Critical Care Medicine

Division Details

RESEARCH AND TRAINING DETAILS	
Faculty	**13**
Total Annual Grant Award Dollars	**$2,669,743**
Total Annual Industry Award Dollars	**$85,000**
Total Publications	**49**

CLINICAL ACTIVITIES AND TRAINING	
Clinical Fellows	**12**
Inpatient Encounters	**10,177**

Row 1: B Zingarelli, M Dewan, J Kaplan, S Poynter

Row 2: B Varisco, L Doughty, R Chima, H Wong

Row 3: C Riley, R Basu, D Wheeler, K Tegtmeyer, E Stalets

Significant Publications

Atkinson SJ, Nolan M, Klingbeil L, Harmon K, Lahni P, **Zingarelli B**, **Wong HR**. **Intestine-Derived Matrix Metalloproteinase-8 Is a Critical Mediator of Polymicrobial Peritonitis**. *Crit Care Med*. 2016 Apr;44(4):e200-e206.

OBJECTIVE: Inhibition of matrix metalloproteinase-8 improves survival following cecal ligation and puncture in mice, making it a potential therapeutic target. In the current study, we expand our understanding of the role of matrix metalloproteinase-8 in sepsis by using an adoptive transfer approach and alternative sepsis models.

DESIGN: We used three different sepsis models: cecal ligation and puncture, cecal slurry, and intestinal implantation. In our first model, we followed adoptive transfer experiments by cecal ligation and puncture to test the hypothesis that matrix metalloproteinase-8-containing myeloid cells are a critical factor in sepsis following cecal ligation and puncture. Our second model, cecal slurry, used intraperitoneal injections of cecal contents to induce polymicrobial peritonitis without tissue compromise in the recipient. Our third model, intestinal implantation, involved ligating and puncturing a cecum from a donor, and then removing the cecum and placing it into the recipient's peritoneal cavity. Clinically, blood samples drawn from pediatric patients were within 24 hours of meeting criteria for septic shock.

MEASUREMENTS AND MAIN RESULTS: In our adoptive transfer experiments, matrix metalloproteinase-8 null mice receiving wild-type marrow had a survival advantage when compared with wild-type mice receiving matrix metalloproteinase-8 null marrow,

suggesting that matrix metalloproteinase-8-containing myeloid cells are not a critical factor in sepsis following cecal ligation and puncture. In our cecal slurry model, we did not see survival advantage among matrix metalloproteinase-8 null mice. Our third model, intestinal implantation, found that mice receiving matrix metalloproteinase-8 null intestine had a survival advantage when compared with mice receiving wild-type intestine, regardless of recipient genotype. Clinically, median matrix metalloproteinase-8 serum concentrations were higher in patients with sepsis and primary intestinal pathology than in septic patients without primary intestinal pathology.

CONCLUSIONS: Intestine-derived matrix metalloproteinase-8 is a critical component of septic peritonitis secondary to intestinal compromise.

Joshi R, Liu S, Brown MD, Young SM, Batie M, Kofron JM, Xu Y, Weaver TE, Apsley K, **Varisco BM**. **Stretch regulates expression and binding of chymotrypsin-like elastase 1 in the postnatal lung**. *FASEB J*. 2016 Feb;30(2):590-600.

Lung stretch is critical for normal lung development and for compensatory lung growth after pneumonectomy (PNX), but the mechanisms by which strain induces matrix remodeling are unclear. Our prior work demonstrated an association of chymotrypsin-like elastase 1 (Cela1) with lung elastin remodeling, and that strain triggered a near-instantaneous elastin-remodeling response. We sought to determine whether stretch regulates Cela1 expression and Cela1 binding to lung elastin. In C57BL/6J mice, Cela1 protein increased 176-fold during lung morphogenesis. Cela1 was covalently bound to serpin peptidase inhibitor, clade A, member 1, resulting in a higher molecular mass in lung homogenate compared to pancreas homogenate. Post-PNX, Cela1 mRNA increased 6-fold, protein 3-fold, and Cela1-positive cells 2-fold. Cela1 expressed predominantly in alveolar type II cells in the embryonic lung and predominantly in CD90-positive lung fibroblasts postnatally. During compensatory lung growth, researchers induced Cela1 expression in nonproliferative mesenchymal cells. In ex vivo mouse lung sections, stretch increased Cela1 binding to lung tissue by 46%. Competitive inhibition with soluble elastin completely abrogated this increase. Areas of stretch-induced elastase activity and Cela1 binding colocalized. The stretch-dependent expression and binding kinetics of Cela1 indicate an important role in stretch-dependent remodeling of the peripheral lung during development and regeneration.

Riley CL, Sarani B, Sullivan JA, Upperman JS, Kane-Gill SL, Bailey H. **Critical Violent Injury in the United States: A Review and Call to Action**. *Crit Care Med*. 2015 Nov;43(11):2460-7.

OBJECTIVE: This review provides an overview of what we know about violent injury requiring critical care, including child physical abuse, homicide, youth violence, intimate partner violence, self-directed injury, firearm-related injury, and elder physical abuse.

DATA SOURCES: We searched PubMed, Scopus, Ovid Evidence-Based Medicine Reviews, and the National Guideline Clearinghouse. We also included surveillance data from the Centers for Disease Control and Prevention and National Trauma Data Bank.

STUDY SELECTION: Search criteria limited articles to English and reports of humans utilizing the following search terms: intentional violence, intentional harm, violence, crime victims, domestic violence, child abuse, elder abuse, geriatric abuse, nonaccidental injury, nonaccidental trauma, and intentional injury in combination with trauma centers, critical care, or emergency medicine. Additionally, we included relevant articles discovered during review of the articles identified through this search.

DATA EXTRACTION: Researchers reviewed two hundred one abstracts for relevance, selected 168 abstracts, and divided into eight categories (child physical abuse, homicide, youth violence, intimate partner violence, self-directed injury, firearm-related injury, and elder physical abuse) for complete review by pairs of authors. In our final review, we included 155 articles (139 articles selected from our search strategy, 16 additional highly relevant articles, many published after we conducted our formal search).

DATA SYNTHESIS: A minority of articles (7%) provided information specific to violent injury requiring critical care. Given what we know about violent injury in general, the burden of critical violent injury is likely substantial, yet we know little about violent injury requiring critical care.

CONCLUSIONS: Significant gaps in knowledge exist and need addressed by meaningful, sustained tracking and study of the epidemiology, clinical care, outcomes, and costs of critical violent injury. Research must aim for not only information but also action, including effective interventions to prevent and mitigate the consequences of critical violent injury.

Wang X, Gu H, Qin D, Yang L, Huang W, Essandoh K, Wang Y, Caldwell CC, Peng T, **Zingarelli B**, Fan GC. **Exosomal miR-223 Contributes to Mesenchymal Stem Cell-Elicited Cardioprotection in Polymicrobial Sepsis**. *Sci Rep*. 2015 Sep 8;5:13721.

Mesenchymal stem cells (MSCs) have shown to elicit cardio-protective effects in sepsis. However, the underlying mechanism remains obscure. While recent studies have indicated that miR-223 is highly enriched in MSC-derived exosomes, whether exosomal miR-223 contributes to MSC-mediated cardio-protection in sepsis is unknown. In this study, researchers utilized loss-of-function approach, and induced sepsis cecal ligation and puncture (CLP). We observed that injection of miR-223-KO MSCs at 1 h post-CLP did not confer protection against CLP-triggered cardiac dysfunction, apoptosis and inflammatory response. However, WT-MSCs were able to provide protection associated with exosome release. Next, treatment of CLP mice with exosomes released from miR-223-KO MSCs significantly exaggerated sepsis-induced injury. Conversely, WT-MSC-derived-exosomes displayed protective effects. Mechanistically, we identified that miR-223-KO exosomes contained higher levels of Sema3A and Stat3, two known targets of miR-223 (5p &3p), than WT-exosomes. Accordingly, these exosomal proteins transferred to cardiomyocytes, leading to increased inflammation and cell death. By contrast, WT-exosomes encased higher levels of miR-223, delivered to cardiomyocytes, resulting in down-regulation of Sema3A and Stat3. These data for the first time indicate that exosomal miR-223 plays an essential role for MSC-induced cardio-protection in sepsis.

Wong HR, Atkinson SJ, Cvijanovich NZ, Anas N, Allen GL, Thomas NJ, Bigham MT, Weiss SL, Fitzgerald JC, Checchia PA, Meyer K, Quasney M, Hall M, Gedeit R, Freishtat RJ, Nowak J, Raj SS, Gertz S, Lindsell CJ. **Combining Prognostic and Predictive Enrichment to Identify Children With Septic Shock Responsive to Corticosteroids**. *Crit Care Med*. 2016 Oct;44(10):e1000-e1003.

OBJECTIVES: Prognostic and predictive enrichment strategies are fundamental tools of precision medicine. Identifying children with septic shock who may benefit from corticosteroids remains a challenge. We combined prognostic and predictive strategies to identify a pediatric septic shock subgroup responsive to corticosteroids.

DESIGN: We conducted a secondary analysis of 288 previously published pediatric subjects with septic shock. For prognostic enrichment, we assigned each study subject a baseline mortality probability using the pediatric sepsis biomarker risk model. For predictive enrichment, we allocated each study subject to one of two septic shock endotypes, based on a 100-gene signature reflecting adaptive immunity and glucocorticoid receptor signaling. The primary study endpoint was a complicated course, defined as the persistence of two or more organ failures at day 7 of septic shock or 28-day mortality. We used logistic regression to test for an association between corticosteroids and complicated course within endotype.

MEASUREMENTS AND MAIN RESULTS: Among endotype B subjects at intermediate to high pediatric sepsis biomarker risk model-based risk of mortality, corticosteroids were independently associated with more than a 10-fold reduction in the risk of a complicated course (relative risk, 0.09; 95% CI, 0.01-0.54; p = 0.007).

CONCLUSIONS: A combination of prognostic and predictive strategies based on serum protein and messenger RNA biomarkers can identify a subgroup of children with septic shock who may be more likely to benefit from corticosteroids. Prospective validation of these strategies and the existence of this subgroup is warranted.

Division Publications

1. Alsaied T, Goldstein SL, Kaddourah A, Poynter SE. **Thrombocytopenia-Associated Multi-Organ Failure Caused by Diabetic Ketoacidosis.** *Pediatr Int*. 2016; 58:232-4.

2. Atkinson S, Nolan M, Klingbeil L, Harmon K, Lahni P, Zingarelli B, Wong H. **Intestine-Derived Matrix Metalloproteinase-8 Is a Critical Mediator of Polymicrobial Peritonitis.** *Crit Care Med*. 2016; 44:e200-e06.

3. Ayalon I, Alder MN, Langner TR, Hafberg ET, Miethke AG, Kaplan JM. **A Case of Salicylate Intoxication Complicated by Coagulopathy, Pulmonary Edema, and Pancreatitis.** *Am J Ther*. 2016.

4. Basu R, Gist K, Wheeler D. **Improving Acute Kidney Injury Diagnostics Using Predictive Analytics.** *Curr Opin Crit Care*. 2015; 21:473-78.

5. Botez G, Piraino G, Hake PW, Ledford JR, O'Connor M, Cook JA, Zingarelli B. **Age-Dependent Therapeutic Effects of Liver X Receptor-Alpha Activation in Murine Polymicrobial Sepsis.** *Innate Immun*. 2015; 21:609-18.

6. Cooper D, Basu R, Price J, Goldstein S, Krawczeski C. **The Kidney in Critical Cardiac Disease: Proceedings from the 10th International Conference of the Pediatric Cardiac Intensive Care Society.** *World J Pediatr Congenit Heart Surg*. 2016; 7:152-63.

7. Dandoy CE, Linscott LL, Davies SM, Leach JL, Myers KC, El-Bietar J, Chima RS, Pate A, Nelson A, Wallace G, Wong HR, Jodele S. **Clinical Utility of Computed Tomography and Magnetic Resonance Imaging for Diagnosis of Posterior Reversible Encephalopathy Syndrome after Stem Cell Transplantation in Children and Adolescents.** *Biol Blood Marrow Transplant*. 2015; 21:2028-32.

8. Doughty L. **Adaptive Immune Function in Critical Illness.** *Curr Opin Pediatr*. 2016; 28:274-80.

9. Essandoh K, Yang L, Wang X, Huang W, Qin D, Hao J, Wang Y, Zingarelli B, Peng T, Fan GC. **Blockade of Exosome Generation with Gw4869 Dampens the Sepsis-Induced Inflammation and Cardiac Dysfunction.** *Biochim Biophys Acta*. 2015; 1852:2362-71.

10. Flores S, Short S, Basu R. **Acute Kidney Injury in Pediatric Heart Transplantation and Extracorporeal Cardiac Support Therapies.** *Prog Pediatr Cardiol*. 2016; 41:25-31.

11. Grunwell JR, Weiss SL, Cvijanovich NZ, Allen GL, Thomas NJ, Freishtat RJ, Anas N, Meyer K, Checchia PA, Shanley TP, Bigham MT, Fitzgerald J, Howard K, Frank E, Harmon K, Wong HR. **Differential Expression of the Nrf2-Linked Genes in Pediatric Septic Shock.** *Crit Care*. 2015; 19:327.

12. Guo C, Goodwin AJ, Buie JN, Cook JA, Halushka PV, Argraves K, Zingarelli B, Zhang XK, Wang L, Fan H. **A Stromal Cell-Derived Factor 1 Alpha Analogue Improves Endothelial Cell Function in Lipopolysaccharide-Induced Acute Respiratory Distress Syndrome.** *Mol Med*. 2016.

13. Hanna W, Berrens Z, Langner T, Lahni P, Wong H. **Interleukin-27: A Novel Biomarker in Predicting Bacterial Infection among the Critically Ill.** *Critical Care*. 2015; 19:378.

14. Hicks PJ, Margolis M, Poynter SE, Chaffinch C, Tenney-Soeiro R, Turner TL, Waggoner-Fountain L, Lockridge R, Clyman SG, Schwartz A, Appd Learn-Nbme Pediatrics Milestones Assessment Group. **The Pediatrics Milestones Assessment Pilot: Development of Workplace-Based Assessment Content, Instruments, and Processes.** *Acad Med*. 2016; 91:701-9.

15. Jacobs L, Chima RS. **Intensive Care Outcomes for Hematopoietic Stem Cell Transplant Recipients: More of the Same.** *Pediatr Crit Care Med*. 2016; 17:272-3.

16. Jodele S, Fukuda T, Mizuno K, Vinks AA, Laskin BL, Goebel J, Dixon BP, Chima RS, Hirsch R, Teusink A, Lazear D, Lane A, Myers KC, Dandoy CE, Davies SM. **Variable Eculizumab Clearance Requires Pharmacodynamic Monitoring to Optimize Therapy for Thrombotic Microangiopathy after Hematopoietic Stem Cell Transplantation.** *Biol Blood Marrow Transplant*. 2016; 22:307-15.

17. Joshi R, Liu S, Brown MD, Young SM, Batie M, Kofron JM, Xu Y, Weaver TE, Apsley K, Varisco BM. **Stretch Regulates Expression and Binding of Chymotrypsin-Like Elastase 1 in the Postnatal Lung.** *FASEB J*. 2016; 30:590-600.

18. Kaddourah A, Goldstein SL, Basu R, Nehus EJ, Terrell TC, Brunner L, Bennett MR, Haffner C, Jefferies JL. **Novel Urinary Tubular Injury Markers Reveal an Evidence of Underlying Kidney Injury in Children with Reduced Left Ventricular Systolic Function: A Pilot Study.** *Pediatr Nephrol*. 2016; 31:1637-45.

19. Kesselheim JC, Schwartz A, Belmonte F, Boland KA, Poynter S, Batra M, Association of Pediatric Program Directors Longitudinal Educational Assessment Research Network Study Group on Social M, Professionalism. **A National Survey of Pediatric Residents' Professionalism and Social Networking: Implications for Curriculum Development.** *Acad Pediatr*. 2016; 16:110-4.

20. Maher KO, Chang AC, Shin A, Hunt J, Wong HR. **Innovation in Pediatric Cardiac Intensive Care: An Exponential Convergence toward Transformation of Care.** *World J Pediatr Congenit Heart Surg*. 2015; 6:588-96.

21. Menon K, McNally J, Choong K, Lawson M, Ramsay T, Wong H. **A Cohort Study of Pediatric Shock: Frequency of Corticosteriod Use and Association with Clinical Outcomes.** *Shock*. 2015; 44:402-09.

22. Menon K, Wong HR. **Corticosteroids in Pediatric Shock: A Call to Arms.** *Pediatr Crit Care Med*. 2015; 16:e313-7.

23. Menon S, Goldstein SL, Mottes T, Fei L, Kaddourah A, Terrell T, Arnold P, Bennett MR, Basu RK. **Urinary Biomarker Incorporation into the Renal Angina Index Early in Intensive Care Unit Admission Optimizes Acute Kidney Injury Prediction in Critically Ill Children: A Prospective Cohort Study.** *Nephrol Dial Transpl*. 2016; 31:586-94.

24. O'Hearn K, McNally D, Choong K, Acharya A, Wong H, Lawson M, Ramsay T, McIntyre L, Gilfoyle E, Tucci M. **Steroids in Fluid and/or Vasoactive Infusion Dependent Pediatric Shock: Study Protocol for a Randomized Controlled Trial.** *Trials*. 2016; 17:238.

25. Pate A, Rotz S, Warren M, Hirsch R, Cash M, Myers KC, El-Bietar J, Nelson A, Wallace G, Filipovich AH, Bleesing J, Chima RS, Davies SM, Jodele S, Dandoy CE. **Pulmonary Hypertension Associated with Bronchiolitis Obliterans after Hematopoietic Stem Cell Transplantation.** *Bone Marrow Transplant*. 2016; 51:310-2.

26. Patterson M, Militello L, Bunger A, Taylor R, Wheeler D, Klein G, Geis G. **Leveraging the Critical Decision Method to Develop Simulation-Based Training for Early Recognition of Sepsis.** *J Cogn Eng Decis Mak*. 2016; 10:36-56.

27. Poe S, Vandivier-Pletsch RH, Clay M, Wong HR, Haynes E, Rothenberg FG. **Cardiac Troponin Measurement in the Critically Ill: Potential for Guiding Clinical Management.** *J Investig Med*. 2015; 63:905-15.

28. Radabaugh CL, Ruch-Ross HS, Riley CL, Stockwell JA, Conway EE, Jr., Mink RB, Agus MS, Poss WB, Salerno RA, Vernon DD. **Practice Patterns in Pediatric Critical Care Medicine: Results of a Workforce Survey.** *Pediatr Crit Care Med*. 2015; 16:e308-12.

29. Riley CL, Sarani B, Sullivan JA, Upperman JS, Kane-Gill SL, Bailey H, Society of Critical Care Medicine. **Critical Violent Injury in the United States: A Review and Call to Action.** *Crit Care Med*. 2015; 43:2460-7.

30. Sanders R, Nett S, Davis K, Parker M, Bysani G, Adu-Darko M, Bird G, Cheifetz I, Derbyshire A, Emeriaud G. **Family Presence During Pediatric Tracheal Intubations.** *JAMA Pediatr*. 2016; 170:e154627.

31. Siew ED, Basu RK, Wunsch H, Shaw AD, Goldstein SL, Ronco C, Kellum JA, Bagshaw SM, ADQI Consensus Group. **Optimizing Administrative Datasets to Examine Acute Kidney Injury in the Era of Big Data: Workgroup Statement from the 15(Th) Adqi Consensus Conference.** *Can J Kidney Health Dis*. 2016; 3:12.

32. Sweeney T, Wong H. **Risk Stratification and Prognosis in Sepsis: What Have We Learned from Microarrays?** *Clinics In Chest Medicine*. 2016; 37:209-18.

33. Wang X, Gu H, Qin D, Yang L, Huang W, Essandoh K, Wang Y, Caldwell CC, Peng T, Zingarelli B, Fan GC. **Exosomal Mir-223 Contributes to Mesenchymal Stem Cell-Elicited Cardioprotection in Polymicrobial Sepsis.** *Sci Rep*. 2015; 5:13721.

34. Webster DL, Fei L, Falcone RA, Kaplan JM. **Higher-Volume Hypertonic Saline and Increased Thrombotic Risk in Pediatric Traumatic Brain Injury.** *J Crit Care*. 2015; 30:1267-71.

35. Weitkamp J, Guthrie S, Wong H, Moldawer L, Baker H, Wynn J. **Histological Chorioamnionitis Shapes the Neonatal Transcriptomic Immune Response.** *Early Hum Dev*. 2016; 98:1-6.

36. Weled BJ, Adzhigirey LA, Hodgman TM, Brilli RJ, Spevetz A, Kline AM, Montgomery VL, Puri N, Tisherman SA, Vespa PM, Pronovost PJ, Rainey TG, Patterson AJ, Wheeler DS, Task Force on Models for Critical Care. **Critical Care Delivery: The Importance of Process of Care and Icu Structure to Improved Outcomes: An Update from the American College of Critical Care Medicine Task Force on Models of Critical Care.** *Crit Care Med*. 2015; 43:1520-5.

37. Wheeler D. **Significance and Implication of the Ventilator-Associated Tracheobronchitis Diagnosis Reply.** *Pediatric Crit Care Med*. 2016; 17:98-99.

38. Wheeler D. **Ventilator-Associated Respiratory Infections: Choosing between Scylla and Charybdis.** *Pediatric Crit Care Med*. 2016; 17:361-63.

39. Wheeler D. **Do You Know How Much It Costs?** *Intensive Care Medicine*. 2015; 41:1454-56.

40. Wheeler D. **Is the Golden Age of the Golden Hour in Sepsis Over?** *Critical Care*. 2015; 19:477.

41. Wheeler D, Weled B. **Y Critical Care Delivery and Icu Structure-the Elephant in the Room Reply.** *Crit Care Med*. 2015; 43:E591-E92.

42. Wheeler DS. **A Changing Workforce for the Changing Needs of Critically Ill Children in the United States and Canada.** *Pediatr Crit Care Med*. 2015; 16:791-2.

43. Wheeler DS, Underhill SM, Stolz DB, Murdoch GH, Thiels E, Romero G, Amara SG. **Amphetamine Activates Rho Gtpase Signaling to Mediate Dopamine Transporter Internalization and Acute Behavioral Effects of Amphetamine.** *Proc Natl Acad Sci U S A*. 2015; 112:E7138-47.

44. Wheeler DS, Whitt JD, Lake M, Butcher J, Schulte M, Stalets E. **A Case-Control Study on the Impact of Ventilator-Associated Tracheobronchitis in the Picu.** *Pediatr Crit Care Med*. 2015; 16:565-71.

45. Whitmore LC, Hook JS, Philiph AR, Hilkin BM, Bing X, Ahn C, Wong HR, Ferguson PJ, Moreland JG. **A Common Genetic Variant in Tlr1 Enhances Human Neutrophil Priming and Impacts Length of Intensive Care Stay in Pediatric Sepsis.** *J Immunol*. 2016; 196:1376-86.

46. Wong H, Atkinson S, Cvijanovich N, Anas N, Allen G, Thomas N, Bigham M, Weiss S, Fitzgerald J, Checchia P. **Combining Prognostic and Predictive Enrichment Strategies to Identify Children with Septic Shock Responsive to Corticosteroids.** *Crit Care Med*. 2016; 44:e1000-3.

47. Wong HR, Cvijanovich NZ, Anas N, Allen GL, Thomas NJ, Bigham MT, Weiss SL, Fitzgerald J, Checchia PA, Meyer K, Quasney M, Hall M, Gedeit R, Freishtat RJ, Nowak J, Raj SS, Gertz S, Howard K, Harmon K, Lahni P, et al. **Prospective Testing and Redesign of a Temporal Biomarker Based Risk Model for Patients with Septic Shock: Implications for Septic Shock Biology.** *EBioMedicine*. 2015; 2:2087-93.

48. Wong HR, Cvijanovich NZ, Anas N, Allen GL, Thomas NJ, Bigham MT, Weiss SL, Fitzgerald J, Checchia PA, Meyer K, Shanley TP, Quasney M, Hall M, Gedeit R, Freishtat RJ, Nowak J, Raj SS, Gertz S, Dawson E, Howard K, et al. **A Multibiomarker-Based Model for Estimating the Risk of Septic Acute Kidney Injury.** *Crit Care Med*. 2015; 43:1646-53.

49. Zingarelli B. **Shock, Ischemia, and Reperfusion Injury**. In: D Nichols, D Shaffner, eds. *Roger's Textbook of Pediatric Intensive Care*. Philadelphia PA: Wolters Kluwer Health; 2015:253-68.

Grants, Contracts, and Industry Agreements

Annual Grant Award Dollars

Investigator	Title	Sponsor	ID	Dates	Amount
Ranjit Chima, MD	Life After Pediatric Sepsis Evaluation	National Institutes of Health (Children's Hosp & Reg Med Ct-Seattle)	R01 HD073362	4/1/2015 - 6/30/2016	$39,000
Ranjit Chima, MD	Heart and Lung Failure ? Pediatric Insulin Titration Trial	National Institutes of Health (Children's Hospital Boston)	U01 HL107681	7/1/2011 - 6/30/2016	$48,000
Ranjit Chima, MD	Approaches and Decisions for Acute Pediatric TBI (ADAPT)	National Institutes of Health (University of Pittsburgh)	U01 NS081041	7/1/2013 - 6/30/2018	$27,750
Lesley Doughty, MD	Early Rehabilitation Protocol in the Pediatric ICU for Children with Acute Brain Injury	Patient-Centered Outcome Research Inst. (Children's Hospital of Pittsburgh)	CER-1310-08343	9/1/2015 - 8/31/2017	$77,000

Sue Poynter, MD	Multi-Center Trial of Limiting PGY 2&3 Resident Work Hours In ICU	National Institutes of Health (Brigham & Women's Hospital)	U01 HL111478	9/15/2012 - 1/31/2018	$349,404
Erika L Stalets, MD	Age of Blood in Children in Pediatric Intensive Care Units	National Institutes of Health (Washington University)	U01 HL116383	7/15/2013 - 5/31/2016	$53,999
Sonya C Tang Girdwood, MD-PHD	PK of Oseltamivir in Critically Ill Children: Oral vs Enteric Tube Administration	American Academy of Pediatrics	AAP_Tang	8/10/2015 - 8/9/2017	$3,000
Brian Varisco, MD	Cela1 Mediates Stretch-regulated Elastin Remodeling During Alveolar Septation	National Institutes of Health	K08 HL131261	1/7/2016 - 12/31/2019	$128,250
Brian Varisco, MD	Chymotrypsin Like Elastase-1 Links Alveolar and Microvascular Growth	Parker B. Francis Fellowship Program	PBF - Varisco	7/1/2014 - 6/30/2017	$52,000
Hector R Wong, MD	Stratification of Pediatric Septic Shock	National Institutes of Health	R01 GM099773	8/7/2012 - 6/30/2017	$373,107
Hector R Wong, MD	Novel Diagnostic and Stratification Tools for Septic Shock	National Institutes of Health	R01 GM108025	5/1/2014 - 2/28/2018	$790,145
Basilia Zingarelli, MD-PHD	PPARgamma and PPARgamma Agonists in Septic Shock	National Institutes of Health	R01 GM067202	9/14/2012 - 6/30/2017	$369,335
Basilia Zingarelli, MD-PHD	Role of Eicosanoids in Shock	National Institutes of Health (Medical University of South Carolina)	R01 GM027673	7/1/2012 - 3/31/2016	$33,856
Basilia Zingarelli, MD-PHD	Duplex miR-223 and Exosomes in Sepsis	National Institutes of Health (University of Cincinnati)	R01 GM112930	1/1/2015 - 12/31/2018	$16,797
Basilia Zingarelli, MD-PHD	Age-dependent Mechanisms of Metabolic Recovery in Hemorrhagic Shock	National Institutes of Health	R01 GM115973	9/1/2015 - 8/31/2019	$308,100
Total Annual Grant Award Dollars					**$2,669,743**

Annual Industry Award Dollars

Investigator	Industry Sponsor	Amount
Rajit K Basu, MD	La Jolla Pharmaceuticals	$85,000
Total Annual Industry Award Dollars		**$85,000**