

2014 Research Annual Report

Pathology and Laboratory Medicine



Division Summary

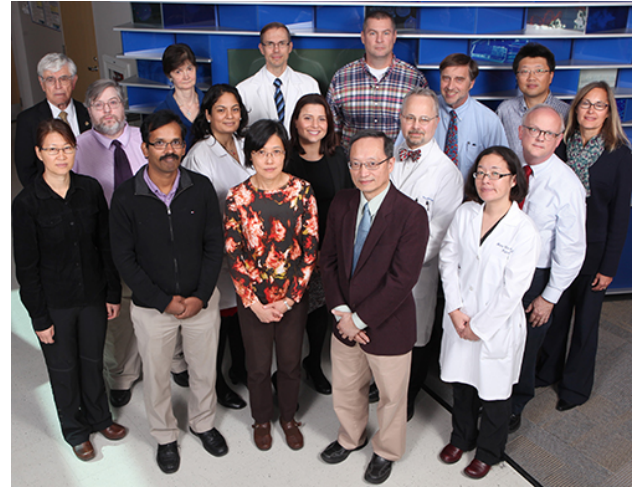
RESEARCH AND TRAINING DETAILS

Number of Faculty	23
Direct Annual Grant Support	\$1,373,077
Direct Annual Industry Support	\$97,399
Peer Reviewed Publications	61

CLINICAL ACTIVITIES AND TRAINING

Number of Clinical Fellows	2
Inpatient Encounters	817,267
Outpatient Encounters	985,264

Division Photo



Row 1: D Wang, K Shanmukhappa, L Miles, P Tang, M Warren
Row 2: R McMaster, A Gupta, R Sheridan, J Mortensen, P Steele
Row 3: K Bove, M Collins, K Stringer, M Baker, D Witte, G Huang, K Wikenheiser-Brokamp

Significant Accomplishments

Investigating Brain Tumors

The Pediatric Brain Tumor Consortium is part of a national effort to improve the outcome for the nearly 4,000 new pediatric brain tumor cases diagnosed and managed each year in this country. **Maryam Fouladi, MD, MSc**, chairs the Consortium, which develops treatment protocols, central pathology review and banking of rare tissue specimens to benefit investigators in their research.

Lili Miles, MD, is responsible for central pathology review of tumor cases for multiple clinical studies in the consortium. Miles directs the tissue banking efforts for these cases from across the US.

Cincinnati Children's has also established the Diffuse Intrinsic Pontine Glioma (DIPG) study, led by **Mariko DeWire, MD**. DeWire has organized a multidisciplinary group to obtain these rare tumor specimens from autopsy and patient families now contribute to the effort to better understand these highly lethal tumors. Fifteen patients have contributed to the study and extensive investigations are underway.

Advances in Metabolomics

Our division has made major investments in mass spectrometry to enhance research at Cincinnati Children's. We established a Mass Spectrometry Metabolomics Core facility to provide insight into how metabolic changes account for disease, to search for disease biomarkers, and to evaluate and monitor responses to therapy.

Using a state-of-the-art Waters Xevo G2S Q-TOF (triple quadrupole/time of flight) instrument capable of extremely fast scanning speeds (80,000 ions/sec), we can detect as many as 10,000 metabolites from a drop of urine, blood, plasma, tissue or cell extract. We can compare diseased and non-diseased states, pre- and post-treatment changes, or longitudinal changes that may occur with disease. Consequently, we have found novel metabolic changes of clinical significance. Among them are perturbations in lipid metabolism in cell lines, animal models and patients with Fanconi Anemia; the mechanism behind patients with PFIC3 heterozygosity developing liver disease in early life; skin barrier development; modulating macrophage immune function during infections; and lipid metabolism in airway disease.

The Mass Spectrometry Metabolomics Core is complemented by the newly formed Nuclear Magnetic Resonance Metabolomics Core directed by [Lindsey Romick-Rosendale](#), making a powerful platform for biomarker discovery.

Faculty Teaching Recognized

The Division of Pathology has a history of contributions to the University of Cincinnati College of Medicine medical student curriculum and educational training programs. In the past year, [Keith Stringer, MD](#); [Kathryn Wikenheiser-Brokamp, MD, PhD](#); and [David Witte, MD](#), have received awards for their teaching contributions.

[Anita Gupta, MD](#), was invited to lecture at the 2014 Indo-Global Healthcare Summit in Hyderabad, India, in recognition of her contributions to the understanding of liver tumors and vascular malformations and tumors in children.

Division Publications

1. Abonia JP, Wen T, Stucke EM, Grotjan T, Griffith MS, Kemme KA, Collins MH, Putnam PE, Franciosi JP, von Tiehl KF, Tinkle BT, Marsolo KA, Martin LJ, Ware SM, Rothenberg ME. **High prevalence of eosinophilic esophagitis in patients with inherited connective tissue disorders.** *J Allergy Clin Immunol.* 2013; 132:378-86.
2. Alsidawi S, Morris JC, Wikenheiser-Brokamp KA, Starnes SL, Karim NA. **Mucoepidermoid carcinoma of the lung: a case report and literature review.** *Case Rep Oncol Med.* 2013; 2013:625243.
3. Bessho K, Shanmukhappa K, Sheridan R, Shivakumar P, Mourya R, Walters S, Kaimal V, Dilbone E, Jegga AG, Bezerra JA. **Integrative genomics identifies candidate microRNAs for pathogenesis of experimental biliary atresia.** *BMC Syst Biol.* 2013; 7:104.
4. Brown NM, Galandi SL, Summer SS, Zhao X, Heubi JE, King EC, Setchell KD. **S-(-)-equol production is developmentally regulated and related to early diet composition.** *Nutr Res.* 2014; 34:401-9.
5. 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.
6. Collins MH. **Histopathology of eosinophilic esophagitis.** *Dig Dis.* 2014; 32:68-73.
7. Collins MH. **Histopathologic features of eosinophilic esophagitis and eosinophilic gastrointestinal diseases.** *Gastroenterol Clin North Am.* 2014; 43:257-68.
8. Collins MH, Reyes-Mugica M. **Defining the transition zone of Hirschsprung disease.** *Pediatr Dev Pathol.* 2013; 16:235-6.
9. Cui R, Gale RP, Zhu G, Xu Z, Qin T, Zhang Y, Huang G, Li B, Fang L, Zhang H, Pan L, Hu N, Qu S, Xiao Z. **Serum iron metabolism and erythropoiesis in patients with myelodysplastic syndrome not receiving RBC transfusions.** *Leuk Res.* 2014; 38:545-50.
10. Cundiff WB, McCormack FX, Wikenheiser-Brokamp K, Starnes S, Kotloff R, Benzaquen S. **Successful**

- management of a chronic, refractory bronchopleural fistula with endobronchial valves followed by talc pleurodesis.** *Am J Respir Crit Care Med.* 2014; 189:490-1.
11. DeBurger B, Mortensen J. **MALDI-ToF: One Lab's Experience.** *Journal of Continuing Education Topics & Issues.* 2014; 16:38-45.
 12. Dorris K, Sobo M, Onar-Thomas A, Panditharatna E, Stevenson CB, Gardner SL, Dewire MD, Pierson CR, Olshefski R, Rempel SA, Goldman S, Miles L, Fouladi M, Drissi R. **Prognostic significance of telomere maintenance mechanisms in pediatric high-grade gliomas.** *J Neurooncol.* 2014; 117:67-76.
 13. El Kasmi KC, Anderson AL, Devereaux MW, Vue PM, Zhang W, Setchell KD, Karpen SJ, Sokol RJ. **Phytosterols promote liver injury and kupffer cell activation in parenteral nutrition-associated liver disease.** *Sci Transl Med.* 2013; 5:206ra137.
 14. Franciosi JP, Hommel KA, Bendo CB, King EC, Collins MH, Eby MD, Marsolo K, Abonia JP, von Tiehl KF, Putnam PE, Greenler AJ, Greenberg AB, Bryson RA, Davis CM, Olive AP, Gupta SK, Erwin EA, Klinnert MD, Spergel JM, Denham JM, Furuta GT, Rothenberg ME, Varni JW. **PedsQL eosinophilic esophagitis module: feasibility, reliability, and validity.** *J Pediatr Gastroenterol Nutr.* 2013; 57:57-66.
 15. Goyama S, Schibler J, Cunningham L, Zhang Y, Rao Y, Nishimoto N, Nakagawa M, Olsson A, Wunderlich M, Link KA, Mizukawa B, Grimes HL, Kurokawa M, Liu PP, Huang G, Mulloy JC. **Transcription factor RUNX1 promotes survival of acute myeloid leukemia cells.** *J Clin Invest.* 2013; 123:3876-88.
 16. Gupta A, Sheridan RM, Towbin A, Geller JI, Tiao G, Bove KE. **Multifocal hepatic neoplasia in 3 children with APC gene mutation.** *Am J Surg Pathol.* 2013; 37:1058-66.
 17. Gupta M, Khalequzzaman M, Jodele S, Mortensen J, Mueller MA, Gupta A. **Crusted scabies in a 15-year-old boy with congenital neutropenia and myelodysplastic syndrome.** *J Clin Oncol.* 2014; 32:e49-51.
 18. Harley IT, Stankiewicz TE, Giles DA, Softic S, Flick LM, Cappelletti M, Sheridan R, Xanthakos SA, Steinbrecher KA, Sartor RB, Kohli R, Karp CL, Divanovic S. **IL-17 signaling accelerates the progression of nonalcoholic fatty liver disease in mice.** *Hepatology.* 2014; 59:1830-9.
 19. Henderson CJ, Ngeow J, Collins MH, Martin LJ, Putnam PE, Abonia JP, Marsolo K, Eng C, Rothenberg ME. **Increased prevalence of eosinophilic gastrointestinal disorders in pediatric PTEN hamartoma tumor syndromes.** *J Pediatr Gastroenterol Nutr.* 2014; 58:553-60.
 20. Ibrahim SH, Gores GJ, Hirsova P, Kirby M, Miles L, Jaeschke A, Kohli R. **Mixed lineage kinase 3 deficient mice are protected against the high fat high carbohydrate diet-induced steatohepatitis.** *Liver Int.* 2013; 34:427-437.
 21. Jenson EG, Baker M, Paydarfar JA, Gosselin BJ, Li Z, Black CC. **MCM2/TOP2A (ProExC) immunohistochemistry as a predictive marker in head and neck mucosal biopsies.** *Pathol Res Pract.* 2014; 210:346-50.
 22. Kesarwani M, Huber E, Azam M. **Overcoming AC220 resistance of FLT3-ITD by SAR302503.** *Blood Cancer J.* 2013; 3:e138.
 23. Khandelwal P, Brewer AJ, Minevich E, Miles L, Geller JI. **High-grade transitional cell carcinoma of the bladder in a 5-year-old boy successfully treated with partial cystectomy and intravesical bacillus Calmette-Guerin.** *J Pediatr Hematol Oncol.* 2014; 36:e234-6.
 24. Koh CP, Wang CQ, Ng CE, Ito Y, Araki M, Tergaonkar V, Huang G, Osato M. **RUNX1 meets MLL: epigenetic regulation of hematopoiesis by two leukemia genes.** *Leukemia.* 2013; 27:1793-802.
 25. Kohli R, Setchell KD, Kirby M, Myronovych A, Ryan KK, Ibrahim SH, Berger J, Smith K, Toure M, Woods SC, Seeley RJ. **A surgical model in male obese rats uncovers protective effects of bile acids post-bariatric surgery.** *Endocrinology.* 2013; 154:2341-51.
 26. Leach JL, Greiner HM, Miles L, Mangano FT. **Imaging spectrum of cortical dysplasia in children.** *Semin Roentgenol.* 2014; 49:99-111.

27. Li A, Yang Y, Gao C, Lu J, Jeong HW, Liu BH, Tang P, Yao X, Neuberg D, Huang G, Tenen DG, Chai L. **A SALL4/MLL/HOXA9 pathway in murine and human myeloid leukemogenesis.** *J Clin Invest.* 2013; 123:4195-207.
28. McCormack FX, Wilmott C, Young LR, Wikenheiser-Brokamp K. **An atoll variant that mocks.** *Am J Respir Crit Care Med.* 2013; 188:110.
29. Melendez J, Liu M, Sampson L, Akunuru S, Han X, Vallance J, Witte D, Shroyer N, Zheng Y. **Cdc42 coordinates proliferation, polarity, migration, and differentiation of small intestinal epithelial cells in mice.** *Gastroenterology.* 2013; 145:808-19.
30. Miles L, Greiner HM, Miles MV, Mangano FT, Horn PS, Leach JL, Seo JH, Lee KH. **Interaction between akt1-positive neurons and age at surgery is associated with surgical outcome in children with isolated focal cortical dysplasia.** *J Neuropathol Exp Neurol.* 2013; 72:884-91.
31. 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.
32. Myronovych A, Kirby M, Ryan KK, Zhang W, Jha P, Setchell KD, Dexheimer PJ, Aronow B, Seeley RJ, Kohli R. **Vertical sleeve gastrectomy reduces hepatic steatosis while increasing serum bile acids in a weight-loss-independent manner.** *Obesity (Silver Spring).* 2014; 22:390-400.
33. Pandey MK, Jabre NA, Xu YH, Zhang W, Setchell KD, Grabowski GA. **Gaucher disease: chemotactic factors and immunological cell invasion in a mouse model.** *Mol Genet Metab.* 2014; 111:163-71.
34. Peariso K, Standridge SM, Hallinan BE, Leach JL, Miles L, Mangano FT, Greiner HM. **Presentation, diagnosis and treatment of bilateral Rasmussen's encephalitis in a 12-year-old female.** *Epileptic Disord.* 2013; 15:324-32.
35. Powell EA, Blecker-Shelly D, Montgomery S, Mortensen JE. **Application of matrix-assisted laser desorption ionization-time of flight mass spectrometry for identification of the fastidious pediatric pathogens *Aggregatibacter*, *Eikenella*, *Haemophilus*, and *Kingella*.** *J Clin Microbiol.* 2013; 51:3862-4.
36. Rahrmann EP, Watson AL, Keng VW, Choi K, Moriarity BS, Beckmann DA, Wolf NK, Sarver A, Collins MH, Moertel CL, Wallace MR, Gel B, Serra E, Ratner N, Largaespada DA. **Forward genetic screen for malignant peripheral nerve sheath tumor formation identifies new genes and pathways driving tumorigenesis.** *Nat Genet.* 2013; 45:756-66.
37. Rams TE, Feik D, Mortensen JE, Degener JE, van Winkelhoff AJ. **Antibiotic susceptibility of periodontal *Enterococcus faecalis*.** *J Periodontol.* 2013; 84:1026-33.
38. 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.
39. Ryan TD, Gupta A, Gupta D, Goldenberg P, Taylor MD, Lorts A, Jefferies JL. **Dilated cardiomyopathy in a 32-year-old woman with Russell-Silver syndrome.** *Cardiovasc Pathol.* 2014; 23:21-7.
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- RJ, Magee JC, Childhood Liver Disease R, Education N. **Extrahepatic anomalies in infants with biliary atresia: results of a large prospective North American multicenter study.** *Hepatology*. 2013; 58:1724-31.
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 47. Stanek J. **Comparison of placental pathology in preterm, late-preterm, near-term, and term births.** *Am J Obstet Gynecol*. 2014; 210:234 e1-6.
 48. Stanek J. **Periarterial stem villous edema is associated with hypercoiled umbilical cord and stem obliterative endarteritis.** *Open Journal of Obstetrics and Gynecology*. 2013; 3 :9-14.
 49. Stanek J, Biesiada J, Trzeszcz M. **Clinicoplacental phenotypes vary with gestational age: an analysis by classical and clustering methods.** *Acta Obstet Gynecol Scand*. 2014; 93:392-8.
 50. Summer SS, Ollberding NJ, Guy T, Setchell KD, Brown N, Kalkwarf HJ. **Cross-border use of food databases: equivalence of US and Australian databases for macronutrients.** *J Acad Nutr Diet*. 2013; 113:1340-5.
 51. Turner K, Belludi C, Hagen M, Ruger K, Rhodes J, Mortensen J. **Case Twenty Six: Fatal Fungal Meningitis in an Immunocompetent Patient.** *Journal of Continuing Education Topics and Issues*. 2013; 15.
 52. Turpin B, Miller W, Rosenfeldt L, Kombrinck K, Flick MJ, Steinbrecher KA, Harmel-Laws E, Mullins ES, Shaw M, Witte DP, Revenko A, Monia B, Palumbo JS. **Thrombin drives tumorigenesis in colitis-associated colon cancer.** *Cancer Res*. 2014; 74:3020-30.
 53. 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.
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 55. Watson AL, Anderson LK, Greeley AD, Keng VW, Rahrmann EP, Halfond AL, Powell NM, Collins MH, Rizvi T, Moertel CL, Ratner N, Largaespada DA. **Co-targeting the MAPK and PI3K/AKT/mTOR pathways in two genetically engineered mouse models of schwann cell tumors reduces tumor grade and multiplicity.** *Oncotarget*. 2014; 5:1502-14.
 56. Wen T, Stucke EM, Grotjan TM, Kemme KA, Abonia JP, Putnam PE, Franciosi JP, Garza JM, Kaul A, King EC, Collins MH, Kushner JP, Rothenberg ME. **Molecular diagnosis of eosinophilic esophagitis by gene expression profiling.** *Gastroenterology*. 2013; 145:1289-99.
 57. Xanthakos SA, Podberesky DJ, Serai SD, Miles L, King EC, Balistreri WF, Kohli R. **Use of magnetic resonance elastography to assess hepatic fibrosis in children with chronic liver disease.** *J Pediatr*.

2014; 164:186-8.

58. Zafar MA, McCormack FX, Rahman S, Tencza C, Wikenheiser-Brokamp KA, Young LR, Shizukuda Y, Elwing JM. **Pulmonary vascular shunts in exercise-intolerant patients with lymphangioleiomyomatosis**. *Am J Respir Crit Care Med*. 2013; 188:1167-70.
59. Zhang W, Quinn B, Barnes S, Grabowski GA, Sun Y, Setchell KD. **Metabolic Profiling and Quantification of Sphingolipids by Liquid Chromatography-Tandem Mass Spectrometry**. *Journal of Glycomics and Lipidomics*. 2013; 3:1-8.
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61. Zhu X, He F, Zeng H, Ling S, Chen A, Wang Y, Yan X, Wei W, Pang Y, Cheng H, Hua C, Zhang Y, Yang X, Lu X, Cao L, Hao L, Dong L, Zou W, Wu J, Li X, Zheng S, Yan J, Zhou J, Zhang L, Mi S, Wang X, Zhang L, Zou Y, Chen Y, Geng Z, Wang J, Zhou J, Liu X, Wang J, Yuan W, Huang G, Cheng T, Wang QF. **Identification of functional cooperative mutations of SETD2 in human acute leukemia**. *Nat Genet*. 2014; 46:287-93.

Faculty, Staff, and Trainees

Faculty Members

David Witte, MD, Professor

Leadership Division Director

Research Interests Renal pathology, molecular pathology

Mohammad Azam, PhD, Assistant Professor

Research Interests Cancer Biology and Neural Tumors Program

Michael Baker, MD, Assistant Professor

Research Interests Pulmonary pathology, Cardiac pathology

Kevin E Bove, MD, Professor

Research Interests Pediatric liver disease, biliary atresia

Margaret H Collins, MD, Professor

Research Interests Pediatric gastrointestinal pathology, especially pediatric eosinophilic gastrointestinal disorders, pediatric inflammatory bowel disease, pediatric bowel motility disorders

Anita Gupta, MD, Assistant Professor

Research Interests Liver tumor pathology, vascular anomalies

Gang Huang, PhD, Assistant Professor

Research Interests Cancer pathology

Richard L McMasters, MD, Assistant Professor

Research Interests Hematopathology

Lili Miles, MD, Associate Professor

Leadership Director, Training Program

Research Interests Brain tumor, epilepsy research, neuromuscular diseases and NASH liver

Michael Miles, PharmD, Professor

Research Interests Neuropathology of mitochondrial disease

Jun Q Mo, MD, Associate Professor

Research Interests Hematopathology

Joel E Mortensen, PhD, Associate Professor

Leadership Director, Diagnostic Infectious Disease Lab

Research Interests Microbiology

Lindsey Romick-Rosendale, PhD, Assistant Professor

Research Interests Metabolomics

Kenneth D Setchell, PhD, Professor

Leadership Director, Mass Spec Lab

Research Interests Biochemistry, Bile acids, Sterol and cholesterol metabolism, Steroids, Liver disease, Liver transplantation, Gastroenterology, Nutrition/Diet, Phytochemicals, Isoflavones/Lignans, Breast cancer, Colon cancer, Mass spectrometry – biomedical mass spectrometry, Chromatography, Analytical Biochemistry, Assay development, Therapeutic drug monitoring, Pharmacokinetics and metabolism, Genetics

S. Kumar Shanmukhappa, PhD, Assistant Professor

Research Interests Experimental animal models

Amy Sheil, MD, Assistant Professor

Rachel Sheridan, MD, Assistant Professor

Research Interests Liver pathology, biliary atresia

Jerzy W Stanek, MD, PhD, Professor

Research Interests Pathology and pathomechanisms of in-utero hypoxia, particularly in the placenta; Pathology of perinatal mortality and morbidity

Paul E Steele, MD, Associate Professor

Leadership Medical Director, Clinical Lab

Research Interests Clinical lab medicine

Keith F Stringer, MD, Assistant Professor

Research Interests Microscopic techniques for assessing mRNA expression, protein production and cellular identity in eukaryotic tissues

Peter Tang, PhD, Assistant Professor

Research Interests Special chemistry

Mikako Warren, MD, Assistant Professor

Research Interests Renal pathology

Kathryn Wikenheiser-Brokamp, MD, PhD, Associate Professor

Research Interests Genetic and developmental basis of lung disease, lung cancer and pediatric cystic lung disease

Trainees

- **Dehua Wang, MD**, PL-6, Indiana University
- **Daniel Leino, MD**, PL-6, University of Michigan
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Division Collaboration

Providing technical and professional support for NIH study to characterize a metabolic disease animal model (David Witte MD)

Human Genetics » Gregory Grabowski MD

Digestive Health Center: Integrated morphology core lab, provides technical and professional support to members of the DHC involved in basic and translational research in gastrointestinal tract. (David Witte MD, Kevin Bove MD, Rachel Sheridan MD)

Gastroenterology, Hepatology and Nutrition » Mitch Cohen MD and Jorge Bezerra MD

Director of Pathology Core for multicenter BARC and CLIC studies on biliary atresia and other chronic liver disorders in children. (Kevin Bove MD, Ken Setchell PhD)

Gastroenterology, Hepatology and Nutrition » James Heubi, MD, John Bucuvalas MD, Jorge Bezerra MD, and Kathleen Campbell MD

Providing technical and professional support for NIH placental studies (Jerzy Stanek MD, PhD)

Endocrinology » Stuart Handwerger MD

Providing pathology professional and technical support for establishment of Biorepository service and support for Rheumatology core lab for Cincinnati Rheumatic Diseases Center and multicenter study for lupus nephritis. (David Witte MD)

Rheumatology » John Harley MD, Sue Thompson, PhD, and Hermine Brunner MD

Providing professional support for the Cincinnati Center for Eosinophilic Disorders program and related research. (Margaret Collins MD)

Allergy & Immunology » Marc Rothenberg MD and Pablo Abonia MD

Providing pathology professional and technical support for multicenter referral service for the High Grade Glioma program and basic research program. (David Witte MD, Lili Miles MD)

Hematology/Oncology » Maryam Fouladi MD and Richard Drissi PhD

Joint development of Leukemia Biology program at Cincinnati Children's. (Mohammad Azam PhD, Gang Huang PhD)

Hematology/Oncology » Yi Zheng PhD, James Mulloy PhD, and Jose Cancelas MD, PhD

Hemangioma/vascular malformation clinical program. Providing professional diagnostic and technical pathology support for multidisciplinary patient care program. (Anita Gupta MD)

Hematology/Oncology » Denise Adams MD and Anita Gupta MD

Pediatric General and Thoracic Surgery » Richard Azizkhan MD and Anusa Dasgupta MD

Development of a centralized therapeutic drug monitoring program for personalized medical care. (Ken Setchell PhD)

Clinical Pharmacology » Sander Vinks, PharmD, PhD

Grants, Contracts, and Industry Agreements

AZAM, M**Improved Therapeutic Approaches for Hematological Disorder Treated with Tyrosine**

National Institutes of Health

R01 CA 155091 05/01/12-03/31/17 \$201,275

Mechanisms of Drug Resistance in Myeloproliferative Neoplasms Treated With JAK2 Inhibitor

National Institutes of Health

R21 HL 114074 06/01/13-03/31/15 \$147,000

COLLINS, M**Meritage Oral Budesonide Suspension in Adolescent and Young Adults with Eosinophilic Esophagitis**

Meritage Pharma, Inc.

06/13/12-06/12/14 \$320,541

WAGH, P**Training Program in Cancer Therapeutics**

National Institutes of Health(University of Cincinnati)

T32 CA 11784 09/01/13-08/31/14 \$41,364

WIKENHEISER-BROKAMP, K**Mechanisms of Dicer1 Function in Lung Organogenesis and Cystic Lung Disease**

National Institutes of Health

R01 HL 109265 06/15/11-05/31/15 \$253,525

Mechanisms Underlying DICER1 Suppression of Pleuropulmonary Blastoma Initiation

St. Baldrick's Foundation

07/01/11-06/30/16 \$129,250

PIM-1 and p130 as Prognostic Biomarkers and Therapeutic Targets in Lung Cancer

University of Cincinnati

05/01/14-04/30/15 \$50,000

Rb-p16 Regulatory Pathway in Lung Carcinogenesis

American Cancer Society National

07/01/10-06/30/14 \$150,000

WITTE, D**Digestive Health Center: Bench to Bedside Research in Pediatric Digestive Disease - Integrative Morphology Core**

National Institutes of Health

P30 DK 078392 06/01/12-05/31/17 \$80,122

Current Year Direct \$1,373,077**Industry Contracts****MORTENSEN, J**

Current Year Direct Receipts \$97,399

Total \$1,470,476