2014 Research Annual Report

Pediatric General and Thoracic Surgery

Division Summary

RESEARCH AND TRAINING DETAILS				
Number of Faculty	26			
Number of Joint Appointment Faculty	24			
Number of Research Fellows				
Number of Research Students	6			
Number of Support Personnel				
Direct Annual Grant Support	\$2,157,854			
Direct Annual Industry Support	\$77,085			
Peer Reviewed Publications	83			
CLINICAL ACTIVITIES AND TRAINING				
Number of Clinical Staff	13			
Number of Clinical Fellows	7			
Inpatient Encounters	6,416			
Outpatient Encounters	12,174			

Division Photo



Cincinnati Children's

Row 1: F Lim, R Dasgupta Row 2: M Helmrath, S Keswani, D vonAllmen Row 3: A Peña, J Frischer

Significant Accomplishments

Intestinal Models Pave the Way for Intestinal Rehabilitation

Michael Helmrath, MD, Surgical Director of the Intestinal Rehabilitation Center, and his team focus on strategies to improve the outcomes of children with intestinal failure. Understanding the biology of intestinal stem cells is a key to unravel the mechanism involved during the disease process. To that end, the Helmrath team developed *in vitro* culture techniques to maintain and expand individual human intestinal stem cells derived from human tissue samples.

Utilizing those techniques, the Helmrath lab is able to culture intestinal stem cells derived from a variety of diseased tissues. In association with colleagues in Pulmonary Medicine, we are using stem cells derived from patients with cystic fibrosis as a tool for evaluating promising drug compounds. In collaboration with investigators at the University of Cincinnati and in Gastroenterology, we also use intestinal stem cells to study intestinal infectious diseases.

The Helmrath lab, in collaboration with James Wells, PhD, Developmental Biology, and Noah Shroyer, PhD, Gastroenterology, also has developed a murine model of a vascularized and functional human intestine to study human intestinal physiology. These intestinal models will pave the way for understanding gastrointestinal related diseases and lead to the personalized treatment of patients.

Discovering Strategies for Treating Fetal Myelomeningocele

A team led by Jose Peiro, MD, Director of Endoscopic Fetal Surgery at the Cincinnati Fetal Center, is investigating the basic mechanisms of pediatric and fetal surgical congenital malformations, focusing especially upon fetal myelomeningocele (MMC), fetal congenital diaphragmatic hernia (CDH) and gastroschisis.

In MMC, we are improving the fetoscopic approach for intrauterine repair by evaluating different patches and sealants in animal models then translating these techniques for use in the human fetus. A new clinical trial will compare fetoscopic MMC repair in humans against the standardized open fetal surgery approach.

We are using a mouse model of neural tube defects to investigate how maternal immune status can influence incidence of congenital malformations. We also are studying ways to use neural progenitor cells collected from the amniotic fluid of MMC patients as a potential form of neural regeneration (cell therapy).

Evaluating Fetal Surgery to Support Lung Development

In CDH, studies in animal models indicate that early fetal tracheal occlusion may induce faster and better fetal lung growth. A new animal model of CHAOS ligation of the fetal trachea early in gestation perfectly resembles the human histology of this condition. To continue this work, our team has begun studies to evaluate the metabolomics and proteomics of these tissues and fluids.

We expect to start very soon with fetoscopic tracheal occlusion in human fetuses with severe CDH by detachable balloon insertion. This work will contribute to the ongoing multicenter TOTAL trial.

Can Elective Preterm Delivery Prevent Gastroschisis?

In gastroschisis, we are leading/participating in an innovative international multicenter study designed to analyze elective preterm deliveries at 34 weeks' gestation instead of spontaneous delivery as an approach to avoid intestinal inflammation and obtain better neonatal outcomes.

Research Highlights

Professor of Pediatric Surgery Nikolai A. Timchenko, PhD

Dr. Timchenko and his lab apply comprehensive basic science approaches to investigate the molecular mechanisms of liver cancer. Three major discoveries have been made in his lab during last year. First: normal liver expresses several tumor suppressor proteins which protect the liver from development of cancer. Dr. Timchenko found that a small subunit of proteasome, gankyrin, is a key molecule which is activated during development of liver cancer and eliminates five tumor suppressor proteins including p53, Rb, C/EBPa, HNF4a and p16 (Jiang et al. Hepatology 2013). Second: the main characteristic of liver cancer is a failure of hepatocytes to stop proliferation leading to liver tumors. Using unique animal models, Dr. Timchenko found that a complex communication of several signaling pathways is required for termination of liver proliferation. His recent work shows that disruption of this network leads to failure of liver to stop proliferation. This finding has been recently published in Hepatology (Jin et al 2014). In the same issue of Hepatology, Dr. G. Michalopoulos has written a review emphasizing the significance of this work for the field of liver cancer. Third: it is known that fatty liver might cause the development of hepatocellular carcinoma. Dr. Timchenko has elucidated mechanisms of development of fatty liver diseases (Jin et al 2013 Cell Reports). These mechanisms include epigenetic elevation of enzymes of triglyceride synthesis and following accumulation of fat droplets.

Dr. Timchenko's studies are supported by two NIH R01 grants.

Biliary Atresia - Gregory Tiao, MD

Dr. Tiao is the surgical director of Liver Transplantation. He is now developing research in liver disease with the focus on hepatoblastoma. In addition, he continues to develop his research in Biliary Atresia through an ongoing R01 project funded by the National Institute of Health.

Richard Falcone, MD

Trauma research continues to focus on the triage of pediatric trauma patients within the trauma system and at the level of the pediatric trauma hospital. The trauma group is currently working on a project in collaboration with researchers from Children's Hospital of LA and the Medical College of Wisconsin on work to better understand how pediatric trauma teams are activated to minimize under-triage to improve care. We are also working on a project to understand the statewide triage of pediatric trauma patients. In addition, work has continued on expanding our trauma simulation program to educate rural emergency department providers and studying the impact of this training on quality of care for pediatric trauma. Finally, our group continues to expand our work on reducing unintentional injuries to children under five in Hamilton County with support from Kohl's Cares for Kids and Messer Construction funding.

Center for Bariatric Research and Innovation - Thomas Inge, MD, PhD

Dr. Inge and Dr. Jenkins together direct the Center for Bariatric Research and Innovation (CBRI). In addition to participation in a long and growing list of collaborative studies, this Center partners with four other adolescent bariatric centers and the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK) to lead the national effort to prospectively gather data and publish evidence-based recommendations for use of weight loss surgery in adolescents. The Teen LABS study is in the second cycle, eighth year of funding by the NIDDK. Additionally, Dr. Inge received an award from Ethicon EndoSurgery to conduct a long-term follow-up study (FABS5+) to assess health and weight maintenance of patients who had surgery five through 12 years ago. The CBRI is currently partnering with Dr. Aaron Kelly (Univ. of Minn.) and Dr. Elaine Urbina (Cincinnati Children's- Heart Institute) on an NIH-funded study to assess cardiovascular changes in patients after bariatric surgery.

Daniel von Allmen, MD

Dr. von Allmen continues work on surgical innovation focused on image guided surgery. His work seeks to combine advances in imaging technology with the accuracy and reliability of robotics to improve patient care. His work is supported through joint funding between the Cincinnati Children's Hospital Medical Center and the Ben Gurion University in Israel.

Chronic Liver Disease - Jaimie Nathan, MD

Dr. Nathan continues to focus on elucidating the role of gut microbiota in the modulation of liver injury and cholangiopathies. His studies involve a novel mouse model of small bowel bacterial overgrowth, in which a small bowel self-filling blind loop is surgically created. With this model, he is studying the gut-liver axis as it relates to the pathogenesis of a number of cholangiopathies which can progress to end-stage liver disease. Dr. Nathan is surgical director of the Intestinal Transplant Program.

Biology of Vascular Malformations – Belinda Dickie, MD, PhD, and Peter Dickie, PhD Dr. Dickies' research lab is continuing their work in exploring the underlying genetic and cellular defects associated with the pathogenesis of lymphatic and venous malformations. Several unique endothelial cell lines have been established and potential novel genetic mutations have been identified.

Dr. Belinda Dickie is also a part of the Colorectal Center and is looking at the long term outcomes of patients with congenital colorectal anomalies (Hirschsprung's disease and anorectal malformations).

Mounira Habli, MD

The mission of the Habli Laboratory of Fetal growth and Developmental Origins of Adult Disease is to deliver healthier babies, free of adult diseases. This mission drives everything we do.

Our lab has taken on an extremely challenging project examining the cellular and molecular mechanisms of fetal programming in IUGR and tries to develop targeted therapy. We developed and validated a unique surgical IUGR mouse model that recapitulates human placental insufficiency. We are examining a novel placental therapy leading to fetal reprogramming and alleviating the risk of adult onset of disease such as metabolic syndrome. We further identified potential pathways for development of adult onset disease in growth-restricted newborn. Our intention to apply in 2015 for external funding.

Laboratory for Regenerative Wound Healing – Sundeep Keswani, MD, FACS, FAAP Dr. Keswani is focusing on the molecular mechanisms underlying the fetal regenerative wound healing phenotype. If the goals of the project are realized, his work may yield a wide range of therapeutics for diseases characterized by excessive fibroplasia. To that end, this year, he has developed and patented a novel hydrogel that results in regenerative tissue repair in the skin. His collaborators at Stanford University have also demonstrated that this hydrogel has beneficial effects in a model of lung fibrosis. His basic science interests in fetal wound healing are closely paired with his clinical practice in fetal surgery. His research is funded by a K08 award and he has also recently been awarded a five-year \$1.6 million R01 from the National Institute Health.

Significant Publications

Inge TH, **King WC**, **Jenkins TM**, Courcoulas AP, Mitsnefes M, Flum DR, Wolfe BM, Pomp A, Dakin GF, Khandelwal S, Zeller MH, Horlick M, Pender JR, Chen JY, Daniels SR. The effect of obesity in adolescence on adult health status. *Pediatrics*. 2013 132;(6):1098-104.

The purpose of this publication was to show the testing of the hypothesis that adolescent obesity would be associated with greater risks of adverse health in severely obese adults. It was concluded that severe obesity at age 18 was independently associated with increased risk of several comorbid conditions in adults undergoing bariatric surgery.

Jenkins TM, Buncher CR, Akers R, Daniels SR, Lawson ML, Khoury PR, Wilson TP, Inge TH. Validation of a weight history questionnaire to identify adolescent obesity. *Obes Surg.* 2013 23;(9):1404-12.

Past body weight may be a more informative factor than current weight for risk of chronic disease development. Often, investigators must rely on subject recall to gauge past body weights. The Cincinnati Weight History Questionnaire (CWHQ) was developed to aid in the retrospective identification of adults who were obese during adolescence. The CWHQ proved to be a moderately sensitive, but highly specific instrument for detecting adolescent obesity in a cohort of young adult females. Epidemiologic research seeking to discriminate between adults with adult-onset vs. adolescent-onset obesity may find the CWHQ useful.

Mohanty SK, **Donnelly B**, **Bondoc A**, Jafri M, **Walther A**, Coots A, McNeal M, Witte D, **Tiao GM**. Rotavirus replication in the cholangiocyte mediates the temporal dependence of murine biliary atresia. *PLoS One*. 2013 3;8(7):e69069.

Biliary atresia (BA) is a neonatal disease that results in obliteration of the biliary tree. The murine model of BA, which mirrors the human disease, is based upon infection of newborn mice with rhesus rotavirus (RRV), leading to an obstructive cholangiopathy. The purpose of this study was to characterize the temporal relationship between viral infection and the induction of this model. The findings of this research confirm a temporal dependence of RRV infection in murine BA and begin to define a pathophysiologic role of the maturing cholangiocyte.

Jones HN, Crombleholme T, **Habli M**. Adenoviral-mediated placental gene transfer of IGF-1 corrects placental insufficiency via enhanced placental glucose transport mechanisms. *PLoS One*. 2013 8(9): e74632.

Previous work in our laboratory demonstrated that over-expression of human insulin-like growth factor -1 (hIGF-1) in the placenta corrects fetal weight deficits in mouse, rat, and rabbit models of intrauterine growth restriction without changes in placental weight. The underlying mechanisms of this effect have not been elucidated. To investigate the effect of intra-placental IGF-1 over-expression on placental function we examined glucose transporter expression and localization in both a mouse model of IUGR and a model of human trophoblast, the BeWo Choriocarcinoma cell line. It was found that enhanced GLUT isoform transporter expression and relocalization to the membrane may be an important mechanism in Ad-hIGF-1mediated correction of placental insufficiency.

Peiro JL, Fontecha CG, Ruano R, Esteves M, Fonseca C, **Marotta M**, Haeri S, Belfort MA. Single-Access Fetal Endoscopy (SAFE) for myelomeningocele in sheep model I: amniotic carbon dioxide gas approach. *Surg Endosc*. 2013 27;(10):3835-40.

This study aimed to assess the feasibility of single-access fetal endoscopy (SAFE) for the management of myelomeningocele (MMC) using intrauterine carbon dioxide as a distension medium in a sheep model. It confirmed the validity of the animal MMC model. None of the control animals was able to stand or walk, and all had a significant defect in the lumbar area with continuous leakage of cerebrospinal fluid, ventriculomegaly, and a Chiari-II malformation. All the treated animals, independently of the number of ports used in the repair, were able to walk and had a closed defect with resolution of the Chiari malformation. Therefore, the SAFE patch and glue coverage of surgically created fetal MMC is feasible and effective in restoring gross neurologic function in the fetal lamb model.

Division Publications

- Alhajjat AM, Strong BS, Durkin ET, Turner LE, Wadhwani RK, Midura EF, Keswani SG, Shaaban AF. Trogocytosis as a mechanistic link between chimerism and prenatal tolerance. *Chimerism*. 2013; 4:126-31.
- Alonso EM, Ng VL, Anand R, Anderson CD, Ekong UD, Fredericks EM, Furuya KN, Gupta NA, Lerret SM, Sundaram S, Tiao G, Studies of Pediatric Liver Transplantation Research G. The SPLIT research agenda 2013. Pediatr Transplant. 2013; 17:412-22.
- Al-Shanafey SN, Fontecha CG, Canyadell MA, Soldado FC, Rojo AA, Conesa XJ, Toran NT, Ibanez VM, Peiro JL. Reduction in neural injury with earlier delivery in a mouse model of congenital myelomeningocele: laboratory investigation. *J Neurosurg Pediatr.* 2013; 12:390-4.
- 4. Azizkhan RG. Complex vascular anomalies. Pediatr Surg Int. 2013; 29:1023-38.
- Balaji S, King A, Crombleholme TM, Keswani SG. The Role of Endothelial Progenitor Cells in Postnatal Vasculogenesis: Implications for Therapeutic Neovascularization and Wound Healing. Adv Wound Care (New Rochelle). 2013; 2:283-295.
- Balaji S, King A, Dhamija Y, Le LD, Shaaban AF, Crombleholme TM, Keswani SG. Pseudotyped adenoassociated viral vectors for gene transfer in dermal fibroblasts: implications for wound-healing applications. J Surg Res. 2013; 184:691-8.
- 7. Bhattacharya S, Das A, Ghosh S, Dasgupta R, Bagchi A. Hypoglycosylation of dystroglycan due to T192M mutation: a molecular insight behind the fact. *Gene.* 2014; 537:108-14.
- 8. Bischoff A, Bucher M, Gekle M, Sauvant C. **PAH clearance after renal ischemia and reperfusion is a function of impaired expression of basolateral Oat1 and Oat3**. *Physiol Rep.* 2014; 2:e00243.
- 9. Bischoff A, Levitt MA, Breech L, Pena A. Covered cloacal exstrophy--a poorly recognized condition:

hints for a correct diagnosis. J Pediatr Surg. 2013; 48:2389-92.

- 10. Bischoff A, Levitt MA, Pena A. Update on the management of anorectal malformations. *Pediatr Surg Int.* 2013; 29:899-904.
- 11. Brisighelli G, Bischoff A, Levitt M, Hall J, Monti E, Pena A. Coloboma and anorectal malformations: a rare association with important clinical implications. *Pediatr Surg Int.* 2013; 29:905-12.
- Burgos L, Encinas JL, Garcia-Cabezas MA, Peiro JL, Lopez-Santamaria M, Jaureguizar E. Bladder Changes After Several Coverage Modalities in the Surgically Induced Model of Myelomeningocele in Lambs. Actas Urol Esp. 2014; 38:55-61.
- Calvo-Garcia MA, Lim FY, Stanek J, Bitters C, Kline-Fath BM. Congenital peribronchial myofibroblastic tumor: prenatal imaging clues to differentiate from other fetal chest lesions. *Pediatr Radiol.* 2014; 44:479-83.
- 14. Chuang J, Zeller MH, Inge T, Crimmins N. Bariatric surgery for severe obesity in two adolescents with type 1 diabetes. *Pediatrics*. 2013; 132:e1031-4.
- 15. Coleman A, Kline-Fath B, Keswani S, Lim FY. **Prenatal solid tumor volume index: novel prenatal predictor of adverse outcome in sacrococcygeal teratoma**. *J Surg Res.* 2013; 184:330-6.
- 16. Coleman A, Shaaban A, Keswani S, Lim FY. **Sacrococcygeal teratoma growth rate predicts adverse** outcomes. *J Pediatr Surg.* 2014; 49:985-9.
- Coleman AM, Merrow AC, Elluru RG, Polzin WJ, Lim FY. Tracheal agenesis with tracheoesophageal fistulae: fetal MRI diagnosis with confirmation by ultrasound during an ex utero intrapartum therapy (EXIT) delivery and postdelivery MRI. *Pediatr Radiol.* 2013; 43:1385-90.
- Cost NG, Geller JI, Le LD, Crombleholme TM, Keswani SG, Lim FY, Alam S. Urologic co-morbidities associated with sacrococcygeal teratoma and a rational plan for urologic surveillance. *Pediatr Blood Cancer*. 2013; 60:1626-9.
- 19. Cushing CC, Benoit SC, Peugh JL, Reiter-Purtill J, Inge TH, Zeller MH. Longitudinal trends in hedonic hunger after Roux-en-Y gastric bypass in adolescents. *Surg Obes Relat Dis.* 2014; 10:125-30.
- 20. Devine AA, Gonzalez A, Speck KE, Knight R, Helmrath M, Lund PK, Azcarate-Peril MA. Impact of ileocecal resection and concomitant antibiotics on the microbiome of the murine jejunum and colon. *PLoS One*. 2013; 8:e73140.
- 21. Dickie BH, Webb KM, Eradi B, Levitt MA. The problematic Soave cuff in Hirschsprung disease: manifestations and treatment. *J Pediatr Surg.* 2014; 49:77-80; discussion 80-1.
- Drolet BA, Trenor CC, 3rd, Brandao LR, Chiu YE, Chun RH, Dasgupta R, Garzon MC, Hammill AM, Johnson CM, Tlougan B, Blei F, David M, Elluru R, Frieden IJ, Friedlander SF, Iacobas I, Jensen JN, King DM, Lee MT, Nelson S, Patel M, Pope E, Powell J, Seefeldt M, Siegel DH, Kelly M, Adams DM.
 Consensus-derived practice standards plan for complicated Kaposiform hemangioendothelioma. J Pediatr. 2013; 163:285-91.
- 23. Elahi S, Ertelt JM, Kinder JM, Jiang TT, Zhang X, Xin L, Chaturvedi V, Strong BS, Qualls JE, Steinbrecher KA, Kalfa TA, Shaaban AF, Way SS. **Immunosuppressive CD71+ erythroid cells compromise neonatal host defence against infection**. *Nature*. 2013; 504:158-62.
- 24. Eradi B, Hamrick M, Bischoff A, Frischer JS, Helmrath M, Hall J, Pena A, Levitt MA. The role of a colon resection in combination with a Malone appendicostomy as part of a bowel management program for the treatment of fecal incontinence. *J Pediatr Surg.* 2013; 48:2296-300.
- 25. Fuller MK, Faulk DM, Sundaram N, Mahe MM, Stout KM, von Furstenberg RJ, Smith BJ, McNaughton KK, Shroyer NF, Helmrath MA, Henning SJ. Intestinal stem cells remain viable after prolonged tissue storage. *Cell Tissue Res.* 2013; 354:441-50.
- 26. Gerrein BT, Williams CE, Von Allmen D. Establishing a portfolio of quality-improvement projects in

pediatric surgery through advanced improvement leadership systems. Perm J. 2013; 17:41-6.

- 27. Githu T, Merrow AC, Lee JK, Garrison AP, Brown RL. Fetal MRI of hereditary multiple intestinal atresia with postnatal correlation. *Pediatr Radiol.* 2014; 44:349-54.
- 28. Goldin AB, Dasgupta R, Chen LE, Blakely ML, Islam S, Downard CD, Rangel SJ, St Peter SD, Calkins CM, Arca MJ, Barnhart DC, Saito JM, Oldham KT, Abdullah F. Optimizing resources for the surgical care of children: an American Pediatric Surgical Association Outcomes and Clinical Trials Committee consensus statement. *J Pediatr Surg.* 2014; 49:818-22.
- 29. Habli M, Jones H, Aronow B, Omar K, Crombleholme TM. Recapitulation of characteristics of human placental vascular insufficiency in a novel mouse model. *Placenta*. 2013; 34:1150-8.
- Hamilton TE, Barnhart D, Gow K, Ferrer F, Kandel J, Glick R, Dasgupta R, Naranjo A, He Y, Gratias E, Geller J, Mullen E, Ehrlich P. Inter-rater reliability of surgical reviews for AREN03B2: a COG renal tumor committee study. J Pediatr Surg. 2014; 49:154-8; discussion 158.
- Inge TH, King WC, Jenkins TM, Courcoulas AP, Mitsnefes M, Flum DR, Wolfe BM, Pomp A, Dakin GF, Khandelwal S, Zeller MH, Horlick M, Pender JR, Chen JY, Daniels SR. The effect of obesity in adolescence on adult health status. *Pediatrics*. 2013; 132:1098-104.
- 32. Inge TH, Zeller MH, Jenkins TM, Helmrath M, Brandt ML, Michalsky MP, Harmon CM, Courcoulas A, Horlick M, Xanthakos SA, Dolan L, Mitsnefes M, Barnett SJ, Buncher R, Teen LC. Perioperative outcomes of adolescents undergoing bariatric surgery: the Teen-Longitudinal Assessment of Bariatric Surgery (Teen-LABS) study. JAMA Pediatr. 2014; 168:47-53.
- 33. Jenkins TM, Buncher CR, Akers R, Daniels SR, Lawson ML, Khoury PR, Wilson TP, Inge TH. Validation of a weight history questionnaire to identify adolescent obesity. *Obes Surg.* 2013; 23:1404-12.
- Jenkins TM, Wilson Boyce T, Akers R, Andringa J, Liu Y, Miller R, Powers C, Ralph Buncher C.
 Evaluation of a Teleform-based data collection system: a multi-center obesity research case study. Comput Biol Med. 2014; 49:15-8.
- 35. Jones H, Crombleholme T, Habli M. Regulation of amino acid transporters by adenoviral-mediated human insulin-like growth factor-1 in a mouse model of placental insufficiency in vivo and the human trophoblast line BeWo in vitro. *Placenta*. 2014; 35:132-8.
- Jones HN, Crombleholme T, Habli M. Adenoviral-mediated placental gene transfer of IGF-1 corrects placental insufficiency via enhanced placental glucose transport mechanisms. *PLoS One*. 2013; 8:e74632.
- 37. Kelly AS, Barlow SE, Rao G, Inge TH, Hayman LL, Steinberger J, Urbina EM, Ewing LJ, Daniels SR, American Heart Association Atherosclerosis H, Obesity in the Young Committee of the Council on Cardiovascular Disease in the Young CoNPA, Metabolism, Council on Clinical C. **Severe obesity in children and adolescents: identification, associated health risks, and treatment approaches: a scientific statement from the American Heart Association**. *Circulation*. 2013; 128:1689-712.
- 38. Kelly RE, Jr., Mellins RB, Shamberger RC, Mitchell KK, Lawson ML, Oldham KT, Azizkhan RG, Hebra AV, Nuss D, Goretsky MJ, Sharp RJ, Holcomb GW, 3rd, Shim WK, Megison SM, Moss RL, Fecteau AH, Colombani PM, Cooper D, Bagley T, Quinn A, Moskowitz AB, Paulson JF. Multicenter study of pectus excavatum, final report: complications, static/exercise pulmonary function, and anatomic outcomes. *J Am Coll Surg.* 2013; 217:1080-9.
- Kelly-Mancuso G, Kopelan B, Azizkhan RG, Lucky AW. Junctional epidermolysis bullosa incidence and survival: 5-year experience of the Dystrophic Epidermolysis Bullosa Research Association of America (DebRA) nurse educator, 2007 to 2011. *Pediatr Dermatol.* 2014; 31:159-62.
- 40. Keswani SG, Balaji S, Le LD, Leung A, Parvadia JK, Frischer J, Yamano S, Taichman N, Crombleholme TM. Role of salivary vascular endothelial growth factor (VEGF) in palatal mucosal wound healing.

Wound Repair Regen. 2013; 21:554-62.

- 41. Keswani SG, King A. Intestinal alkaline phosphatase prevents the systemic inflammatory response associated with necrotizing enterocolitis. *J Surg Res.* 2013; 185:e9-10.
- 42. King A, Balaji S, Le LD, Crombleholme TM, Keswani SG. **Regenerative Wound Healing: The Role of** Interleukin-10. *Adv Wound Care (New Rochelle)*. 2014; 3:315-323.
- King A, Balaji S, Marsh E, Le LD, Shaaban AF, Crombleholme TM, Keswani SG. Interleukin-10 regulates the fetal hyaluronan-rich extracellular matrix via a STAT3-dependent mechanism. *J Surg Res.* 2013; 184:671-7.
- 44. King A, Keswani S, Biesiada J, Breech L, Crombleholme T, Huppert J. **The utility of a composite index** for the evaluation of ovarian torsion. *Eur J Pediatr Surg.* 2014; 24:136-40.
- 45. King A, Keswani SG. Sensitivity and predictive value of ultrasound in pediatric cholecystitis. *J Surg Res.* 2014; 186:87-8.
- 46. King A, Sharma-Crawford I, Shaaban AF, Inge TH, Crombleholme TM, Warner BW, Lovvorn HN, 3rd, Keswani SG. The pediatric surgeon's road to research independence: utility of mentor-based National Institutes of Health grants. J Surg Res. 2013; 184:66-70.
- 47. Knod L, Donovan EC, Chernoguz A, Crawford KM, Dusing MR, Frischer JS. Vascular endothelial growth factor receptor-2 inhibition in experimental murine colitis. *J Surg Res.* 2013; 184:101-7.
- 48. Kremer N, Walther AE, Tiao GM. Management of hepatoblastoma: an update. *Curr Opin Pediatr.* 2014; 26:362-9.
- 49. Kruger AJ, Hrovat KB, Xanthakos SA, Inge TH. **Preparation of a severely obese adolescent for significant and long-term weight loss: an illustrative case**. *Pediatr Surg Int*. 2013; 29:835-9.
- 50. Landis MW, Butler D, Lim FY, Keswani S, Frischer J, Haberman B, Kingma PS. Octreotide for chylous effusions in congenital diaphragmatic hernia. *J Pediatr Surg.* 2013; 48:2226-9.
- 51. Levitt MA, Hamrick MC, Eradi B, Bischoff A, Hall J, Pena A. Transanal, full-thickness, Swenson-like approach for Hirschsprung disease. *J Pediatr Surg.* 2013; 48:2289-95.
- 52. Li Y, Fallon SC, Helmrath MA, Gilger M, Brandt ML. Surgical treatment of infantile achalasia: a case report and literature review. *Pediatr Surg Int.* 2014; 30:677-9.
- Matsuo Y, Oberbach A, Till H, Inge TH, Wabitsch M, Moss A, Jehmlich N, Volker U, Muller U, Siegfried W, Kanesawa N, Kurabayashi M, Schuler G, Linke A, Adams V. Impaired HDL function in obese adolescents: impact of lifestyle intervention and bariatric surgery. *Obesity (Silver Spring)*. 2013; 21:E687-95.
- 54. Merrow AC, Frischer JS, Lucky AW. **Pyloric atresia with epidermolysis bullosa: fetal MRI diagnosis** with postnatal correlation. *Pediatr Radiol.* 2013; 43:1656-61.
- 55. Meyers RL, Tiao G, de Ville de Goyet J, Superina R, Aronson DC. Hepatoblastoma state of the art: pretreatment extent of disease, surgical resection guidelines and the role of liver transplantation. *Curr Opin Pediatr.* 2014; 26:29-36.
- 56. Michalsky MP, Inge TH, Teich S, Eneli I, Miller R, Brandt ML, Helmrath M, Harmon CM, Zeller MH, Jenkins TM, Courcoulas A, Buncher RC, Teen LC. Adolescent bariatric surgery program characteristics: the Teen Longitudinal Assessment of Bariatric Surgery (Teen-LABS) study experience. Semin Pediatr Surg. 2014; 23:5-10.
- 57. Miyano G, Ignacio RC, Jr., Wood RE, Inge TH. Improvement of tracheal compression after pectus excavatum repair. *Pediatr Surg Int.* 2013; 29:957-9.
- 58. Miyano G, Jenkins TM, Xanthakos SA, Garcia VF, Inge TH. Perioperative outcome of laparoscopic Roux-en-Y gastric bypass: a children's hospital experience. *J Pediatr Surg.* 2013; 48:2092-8.
- 59. Mohanty SK, Donnelly B, Bondoc A, Jafri M, Walther A, Coots A, McNeal M, Witte D, Tiao GM. Rotavirus

replication in the cholangiocyte mediates the temporal dependence of murine biliary atresia. *PLoS One*. 2013; 8:e69069.

- Ngamprasertwong P, Habli M, Boat A, Lim FY, Esslinger H, Ding L, Sadhasivam S. Maternal hypotension during fetoscopic surgery: incidence and its impact on fetal survival outcomes. *ScientificWorldJournal*. 2013; 2013:709059.
- Oberbach A, Neuhaus J, Inge T, Kirsch K, Schlichting N, Bluher S, Kullnick Y, Kugler J, Baumann S, Till H. Bariatric surgery in severely obese adolescents improves major comorbidities including hyperuricemia. *Metabolism*. 2014; 63:242-9.
- 62. Peiro JL, Fontecha CG, Ruano R, Esteves M, Fonseca C, Marotta M, Haeri S, Belfort MA. Single-Access Fetal Endoscopy (SAFE) for myelomeningocele in sheep model I: amniotic carbon dioxide gas approach. *Surg Endosc.* 2013; 27:3835-40.
- 63. Poling HM, Mohanty SK, Tiao GM, Huppert SS. A comprehensive analysis of aquaporin and secretory related gene expression in neonate and adult cholangiocytes. *Gene Expr Patterns*. 2014; 15:96-103.
- 64. Provenzano MJ, Rutter MJ, von Allmen D, Manning PB, Paul Boesch R, Putnam PE, Black AP, de Alarcon A. Slide tracheoplasty for the treatment of tracheoesophogeal fistulas. *J Pediatr Surg.* 2014; 49:910-4.
- 65. Ruano R, Peiro JL, da Silva MM, Campos JA, Carreras E, Tannuri U, Zugaib M. Early fetoscopic tracheal occlusion for extremely severe pulmonary hypoplasia in isolated congenital diaphragmatic hernia: preliminary results. *Ultrasound Obstet Gynecol.* 2013; 42:70-6.
- 66. Ruano R, Rodo C, Peiro JL, Shamshirsaz AA, Haeri S, Nomura ML, Salustiano EM, de Andrade KK, Sangi-Haghpeykar H, Carreras E, Belfort MA. Fetoscopic laser ablation of placental anastomoses in twin-twin transfusion syndrome using 'Solomon technique'. Ultrasound Obstet Gynecol. 2013; 42:434-9.
- 67. Runck LA, Method A, Bischoff A, Levitt M, Pena A, Collins MH, Gupta A, Shanmukhappa S, Wells JM, Guasch G. **Defining the molecular pathologies in cloaca malformation: similarities between mouse and human**. *Dis Model Mech*. 2014; 7:483-93.
- 68. Sawhney P, Modi AC, Jenkins TM, Zeller MH, Kollar LM, Inge TH, Xanthakos SA. **Predictors and** outcomes of adolescent bariatric support group attendance. *Surg Obes Relat Dis.* 2013; 9:773-9.
- 69. Seif AE, Naranjo A, Baker DL, Bunin NJ, Kletzel M, Kretschmar CS, Maris JM, McGrady PW, von Allmen D, Cohn SL, London WB, Park JR, Diller LR, Grupp SA. A pilot study of tandem high-dose chemotherapy with stem cell rescue as consolidation for high-risk neuroblastoma: Children's Oncology Group study ANBL00P1. Bone Marrow Transplant. 2013; 48:947-52.
- Slusher J, Bates CA, Johnson C, Williams C, Dasgupta R, von Allmen D. Standardization and improvement of care for pediatric patients with perforated appendicitis. *J Pediatr Surg.* 2014; 49:1020-5.
- 71. Stefater MA, Xanthakos SA, Johannigman J, Inge TH. Three-decade metabolic outcome of neonatal gastrectomy and early Roux-en-Y. *Pediatr Surg Int.* 2014; 30:249-52.
- 72. Ubesie AC, Cole CR, Nathan JD, Tiao GM, Alonso MH, Mezoff AG, Henderson CJ, Kocoshis SA. Micronutrient deficiencies in pediatric and young adult intestinal transplant patients. *Pediatr Transplant*. 2013; 17:638-45.
- 73. Ubesie AC, Kocoshis SA, Mezoff AG, Henderson CJ, Helmrath MA, Cole CR. Multiple micronutrient deficiencies among patients with intestinal failure during and after transition to enteral nutrition. *J Pediatr.* 2013; 163:1692-6.
- 74. Villa CR, Habli M, Votava-Smith JK, Cnota JF, Lim FY, Divanovic AA, Wang Y, Michelfelder EC. Assessment of fetal cardiomyopathy in early-stage twin-twin transfusion syndrome: comparison between commonly reported cardiovascular assessment scores. Ultrasound Obstet Gynecol. 2014; 43:646-51.

- 75. Walther A, Cost NG, Garrison AP, Geller JI, Alam S, Tiao GM. Renal rhabdomyosarcoma in a pancake kidney. *Urology*. 2013; 82:458-60.
- 76. Walther A, Geller J, Coots A, Towbin A, Nathan J, Alonso M, Sheridan R, Tiao G. Multimodal therapy including liver transplantation for hepatic undifferentiated embryonal sarcoma. *Liver Transpl.* 2014; 20:191-9.
- 77. Walther AE, Mohanty SK, Donnelly B, Coots A, McNeal M, Tiao GM. **Role of myeloid differentiation** factor 88 in Rhesus rotavirus-induced biliary atresia. *J Surg Res.* 2013; 184:322-9.
- 78. Wang F, Scoville D, He XC, Mahe MM, Box A, Perry JM, Smith NR, Lei NY, Davies PS, Fuller MK, Haug JS, McClain M, Gracz AD, Ding S, Stelzner M, Dunn JC, Magness ST, Wong MH, Martin MG, Helmrath M, Li L. Isolation and characterization of intestinal stem cells based on surface marker combinations and colony-formation assay. *Gastroenterology*. 2013; 145:383-95 e1-21.
- 79. Warshak CR, Wolfe KB, Russell KA, Habli M, Lewis DF, Defranco EA. Influence of adolescence and obesity on the rate of stillbirth. *Paediatr Perinat Epidemiol*. 2013; 27:346-52.
- Wynn J, Aspelund G, Zygmunt A, Stolar CJ, Mychaliska G, Butcher J, Lim FY, Gratton T, Potoka D, Brennan K, Azarow K, Jackson B, Needelman H, Crombleholme T, Zhang Y, Duong J, Arkovitz MS, Chung WK, Farkouh C. Developmental outcomes of children with congenital diaphragmatic hernia: a multicenter prospective study. *J Pediatr Surg.* 2013; 48:1995-2004.
- 81. Yu L, Bennett JT, Wynn J, Carvill GL, Cheung YH, Shen Y, Mychaliska GB, Azarow KS, Crombleholme TM, Chung DH, Potoka D, Warner BW, Bucher B, Lim FY, Pietsch J, Stolar C, Aspelund G, Arkovitz MS, University of Washington Center for Mendelian G, Mefford H, Chung WK. Whole exome sequencing identifies de novo mutations in GATA6 associated with congenital diaphragmatic hernia. *J Med Genet*. 2014; 51:197-202.
- 82. Ziegler MM, Azizkhan RG, Allmen Dv, Weber TR. *Operative pediatric surgery*. New York; McGraw Hill Education Medical.
- 83. Zitsman JL, Inge TH, Reichard KW, Browne AF, Harmon CM, Michalsky MP. Pediatric and adolescent obesity: management, options for surgery, and outcomes. *J Pediatr Surg*. 2014; 49:491-4.

Faculty, Staff, and Trainees

Faculty Members

- Daniel von Allmen, MD, Professor Leadership Division Director
- Richard Azizkhan, MD, Professor Leadership Surgeon-in-Chief

Maria H. Alonso, MD, Associate Professor

Leadership Surgical Director, Kidney Transplant Program; Co-Surgical Director, Intestinal Transplant Surgery

Andrea Bischoff, MD, Assistant Professor

Leadership Assistant Professor, Pediatric Surgery; Pediatric Surgeon, Colorectal Center

Rebeccah L. Brown, MD, Associate Professor

Leadership Associate Director, Trauma Services

A. Roshni Dasgupta, MD, MPh, Assistant Professor

Peter Dickie, MD, Assistant Professor

Richard A. Falcone, MD, MPh, Associate Professor Leadership Director, Trauma Services
Jason S. Frischer, MD, Associate Professor Leadership Director, Colorectal Center; Director, Extracorporeal Membrane Oxygenation Program
Victor F. Garcia, MD, Professor Leadership Founding Director, Trauma Services
Mounira Habli, MD, Assistant Professor Leadership Maternal Fetal Medicine Specialist, Fetal Care Center; Co-Director of Fetal Fellowships
Michael A. Helmrath, MD, MS, Professor Leadership Director of Surgical Research; Surgical Director, Intestinal Rehabilitation Center
Belinda Hsi Dickie, PhD, MD, Assistant Professor Leadership Colorectal Center
Jose Peiro Ibanez, , Associate Professor
 Thomas H. Inge, MD, PhD, FACS, FAAP, Professor Leadership Surgical Director, Surgical Weight Loss Program for Teens; Director, Center for Bariatric Research and Innovation
Todd M. Jenkins, PhD, MPh, Assistant Professor Leadership Director, Data Coordinating Center
Helen Jones, PhD, Assistant Professor Leadership Fetal Care Center
Sundeep G. Keswani, MD, Associate Professor Leadership Director, Pediatric Advanced Wound Care and Skin Service
Foong-Yen Lim, MD, Associate Professor Leadership Surgical Director, Fetal Care Center of Cincinnati
Sujit Mohanty, PhD, Instructor
Jaimie D. Nathan, MD, Assistant Professor Leadership Surgical Director, Intestinal Transplant Program; Surgical Director, Pancreas Center
Alberto Pena, MD, Professor Leadership Founding Director, Colorectal Center
Frederick C. Ryckman, MD, Professor Leadership Senior Vice President, Medical Operations; Professor of Surgery/Transplantation
Aimen Shaaban, MD, Professor Leadership Director, Center for Fetal Cellular and Molecular Therapy
 Gregory M. Tiao, MD, Associate Professor Leadership Surgical Director, Liver Transplantation; Director, Small Bowel Program; Associate Director Pediatric Surgery Training Program
Nikolai Timchenko, PhD, Professor

Trainees

- Alexander Bondoc, MD, PL-9, University of Cincinnati College of Medicine, Cincinnati, OH
- Beth Rymeski, DO, PL-8, University of New England College of Osteopathic Medicine, Biddeford, ME

Division Collaboration

Characterization of intestinal stem cells during intestinal adaptation and development of intestinal regenerative strategies. (Michael Helmrath, MD, MS)

Developmental Biology » James Wells, PhD

Single Cell RNAseq iPS cell (Michael Helmrath, MD, MS) Developmental Biology » S. Steven Potter, PhD

Personalized Cystic Fibrosis Therapy and Research Center. (Michael Helmrath, MD, MS) **Pulmonary Medicine** » John P. Clancy, MD and Anjaparavanda P. (AP) Naren, PhD **Section of Neonatology, Perinatal and Pulmonary Biology** » Jeffrey A. Whitsett, MD

Intestinal Organoids as a model system for studying enteric diseases. Oversee human specimen enteroids core. (Michael Helmrath, MD, MS)

Oncology » Brian D. Weiss, MD, Susanne Wells, PhD, , and Section of Neonatology, Perinatal and Pulmonary Biology » Ardythe Morrow, PhD and University of Cincinnati, Department of Molecular and Cellular Physiology » Yana Zavros, PhD Gastroenterology » Sean Moore University of Cincinnati, Department of Molecular and Cellular Physiology » Marshall Montrose, PhD

Role of FANCD2/BRCA2 in ISCs during irradiation induced injury. (Michael Helmrath, MD, MS) **Experimental Hematology** » Qishen Pang, PhD

Trainine on murine and human entreroids techniques. (Michael Helmrath, MD, MS)

Allergy and Immunology » Simon P. Hogan, PhD

Collection of biological specimens from obese patients and lean comparison patients seeking surgical care at Cincinnati Children's Hospital Medical Center. Provide a long-term repository of such biological specimens and collect sufficient demographic information, anthropometric information, past medical history, surgical information, and clinical test results to permit selection of specimens to be used in hypothesis-driven research studies. These specimens are available to qualified researchers at Cincinnati Children's, or other institutions with IRB approved studies aimed at better understanding the biology of pediatric obesity and related disorders. (Thomas H. Inge, MD, PhD, FACS, FAAP; Todd M. Jenkins, PhD, MPH; Stavra A. Xanthakos, MD, MS)

Pathology and Laboratory Medicine | BioBank »

Collaborative effort to design and maintain the website, and web registry site, for the International Registry for Hypothalamic Obesity Disorders. (Thomas H. Inge, MD, PhD, FACS, FAAP)

Division of Biomedical Informatics »

Collaborative effort to design and maintain the secure web portal used for the adjudication process of the Teen-LABS study. (Thomas H. Inge, MD, PhD, FACS, FAAP)

Division of Biomedical Informatics »

We have been funded by NIH to conduct a controlled study of weight loss surgery for pediatric nonalcoholic steatohepatitis (NASH) (ROI, PI = Xanthakos)

(Thomas H. Inge, MD, PhD, FACS, FAAP; Todd M. Jenkins, PhD, MPH)

Gastroenterology, Hepatology and Nutrition » Stavra A. Xanthakos, MD, MS

Explore the role of IL-17 in NAFLD development and progression in obese adolescents to devise novel preventive and therapeutic strategies for NAFLD. (Thomas H. Inge, MD, PhD, FACS) **Gastroenterology, Hepatology and Nutrition** » Senad Divanovic, PhD

Pilot study to correlate bile acid levels in serum to the reduction in weight in post-bariatric surgery in adolescents. (Thomas H. Inge, MD, PhD, FACS, FAAP; Todd M. Jenkins, PhD, MPH) **Gastroenterology, Hepatology and Nutrition** » Rohit Kohli, MBBS, MS

Locating non-operative cohort of patients who have been out of the Surgical Weight Loss Program for Teens, as well as Healthworks for five or more years to recruit for a follow-up study to obtain height, weight, and blood samples for analysis. (Thomas H. Inge, MD, PhD, FACS, FAAP; Todd M. Jenkins, PhD, MPH)

Heart Institute | Healthworks »

Teen View, Teen-View2, TeenView 3 looking at risk behaviors in the Teen-LABS cohort. (Thomas H. Inge, MD, PhD, FACS, FAAP; Todd M. Jenkins, PhD, MPH)

Behavioral Medicine and Clinical Psychology » Meg H. Zeller, PhD

The objective of the present study is to describe the prevalence of kidney abnormalities in severely obese children, and to evaluate risk factors for kidney abnormalities in severely obese children using the Teen-LABS baseline status. (Thomas H. Inge, MD, PhD, FACS, FAAP; Todd M. Jenkins, PhD, MPH)

Nephrology and Hypertension » Nianzhou Xiau

Assessment of appetite regulatory peptides following gastric bypass surgery in adolescents. (Thomas H. Inge, MD, PhD, FACS, FAAP; Todd M. Jenkins, PhD, MPH)

Endocrinology » Janet Chuang, MD

Assessment of body composition via dual-energy X-ray absorptiometry (DEXA) in adolescents undergoing bariatric surgery. (Thomas H. Inge, MD, PhD, FACS, FAAP; Todd M. Jenkins, PhD, MPH)

General & Community Pediatrics » Heidi J. Kalkwarf, PhD, RD

Data collection and management collaboration for the Teen-LABS, FABS, and FABS 5+ studies. (Thomas H. Inge, MD, PhD, FACS, FAAP; Todd M. Jenkins, PhD, MPH)

Biostatistics & Epidemiology » Rachel Akers, MPH, CCDM

Effect of obesity duration on obstructive sleep apnea syndrome (OSAS) severity and sleep quality in morbidly obese patients with OSAS. (Thomas H. Inge, MD, PhD, FACS, FAAP; Todd M. Jenkins, PhD, MPH)

Pulmonary Medicine » Stacey L. Ishman, MD, MPH

Clinical research coordinator support for the FABS 5+ study. (Thomas H. Inge, MD, PhD, FACS, FAAP; Todd M. Jenkins, PhD, MPH)

Clinical and Translational Research Center » Allison Greenberg

Studying the role of the gut microbiome in the modulation of liver injury and cholangiopathies, which can progress to end-stage liver disease. (Jaimie D. Nathan, MD)

Gastroenterology, Hepatology and Nutrition » Jorge A. Bezerra, MD

Sequencing of somatic mutations in lymphatic malformations. (Peter Dickie, PhD; Belinda Hsi Dickie, MD, PhD)

Human Genetics » Derek E. Neilson, MD

Histopathology of lymphatic malformations. (Peter Dickie, PhD; Belinda Hsi Dickie, MD, PhD) **Pathology and Laboratory Medicine** » Anita Gupta, MD

Zebra fish models of vascular malformation. (Peter Dickie, PhD; Belinda Hsi Dickie, MD, PhD) **Developmental Biology** » Saulius Sumanas, PhD

Medical management of vascular diseases.(Peter Dickie, PhD; Belinda Hsi Dickie, MD, PhD) Cancer and Blood Diseases Institute » Denise M. Adams, MD

Placental pathologies in Hypoplastic Left Heart Syndrome. (Helen N. Jones, PhD)

The Heart Institute » Robert B. Hinton, MD and James F. Cnota, MD

CFCMT Placental effects of Fetal NK cells. (Helen N. Jones, PhD) Center for Fetal Cellular and Molecular Therapy » Aimen F. Shaaban, MD

Maternal Regulatory T cells in Fetal Tolerance. (Aimen F. Shaaban, MD) Infectious Diseases » Sing Sing Way, MD, PhD

Developmental Brain Disorders in Fetal Myelomeningocele: Can they be Reverted by Fetal Prenatal intervention? (Jose L. Peiro, MD)

Developmental Biology » Kenneth J. Campbell, PhD Pediatric Neuroimaging Research Consortium » Weihong Yuan, PhD

Amniotic fluid neural progenitor cells for fetal myelomeningocele regeneration. (Jose L. Peiro, MD) Developmental Biology » Masato Nakafuku MD, PhD

Cell therapy with amniotic fluid progenitor cells and growth factors added to the fetal tracheal occlusion to treat pulmonary hypoplasia of CDH in the fetal lamb. (Jose L. Peiro, MD)

Section of Neonatology, Perinatal and Pulmonary Biology » Jeffrey A. Whitsett, MD

Development of colon-rectal muscles and anal sphincter in myelomeningocele patients. (Jose L. Peiro, MD) **Peña Colorectal Center** » Alberto Peña, MD and Andrea Bischoff, MD

Gastroschisis Ultimate Trial (GUT). An international multicentric randomized study. (Jose L. Peiro, MD) Intestinal Rehabilitation Program » Michael A. Helmrath, MD, MS

Grants, Contracts, and Industry Agreements

Grant and Contract Awards		Annual Direct		
HELMRATH, M				
Mechanisms of Intestinal Stem Cell Expansion Following Resection National Institutes of Health				
R01 DK 083325	05/01/10-06/30/14	\$165,515		
INGE, T				
Teen Longitudinal Assessment of B National Institutes of Health	Bariatric Surgery (Teen-LABS)			
UM1 DK 072493	09/23/11-08/31/16	\$645,196		
JENKINS, T				
Teen Longitudinal Assessment of B National Institutes of Health(Universi	Bariatric Surgery - Data Coordinating Center ty of Cincinnati)			
UM1 DK 095710	09/23/11-08/31/16	\$562,644		
JONES, H				
Insulin-like Growth Factor 1 Gene T National Institutes of Health	herapy; Correction of Placental Insufficiency			
R00 HD 068504	04/01/14-03/31/17	\$159,615		
KESWANI, S				
Novel Mechanisms of Regenerativ	e Fetal Wound Repair by IL-10			
National Institutes of Health				
K08 GM 098831	09/15/11-05/31/15	\$93,123		
LAAKE, D				
Youth Occupant Protection Region	al Coordinator Program			
GG-2014-SA-00-00-003	04/22/14-09/30/15	\$29,713		
LAURENCE, S				
Occupant Protection Regional Coo	rdinator Program			
Ohio Department of Public Safety				
PREV31108	10/01/12-09/30/17	\$25,687		
LIM, F				
Identification of Novel Genes for Co	ongenital Diaphragmatic Hernia			
National Institutes of Health(The Trus	stees of Columbia University)			
R01 HD 057036	07/01/08-06/30/14	\$7,777		

The NK Cell Response to Prenatal A	llotransplantation		
National Institutes of Health			
R01 HL 103745	03/05/13-06/30/16		\$238,000
TIAO, G			
The Molecular Determinants of Virus	s Induced Biliary Atresia		
National Institutes of Health			
R01 DK 091566	04/01/11-03/31/16		\$230,584
	Curren	t Year Direct	\$2,157,854
Industry Contracts			
INGE, T			
Ethicon Endo-Surgery, Inc.			\$77,085
	Current Year Dir	rect Receipts	\$77,085
		Total	\$2,234,939