate planning and study, a bold approach to discovery, determination and persistance. The teaching of these qualities to others would enhance their opportunities for innovation and discovery. Following the principles established by these noted surgical specialists would permit others to adjust their approach to innovation and discovery, and at the same time to advance scientific surgical knowledge to the highest possible level. Studying personalities of the caliber of Cushing and Lillehei through history and understanding their fundamental discoveries would be particularly enlightening and a source of inspiration for others to follow.

NOTES
MINIMALLY INVASIVE SURGICAL TECHNIQUES: SINGLE PORT LAPAROSCOPIC LIVER BIOPSY IN THE DOG AND NON-HUMAN PRIMATE AND LAPAROSCOPIC ASSISTED OVARIOHYSTERECTOMY IN THE DOG

Gregory O. Voronin, DVM
Merck and Company

Reduction, Refinement and Replacement, or the 3 R’s, are the guiding principles for laboratory animal research. Minimally invasive surgical techniques have been shown in many cases to be less painful with quicker recovery times than their open surgical equivalents. Since the advantages of minimally invasive techniques fit well with the principle of refinement and with research support needs, a program of minimally invasive surgery was established at our research facility. This presentation will outline the equipment and training required to establish our program of minimally invasive surgery. The surgical approach and technique of single port laparoscopic liver biopsy in the dog and rhesus macaque will be described. Additionally the surgical technique of single port laparoscopic assisted ovariohysterectomy in the dog will be described. To date we have successfully preformed over 150 single port laparoscopic procedures as a part of IACUC approved studies at our facility and it is hoped that this presentation will encourage other groups to investigate the potential of these techniques to enhance their research support capabilities.
The 26th Annual Meeting
of the
Academy of Surgical Research

September 30 - October 2, 2010
Clearwater Beach, FL – Sandpearl Resort

Alphabetically listed by Author.
Underline indicates presenting Author.
SURGICAL CREATION OF SIDE-WALL AND BIFURCATE ANEURYSMS IN THE CANINE MODEL

Mark Beckel, BS, SRS, Elizabeth Carter CVT SRT ALAT
American Preclinical Services

An aneurysm is a blood-filled dilation or bulge of a blood vessel caused by disease or general weakening of the vessel wall. The purpose of these studies was to mimic cranial aneurisms by creating either side-wall or bifurcated aneurysms off the carotid artery of the canine model. Also the ability to create multiple treatment sites, for the side-wall model, in one canine reduces both cost and number of animals that need to be enrolled onto the study. Preoperatively canines received 81mg of aspirin and 30mg of nifedipine orally and acepromazine 0.04-0.1mg/kg intramuscularly. Anesthesia was then induced using propofol to effect and maintained with isoflurane 1-2%. Buprenorphine was administered 0.008-0.05 mg/kg intramuscularly for analgesia before procedure and then PRN post operatively as well. Depending on the size of aneurysm to be created a section of either external jugular or lateral saphanous vein was harvested (~3-4inches). Both carotid arteries were then exposed and prepped for anastomosis. Animals received Heparin 200-250 iu/kg intravascularly after vessel harvest and carotid artery exposure. Up to four side-wall aneurysms or one bifurcate aneurysm were created using harvested vessel. Holes were created in carotid using 2.8 to 4.0mm aortic punch. Harvested vessels were sutured to carotids using 6-0 prolene then were ligated 4-10mm from anastomosis. Blood flow was restored to carotids to create aneurysm. If there was excessive bleeding/weeping from anastomosis sites protomine 1mg/100iu heparin was administered intravascularly. Post operatively one animal presented ptosis or Horner's syndrome, characterized by droopy eyelid, caused by irritation of the Vagus or Facial nerve during procedure. All animals presented mild to moderate swelling and bruising in the neck area for the first 2-8 days post creation. Of all animals entered onto study (25) only 2 of the aneurysms were not open which did not allow for a successful treatment at that site.

NOTES
A NOVEL ANESTHETIC PROTOCOL DEVELOPED TO DEMONSTRATE THAT GLUTAMATE AND GLUTAMINE COULD BE USED AS A BIOMARKER (FOR STUDY INDICATIONS) IN THE NONHUMAN PRIMATE (NHP)

Anne Burkholder, SRA
Pfizer

This study describes a novel anesthetic protocol developed with our Neurosciences partners within Pfizer Inc. In the evaluation of potassium channel openers for the clinical indications for bipolar disorder, we wanted to demonstrate that glutamate and glutamine could be used as a biomarker (for study indications) in the nonhuman primate (NHP). To create a translatable animal model that would provide no anesthetic glutamatergic changes during Magnetic Resonance Imaging (MRI), Midazolam and Butorphanol were selected for sedation/restraint. Anesthesia was maintained with Isoflurane. Midazolam (list dose range) and Butorphanol (list dose range) was administered to 8 female cynomolgus monkeys (Macaca fascicularis) aged X to XX. This combination was a reliable premed/sedative to isoflurane anesthesia in cynomolgus. This regimen produced a smooth onset of sedation, a lower isoflurane cumulative exposure resulting in a stable anesthetic plane and uneventful recovery periods. The use of nonhuman primates in BiolImaging pre-clinical drug development enables the discovery and evaluation of biomarkers for Pfizer researched disease areas. Translatable biomarker measurements can improve therapeutic efficacy and clinical effects in humans. Non-human primate imaging can also present in vivo challenges, particularly in supportive care, such as temperature control and anesthetic depth. By delivering a robust animal model, World Wide Comparative Medicine was able to develop standards for imaging techniques, develop a viable animal model, and assist in the development of translatable biomarkers for drug development.
DMM MEDIATED OSTEOARTHRITIS LESION FORMATION IN MALE AND FEMALE 8WK OLD VS. 32WK OLD C57BL/6 MICE

Sean Davis, LATG
Amgen Inc.

The goal was to determine the optimal age, and gender of C57BL/6 mouse for the creation of a mouse OA model by means of destabilization of the medial meniscus (DMM).

The focus was to determine what age and gender of C57BL/6 mouse would create a consistent lesion as a result from the DMM surgery, without lesion formation on the control leg and without severe lesion formation on the surgical leg that might significantly impact mobility or require pain management (all animals were provided Buprenex 0.1mg/kg SC peri-operatively).

16 male and 16 female, 8 week old C57BL/6 mice were used to create the young animal cohort. 16 male and 16 female, 32 week old C57BL/6 mice were used to create the aged animal cohort. A Leica stereoscope was used to locate the medial menisco-tibial ligament, and visually confirm full transaction at time of surgery.

Based on the histology scoring provided, the 8 month males had the most severe lesion on the surgical knee, but had a higher number of spontaneous lesion development on the control knee. From the results provided it was determined that the model that had consistent formation of a moderate lesion on the surgical leg without development of lesions on the control leg was the 8 week old male C57BL/6 mouse. Each of the female cohorts used had some formation of OA lesions on the control knee consistent with spontaneous OA development in this strain.

Due to these histologic findings, it can be concluded that the young male mice would likely make the best OA model using the DMM technique, while having the lowest chance of variability arising from lesion formation on the control knee.

NOTES
ULTRASOUND GUIDED LIVER BIOPSY IN THE Cynomolgus Macaque

Jon Ehrmann, SRS, SRA, Sophie Beyer, Dr. James MacGuire, Dr. Stacey Conarello
Bristol-Myers Squibb Co.

Percutaneous needle liver biopsies were performed under ultrasound (U/S) guidance on 8 cynomolgus monkeys to obtain liver samples for RNA, protein and lipid measurements.

Prior to the biopsy procedure, the animal was sedated with atropine, telazol, and hydromorphone. A local analgesic, lidocaine, was also used. Samples were collected following sterile techniques (up to 3 passes were made with the biopsy needle). Regarding post biopsy procedure, each animal was monitored daily cage side for signs of pain, hemorrhage, and general attitude for 3 days.

The advantages of a percutaneous biopsy over an open laparotomy for surgical biopsy include: minimally invasive approach, minimal pain, reduced morbidity/mortality, quick recovery, option for serial prospective time-points, and increased cost effectiveness.
COMPARISON OF A VENTRAL MIDLINE APPROACH WITH A LATERAL FLANK APPROACH FOR MINIMALLY INVASIVE SINGLE PORT LIVER BIOPSY IN THE NON-HUMAN PRIMATE


Merck and Co, Inc.

Minimally invasive surgical techniques have been shown in many cases to be less painful with quicker recovery times than their open surgical equivalents. This refinement was evaluated for obtaining organ biopsies of sufficient quality and quantity to support an IACUC approved research program. This poster will outline the comparative anatomy of the ventral midline and lateral flank approach for laparoscopic access to the abdominal cavity and describe the results of procedures using both approaches. 32 single port liver biopsies were performed in 8 non-human primates. 16 procedures were conducted using a ventral midline approach and 16 procedures were conducted using a lateral flank approach. Post-operative complications consisting of seroma and dehiscence of the skin closure were observed in 4 animals following a ventral midline approach. There were no post-operative complications observed following the lateral flank approach. The lateral flank approach was found to allow equivalent access to the liver lobes and to have fewer post-operative complications. To our knowledge this is the first presentation comparing the ventral midline and lateral flank approach for single port laparoscopic liver biopsies in the non-human primate.
COMPARISON OF BUPRENORPHINE AND FENTANYL TRANSDERMAL PATCH FOR ANALGESIA IN NEW ZEALAND WHITE (NZW) RABBITS UNDERGOING UNILATERAL ULNA OSTECTOMY

L. Johnson, SRS, BS, A. Murphy, J. Doherty, M. Wadanoli
Pfizer

In an effort to refine surgical pain management for rabbits on a bone healing study, the use of fentanyl transdermal patches was compared to previous method using twice daily intramuscular (IM) administration of buprenorphine. Twenty NZW male rabbits, six months old, were divided into two study groups (n=10) to represent each analgesic regimen. In both groups, animals were provided pre-emptive analgesia using buprenorphine. Post operative analgesia was provided by either 25 ug/kg/hr fentanyl transdermal patch or 0.04 mg/kg buprenorphine given BID. All rabbits were evaluated twice daily after surgery for signs of pain, mobility, food consumption and fecal/urine output. A canine analog pain evaluation form was modified for use in assessing effectiveness of analgesia with lower scores indicating less signs compatible with pain. Post operative aggregate pain scores for fentanyl treated rabbits were lower than the buprenorphine treated group. During the first several days post surgery, appetite and fecal / urine output returned to baseline levels more quickly in the fentanyl group compared to buprenorphine treated rabbits. Based on these findings, fentanyl transdermal patches were observed to provide improved analgesic coverage post orthopedic surgery in NZW rabbits.
Monitoring surgical outcomes is an important component of every surgical program, however there is little published information on outcomes for the mouse femoral artery cannulation (FAC) model. During the model development stage, we initiated a Mouse Assessment Form to capture daily observations. The daily assessment log contained information such as: post-op care, limb perfusion, administration of analgesics, use on study, incision status, catheter information (duration of patency), and other comments.

Male CD-1 mice, 20-24 g, and male C57 mice, 25-30 g, were obtained from Charles River Labs, Raleigh, N.C. Under general anesthesia, (Isoflurane, 2.5 %) mice were surgically prepared using aseptic technique. Tygon catheters (sterilized with Ethylene Oxide or soaked in Cidex 28 Day Solution for at least 20 minutes) were placed in the femoral artery and exteriorized midline at the scapular region. Animals were placed in individual cages and allowed to recover for at least 48 hours before they were placed on study. Analgesics were administered pre-operatively, and up to 48 hours post-operatively, if needed.

Feedback regarding 856 mice undergoing FAC surgery at our facility from January through December, 2009 was provided by LAS Staff and ASR Certified Surgeons. 613 animals (72%) were fully functional and available for use on study. 243 animals (28%) could not be used on study. Immediate Post-surgical complications included: animals which did not recover from anesthesia (4), mouse had drop leg – unwilling to use or reduced ability (25) and mouse had hind end paralysis – unable to move at all; reflexes with toe pinch indicated no response/ Paresis – reduced ability to move leg (7). Further post-surgical observations included non-patent catheters (48), exteriorized catheter damaged by mouse (52), mouse died after flushing the catheter (56), drop leg on non-surgical leg (4), mouse was moribund (13), mouse was found dead (27) and mouse was not needed for study (7).

These results provide useful metrics for assessing surgery model outcomes and common complications.
USE OF HEMOCLIPS FOR MONITORING MIGRATION OF INTESTINAL CATHETERS IN DOGS

Kuldip Mirakhur, DVM, MVSc, PhD, Amanda Wilsey and Chris Medina
Abbott Laboratories

Intestinal access ports are used in regional absorption studies. These catheters have been observed to migrate into the intestinal lumen after a certain length of time. The animal does not exhibit the signs of sickness until many days after it has occurred. This makes the model unreliable when used during the period of migration as the compounds may not have been deposited in the right segment of the intestine. The dogs may as well suffer from the advanced signs of sickness due to catheter migration. Hence, application of hemoclips as a marker at the site of the entry of catheters into the intestinal lumen to monitor the migration was carried out.

Twelve adult beagle dogs have been included in the study. These dogs were subjected to a ventral mid line laparotomy for implanting the intestinal catheters into jejunum, ileum and colon under acepromazine, propofol and sevoflurane anesthetic combination. A 9 F silicone catheter (Access Technologies) was introduced perpendicularly into the lumen through a stab incision by a #11 blade in the centre of a 4-0 Prolene purse string suture on the antimesenteric border. A siliconised dacron disc attached to the catheter was sutured to the serosal wall by 4-0 Prolene interrupted sutures to secure it to the gut wall. This catheter was further secured along the gut wall by applying 2-3 interrupted 4-0 Prolene sutures around the beads on the catheter. This procedure was common to all the catheter insertion sites. Hemoclips were placed on the Dacron disc and to the adjacent mesentery. One clip was placed on each gut segment mesentery and 1, 2 and 3 clips on discs respectively on jejunum, ileum and colon. All the catheters were tunneled out of the abdomen and coupled with vascular access ports placed subcutaneously. These animals were radiographed a week after surgery for a base line and then monthly, quarterly or before every study to assess the status of their placement. An alignment of the hemoclips with the respective disc and mesentery was evaluated every time. If survey radiography was indicative, but not confirmatory of any migration, it was confirmed by a contrast radiography by infusing contrast iodine through the catheter. Thus far, all cases of early migration of intestinal catheters have been successfully confirmed prior to performing a study or upon the earliest clinical signs suggesting catheter migration (i.e. inappetence, lethargy, etc.). Use of hemoclips and this radiographic modality has allowed appropriately trained technicians to give preemptive diagnosis to the veterinarian and provides the veterinarian and investigator an early decisive endpoint to help minimize undue discomfort, animal suffering and results in more accurate study data.

NOTES
POSSIBLE BUPIVACAINE RELATED CARDIOTOXICITY IN THE NON-HUMAN PRIMATE (NHP): A POST-OPERATIVE REVIEW

David Moddrelle, SRS, Kyle O'Donohue BS, Theodore Baird PhD

MPI Research

Bupivacaine's relative analgesic efficacy, duration of action, and CNS: Cardiovascular potency ratio are well documented, and render it desirable for use in animal surgical models. However, the cardiotoxic effects of bupivacaine by various routes of administration have been described, and generally are observed at levels in excess of the maximum clinically recommended single therapeutic dose. This abstract addresses electrocardiographic changes manifested in 1/31 NHPs following a routine implantation of a telemetry device to enable cardiovascular function measurements. The protocol for surgery was performed with the approval of the MPI Research IACUC. Peri-operatively, all procedures were uneventful with the exception of one animal who exhibited cardiac arrhythmias post-operatively culminating in mortality at approximately 20 minutes following surgical closure. In this single animal expressing arrhythmias, hemodynamic parameters at the end of the procedure were: SO2 98%, pCO2 28 mmHg, HR 137 beats/min, CBT 100.9 ºF, MAP 58.85 mmHg. Respiration was nominal (22 breaths/min). A series of electrocardiographic events followed post-surgical administration of bupivacaine (2.0 mg/kg – 1.1 mL IM divided between the main two incisions) including increased T-wave amplitude, decreased R:T height ratio, ST segment elevation, and widening of the QRS complex. Over the next 18 minutes the ECG demonstrated a progressive increase in the incidence of various arrhythmias such as junctional beats, AV dissociation, (1st, 2nd, and 3rd degree block), bigeminy and ventricular rhythm. Following the onset of 3rd degree block, the animal lost consciousness and cardiac massage was initiated, the animal was re-intubated and ventilated, and emergency therapeutics were administered. Following unsuccessful resuscitation attempts, a necropsy was performed whereupon it was noted that all tissues appeared normal. Post-hoc examination of the continuous ECG and blood pressure recordings in comparison with peri-operative timed events (i.e., fluid maintenance, extubation, chest tube removal, analgesic, antibiotic, and bupivacaine administrations, etc.) demonstrated a compelling consistency with the known pharmacodynamic profile and mechanism of bupivacaine acute cardiotoxicity (myocardial depression). The consistency of the ECG events with functional bupivacaine cardiotoxicity, with lack of corresponding arrhythmic changes in other animals similarly treated is compelling, and appears to indicate either an idiosyncratic sensitivity of this single animal or inadvertant intravascular administration during IM administration. Conclusion: Continuous recording of the electrocardiogram and blood pressure during recovery from surgery allowed evaluation of the progressive electrocardiographic manifestations of what is temporally and mechanistically consistent with acute bupivacaine-related cumulative sodium channel block.

NOTES
HYDROGEL IS AN ADEQUATE SOURCE OF HYDRATION FOR SURGICALLY MODIFIED RAT MODELS

Stefanie O'Neal, Carole Blaser, BS, Nick Masterson, LAT, April Pruet, BS
Harlan Laboratories, Inc.

Research animals typically receive a sterile, alternative hydration source during transport. These water source alternatives can contain a variety of additives including flavor enhancers and nutritional supplements. The objective of this study was to compare the benefits of the DietGel Recovery hydration source, formulated specifically for surgically modified rodents, and the standard HydroGel hydration source, a multi-purpose water alternative. A total of 116 single-cannulated Hsd:Sprague Dawley®™SD™ rats (7-13 weeks old) were boxed to simulate shipping conditions. The first experimental cohort of animals received either HydroGel or DietGel Recovery at the time of placement into the shipping box. The second experimental cohort was acclimated to either HydroGel or DietGel Recovery for three days prior to boxing and provided the same gel during the simulated shipping. Both experimental cohorts remained in the box for a four day period with ad libitum access to one of the gel hydration sources and Harlan Teklad Global Research Diet 2018S. Daily food consumption, animal weights, and observations were recorded. Animal body weight was used to determine the benefit of a particular hydration source. Animals maintained on the HydroGel benefited from gel acclimation demonstrated by increased food consumption and body weight as compared to the non-acclimated group. Conversely, animals acclimated to the DietGel Recovery had reduced body weight compared to non-acclimated animals and animals maintained on the HydroGel. These findings indicate that the HydroGel is the preferred hydration source for surgically modified rat models.
PILOT STUDY COMPARISON OF TWO CATHETER LOCK SOLUTIONS IN VAP IMPLANTED FERRETS

Allison S. Parlapiano, SRS, VT, LATG
Merck and Co.

Vascular access ports are well documented in the literature as the preferred method for repeated blood draws and infusions in various animal species. In order to prolong patency of the ports, a solution is injected into the port line to “lock” the line from arterial or venous blood back flow. This can reduce the likelihood of clot formation. Historically, a solution of dextrose and heparin had been used in our VAP implanted ferret colony. The dextrose/heparin solution can be a potential problem if the animals are used on studies involving blood glucose levels. While Taurolidine Citrate Solution is more costly than the dextrose/heparin combination, there is no effect on blood glucose levels. The aim of this study was to compare two different lock solutions and their affects on patency, complete blood count, and serum chemistry.

Thirteen male 16 week old ferrets were implanted with vascular access ports (Access Technologies, Skokie, IL) into their left jugular vein. Six were locked with a 50% dextrose/500ul heparin per ml solution. Seven were locked with TCS (Taurolidine Citrate Solution, Access Technologies). The ports were checked for patency, flushed and locked every two weeks. Samples were taken for complete blood cell count, serum chemistry, and anaerobic/aerobic blood cultures.

We found that there was no statistical difference between the dex/hep and TCS maintained animals in length of VAP patency. Both groups showed no significant findings clinically. All CBC and serum chemistries remained within normal limits. There was no clinical significance to the blood cultures taken in either group. This preliminary study shows that taurolidine citrate holds promise as an alternative lock solution for vascular access ports.
Thromboelastography is a coagulopathic diagnostic tool which is quickly gaining popularity in the clinical setting to rapidly diagnose coagulopathic issues. This presentation will demonstrate the uses of this test as it relates to surgery for diagnosis of coagulopathic abnormalities. A background on thromboelastography will be presented, showing how it was developed and how it is used now. Clinical case studies will be presented, highlighting issues such as excess bleeding due to heparin administration, effects on clotting of excess fluid administration, drugs which are designed to affect clotting, clotting effects due to platelet abnormalities, and using thromboelastography to assist in diagnosing unknown bleeding causes. This presentation will be enlightening as it explores the expansive development of this rapid testing method and its importance as a coagulopathic diagnostic tool as it relates to surgery.
DEVELOPMENT OF A SMALL ANIMAL MODEL FOR TELEMETRIC MONITORING OF LEFT VENTRICULAR (LVP) AND AORTIC ARTERIAL (AOP) PRESSURES.

Janelle VanMiddlesworth, AS, LATG, SRT, SRA, Theodore Baird Ph. D., Kyle O'Donohue BS, LATG, Tracie Rindfield SRS, LATG, Matthew Dennisen B.S., LATG

MPI Research

Temporally correlated measurements of AoP and VLP may be of interest in determining the safety profile and/or mode of action of a drug on the cardiovascular system. Although currently available for use in large animals, an implantable telemetry device for simultaneous determination of these endpoints is not currently available for small animals. The present study was designed to employ existing small animal transmitters (DSI-TA11PA-C10 and DSI-TA11PA-C40) in tandem to allow collection of temporally contiguous LVP and AoP, respectively.

Male (Crl:CD) rats were used. A diaphragmatic approach was used to gain access to the left ventricle for the pressure catheter of the TA11PA-C10 device, the body of the transmitter was placed in a subcutaneous pocket on the lower left thorax, and tissues routinely secured and the incision closed. Placement of the TA11PA-C40 for AoP measurements was accomplished by incising in the region of the pubis to gain access to the abdominal aorta, where the pressure catheter was inserted just above the iliac bifurcation and advanced cranially to just below kidney level. The transmitter body was placed in the abdomen, and the suture rib on the body of the systemic transmitter incorporated into the closure of the peritoneum and abdominal muscle with non-absorbable suture. Remaining tissues were closed and the skin secured with staples. During each procedure, correct placement of the pressure catheters was verified during each procedure by visualizing pressure signal output online.

Animals were allowed to recover for one week prior to evaluation of pressure signals. Endpoints including LV (systolic, end diastolic, developed pressure, heart rate, +dP/dt, and –dP/dt) and aortic (systolic, diastolic, mean, HR, and pulse height) demonstrated minimal inter-animal variability, good agreement with published values, and were viably measured for up to 8 weeks post-implantation. Necropsy evaluations confirmed normal healing post-surgery, with both LVP and AoP catheters still positioned appropriately in situ.

This model proved viable for reliably measuring temporally correlated LVP and AoP.

NOTES
The 26th Annual Meeting of the Academy of Surgical Research

September 30 - October 2, 2010
Clearwater Beach, FL – Sandpearl Resort
# ASR Certifications

## Surgical Research Specialist (SRS)

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The 26th Annual Meeting of the Academy of Surgical Research
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Exhibitor Hours:
Set-up
Thursday, September 30
8am-4pm

Teardown
Friday, October 1
3pm-4:30pm
Access Technologies
Booth #4
For 30 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. We offer a complete line of vascular access ports, catheters, needles, infusion and extension sets, and accessories for species from mice to non-human primates. Custom design and prototyping is our specialty. Access Technologies prides itself on offering high quality products and superior technical and customer support. To learn more visit us at www.norfolkaccess.com, email pwolf@norfolkmedical.com, or call us 847-674-7131.

ALN Magazine
Booth #10
ALN Magazine is a publication of resources, products, and information to design, build, and equip today's research animal facilities. Free subscriptions available at www.alnmag.com.

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Booth #22
Americans for Medical Progress is a non-profit advocacy organization that helps to marginalize animal rights campaigns against research. We provide confidential security and public affairs counsel to institutions and individuals challenged by activists. AMP ensures the voices of scientists and the patients who benefit from animal research are heard in the media. Our “Raising Voices, Saving Lives” campaign offers fellowship opportunities, advocacy training and outreach materials including our free DVD series, Speaking for Research. Our e-newsletter provides the latest news, analysis and context for research professionals. It's a must-read for those wishing to stay current on this rapidly-moving issue. Contact: Jacquie Calnan, President, amp@amprogress.org, 703 836 9595 x100.

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The Biological Test Center
Booth #17
The Biological Test Center is a GLP/cGMP pre-clinical contract laboratory with a 30 year history of specializing in ophthalmic drug and medical device development. The facility is AAALAC, International accredited and registered with the USDA. In addition to a wide-range of surgical and ocular device studies, the Center has multiple surgical suites and state-of-the art equipment for on-site surgical training programs.
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BioVision Veterinary Endoscopy offers a compact endoscopic tower along with hands-on surgical training. BioVision is the leading endoscopic visualization company dedicated to bringing minimally invasive surgery and diagnostics to veterinarians. Our system scales to multiple endoscopic applications, from simple exam room diagnostic Otoscopy to therapeutic Laparoscopy and Arthroscopy.

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ClearH2O manufactures hydration and nutrient fortified gel products for laboratory animals. HydroGel is used with the top U.S. animals breeders to ship animals and the DietGel product line improves/maintains the health of laboratory animals. COMING SOON: The MediGel product line will help medicate rodents and prevent pinworm outbreaks.

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Colonial Medical Supply is the exclusive vendor for the TonoLab. This tonometer is specifically designed for rodent research. We also sell and service anesthesia delivery systems; life support monitors, surgical support systems and a full line of fluid management equipment. We deliver the highest quality of equipment and service.
Covance Research Products Inc. Booth #3
Covance Research Products Inc. provides purpose-bred animals and surgical services to the biomedical research community. Covance’s surgical services include vascular access ports (VAPs), telemetry implantation, sterilization procedures, and digital radiography in multiple species such as nonhuman primates, canines, rabbits, ferrets, guinea pigs, and swine.

DRE Veterinary Booth #19
DRE Veterinary delivers new and professionally refurbished veterinary and animal related equipment. Veterinary specific products include MRI-compatible anesthesia systems (including rodent systems), animal monitoring/telemetry, medical gas systems, specialty operating/exam tables, surgical lighting, electrocautery units, and other medical supplies. DRE’s Animal Health Division has partnered with veterinary, university, and research professionals since 1984.

Data Sciences International (DSI) Booth #9
DSI provides advanced physiological monitoring solutions for pulmonary, cardiovascular, and CNS applications involving acute or chronic studies. Products include advanced data acquisition and analysis systems synchronizing implantable and externally worn telemetry with hardwired amplifiers. Infusion solutions include catheters and iPRECIO infusion pumps. Global offices provide local support and product expertise.

Instech Solomon Booth #15
Instech Solomon continues to innovate with its release of Orchesta™ automated infusion and ABS2 automated blood sampling technologies. Please ask about our new dual channel VAH™ harness and WhiteTip™ Catheter as well as other new infusion products.

Kubtec Booth #18
Kubtec develops and manufactures compact digital cabinet x-ray inspection systems, offering a range of digital detectors, from 2” x 2” to 17” x 17,” for small animal imaging. DIGICOM software provides image analysis tools and ability to save images in several formats. All systems available with film based imaging option.
Lomir Biomedical, Inc.  
Booth #8
Since 1989 Lomir has distinguished itself as a leading-edge designer and manufacturer of high quality innovative, easy to use and durable equipment for biomedical research facilities around the world. Lomir is the world’s largest manufacturer of animal jackets, infusion products and restrainers. Jacket models have been extended to include many custom made options and protective undershirts for large animals. Lomir products are available for all laboratory animals. Lomir’s success is founded on respect for integrity and its absolute commitment to customer satisfaction. Biomedical research is costly venture and our durable and reliable products reduce or eliminate many of the factors that can compromise investigations, whether they involve toxicology, pharmacology, physiology, neuroscience and veterinary science.

Marshall BioResources  
Booth #5
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Mouse Specifics, Inc.  
Booth #14
Mouse Specifics provides instrumentation for non-invasive ECG monitoring and recording in conscious mice and rats. The ECGenie records electrocardiograms without anesthetic, surgery, or implants for arrhythmia detection and the study of autonomic nervous system activity. Validated against radiotelemetry, the ECGenie rapidly provides an accurate assessment of cardiovascular health, including all of the PQRST interval durations, and heart rate variability in the time and frequency domains. The ECGenie can also monitor the ECG during anesthesia induction, surgery, and recovery. Moreover, the ECG can be recorded in neonatal pups beginning on day 1 of life.

Preclinical Surgical Services  
Booth #12
Preclinical Surgical Services within the Piedmont Triad Research Park, is a boutique “fee-for-service” contract research organization, specializing in medical device efficacy evaluations. The organization is directed by Dr. Vince Mendenhall, DVM, PhD, who has close to 40 years experience in all areas and specialties of surgical research. Website: www.preclinicalsurgeries.com; Email: surgicalservices@wfubmc.edu.
**Strategic Applications Inc. (SAI)**

SAI provides all of the products and training necessary to run successful infusion related research in any laboratory species. SAI introduces Axios, the only networked infusion and data management software system capable of monitoring and controlling both syringe and ambulatory pumps. Axios is specifically designed to meet the needs of GLP Toxicology and Safety Pharmacology studies.

**STAAR Booth #6**

STAAR's cornerstone product, the MouseOx® is the world's first and only pulse oximeter for mice and rats. It provides real-time measurements of Arterial Oxygen Saturation, Pulse Rate, Pulse Distention, Breath Rate, and Effort to Breathe from one simple non-invasive sensor. The MouseOx monitors Neonatal through Adult mice and rats.

**Taconic Booth #21**

Taconic, a leading provider of life sciences solutions to researchers worldwide, offers innovative animal models and scientific services for in vivo biomedical studies. Taconic's wide range of advanced solutions include custom model design, generation and production, off-the-shelf model repositories, compound profiling, imaging, phenotyping, contract research, genetic monitoring and health testing.

**World Precision Instruments Booth #1**

Founded in 1967, WPI began as a small manufacturer of amplifiers and stimulators used in nerve, skin, and muscle research. Throughout the years, the company has focused its efforts on the continued expansion and enhancement of its product portfolio. World Precision Instruments, Inc. (WPI) is a leading global provider of powerful, cutting-edge laboratory solutions for the life sciences. Headquartered in Sarasota, Florida, the company's mission is to offer the broadest range of instruments and tools, to enable professionals throughout the biomedical community to conduct research that is more thorough, more efficient, and more accurate. From neurophysiology and cardiovascular physiology, to cell biology and free radical research, WPI provides the equipment needed to ensure success.
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