

**CURRICULUM VITAE**  
University of Pittsburgh School of Medicine

**BIOGRAPHICAL**

Name: Michael Jason Morowitz, MD  
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Pediatric General & Thoracic Surgery  
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**EDUCATION AND TRAINING**

**UNDERGRADUATE**

9/90 – 5/94	Dartmouth College Hanover, NH	A.B.
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**GRADUATE**

8/94 – 5/98	Duke University School of Medicine Durham, NC	M.D.
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**POSTGRADUATE**

6/98 – 6/99	Hospital of the University of Pennsylvania Philadelphia, PA	Intern, Surgery (Jon Morris, MD)
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7/99 – 6/05	Hospital of the University of Pennsylvania Philadelphia, PA	Residency, Surgery (Jon Morris, MD)
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7/05 – 6/07	University of Alabama at Birmingham Birmingham, AL	Fellowship, Pediatric Surgery (Keith Georgeson, MD)
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**APPOINTMENTS AND POSITIONS (Current positions in bold)**

**ACADEMIC**

8/07 – 9/10	University of Chicago Pritzker School of Medicine Chicago, IL	Assistant Professor of Surgery Assistant Professor of Pediatrics
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10/10 – 3/11	Univ. of Pittsburgh School of Medicine Department of Surgery Pittsburgh, PA	Visiting Assistant Professor of Surgery Pediatric Surgery
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4/11 – 4/16	Univ. of Pittsburgh School of Medicine Department of Surgery Pittsburgh, PA	Assistant Professor of Surgery Pediatric Surgery
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7/14 – 7/16	University of Pittsburgh Graduate School of Public Health Pittsburgh, PA	Assistant Professor of Human Genetics Department of Human Genetics
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<b>2016 –</b>	<b>Univ. of Pittsburgh School of Medicine Center for Medicine and the Microbiome Pittsburgh, PA</b>	<b>Associate Director</b>
5/16 – 7/20	Univ. of Pittsburgh School of Medicine Department of Surgery Pittsburgh, PA	Associate Professor of Surgery Pediatric Surgery
7/16 – 7/20	University of Pittsburgh Graduate School of Public Health	Associate Professor of Human Genetics Department of Human Genetics
8/20 – 8/22	Univ. of Pittsburgh School of Medicine Department of Surgery Pittsburgh, PA	Associate Professor of Surgery with Tenure (Pediatric Surgery)
<b>8/22</b>	<b>Univ. of Pittsburgh School of Medicine Department of Surgery Pittsburgh, PA</b>	<b>Professor of Surgery with Tenure (Pediatric Surgery)</b>

## NON-ACADEMIC

### Hospital Appointments

Active Staff	Mount Sinai Hospital	09/07 – 01/09
Active Staff	The University of Chicago Hospitals Chicago, IL	08/07 – 09/10
Active Staff	Good Samaritan Hospital Downers Grove, IL	09/07 – 9/10
Active Staff	Edward Hospital Naperville, IL	11/07 – 09/10
Active Staff	Adventist Hinsdale Hospital Hinsdale, IL	01/08 – 09/10
Active Staff	NorthShore University Health System Evanston, IL	05/09 – 9/10
<b>Active Staff</b>	<b>UPMC Children’s Hospital of Pittsburgh</b>	<b>10/10 –</b>
<b>Active Staff</b>	<b>UPMC Magee-Womens Hospital</b>	<b>10/10 –</b>

## CERTIFICATION AND LICENSURE

### SPECIALTY CERTIFICATION

American Board of Surgery (ABS-Surgery)	050942	2/7/06 – 12/13/26
American Board of Surgery (ABS-Pediatric Surgery)	001041	3/31/08 – 12/31/2028
Advanced Trauma Life Support (ATLS)	218650	10/15/10 – 9/5/26

### MEDICAL LICENSURE

National Provider Identification Number	1972715654	
Pennsylvania Bureau of Professional & Occupational Affairs	MD073623L	4/12/01 – 12/31/26
Arizona Medical Board	75870	
State of Delaware Physician M.D.	C1-0027195	5/22/24 – 3/31/25
Commonwealth of Massachusetts Physician License	288308	7/14/22 – 4/23/27
Alabama Medical Licensure Commission	MD.26451	1/1/05 – 12/31/07

Illinois Department of Financial & Professional Regulation  
Drug Enforcement Agency (DEA)

336.079762  
BM8379287

6/7/07 – 7/31/11  
1/12/09 – 1/31/24

### MEMBERSHIPS IN PROFESSIONAL AND SCIENTIFIC SOCIETIES

American College of Surgeons- Associate Fellow	2007 – 2010
Surgical Infection Society	2008 –
American Pediatric Surgical Association	2009 –
Association for Academic Surgery	2009 –
American College of Surgeons- Fellow	2010 –
Surgical Biology Club	2013 –
Society of University Surgeons	2014 –

### HONORS AND AWARDS

Magna Cum Laude, Dartmouth College	1994
American Cancer Society Postdoctoral Fellowship, Children's Hospital of Philadelphia	2002
Surgical Infection Society Junior Faculty Fellowship	2008
March of Dimes Basil O'Connor Starter Scholar Research Award	2009
Surgical Infection Society Junior Faculty Fellowship	2009
US News Top Doctors- Pediatric Surgeon at Children's Hospital of Pittsburgh of UPMC	2012
Pittsburgh Magazine Top Doctor	2021-2025

### PUBLICATIONS

#### Original Peer Reviewed Articles

1. Accorsi R, Morowitz MJ, Charron M, Maris JM. Pinhole imaging of <sup>131</sup>I-metaiodobenzylguanidine (<sup>131</sup>I-MIBG) in an animal model of neuroblastoma. *Pediatr Radiol*. 2003 Oct;33(10):688-92. PMID: 12908090.
2. Wang J, Sheppard GS, Lou P, Kawai M, BaMaung N, Erickson SA, Tucker-Garcia L, Park C, Bouska J, Wang YC, Frost D, Tapang P, Albert DH, Morgan SJ, Morowitz M, Shusterman S, Maris JM, Lesniewski R, Henkin J. Tumor suppression by a rationally designed reversible inhibitor of methionine aminopeptidase-2. *Cancer Res*. 2003 Nov 15;63(22):7861-9. PMID: 14633714.
3. **Morowitz M**, Shusterman S, Mosse Y, Hii G, Winter CL, Khazi D, Wang Q, King R, Maris JM. Detection of single-copy chromosome 17q gain in human neuroblastomas using real-time quantitative polymerase chain reaction. *Mod Pathol*. 2003 Dec;16(12):1248-56. PMID: 14681326.
4. **Morowitz MJ**, Barr R, Wang Q, King R, Rhodin N, Pawel B, Zhao H, Erickson SA, Sheppard GS, Wang J, Maris JM, Shusterman S. Methionine aminopeptidase 2 inhibition is an effective treatment strategy for neuroblastoma in preclinical models. *Clin Cancer Res*. 2005 Apr 1;11(7):2680-5. PMID: 15814649.
5. Fang J, Quinones QJ, Holman TL, **Morowitz MJ**, Wang Q, Zhao H, Sivo F, Maris JM, Wahl ML. The H<sup>+</sup>-linked monocarboxylate transporter (MCT1/SLC16A1): a potential therapeutic target for high-risk neuroblastoma. *Mol Pharmacol*. 2006 Dec;70(6):2108-15. PMID: 17000864.
6. Poroyko V, White JR, Wang M, Donovan S, Alverdy J, Liu DC, **Morowitz MJ**. Gut microbial gene expression in mother-fed and formula-fed piglets. *PLoS One*. 2010 Aug 27;5(8):e12459. PMID: 20805981.

7. **Morowitz MJ**, Deneff VJ, Costello EK, Thomas BC, Poroyko V, Relman DA, Banfield JF. Strain-resolved community genomic analysis of gut microbial colonization in a premature infant. *Proc Natl Acad Sci U S A*. 2011. Jan 18;108(3):1128-33. PMID: 21191099.
8. Poroyko V, **Morowitz M**, Bell T, Ulanov A, Wang M, Donovan S, Bao N, Gu S, Hong L, Alverdy JC, Bergelson J, Liu DC. Diet creates metabolic niches in the “immature gut” that shape microbial communities. *Nutr Hosp*. 2011 Nov-Dec;26(6):1283-95. PMID: 22411374.
9. Sodhi CP, Neal MD, Siggers R, Sho S, Ma C, Branca MF, Prindle T Jr, Russo AM, Afrazi A, Good M, Brower-Sinning R, Firek B, **Morowitz MJ**, Ozolek JA, Gittes GK, Billiar TR, Hackam DJ. Intestinal epithelial Toll-like receptor 4 regulates goblet cell development and is required for necrotizing enterocolitis in mice. *Gastroenterology*. 2012 Sep;143(3):708-18. PMID: 22796522.
10. Sharon I, **Morowitz MJ**, Thomas BC, Costello EK, Relman DA, Banfield JF. Time series community genomics analysis reveals rapid shifts in bacterial species, strains and phage during infant gut colonization. *Genome Res*. 2013 Jan;23(1):111-20. PMID: 22936250.
11. Carlisle EM, Poroyko V, Caplan MS, Alverdy J, **Morowitz MJ**, Liu D. Murine gut microbiota and transcriptome are diet dependent. *Ann Surg*. 2013 Feb;257(2):287-94. PMID: 23001074.
12. Nelson RK, Poroyko V, **Morowitz MJ**, Liu D, Alverdy JC. Effect of dietary monosaccharides on *Pseudomonas aeruginosa* virulence. *Surg Infect*. 2013 Feb;14(1):35-42. PMID: 23451729.
13. Costello EK, Carlisle EM, Bik EM, **Morowitz MJ**, Relman DA. Microbiome assembly across multiple body sites in low-birthweight infants. *MBio*. 2013 Oct 29;4(6):e00782-13. PMID: 24169577.
14. Brown CT, Sharon I, Thomas BC, Castelle CJ, **Morowitz MJ**, Banfield JF. Genome resolved analysis of a premature infant gut microbial community reveals a *Varibaculum cambriense* genome and a shift towards fermentation-based metabolism during the third week of life. *Microbiome*. 2013 Dec 17;1(1):30. PMID: 24451181.
15. Brooks B, Firek BA, Miller CS, Sharon I, Thomas BC, Baker R, **Morowitz MJ**, Banfield JF. Microbes in the neonatal intensive care unit resemble those found in the gut of premature infants. *Microbiome*. 2014 Jan 28;2(1):1. PMID: 24468033.
16. Zhong D, Brower-Sinning R, Firek B, **Morowitz MJ**. Acute appendicitis in children is associated with an abundance of bacteria from the phylum Fusobacteria. *J Pediatr Surg*. 2014 Mar;49(3):441-6. PMID: 24650474.
17. Good M, Sodhi CP, Ozolek JA, Buck RH, Goehring KC, Thomas DL, Vikram A, Bibby K, **Morowitz MJ**, Firek B, Lu P, Hackam DJ. *Lactobacillus rhamnosus* HN001 decreases the severity of necrotizing enterocolitis in neonatal mice and preterm piglets: evidence in mice for a role of TLR9. *Am J Physiol Gastrointest Liver Physiol*. 2014 Jun 1;306(11):G1021-32. PMID: 24742987.
18. Brower-Sinning R, Zhong D, Good M, Firek B, Baker R, Sodhi CP, Hackam DJ, **Morowitz MJ**. Mucosa-associated bacterial diversity in necrotizing enterocolitis. *PLoS One*. 2014 Sep 9;9(9):e105046. PMID: 25203729.
19. Xiong W, Giannone RJ, **Morowitz MJ**, Banfield JF, Hettich RL. Development of an enhanced metaproteomic approach for deepening the microbiome characterization of the human infant gut. *J Proteome Res*. 2015 Jan 2;14(1):133-41. PMID: 25350865.

20. Raveh-Sadka T, Thomas BC, Singh A, Firek B, Brooks B, Castelle CJ, Sharon I, Baker R, Good M, **Morowitz MJ**, Banfield JF. Gut bacteria are rarely shared by co-hospitalized premature infants, regardless of necrotizing enterocolitis development. *Elife*. 2015 Mar 3;4. PMID: 25735037.
21. Watson C, King A, Mitra S, Shaaban AF, Goldstein AM, **Morowitz MJ**, Warner BW, Crombleholme TM, Keswani SG. What does it take to be a successful pediatric surgeon-scientist? *J Pediatr Surg*. 2015 Jun;50(6):1049-52. PMID: 25840603.
22. Young JC, Pan C, Adams RM, Brooks B, Banfield JF, **Morowitz MJ**, Hettich RL. Metaproteomics reveals functional shifts in microbial and human proteins during a preterm infant gut colonization case. *Proteomics*. 2015 Oct;15(20):3463-73. PMID: 26077811.
23. Brooks B, Mueller RS, Young JC, **Morowitz MJ**, Hettich RL, Banfield JF. Strain-resolved microbial community proteomics reveals simultaneous aerobic and anaerobic function during gastrointestinal tract colonization of a preterm infant. *Front Microbiol*. 2015 Jul 1;6:654. PMID: 26191049.
24. Cunningham KE, Vincent G, Sodhi CP, Novak EA, Ranganathan S, Egan CE, Stolz DB, Rogers MB, Firek B, **Morowitz MJ**, Gittes GK, Zuckerbraun BS, Hackam DJ, Mollen KP. Peroxisome proliferator-activated receptor- $\gamma$  coactivator 1- $\alpha$  (PGC1 $\alpha$ ) protects against experimental murine colitis. *J Biol Chem*. 2016 May 6;291(19):10184-200. PMID: 26969166.
25. Rogers MB, Brower-Sinning R, Firek B, Zhong D, **Morowitz MJ**. Acute appendicitis in children is associated with a local expansion of Fusobacteria. *Clin Infect Dis*. 2016 Jul 1;63(1):71-8. PMID: 27056397.
26. Licina D, Bhangar S, Brooks B, Baker R, Firek B, Tang X, **Morowitz MJ**, Banfield JF, Nazaroff WW. Concentrations and sources of airborne particles in a neonatal intensive care unit. *PLoS One*. 2016 May 13;11(5):e0154991. PMID: 27175913.
27. Raveh-Sadka T, Firek B, Sharon I, Baker R, Brown CT, Thomas BC, **Morowitz MJ**, Banfield JF. Evidence for persistent and shared bacterial strains against a background of largely unique gut colonization in hospitalized premature infants. *ISME J*. 2016 Dec;10(12):2817-2830. PMID: 27258951.
28. Yeh A, Rogers MB, Firek B, Neal MD, Zuckerbraun BS, **Morowitz MJ**. Dysbiosis across multiple body sites in critically ill adult surgical patients. *Shock*. 2016 Dec;46(6):649-654. PMID: 27454385.
29. Keswani SG, Moles CM, **Morowitz M**, Zeh H, Kuo JS, Levine MH, Cheng LS, Hackam DJ, Ahuja N, Goldstein AM; Basic Science Committee of the Society of University Surgeons. The future of basic science in academic surgery: identifying barriers to success for surgeon-scientists. *Ann Surg*. 2016 Sep 16. [Epub ahead of print].
  - Comment in: The extinction of the Surgeon Scientist. Kibbe MR, Velazquez OC. *Ann Surg*. 2017 Jun;265(6):1060-1061.
30. Bhangar S, Brooks B, Firek B, Licina D, Tang X, **Morowitz MJ**, Banfield JF, Nazaroff WW. Pilot study of sources and concentrations of size-resolved airborne particles in a neonatal intensive care unit. *Building and Environment*. 2016 Sep; 106:10-19. doi: 10.1016/j.buildenv.2016.06.020.
31. Rogers MB, Firek B, Shi M, Yeh A, Brower-Sinning R, Aveson V, Kohl BL, Fabio A, Carcillo JA, **Morowitz MJ**. Disruption of the microbiota across multiple body sites in critically ill children. *Microbiome*. 2016 Dec 29;4(1):66. PMID: 28034303.

32. Rogers MB, Aveson V, Firek B, Yeh A, Brooks B, Brower-Sinning R, Steve J, Banfield JF, Zureikat A, Hogg M, Boone BA, Zeh HJ, **Morowitz MJ**. Disturbances of the perioperative microbiome across multiple body sites in patients undergoing pancreaticoduodenectomy. *Pancreas*. 2017 Feb;46(2):260-267. PMID: 27846140.
33. Olm MR, Brown CT, Brooks B, Firek B, Baker R, Burstein D, Soenjoyo K, Thomas BC, **Morowitz M**, Banfield J. Identical bacterial populations colonize premature infant gut, skin, and oral microbiomes and exhibit different in situ growth rates. *Genome Res*. 2017 Apr;27(4):601-612. PMID: 28073918.
34. **Morowitz MJ**, Di Caro V, Pang D, Cummings J, Firek B, Rogers MB, Ranganathan S, Clark RS, Aneja RK. Dietary supplementation with nonfermentable fiber alters the gut microbiota and confers protection in murine models of sepsis. *Crit Care Med*. 2017 May;45(5):e516-e523. PMID: 28252538.
35. Costello EK, Sun CL, Carlisle EM, **Morowitz MJ**, Banfield JF, Relman DA. Candidatus *Mycoplasma girerdii* replicates, diversifies, and co-occurs with *Trichomonas vaginalis* in the oral cavity of a premature infant. *Sci Rep*. 2017 Jun 19;7(1):3764. 10.1038/s41598-017-03821-7. PMID: 28630471.
36. Xiong W, Brown CT, **Morowitz MJ**, Banfield JF, Hettich RL. Genome-resolved metaproteomic characterization of preterm infant gut microbiota development reveals species-specific metabolic shifts and variabilities during early life. *Microbiome*. 2017 Jul 10;5(1):72. doi: 10.1186/s40168-017-0290-6. PMID: 28693612.
37. Brooks B, Olm MR, Firek BA, Baker R, Thomas BC, **Morowitz MJ**, Banfield JF. Strain-resolved analysis of hospital rooms and infants reveals overlap between the human and room microbiome. *Nat Commun*. 2017 Nov 27;8(1):1814. doi: 10.1038/s41467-017-02018-w. PMID: 29180750.
38. Rahman SF, Olm MR, **Morowitz MJ**, Banfield JF Machine Learning Leveraging Genomes from Metagenomes Identifies Influential Antibiotic Resistance Genes in the Infant Gut Microbiome. *mSystems*. 2018 Jan 9;3(1). pii: e00123-17. doi: 10.1128/mSystems.00123-17. eCollection 2018 Jan-Feb. PMID: 29359195.
39. Goyal A, Yeh A, Bush BR, Firek BA, Siebold LM, Rogers MB, Kufen AD, Morowitz MJ. Safety, Clinical Response, and Microbiome Findings Following Fecal Microbiota Transplant in Children With Inflammatory Bowel Disease. *Inflamm Bowel Dis*. 2018 Jan 18;24(2):410-421. doi: 10.1093/ibd/izx035. PMID: 29361092.
  - 2018 Most Cited Paper Award from Inflammatory Bowel Diseases.
40. Lu P, Sodhi CP, Yamaguchi Y, Jia H, Prindle T Jr, Fulton WB, Vikram A, Bibby KJ, **Morowitz MJ**, Hackam DJ. Intestinal epithelial Toll-like receptor 4 prevents metabolic syndrome by regulating interactions between microbes and intestinal epithelial cells in mice. *Mucosal Immunol*. 2018 May;11(3):727-740. doi: 10.1038/mi.2017.114. Epub 2018 Jan 24. PMID: 29363671.
41. Brown CT, Xiong W, Olm MR, Thomas BC, Baker R, Firek B, **Morowitz MJ**, Hettich RL, Banfield JF. Hospitalized Premature Infants Are Colonized by Related Bacterial Strains with Distinct Proteomic Profiles. *MBio*. 2018 Apr 10;9(2). pii: e00441-18. doi: 10.1128/mBio.00441-18. PMID: 29636439.
42. Brooks B, Olm MR, Firek BA, Baker R, Geller-McGrath D, Reimer SR, Soenjoyo KR, Yip JS, Dahan D, Thomas BC, **Morowitz MJ**, Banfield JF. The developing premature infant gut microbiome is a major factor

- shaping the microbiome of neonatal intensive care unit rooms. *Microbiome*. 2018 Jun 20;6(1):112. doi: 10.1186/s40168-018-0493-5. PMID: 29925423.
43. Orlova E, Yeh A, Shi M, Firek B, Ranganathan S, 23andMe Research Team, Whitcomb DC, Finegold DN, Ferrell RE, Barmada MM, Marazita ML, Hinds DA, Shaffer JR, **Morowitz MJ**. Genetic association and differential expression of PITX2 with acute appendicitis. *Human Genetics*. 2018 Nov 3. doi: 10.1007/s00439-018-1956-2.
44. Yeh A, Connors E, Firek B, Rogers MB, Cheek R, Ozolek J, Mollen KP, **Morowitz MJ**. Plant-based enteral nutrition modifies the gut microbiota and improves outcomes in murine models of chemically-induced colitis. *Cell Mol Gastroenterol Hepatol*. 2019;7(4):872-874.e6. doi: 10.1016/j.jcmgh.2019.01.007.
45. McClanahan D, Yeh A, Firek B, Zettle S, Rogers R, Richard Cheek MD<sup>2</sup>, Nguyen M, Gayer C, **Morowitz MJ**. Pilot Study of the Effect of Plant-Based Enteral Nutrition on the Gut Microbiota in Chronically Ill Tube-Fed Children. *JPEN J Parenter Enteral Nutr*. 2019 Jan 15. doi: 10.1002/jpen.1504.
46. Olm MR, West PT, Brooks B, Firek BA, Baker R, **Morowitz MJ**, Banfield JF. Genome-resolved metagenomics of eukaryotic populations during early colonization of premature infants and in hospital rooms. *Microbiome*. 2019 Feb 15;7(1):26. doi: 10.1186/s40168-019-0638-1.
47. Di Caro V, Cummings JL, Alcamo AM, Piganelli JD, Clark RSB, **Morowitz MJ**, Aneja RK. Dietary Cellulose Supplementation Modulates the Immune Response in a Murine Endotoxemia Model. *Shock*. 2019 Apr;51(4):526-534.
48. Gopalakrishna KP, Macadangdang BR, Rogers MB, Tometich JT, Firek BA, Baker R, Junyi Ji J, Ma C, Good M, **Morowitz MJ**, Hand TW. Maternal IgA protects against the development of necrotizing enterocolitis in premature infants. *Nature Medicine*. 2019 Jun 17. doi: 10.1038/s41591-019-0480-9.
- Feature: In Brief, *Nature Review Gastro & Hepatology* 2019 July 1.
  - Feature: Preview, *Cell Host Microbe* 2019 August.
  - Feature: Preview, *Immunity* 2019 August.
49. Steen EH, Moles CM, Goldstein AM, **Morowitz MJ**, Gosain A, Mollen KP, Hackam D, Keswani SG. The Pediatric Surgeon-Scientist: Succeeding in Today's Academic Environment. *J Surg Res*. Epub 2019 Jul 19;244:502-508.
50. Olm MR, Bhattacharya N, Crits-Christoph A, Firek BA, Baker R, Song YS, **Morowitz MJ**, Banfield JF. Necrotizing enterocolitis is preceded by increased gut bacterial replication, *Klebsiella*, and fimbriae-encoding bacteria. *Science Advances*. 2019 Dec 11;5(12):eaax5727. doi: 10.1126/sciadv.aax5727.
51. Al-Shayeb B, Sachdeva R, Chen LX, Ward F, Munk P, Devoto A, Castelle CJ, Olm MR, Bouma-Gregson K, Amano Y, He C, Méheust R, Brooks B, Thomas A, Lavy A, Matheus-Carnevali P, Christine Sun C, Goltsman DSA, Borton MA, Sharrar A, Jaffe AL, Nelson TC, Kantor R, Keren R, Lane KR, Farag IF, Lei S, Finstad K, Amundson R, Anantharaman K, Zhou J, Probst AJ, Power ME, Tringe SG, Li WJ, Wrighton K, Harrison S, **Morowitz MJ**, Relman DA, Doudna JA, Lehours AC, Warren L, Cate JHD, Santini JM, Banfield JF. Clades of huge phage from across Earth's ecosystems. *Nature*. 2020 Feb;578(7795):425-431. doi: 10.1038/s41586-020-2007-4.
52. Sher Y, Olm MR, Raveh-Sadka T, Brown CT, Sher R, Firek B, Baker R, **Morowitz MJ**, Banfield JF. Combined analysis of microbial metagenomic and metatranscriptomic sequencing data to assess in situ

- physiological conditions in the premature infant gut. *PLoS One*. 2020 Mar 4;15(3):e0229537. doi: 10.1371/journal.pone.0229537.
53. Taylor MD, Allada V, Moritz ML, Nowalk AJ, Sindhi R, Aneja RK, Torok K, **Morowitz MJ**, Michaels M, Carcillo JA. Pediatric Use of C-Reactive Protein and Ferritin Biomarkers in Daily Pediatric Practice. *Rev*. 2020 Apr;41(4):172-183. doi: 10.1542/pir.2018-0101.
54. Simon DW, Rogers MB, Gao Y, Vincent G, Firek BA, Janesko-Feldman K, Vagni V, Kochanek PM, Ozolek JA, Mollen KP, Clark RSB, **Morowitz MJ**. Depletion of gut microbiota is associated with improved neurologic outcome following traumatic injury. *Brain Res*. 2020 Nov 15;1747:147056. doi: 10.1016/j.brainres.2020.147056. Epub 2020 Aug 13.
55. Davis JA, Baumgartel K, **Morowitz MJ**, Giangrosso V, Demirci JR. The Role of Human Milk in Decreasing Necrotizing Enterocolitis Through Modulation of the Infant Gut Microbiome: A Scoping Review *J Hum Lact*. 2020 Aug 26:890334420950260. doi: 10.1177/0890334420950260. Online ahead of print.
56. Reitz KM, Seymour CW, Vates J, Quintana M, Viele K, Detry M, **Morowitz M**, Morris A, Bethe B, Kennedy J, Zuckerbraun, Girard TD, Marroquin OC, Esper S, Holder-Murray J, Newman AB, Berry S, Angus DC, Neal M. Strategies to Promote Resiliency (SPRY): a randomised embedded multifactorial adaptive platform (REMAP) clinical trial protocol to study interventions to improve recovery after surgery in high-risk patients. *BMJ Open*. 2020 Sep 29;10(9):e037690. doi: 10.1136/bmjopen-2020-037690.
57. Holder-Murray J, Yeh A, Rogers MB, Firek B, Mahler B, Medich D, Celebrezze J, **Morowitz MJ**. Time-dependent displacement of commensal skin microbes by pathogens at the site of colorectal surgery. *Clin Infect Dis*. 2020 Oct 24:ciaa1615. doi: 10.1093/cid/ciaa1615.
58. Cuna AC, **Morowitz MJ**, Ahmed I, Umar S, Sampath V. Dynamics of the Preterm Gut Microbiome in Health and Disease. *Am J Physiol Gastrointest Liver Physiol*. 2021 Jan 13. doi: 10.1152/ajpgi.00399.2020.
59. Olm MR, Crits-Cristoph A, Bouma-Gregson K, Firek B, **Morowitz MJ**, Banfield JB. InStrain enables population genomic analysis from metagenomic data and rigorous detection of identical microbial strains. *Nature Biotech*, 2021 Jan 18. doi: 10.1038/s41587-020-00797-0. Online ahead of print.
60. Opeyemi O, Rogers M, Firek B, Janesko-Feldman K, Vagni V, Mullett S, Wendell S, Nelson B, New L, Marino E, Kochanek P, Bayir H, Clark R, **Morowitz MJ**, Sustained Dysbiosis and Decreased Fecal Short Chain Fatty Acids after Traumatic Brain Injury and Impact on Neurologic Outcome. Simon D. *J Neurotrauma*. 2021 Jun 7. doi: 10.1089/neu.2020.7506. Online ahead of print.
61. West PP, Peters S, Olm M, Yu F, Lou Y, Firek B, Baker R, Johnson A, **Morowitz MJ**, Hettich R, Banfield JF. Genetic and behavioral adaptation of *Candida parapsilosis* to the microbiome of hospitalized infants revealed by in situ genomics, transcriptomics and proteomics. *Microbiome*. 2021 Jun 21;9(1):142. doi: 10.1186/s40168-021-01085-y.
62. Lou YC, Olm MR, Diamond S, Crits-Cristoph A, Firek B, Baker R, **Morowitz MJ**, Banfield JB. Infant gut strain persistence is associated with maternal origin, phylogeny, and traits including surface adhesion and iron acquisition. *Cell Reports Medicine*. 2021 Sep 7. doi: <https://doi.org/10.1016/j.xcrm.2021.100393>.
63. Rogers MB, Simon D, Firek B, Silfies L, Fabio A, Bell MJ, Yeh A, Azar J, Cheek R, Kochanek PM, Peddada SD, **Morowitz MJ**. Temporal and spatial changes in the microbiome following pediatric severe

traumatic brain injury. *Pediatr Crit Care Med*. 2022 Jun 1;23(6):425-434. doi: 10.1097/PCC.0000000000002929. Epub 2022 Mar 11.PMID: 35283451.

64. Cyclic GMP-AMP synthase contributes to epithelial homeostasis in intestinal inflammation via Beclin-1-mediated autophagy. Khan S, Mentrup HL, Novak EA, Siow VS, Wang Q, Crawford EC, Schneider C, Comerford TE 4th, Firek B, Rogers MB, Loughran P, **Morowitz MJ**, Mollen KP. *FASEB J*. 2022 May;36(5):e22282. doi: 10.1096/fj.202200138R.PMID: 35344224.
65. The NICU Antibiotics and Outcomes (NANO) trial: a randomized multicenter clinical trial assessing empiric antibiotics and clinical outcomes in newborn preterm infants. **Morowitz MJ**, Katheria AC, Polin RA, Pace E, Huang DT, Chang CH, Yabes JG. *Trials*. 2022 May 23;23(1):428. doi: 10.1186/s13063-022-06352-3.PMID: 35606829.
66. Experimental validation that human microbiome phages use alternative genetic coding. Peters SL, Borges AL, Giannone RJ, **Morowitz MJ**, Banfield JF, Hettich RL. *Nat Commun*. 2022 Sep 29;13(1):5710. doi: 10.1038/s41467-022-32979-6.PMID: 36175428.
67. Antibiotic resistance and host immune system-induced metal bactericidal control are key factors for microbial persistence in the developing human preterm infant gut microbiome. Peters SL, **Morowitz MJ**, Hettich RL. *Front Microbiol*. 2022 Nov 21;13:958638. doi: 10.3389/fmicb.2022.958638. eCollection 2022.PMID: 36478853.
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71. Epithelial NAD<sup>+</sup> depletion drives mitochondrial dysfunction and contributes to intestinal inflammation. Novak EA, Crawford EC, Mentrup HL, Griffith BD, Fletcher DM, Flanagan MR, Schneider C, Firek B, Rogers MB, **Morowitz MJ**, Piganelli JD, Wang Q, Mollen KP. *Front Immunol*. 2023 Sep 7;14:1231700. doi: 10.3389/fimmu.2023.1231700.
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74. Neonatal Diet Type and Associations With Adverse Feeding Outcomes in Neonates With Critical Congenital Heart Defects. Davis JA, Baumgartel K, Baust T, Conley YP, **Morowitz MJ**, Ren D, Demirci JR. *J Perinat Neonatal Nurs*. 2024 Jan-Mar 01;38(1):54-64. doi: 10.1097/JPN.0000000000000790. Epub 2024 Jan 12. PMID: 38236148; PMCID: PMC10807746.
75. Crosstalk between DNA Damage Repair and Metabolic Regulation in Hematopoietic Stem Cells. Xu J, Fei P, Simon DW, **Morowitz MJ**, Mehta PA, Du W. *Cells*. 2024 Apr 24;13(9):733. doi:10.3390/cells13090733. PMID: 38727270; PMCID: PMC11083014.
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77. Anaerobe-Targeted Antibiotic Therapy in the Neonatal Intensive Care Unit. Green MB, Zevallos Barboza A, Mukhopadhyay S, Gerber JS, **Morowitz MJ**, Puopolo KM, Flannery DD. *J Pediatric Infect Dis Soc*. 2025 Jan 20;14(1): piae109. doi:10.1093/jpids/piae109. PMID: 39392923.
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### Other Peer Reviewed Publications

1. **Morowitz M**, Huff D, von Allmen D. Epithelial ovarian tumors in children: a retrospective analysis. *J Pediatr Surg*. 2003 Mar;38(3):331-5; discussion 331-5. Review. PMID: 12632344.
2. **Morowitz MJ**, Markowitz R, Kamath BM, von Allmen D. Dieulafoy's lesion and segmental dilation of the small bowel: an uncommon cause of gastrointestinal bleeding. *J Pediatr Surg*. 2004 Nov;39(11):1726-8. PMID: 15547843.
3. **Morowitz MJ**, Poroyko V, Caplan M, Alverdy J, Liu DC. Redefining the role of intestinal microbes in the pathogenesis of necrotizing enterocolitis. *Pediatrics*. 2010 Apr;125(4):777-85. Review. PMID: 20308210.
4. Seal JB, **Morowitz M**, Zaborina O, An G, Alverdy JC. The molecular Koch's postulates and surgical infection: a view forward. *Surgery*. 2010 Jun;147(6):757-65. Review. PMID: 20494210.
5. Carlisle EM, **Morowitz MJ**. Pediatric surgery and the human microbiome. *J Pediatr Surg*. 2011 Mar;46(3):577-84. Review. PMID: 21376215.
6. **Morowitz MJ**, Babrowski T, Carlisle EM, Olivas A, Romanowski KS, Seal JB, Liu DC, Alverdy JC. The human microbiome and surgical disease. *Ann Surg*. 2011 Jun;253(6):1094-101. PMID: 21422915.
7. **Morowitz MJ**, Carlisle EM, Alverdy JC. Contributions of intestinal bacteria to nutrition and metabolism in the critically ill. *Surg Clin North Am*. 2011 Aug;91(4):771-85. Review. PMID: 21787967.
8. Carlisle EM, **Morowitz MJ**. The intestinal microbiome and necrotizing enterocolitis. *Curr Opin Pediatr*. 2013 Jun;25(3):382-7. Review. PMID: 23657248.

9. Kitsios GD, **Morowitz MJ**, Dickson RP, Huffnagle GB, McVerry BJ, Morris A. Dysbiosis in the intensive care unit: microbiome science coming to the bedside. *J Crit Care*. 2016 Oct 11;38:84-91. [Epub ahead of print]. PMID: 27866110.
10. Krezalek MA, Yeh A, Alverdy JC, **Morowitz M**. Influence of nutrition therapy on the intestinal microbiome. *Curr Opin Clin Nutr Metab Care*. 2016 Dec 16. [Epub ahead of print] PMID: 27997410.
11. Goldstein AM, Blair AB, Keswani SG, Gosain A, **Morowitz M**, Kuo JS, Levine M, Ahuja N, Hackam DJ, Basic Science Committee of the Society of University Surgeons. A Roadmap for Aspiring Surgeon-Scientists in Today's Healthcare Environment. *Ann Surg*. 2019 Jan;269(1):66-72. doi: 10.1097/SLA.0000000000002840.
12. Antibiotic therapy and necrotizing enterocolitis. Pace E, Yanowitz TD, Waltz P, **Morowitz MJ**. *Semin Pediatr Surg*. 2023 Jun;32(3):151308. doi: 10.1016/j.sempedsurg.2023.151308. PMID: 37295297.

### Other Non-peer Reviewed Publications

1. Shogan BD, Smith DP, Packman AI, Kelley ST, Landon EM, Bhangar S, Vora GJ, Jones RM, Keegan K, Stephens B, Ramos T, Kirkup BC Jr, Levin H, Rosenthal M, Foxman B, Chang EB, Siegel J, Cobey S, An G, Alverdy JC, Olsiewski PJ, Martin MO, Marrs R, Hernandez M, Christley S, **Morowitz M**, Weber S, Gilbert J. The Hospital Microbiome Project: Meeting report for the 2<sup>nd</sup> Hospital Microbiome Project, Chicago, USA, January 15, 2013. *Stand Genomic Sci*. 2013 Jul 25;8(3):571-9. PMID: 24501640.
2. Alverdy J, Gilbert J, DeFazio JR, Sadowsky MJ, Chang EB, **Morowitz MJ**, Teitelbaum DH. Proceedings of the 2013 ASPEN Research Workshop: the interface between nutrition and the gut microbiome: implications and applications for human health. *JPEN J Parenter Enteral Nutr*. 2014 Feb;38(2):167-78. Review. PMID: 24379111.
3. **Morowitz M**. *Bifidobacterium breve* BBG-001 in very preterm infants: a randomized controlled phase 3 trial. In Year Book of Pediatrics 2017. Elsevier Mosby, Philadelphia, PA, 2017.
4. Bope A, Weir M, Pruden A, **Morowitz MJ**, Mitchell J, Dannemiller K. Translating Research to Policy at the NCSE 2017 Symposium "Microbiology of the Built Environment: Implications for Health and Design." *Microbiome*. 2018 Sep 15;6(1):160. doi: 10.1186/s40168-018-0552-y.
5. Goyal A, **Morowitz M**. Author's reply to Drs. Franco Scaldaferrri and Valentina Petito, PhD. *Inflamm Bowel Dis*. 2019 Jul 17;25(8):e102. Doi: 10.1093/ibd/izz029.
6. From tofu to T-bones: how vegan and ketogenic diets shape our immune defenses. **Morowitz MJ**. *J Leukoc Biol*. 2024 Jun 28;116(1):1-2. doi:10.1093/jleuko/qiae097. PMID: 38648518

### Book Chapters

1. **Morowitz M**, Nance M. Pediatric Surgery. In: The Surgical Review: An Integrated Basic and Clinical Science Study Guide. Lippincott Williams & Wilkins, Philadelphia, PA, 2005.

2. **Morowitz M**, Georgeson K. Laparoscopic assisted pull-through for Hirschsprung's Disease. In: Atlas of Pediatric Laparoscopy and Thoracoscopy. Elsevier, Philadelphia, PA, 2008.
3. **Morowitz M**. Necrotizing Enterocolitis. In: Fundamentals of Pediatric Surgery, 2<sup>nd</sup> Edition. Springer, New York, NY, 2016.
4. Ramos-Jimenez RG and **Morowitz MJ**. Microbiome: Current Status and Future Applications. In: Success in Academic Surgery: Basic Science. Springer Nature Switzerland AG 2019.
5. Ramos-Jimenez RG, Simon D, **Morowitz MJ**. Critical Illness and the Microbiome. Accepted for publication in: Pediatric Critical Care, 6<sup>th</sup> Edition. Elsevier, Philadelphia, PA.

### Published Abstracts

1. Lawson, J. H., L. E. Diamond, S. S. Lin, C. W. Hoopes, L. J. Daniels, **M. J. Morowitz**, M. K. Kalady, et al. "Human Membrane Cofactor Protein (CD46) Prevents Hyperacute Xenograft Rejection in Porcine-to-Baboon Cardiac Xenotransplantation." *Circulation* 96, no. 8 (October 21, 1997): 3167–3167.
2. Mosse, Y. P., D. Khazi, J. Greshock, **M. J. Morowitz**, B. L. Weber, and J. M. Maris. "Functional Genomic Analysis of Neuroblastoma for High Resolution Mapping of 11q Deletions." *Pediatric Research* 53, no. 4 (April 2003): 270A-270A.
3. Di Caro, Valentina, Jessica Cummings, Diana Pang, Victor Hsue, Jernghun Kim, Robert Clark, **Michael Morowitz**, and Rajesh Aneja. "DIETARY FIBER SUPPLEMENTATION CONFERS PROTECTION IN A MURINE MODEL OF SEPSIS." *Critical Care Medicine* 43, no. 12 (December 2015).
4. Kitsios, G. D., A. Fitch, S. Rapport, **M. J. Morowitz**, A. M. Morris, and B. J. McVerry. "The Composition Of The Oral, Lung And Gut Microbiome In Adult Critically Ill Patients With Or At Risk For The Acute Respiratory Distress Syndrome." *American Journal of Respiratory and Critical Care Medicine* 193 (2016).
5. Goyal, Alka, Adam Kufen, Zachary Jackson, and **Michael Morowitz**. "A Study of Fecal Microbiota Transplantation in Pediatric Patients with Inflammatory Bowel Disease." *Inflammatory Bowel Diseases* 22 (March 2016): S74–S74. <https://doi.org/10.1097/01.MIB.0000480335.83446.9c>.
6. Bush, Brian R., Matthew B. Rogers, Brian Firek, Adam Kufen, Zachary Jackson, **Michael Morowitz**, and Alka Goyal. "Dynamic Changes in the Intestinal Microbiota Following Fecal Microbiota Transplantation for Refractory Inflammatory Bowel Disease in Children." *Gastroenterology* 150, no. 4 (April 2016): S541–S541. [https://doi.org/10.1016/S0016-5085\(16\)31857-1](https://doi.org/10.1016/S0016-5085(16)31857-1).
7. Yeh, A., M. B. Rogers, B. Firek, B. Zuckerbraun, M. D. Neal, and **M. J. Morowitz**. "THE MICROBIOTA OF FIVE BODY SITES IN CRITICALLY ILL ADULT SURGICAL PATIENTS IS HIGHLY DISORDERED AND UNSTABLE OVER TIME." *Shock* 45, no. 6 (June 2016): 43–44.
8. Simon, Dennis, Raj Aneja, Lee New, Vincent Vagni, Hulya Bayir, **Michael Morowitz**, Patrick Kochanek, and Robert Clark. "ACUTE INFLAMMATORY RESPONSE TO TRAUMATIC BRAIN INJURY IS AFFECTED BY MODULATORS OF GUT MICROBIOTA." *Critical Care Medicine* 44, no. 12 (December 2016).
9. Goyal, Alka, Andrew Yeh, Leah Siebold, Kathleen Calabro, Brian Firek, Brian R. Bush, and **Michael Morowitz**. "CLINICAL EFFICACY AND MICROBIOME FINDINGS FOLLOWING FECAL MICROBIOTA TRANSPLANT IN CHILDREN WITH REFRACTORY INFLAMMATORY BOWEL

DISEASE.” *Gastroenterology* 152, no. 5 (April 2017): S959–S959. [https://doi.org/10.1016/S0016-5085\(17\)33256-0](https://doi.org/10.1016/S0016-5085(17)33256-0).

10. Di Caro, Valentina, Jon D. Piganelli, **Michael J. Morowitz**, Alicia Alcamo, Jessica L. Cummings, and Rajesh K. Aneja. “DIETARY CELLULOSE SUPPLEMENTATION MODULATE THE IMMUNE RESPONSE DURING SEPSIS.” *Shock* 47, no. 6 (June 2017): 56–57.
11. Lu, Peng, Chhinder P. Sodhi, Yukihiro Yamaguchi, Hongpeng Jia, Thomas Prindle, William B. Fulton, Amit Vikram, **Michael J. Morowitz**, and David J. Hackam. “DELETION OF THE ENDOTOXIN RECEPTOR TOLL-LIKE RECEPTOR 4 FROM INTESTINAL EPITHELIAL CELLS LEADS TO METABOLIC SYNDROME IN MICE.” *Shock* 47, no. 6 (June 2017): 16–16.
12. Alcamo, Alicia, Jessica Cummings, Valentina Di Caro, Elizabeth Novak, **Michael Morowitz**, Kevin Mollen, Robert Clark, and Raj Aneja. “EFFECTS OF HIGH-FIBER SUPPLEMENTATION ON GUT BARRIER FUNCTION IN A MURINE SEPSIS MODEL.” *Critical Care Medicine* 46, no. 1 (January 2018): 750–750. <https://doi.org/10.1097/01.ccm.0000529535.95693.a0>.
13. Baumgartner, Robert Anton Ulrich, Adam Fitch, Barbara Methe, Kelvin Li, Brian Firek, Sandeep Patel, Alison Morris, **Michael Morowitz**, and Catalin Toma. “CHARACTERIZING THE MICROBIOME IN PATIENTS WITH AND WITHOUT CORONARY ARTERY DISEASE.” *Journal of the American College of Cardiology* 71, no. 11 (March 10, 2018): 129–129. [https://doi.org/10.1016/S0735-1097\(18\)30670-3](https://doi.org/10.1016/S0735-1097(18)30670-3).

#### Unpublished abstracts

1. **Morowitz M**, Poroyko V, Zaborina O, Alverdy J, Liu D. A novel pathogenic mechanism for necrotizing enterocolitis: factors present in intestinal contents from premature infants activate the virulence of common gut bacteria. Academic Surgical Congress, Feb 3-6, 2009. Ft. Myers, FL.
2. **Morowitz M**, Poroyko V, White JR, Donovan S, Alverdy J, Liu D. High throughout profiling of gut bacteria in milk fed and formula fed newborns. Academic Surgical Congress, Feb 2-5, 2010. San Antonio, TX.
3. **Morowitz M**, Sikora B, Sirk J, Lestina M, Gray K. The green appendectomy: measuring and mitigating the carbon footprint of surgical procedures. Feb 3, 2011. Academic Surgical Congress, Huntington Beach, CA.
4. **Morowitz M**, Young J, Pan C, Brooks B, Mueller R, Banfield J, Hettich R. Proteogenomic characterization of the human infant intestinal microbiome. Feb 16, 2012. Academic Surgical Congress, Las Vegas, NV.
5. Brower-Sinning R, Zhong D, Good M, Firek B, Baker R, Sodhi C, Hackam D, **Morowitz M**. An analysis of mucosa-associated microbial diversity in the early recognition of necrotizing enterocolitis. Oct 9, 2013. American College of Surgeons Clinical Congress, Washington, DC.
6. Brower-Sinning R, **Morowitz M**. Bacterial populations of the gut, mouth and skin are unstable over time in critically ill children. Feb 5, 2014. Academic Surgical Congress, San Diego, CA.
7. Aveson VG, Brower-Sinning R, Firek B, Boone B, Steve J, Hogg M, Zureikat A, Zeh HJ, **Morowitz MJ**. Microbial determinants of clinical outcomes in patients undergoing the Whipple procedure. Feb 3, 2015. 10<sup>th</sup> Annual Academic Surgical Congress, Las Vegas, NV.
8. Rogers M, **Morowitz M**. Acute appendicitis in children is associated with an abundance of bacteria from the genus *Fusobacterium*. Apr 17, 2015. Surgical Infection Society, Los Angeles, CA.

9. Keswani SG, Moles CM, **Morowitz M**, Levine M, Ahuja N, Zeh H, Kuo J, Goldstein AM. Surgery and basic science: an identity crisis. Feb 3, 2016. Academic Surgical Congress, Jacksonville, FL.
10. Orlova E, Yeh A, Firek B, Barmada M, Ferrell R, Finegold D, Kammerer C, Shaffer J, Whitcomb D, Ranganathan S, Hinds D, **Morowitz M**. Genome-wide association study identifies susceptibility loci for acute appendicitis. May 16, 2016. American Pediatric Surgical Association Annual Meeting, San Diego, CA.
11. Yeh A, **Morowitz M**. Monitoring the skin microbiota of colorectal surgery patients to predict surgical site infections. February 7, 2017. Academic Surgical Congress, Las Vegas, NV.

### **Other Conference Activity**

1. **Morowitz M**. Poster Session II. Moderator, May 15, 2016. American Pediatric Surgical Association Annual Meeting, San Diego, CA.
2. Mollen K, **Morowitz M**. Integrated oral presentations session II: Outcomes/clinical: Pediatrics. Moderator, Feb 3, 2016. Academic Surgical Congress, Jacksonville, FL.
3. **Morowitz M**. MFG-E8 reduces inflammation and attenuates lung injury in neonatal sepsis. Discussant, Oct 5, 2015. American College of Surgeons Clinical Congress, Chicago, IL.
4. **Morowitz M**. Paucity of bacteria implicated in pathogenesis of experimental necrotizing enterocolitis. Discussant, Apr 17, 2015. Surgical Infection Society, Los Angeles, CA.
5. **Morowitz M**. Expression of MiR-21 is advantageous in the immune response to peritonitis. Discussant, May 1, 2014. 34<sup>th</sup> Annual Meeting of the Surgical Infection Society, Baltimore, MD.
6. **Morowitz M**. Enteral IAP reduces biologically active LPS and TLR4 expression in the rat model of necrotizing enterocolitis. Discussant, Oct 8, 2013. American College of Surgeons Clinical Congress, Washington, DC.
7. **Morowitz M**. Diverse early intestinal microbiota as a key factor in necrotizing enterocolitis. Discussant, Oct 3, 2012. American College of Surgeons Clinical Congress, Chicago, IL.
8. **Morowitz M**. Microbiology of intestinal failure/transplantation. Moderator, Sep 8, 2012. 7<sup>th</sup> International Pediatric Intestinal Failure and Rehabilitation Symposium, Pittsburgh, PA.
9. **Morowitz M**. Pro/con debate: Nutritional support: does it matter? Apr 18, 2015. Surgical Infection Society, Los Angeles, CA.
10. **Morowitz M**. Microbiome Workshop. Co-leader, April 3, 2017. Cardiovascular Epidemiology Conference, University of Pittsburgh, Pittsburgh, PA.

## **PROFESSIONAL ACTIVITIES**

### **Teaching**

Experienced in teaching medical students, graduate students, residents, and pediatric surgery fellows.

Teaching includes:

1. Core curriculum lectures to pediatric surgery fellows and surgery residents, twice per year.
2. Lectures to neonatal nurse practitioners, once every other year.
3. MSCMP 3790: graduate student class “Personalized Medicine,” one lecture per year, 2015-2018.
4. Honors 1510: undergraduate class “Pediatrics: bench to bedside,” one lecture per year, 2017-2019.

## Mentorship

### Training grants:

1. Trainer, *Training in Trauma and Sepsis Research* (T32GM008516-26, Billiar (PI), 7/1/1994-6/30/2024).
  - Rafael Ramos-Jimenez, MD, Surgical resident 2018-2021.
    - i. Best poster presentation, 2019 Department of Surgery Research Day.
  - Elizabeth Pace, MD, Surgical resident 2020-2023.
2. Trainer, *Pediatric Neurointensive Care and Resuscitation Research* (T32 ND040686, Kochanek (PI) 09/25/00–04/30/21).
  - Justin Azar, MD, Fellow in pediatric critical care medicine 2018-2020.
3. Trainer, *Fellowship in Primary Care Research* (T32 T32HP22240, Ray (PI)).
  - Jessica Davis, RN, PhD 2023-

### Pre-doctoral candidates:

1. Hannah Lee, Medical Student, Longitudinal Clinical Workshop, 2011.
2. Jeremy Kauffman, Medical Student, Scholarly Research Project, 2011-2013.
3. Diana Zhong, Medical Student, Summer Research Project and Scholarly Research Project, 2013-2015.
4. Victoria Aveson, Medical Student, Scholarly Research Project, 2013 – 2016.
5. Brian Bush, Medical Student, Scholarly Research Project, 2014 – 2017.
6. Katya Orlova, MS Human Genetics, Thesis Advisor, 2015.
7. Shilpa Argade, Medical Student, Scholarly Research Project, 2015 – 2018.
8. Danielle McClanahan, Medical Student, Scholarly Research Project, 2015 – 2018.
  - Awarded Certificate of Merit, 2018 Scholar’s Day, University of Pittsburgh School of Medicine, “Microbiome of Tube-Fed Children on a Blenderized Whole-Food Diet”.
9. Travis Churilla, Medical Student, Dean’s Summer Research Program, 2018.
  - Selected for 2018 Department of Pathology Klionsky Fellowship for this research.
10. Kathy Gopalakrishna, PhD candidate in Human Genetics, Dissertation Committee, 2018-2019.
11. Guojun Wu, Medical Student, Tsinghua University School of Medicine, Beijing, China, 2018-2020.
12. Joanne Huang, Medical Student, Dean’s Summer Research Program, 2019- 2022.
  - Selected for 2019 Department of Pathology Klionsky Fellowship for this research.
13. David Rivetti, Medical Student, Scholarly Research Project, 2021 – 2023.
14. Mona Chatrizeh, MSTP student, PhD candidate in Cellular and Molecular Pathology, primary advisor, 2021-

Post-doctoral:

1. Kelley Baumgartel, PhD, RN, Post-doctoral Advisor, 2015 – 2018.
  - Currently Assistant Professor, School of Nursing, Duquesne University.
2. Andrew Yeh, MD, Resident in General Surgery 2015-2018.
  - Awarded Shock Travel Award based on scientific merit and financial need for the abstract “The microbiota across five body sites in critically ill adult surgical patients is highly disordered and unstable over time”, 39<sup>th</sup> Annual Meeting of the Shock Society, June 2016.
  - Awarded Susman Award for Top Overall Presentation, Surgical Infection Society, May 2017.
  - Awarded SUS Resident Research Award for best oral presentation by a resident, “Whole-Food Enteral Nutrition Prevents Gut Dysbiosis and Improves Outcomes in a Mouse Colitis Model” Academic Surgical Congress, February 2018.
  - To begin fellowship in Pediatric Surgery at Washington University of St. Louis, August 2020.
3. Rachel Kolko, PhD, Post-doctoral Associate, Department of Psychiatry, Grant Proposal Advisor, 2016.
4. Rafael Ramos-Jimenez, MD, Resident in General Surgery 2018-2021.
  - Best Research Presentation Award, 2020 Department of Surgery Annual Research Day.
5. Justin Azar, MD, Fellow in Pediatric Critical Care Medicine 2018-2020.
6. Elizabeth Pace, MD, Surgical resident 2020-2023.
7. Jessica Davis, PhD, RN, Post-doctoral Advisor, 2023-

Faculty:

1. Tagbo Niepa, PhD, Assistant Professor, University of Pittsburgh Swanson School of Engineering, Faculty mentoring committee 2018-2022.

## RESEARCH SUPPORT

### Current

1R01NS127372-01 Morowitz (PI) 1/01/2023-12/31/2027  
NIH/NINDS 6 calendar

#### *Impact of microbiota-derived metabolites on traumatic brain injury-related neurodegeneration*

This discovery- based proposal will investigate chronic intestinal dysbiosis, specifically the depletion of acetate-producing commensal bacteria, as a novel mechanism of TBI-related neurodegeneration and chronic microglial activation.

Role: MPI (multi-PI award with R. Clark, A. Puccio and D. Simon)

2R01AI092531-06 Morowitz (PI) 07/15/11-6/30/26  
NIH/NIAID 2.4 calendar

#### *Population genomic analysis of gut microbial colonization in premature infants*

The goal of this research is to use high-resolution metagenomics analyses to track gut microbial communities during early intestinal colonization in infants with and without necrotizing enterocolitis.

Role: MPI (multi-PI award with J. Banfield)

Total Cost: \$ 3,469,420

Percent of effort – 20%

1 R01 HD097578-01 Morowitz (PI) 9/13/19-8/31/25  
NIH/NICHD 2.4 calendar

*The NICU Antibiotics and Outcomes (NANO) Trial*

The NANO Trial is a multicenter randomized clinical trial to formally study whether the incidence of adverse outcomes is higher in infants receiving EA in the first week of life compared to babies receiving placebo.

Role: MPI (multi-PI award with R. Polin and A. Katheria, MD)

Total Cost: \$ 2,709,795 Percent of effort – 20%

**Prior**

1 R01 DK120697-01A1 Hand (PI) 9/01/2019- 08/31/2024  
NIH/NIDDK 0.6 calendar

*Mechanisms of maternal Immunoglobulin A control over the neonatal microbiota and the development of Necrotizing Enterocolitis*

The goal of this research is to describe the mechanism via which maternal milk protects the intestine via shaping the neonatal bacterial flora via specific binding to individual bacterial strains.

Role: Co-investigator

Total Sub-award Cost: \$37,772 Percent of effort – 5%

1 R01 DK120986 Mollen (PI) 9/01/2019- 08/31/2024  
NIH/NIDDK .24 calendar

*Mitochondrial Communication During the Pathogenesis of Inflammatory Bowel Disease*

The goal of this research is to investigate how abnormalities in mitochondrial function and cellular metabolism within the intestinal epithelium contribute to disease in the hopes of identifying novel therapeutic strategies for IBD aimed at improving mitochondrial health in the intestine.

Role: Co-investigator

Total Sub-award Cost: \$262,285 Percent of effort – 2%

1 R21 NS115173-01A1 Morowitz (PI) 4/01/2020-3/31/2022  
NIH/NINDS .6 calendar

*Gut microbial metabolite-mediated neuroprotection in traumatic brain injury*

This exploratory study will investigate the hypothesis that persistent dysbiosis, specifically the depletion of acetate-producing commensal bacteria in the gut, fuels pro-inflammatory microglial polarization and worsens neurologic outcome from TBI.

Role: MPI (multi-PI award with R. Clark and D. Simon)

U10 HD049983-11 Carcillo (PI) 12/24/14-11/30/20  
NICHD Collaborative Pediatric Critical Care Research Network

The goal of this project is to lead the University of Pittsburgh's effort to support clinical research projects sponsored by the CPCCRN and its investigators.

Role: Co-investigator

GRANT12838999 Morowitz (PI) 9/01/2019- 09/14/2020  
NIH/NIGMS .012 calendar

*2019 Pittsburgh Rust Belt Microbiome Conference*

This application requests partial funding for the 2019 Pittsburgh Rust Belt Microbiome Conference.

Role: MPI (multi-PI award with A.Morris, L. Hiller, W. Ruder)

Research Grant #25-FY20-14 Morowitz (PI) 01/01/2020-12/31/20

March of Dimes 0.36 calendar  
*Genetic and microbial determinants of outcomes in the NANO Trial*  
The goal of this March of Dimes Clinical and Social Science Challenge Grant is to identify genomic and microbiome determinants of adverse outcomes among infants in the NANO trial.  
Role: PI

SPRY Neal (PI) 2/1/18-7/31/20  
Strategies to Promote ResiliencY- An Adaptive Randomized Clinical Trial of Metformin in High Risk Surgical Patients  
Funding: UPMC Enterprises – Immune Transplant and Therapy Center  
The goal of this clinical trial is to compare outcomes in surgical patients receiving metformin or placebo, and to evaluate metformin-induced changes in the gut microbiota.  
Role: Co-investigator

5U19AI067773-14 Morowitz (PI) 08/01/18-07/31/20  
NIH/NIAID 2.4 calendar  
*Effects of the gut microbiota on response to JP4-039 therapy after radiation injury*  
The goal of this research is to determine if resolution of dysbiosis after total body irradiation increases the therapeutic efficacy of the GS-nitroxide JP4-039.  
Role: Sub-award PI (Sub 25GG011896-49)

Alfred P. Sloan Foundation 20110-6-06 Banfield (PI) 01/01/13-03/31/19  
*Analysis of the ICU room environment as a source for microorganisms colonizing the GI tract of preterm infants*  
The goal of this research is to determine if the ICU environment is an important reservoir for microorganisms that colonize the gastrointestinal tract of premature infants.  
Role: Co-investigator

I#0052116 Huang (PI) 11/01/2015 – 12/31/2018  
Thermo Fisher  
Microbiome And Procalcitonin Long term outcomes Epidemiology (MAPLE). This research study will help answer how a new blood test (procalcitonin), the bacteria of the mouth and GI tract, and outcomes interact and change over time.  
Role: Co-investigator

R21 HD087802 Morowitz (PI) 04/12/16-09/30/18  
*Disruption of the microbiome after severe traumatic brain injury*  
The goal of this research project is to characterize short-term changes in the microbial communities of the skin, mouth, and GI tract after severe traumatic brain injury, and to correlate these changes with clinical outcomes.  
Role: PI

R01 GM103600-01 Morowitz (PI) 06/19/14-07/30/18  
*Proteogenomic analysis of inflammation and dysbiosis in the infant gut*  
The goal of this research is to use high-resolution proteomic measurements to simultaneously track whole community microbial function and gut inflammation to determine temporal relationships between the microbiota and necrotizing enterocolitis.  
Role: MPI (multi-PI award with J. Banfield and R. Hettich)

Clinical and Translational Science Institute (University of Pittsburgh)  
Basic to Clinical Collaborative Research Pilot Program Morowitz (PI) 1/1/14 – 12/31/14  
*Microbial determinants of clinical outcomes in patients undergoing the Whipple procedure*  
The goal of this research is to determine if microbial populations across multiple body locations impact short and long-term outcomes of patients with pancreatic cancer undergoing the Whipple procedure.  
Role: PI

Basil O'Connor Starter Scholar Research Award Morowitz (PI) 02/01/10-01/31/13  
March of Dimes Birth Defects Foundation  
*Pathogenicity of intestinal microbes in milk fed and formula fed premature infants*  
The goal of this research is to compare bacterial virulence genes and virulence proteins in the intestinal contents of milk fed and formula fed premature infants.  
Role: PI

Surgical Infection Society Junior Faculty Fellowship Morowitz (PI) 2008-2010  
*High-throughput sequencing analysis of intestinal bacteria in necrotizing enterocolitis*  
The goal of this research is to isolate and sequence bacterial DNA and RNA directly from a limited number of human intestinal segments resected from infants with NEC.  
Role: PI

### **Nonfunded Research**

*Influences of high-fiber, organic whole-food formula on the gut microbiome in critically ill children*  
Morowitz (co-PI with Rajesh Aneja, MC) 2017-  
This is a pilot single center randomized clinical trial to study how the gut microbiome changes in critically ill children receiving standard enteral feeds and in children receiving plant-based natural nutrition. The plant-based enteral product is provided by Functional Formularies, Inc., who plays no role in study design or analysis, and is not funding any other portion of the study.  
IRB PRO17080103

### **Active IRB Protocols**

PRO10090089 Population genomic analysis of gut microbial colonization in premature infants  
PRO17100513 Survey of mothers' willingness to participate in the NANO Trial  
PRO18010284 The NICU Antibiotics and Outcomes Trial (NANO)  
PRO16050140 The ICU environment as a source of microbes colonizing the infant gut-part3  
PRO16030078 Population genomic analysis of gut microbial colonization in infants-2  
PRO15110576 Gut Microbiota of Tube-Fed Children on a Whole-Food Nutritional Product

### **Patents**

Methods Of Screening Milk Antibodies For Treating And/Or Preventing Necrotizing Enterocolitis (NEC)  
Filed: 12.11.18 (Provisional).

### **Ad Hoc Journal Reviews**

Pediatrics	2010
Annals of Surgery	2012-2013
Journal of Pediatric Surgery	2012-2016
Nature Reviews: Gastroenterology & Hepatology	2012
PLoS One	2012-2016
Microbiology and Molecular Biology Reviews	2013
Microbiome	2013-2016, 2020, 2021
Pediatric Diabetes	2013-2016
JAMA (Journal of the American Medical Association)	2013-2014, 2017, 2019, 2023-4
New England Journal of Medicine	2014
Lancet	2015
Surgery	2015-2016
Annals of Surgical Oncology	2015
Archives of Disease in Childhood	2015
BMC Medical Genomics	2016
Pancreas	2016
American Journal of Perinatology	2017, 2020
Journal of Surgical Research	2017, 2018, 2019, 2021
Gut	2018, 2019
JAMA Network Open	2018, 2023
Journal of Leukocyte Biology	2018
Journal of the Pediatric Infectious Diseases Society	2018
Scientific Reports	2018-2019
Journal of Parenteral and Enteral Nutrition	2019
Nature Communications	2019
Clinical Nutrition	2019
npj Biofilms and Microbiomes	2019
Genomics Proteomics and Bioinformatics	2019
Critical Care	2019
Journal of Intensive Care Medicine	2020
npj Biofilms and Microbiomes	2020
BMC Microbiology	2021
Nature Microbiology	2021
Cellular and Molecular Gastroenterology and Hepatology	2021
Pediatric Research	2021, 2024
EBioMedicine	2021
Journal of Clinical Investigation (JCI)	2023
Clinical Microbiology and Infection	2023
Shock	2024
Science Translational Medicine	2024

**Ad Hoc Grant Reviews**

Thrasher Research Fund	2012
Warren and Clara Cole Advisory Board	2012
March of Dimes Foundation	2014
NIH -- National Heart, Lung and Blood Institute	2017, 2018, 2024
Michigan State University, Center for Research on Ingredient Safety	2017
University of Maryland Baltimore, ATIP Grant Program	2018

NIH, Developmental Brain Disorders Study Section	2018
UPSOM Competitive Medical Research Fund	2018, 2019
University of Pittsburgh, Central Research Development Fund	2019
Department of Defense Combat Readiness-Medical Research Program	2020, 2022
Department of Psychiatry Research Review Committee	2020
NIH, Digestive System Host Defense, Microbial Interactions and Immune and Inflammatory Diseases (DHMI)	2021
NIH, Genes, Genomes and Genetics, Genetic Variation and Evolution (GVE)	2021
NIH, CSR Special Emphasis Panel ZRG1 GGG-X	2022
Novo Nordisk Foundation Synergy 2023	2023
NIH, Etiology, Diagnostic, Intervention and Treatment of Infectious Diseases (EDIT)	2024

### **Current Research Interests**

1. Human microbiome
2. Necrotizing enterocolitis and neonatal sepsis
3. Traumatic brain injury
4. Nutrition during critical illness
5. Inflammatory bowel disease

### **Invited Lectures**

#### *Local*

Jan 6, 2011, The human microbiome and the neonatal ICU. Newborn Medicine Grand Rounds, Magee Women's Hospital, Pittsburgh, PA.

Feb 2, 2012, The human microbiome: concepts and applications in pediatrics. Pediatrics, Grand Rounds, Children's Hospital of Pittsburgh of UPMC, Pittsburgh, PA.

July 23, 2013, Metagenomic studies of the gut microbiome in hospitalized children. Molecular Medicine Research Seminar, Children's Hospital of Pittsburgh of UPMC, Pittsburgh, PA.

Oct 4, 2013, Metagenomic studies of the gut microbiome in hospitalized babies and children. Science 2013 Conference, University of Pittsburgh, Pittsburgh, PA.

Nov 15, 2013, Host genetics and the human microbiome. Human Genetics Noon Seminar Series, University of Pittsburgh, Pittsburgh, PA.

Jan 18, 2014, The human microbiome and surgical disease. Department of Surgery Grand Rounds, University of Pittsburgh Medical School, Pittsburgh, PA.

Nov 5, 2014, A future where bacteria are our friends and not our enemies. Changing the Future, Changing Lives event, Children's Hospital of Pittsburgh of UPMC, Pittsburgh, PA.

Mar 6, 2015, Assembly of the intestinal microbiome in premature infants with necrotizing enterocolitis. Senior Vice Chancellor's Research Seminar Series, University of Pittsburgh, Health Sciences, Pittsburgh, PA.

Apr 9, 2015, Assembly of the intestinal microbiome in premature infants with necrotizing enterocolitis. Microbiology Class 03-391, Carnegie Mellon University, Pittsburgh, PA.

Jun 4, 2015, Assembly of the intestinal microbiome in premature infants with necrotizing enterocolitis. Newborn Grand Rounds, University of Pittsburgh School of Medicine, Pittsburgh, PA.

Sep 17, 2015, Updates in surgical infectious disease. Division of Pediatric General & Thoracic Surgery Academic Morning, Children's Hospital of Pittsburgh of UPMC, Pittsburgh, PA.

Sep 1, 2015, Disruption of the microbiome across multiple body sites in critically ill children. CRISMA Research Conference, Department of Critical Care Medicine, University of Pittsburgh, Pittsburgh, PA.

Feb 15, 2017, Assembly of the intestinal microbiome in premature infants with necrotizing enterocolitis. MMG Seminar Series, Department of Microbiology & Molecular Genetics, University of Pittsburgh School of Medicine, Pittsburgh, PA.

Oct 11, 2017, Incorporation of the gut microbiome into studies of radiation injury. CMCR Seminar Bridgeside Point, Pittsburgh, PA.

Dec 15, 2017, Incorporating the gut microbiome into personalized medicine. University of Pittsburgh School of Dentistry, Periodontics retreat, Pittsburgh, PA.

Feb 1, 2019, Antibiotics, NEC, and the Infant Gut Microbiome. Newborn Medicine Research Seminar, UPMC Children's Hospital of Pittsburgh.

Feb 13, 2019, Plant-based Enteral Nutrition as a Modifier of Dysbiosis and Intestinal Inflammation. GI Basic Science Conference. UPMC Children's Hospital of Pittsburgh.

April 16, 2019, Incorporating the gut microbiome into personalized medicine. Microbiology Class 03-391, Carnegie Mellon University, Pittsburgh, PA.

May 15, 2019, Redefining microbial health and microbial disease. Pittsburgh Life Sciences Week, Pittsburgh, PA.

April 10, 2024, Antibiotics and the Infant Gut Microbiome. Microbiology Class 03-391, Carnegie Mellon University, Pittsburgh, PA.

April 14, 2025. Antibiotics, diet and the microbiome in critical illness. Dermatology Basic Science Seminar. University of Pittsburgh School of Medicine, Pittsburgh, PA.

### *Regional*

Apr 5, 2016, Genetic and microbial risk factors for acute appendicitis in children. Department of Surgery Research Conference, Women & Children's Hospital of Buffalo, Buffalo, NY.

Feb 15, 2019 Plant-based Enteral Nutrition as a Modifier of Dysbiosis and Intestinal Inflammation. Penn State University Microbiome Center, Penn State University, State College, PA.

### *National*

June 13, 2011, Metagenomics: what does it mean and how is it done? 34<sup>th</sup> Annual Conference on Shock, Norfolk VA.

Feb 9, 2013, Host-microbe interactions in babies at risk for neonatal necrotizing enterocolitis. American Society for Parental & Enteral Nutrition Research Workshop, Phoenix, AZ.

Sep 15, 2014, Colorectal cancer and the human microbiome. Collaborative Group of the Americas on Inherited Colorectal Cancer, New Orleans, LA.

Oct 27, 2014, Can the microbiome improve surgical treatment? American College of Surgeons Clinical Congress, San Francisco, CA.

Jan 21, 2017, Gut microbiome. Society of Critical Care Medicine, 46<sup>th</sup> Critical Care Conference, Honolulu, HI.

Jan 24, 2017, Microbiology of the built environment. National Council of Science and the Environment 2017 Conference, Arlington, VA.

Feb 26, 2018, The gut microbiome as a driver and treatment for MODS. Society of Critical Care Medicine, San Antonio, TX.

April 5, 2019, An Overview of the Human Microbiome(s) in Health and Disease. American Burn Association, 51<sup>st</sup> Annual Meeting. Las Vegas, NV.

August 6, 2020, Trial design for determining harm from early antibiotics. Pediatric Academic Societies, Neonatal Sepsis Club: Innovation in Antibiotic Regimens in the Very Preterm Infant. Online webinar.

February 1, 2021 Surviving Sepsis 2021: The Microbiome in Disease. Society of Critical Care Medicine, 51<sup>st</sup> Critical Care Congress. Online webinar.

March 5, 2022. The GI Microbiome in Health and Disease. Cool Topics in Neonatology. California Association of Neonatology. San Diego, CA.

April 10, 2024. Antibiotics and the Infant Gut Microbiome. Neonatal Grand Rounds. University of South Alabama. Mobile, AL (virtual).

### *International*

July 19, 2012, Perspectives from the microbiome. 24<sup>th</sup> International Congress of the Transplantation Society, Berlin, Germany.

June 12, 2018 The gut microbiome as a driver and a treatment of critical illness. World Federation of Pediatric Intensive and Critical Care Societies. Singapore, Singapore.

March 18, 2025. Antenatal and postnatal antibiotic exposures and the maternal-infant dyad. Keynote address. Perinatal Society of Australia and New Zealand. Brisbane, Australia.

March 18, 2025. Antibiotics, NEC, and the preterm infant microbiome. Perinatal Society of Australia and New Zealand. Brisbane, Australia.

## SERVICE

### Professional Societies

Strategic Planning Committee, Surgical Infection Society	2013 – 2016
Program Committee, American Pediatric Surgical Association	2015 – 2017
Basic Science Committee, Society of University Surgeons	2015 – 2021
Publications Committee, Society of University Surgeons	2015 – 2017
Co-organizer, Rust Belt Microbiome Conference, Pittsburgh, PA (inaugural meeting)	2019

### University Service

Member	University of Pittsburgh Graduate Faculty Cellular and Molecular Pathology (CMP)	2017 –
Chair	Career Development Committee Burroughs Wellcome Physician Scientist Incubator Program (PI Richard Steinman, MD)	2018 –

### Departmental/Hospital Service

Member	Research Advisory Committee of the UPMC Children's Hospital of Pittsburgh	2015 – 2021
Member	Search Committee, Gastroenterology Division Chief UPMC Children's Hospital of Pittsburgh	2017
Member	ACGME Clinical Competency Committee	2014 - present