PBF Class of 2011 Survey Summary

January 25, 2020

Each year a survey is conducted of the individuals who began their fellowships eight years earlier. All (11) 2011 fellows completed their fellowships in 2014 and 10 completed the survey. This class of fellows has done exceptionally well (Table 1) .

Table 1
2011 PBF Fellows Survey Data Collected in October and November, 2019

Name	Degree	Gender	Current Title	Current Institution/Dept.	PBF Mentor	PBF Institution	% time In Research	Total Pubs (/yr)	Total 1st/Sr.	Director Research Dollars	Type of Research	Research Area
Berndt, Annerose	MD	F	VP, Clin Genomics	UPMC	Shapiro, Steven, D.	University of Pittsburgh	30	30(3.75)	8/1	0	B,T,C	Genetics & Genomics
Cohen, Taylor S.	MD	M	Sr. Scientist	AstraZeneca, Microbial Sciences	Prince, Alice, MD	Columbia University	90	24(3.0)	11/1.4	0	B,T	Immunology
Franke, Molly F.	MD	F	Assoc. Prof.	Harvard Medical School	Murray, Megan B.	Harvard Medical	80	68(8.5)	29/3.6	4,588,000	C	T.B.
Kuo, Christin	MD PhD	F	Assistant Prof.	Stanford University	Krasnow, Mark A.	Stanford University	75	7 (0.9)	3/0.4	1,224,000	B	RCMB
LaFemina, Michael J.	MD	M			Frank, James A.	USCF						
Montandon, Gaspard	PhD	M	Assistant Prof.	University of Toronto, Respirology	Horner, Richard L.	University of Toronto	90	18(2.3)	13/1.6	1,110,000	B	Resp. Neuro
Nichols, Nicole L.	PhD	F	Assistant Prof.	Univ. of Missouri-Columbia - Biomed	Mitchell, Gordon S.	Univ of Wisconsin-	80	24(3.0)	14/1.7	1,637,000	B	Resp. Neuro
Rogers, Angela J.	MD	F	Assistant Prof.	Stanford University/PulmonaryCC	Weiss, Scott T.	Brigham and Women's -	60	30(3.75)	14/1.7	722,400 * (1,750,000)	T	Critical Care
Shaykhiev, Renat	MD	M	Associate Prof.	Weill Cornell Med College	Crystal, Ronald C.	Weill Cornell Medical Coll.	99	21(2.7)	14/1.7	4,950,000	B	RCMB
Toya, Sophie	MD	F			Malik, Asrar, B.	Univ of Illin. at Chicago	0	----	----	0	-------	----------
Weiss, Curtis H.	MD	M	Head of Quality	Pulmonary Div. NorthShore Univ.Hlth	Sznajder, Jacob J.	Northwestern Univ.	40	20(2.5)	14/1.7	4,714,000	C	Critical Care

*8 percentile score – will be funded so included in other calculations.

Each graduate spends a significant amount of time in research averaging 59 % for the total group; 72% for those still in research (range 0-99%) which also places them among the top groups (Table 2). Their areas of research include basic, translational, and clinical research in areas ranging from genetics and genomics to inflammation to respiratory physiology to critical care.

For comparison with the 2011 PBF Fellows, Table 2 below shows the five-year post-PBF Fellowship retention rates in academic research for the 2003-2011 PBF Fellows and the overall retention rate for the1976-2006 PBF Fellows who responded to our survey.

TABLE 2: Retention rates in academic research for PBF Fellows
Shown are five-year retention rates for 2003-2011 fellows and overall retention rate for 1976-2006 fellows

Survey Group	n	Past PBF Fellows still in academic research	no research effort	1–49% effort	50-74% effort	≥ 75% effort
1976-2006 Fellows	365	83% (n=303)	17% (n=62)	27% (n=100)	23% n=84)	33% (n=119)
Class of 2003	12	100% (n=12)	0	17% (n=2)	33% (n=4)	50% (n=6)
Class of 2004	15	100% (n=15)	0	13% (n=2)	47% (n=7)	40% (n=6)
Class of 2005	17	76% (n=13)	23.5% (n=4)	6% (n=1)	47% (n=8)	23.5% (n=4)
Class of 2006	15	73% (n=11)	27% (n=4)	0	20% (n=3)	53% (n=8)
Class of 2007	18	89% (n=16)	11% (n=2)	6% (n=1)	11% (n=2)	72% (n=13)
Class of 2008	17	94% (n=16)	6% (n=1)	6% (n=1)	18% (n=3)	70% (n=12)
Class of 2009	10	90% (n=9)	10% (n=1)	10% (n=1)	20% (n=2)	60% (n=6)
Class of 2010	10	100% (n=10)	0	20% (n=2)	30% (n=3)	50% (n=5)
Class of 2011	11	82% (n=9)	18% (n=2)	18% (n=2)	9% (n=1)	45% (n-5)

Their research is clearly impactful as evidenced by the number of publications from 2010-2018: total of 242 with an average of 22 per fellow (range 9-68) or 2.7 per year (range 0-8.5). They were first or senior author on 120 of those publications (individual range 0-29) and they continue to publish in high impact journals (Tables 3 and 4). Of note, as the areas of research continue to evolve the list of journals currently used to assess impact has been expanded to include key clinical journals including JAMA, New England Journal of Medicine, and Lancet.

TABLE 3: 2011 PBF Fellows: Peer-reviewed publications in high-impact journals since PBF Fellowship		
Journal	**Impact Factor**	**# of Publications**
Nature	43	3
Nature Medicine	29.9	3
Nature Genetics	28	0
American Journal of Respiratory & Critical Care Medicine	16.5	17
Journal of Clinical Investigation	12.3	2
Proceedings of the National Academy of Sciences	9.6	1
Journal of Immunology	4.7	1
Am Journal of Physiology: Lung Cellular & Molecular Physiology	4.1	2
American Journal of Respiratory Cellular & Molecular Biology	4.5	5
New England Journal of Medicine	72.4	0
JAMA	51.3	0
Lancet	59	0

TABLE 4 Peer-Reviewed Publications per Year			
Survey Group	**n**	**Average Pubs/Yr**	**Average Pubs/Yr as 1st, 2nd, or last author**
PBF Fellows, years 1976-2006	365	2.7	1.8
PBF Fellows, class of 2003	12	1.7	1.3
PBF Fellows, class of 2004	15	3.9	2.1
PBF Fellows, class of 2005	17	2.1	1.3
PBF Fellows, class of 2006	15	2.5	1.6
PBF Fellows, class of 2007	18	2.6	1.2
PBF Fellows, class of 2008	17	3.3	1.5
PBF Fellows, class of 2009	10	4.1*	2.3*
PBF Fellows, class of 2010	10	3.0	1.0+
PBF Fellows, class of 2011	11	2.7	1.3

*Note: The numbers for the 2009 class are exceptionally high due to one fellow with 109 publications in the eight years since beginning his PBF Fellowship.

In aggregate, this class of fellows has obtained $19,970,000 in direct research funding (range: $0 to $4,950,000-Table 1). The cost of supporting this group of fellows was $1,710,000 so the total RO1 (new research dollars: invested dollars) is 11:1 (Table 5).

TABLE 5
Direct research dollars received during 8-year period following PBF Award start date

Survey Group	n	PBF Funding for Fellows Group	Total research dollars rec'd by survey group since PBF Fellowship	ROI
PBF Fellows, class of 2003	12	$1.73M	$20.78M	14.5
PBF Fellows, class of 2004	15	$1.86M	$27.83M	14.7
PBF Fellows, class of 2005	17	$2.24M	$24.67M	11.0
PBF Fellows, class of 2006	15	$2.07M	$40.7M	19.7*
PBF Fellows, class of 2007	18	$2.59M	$37.8M	14.6
PBF Fellows, class of 2008	17	$2.55M	$43/7M	17.1**
PBF Fellows, class of 2009	10	$1.56M	$28.3M	18.1
PBF Fellows, class of 2010	10	$1.56M	$12.4M	8.0
PBF Fellows, class of 2011	11	$1.71M	$20.0M	11.7

* ROI reflects the extraordinarily high research funding received by two 2006 PBF Fellows. ROI for the other 13 fellows is 6.8.
** ROI reflects the extraordinarily high research funding received by two 2008 PBF Fellows, ROI for the other 15 fellows is 11.1.

CONCLUSIONS

Eighty-two percent (82%), (9), of the 2011 PBF Fellows hold academic appointment and continue to be engaged in research. Of note, seven are in traditional academic positions while two hold senior leadership roles in industry. This puts this class in the group with the highest retention rates in academia. All of the fellows in academics have obtained some independent research funding. The publication rates for these fellows is high, as is the ROI.

2011 PBF Fellows Survey conducted in October and November, 2019

The 2011 PBF Fellows research and what the PBF Fellowship meant to their careers – in their own words (in response to our survey questions):

Annerose Berndt, DVM, PhD – Vice President, Clinical Genomics, UPMC

Research Focus: The Parker B Francis mentorship enable the studies of genetic causes of pulmonary diseases. The gained experience allowed me to lead the build-out and directing of the UPMC Genome Center, UPMC's genomics core facility that provides high-throughput DNA and RNA sequencing and pharmacogenomics services. Under my leadership the facility became CLIA/CAP accredited and now provides clinical-grade whole genome and exome sequencing and pharmacogenomics services to patients. We are currently working closely with our pulmonary physicians to provide clinical use of genomic information for our pulmonary patients with idiopathic pulmonary fibrosis (IPF). This will allow our patients to understand their genetic markers and will guide our physicians in treatment strategies.

Role of PBF Fellowship: Very influential – helped me to start my research career and broaden my scientific knowledge about pulmonary diseases and genetics/genomics.

Taylor Cohen, PhD - Senior Scientist, AstraZeneca, Microbial Sciences, BioPharma Division

Research Focus: We are trying to understand how the gut microbiome influences inflammation associated with chronic diseases, such as COPD and Asthma.

Role of PBF Fellowship: The PBF Fellowship enabled me the freedom to dive deeper into immune signaling in the lung. Preparing me to research a wider range of disease indications.

Molly Franke, ScD – Associate Professor, Harvard Medical School, Global Health and Social Medicine Division

Research Focus: Although my work informs many health conditions, I remain engaged in research to optimize treatment for drug resistant tuberculosis. In 2015, I joined the endTB project, which aims to scale-up access to two new TB drugs (bedaquiline and delamanid) to 3,200 MDR- TB patients in 17 countries and establish an evidence base for the safety and efficacy of these drugs. I serve as a methodologic advisor and analyst on this study. The stakes are high: results of this influential project will inform global policy and clinical practice for these drugs. I have led analyses and presented early efficacy results for this cohort at the International Union Against Tuberculosis and Lung Disease World Conference on Lung Health. In 2017, the Wall Street Journal cited these findings. In 2018, we submitted a report to the World Health Organization to inform their guidelines on bedaquiline and delamanid use, and in 2019, I submitted an R01 application, which aims to advance epidemiologic methods for the analysis of tuberculosis treatment cohorts.

In addition to methodological work, I have developed an independent research agenda on TB in children, a group often neglected in TB research. I am the Project PI for an NIH/NIAID U19 Center for Excellence in

Translational Research Grant, which aims to improve TB diagnostics in children by identifying an alternative diagnostic sample type that could replace sputum and gastric aspirate samples, which are insensitive are rarely available. My team and I have shared preliminary findings from this project locally and internationally at the International Union Against Tuberculosis and Lung Disease World Conference on Lung Health in both poster and podium presentations.

Role of PBF Fellowship: *The PBF fellowship was critical to my career development, offering protective time to explore new collaborations and funding opportunities while also bolstering my publication record, which made me a more attractive grant applicant.*

Christin Kuo, MD – Assistant Professor, Stanford University, Department of Pediatrics, Pulmonary Division

Research Focus: Our research focuses on the development and function of a sensory and secretory cell type in the lung called the neuroendocrine (NE) cell. There are too many clusters of NE cells in a group of pediatric patients with respiratory disease. In adults, abnormal NE cells are detected in ~20% of all lung cancers, including some of the most aggressive, metastatic tumors (such as small cell lung cancer and large cell neuroendocrine carcinoma). We want to understand how NE cells (in different scenarios) contribute to lung diseases and to achieve this goal, we need to identify the underlying, predicted diversity within this population. We want to identify the complete collection of secreted signals and their targets. From the first human samples over the past year, we have found unexpected diversity of peptides and hormones expressed by each cell and are now identifying their targets in the lung. These results will lay the foundation to help us understand the physiologic consequences associated with increased or dysfunctional NE cells in pediatric patients and in patients with NE tumors and ultimately guide our management for this group of diseases currently lacking in targeted therapies.

Role of PBF Fellowship: The PBF award was critical in providing support for the training during my clinical fellowship and allowed me to develop the preliminary data for my K08 award to study molecular basis of neuroendocrine cell development using single cell RNA sequencing technologies. The work supported by this grant also led to a publication in Cell.

Michael LeFemina, MD - (no response) – presumed no longer in academic medicine, based on outreach.

Gaspard Montandon, PhD– Assistant Professor, Department of Respirology, University of Toronto

Research Focus: Opioid drugs are the mainstay of pain management but present unwanted side-effects such as respiratory depression than can be lethal with overdose. My research aims to understand how opioid drugs affect the respiratory system and to identify safe opioid pain killers with reduced side-effects. My research combines basic research, clinical sciences, and drug discovery in zebrafish to identify new pain therapies.

Role of PBF Fellowship: The PBF Fellowship was a key-step toward my independence as a postdoctoral fellow, which eventually led me to an independent position as a scientist. With its support, I was able to develop a unique research program related to opioid-induced respiratory depression.

Nicole Nichols, PhD – Assistant Professor, Department Biomedical Sciences, University of Missouri-Columbia

Research Focus: By understanding how ventilation is at first maintained and how harnessing or unmasking pathways that underlie the ability of the respiratory system to adapt to ongoing pathology, we can enhance the contributions from respiratory muscles and spared motor neurons to repair ventilatory deficits in a novel model of respiratory motor neuron death. This research may lead to translational studies to positively increase the quality of life by preserving/restoring breathing in patients suffering from respiratory motor neuron loss, including those with neuromuscular disorders or neurodegenerative diseases.

- As part of my Parker B. Francis Postdoctoral Fellowship funded studies and during the K phase of my K99/R00 award, I gained experience and knowledge concerning motor plasticity and how it is regulated and enhanced in a rodent model of ALS (SOD1G93A rats). Key discoveries in these studies included: 1) the environment near the phrenic motor nucleus (motor nucleus that controls the diaphragm) was improved via stem cell implants, thereby slowing phrenic motor neuron death; 2) respiratory plasticity was induced with acute intermittent hypoxia (AIH) at end-stage and completely reversed functional deficits in phrenic motor output; and 3) enhanced respiratory plasticity is BDNF and MEK/ERK dependent. Overall, an important finding from these studies was that AIH restores phrenic motor output in motor neuron disease and the mechanism responsible was revealed, suggesting that AIH may be a novel treatment option aimed at preserving breathing capacity as long as possible when respiratory function is impaired.

- Following these studies, a central unanswered question remained: does phrenic motor neuron death itself enhance respiratory plasticity, and if so, by what mechanism? Toward the end of my postdoctoral studies, I developed a new model of respiratory motor neuron death in rats: intrapleural injections of saporin conjugated to cholera toxin B fragment (CTB-SAP). This model formed the basis of my K99/R00 grant. I developed the CTB-SAP model to enable us to study which factors trigger enhanced respiratory plasticity following phrenic motor neuron death without complications often present in the mutant SOD1 transgenic model. This novel model is advantageous because cell death is targeted selectively by injection location, the magnitude of its effects is dose dependent and, once cell death has occurred, the model is stable. Key discoveries thus far indicate that CTB-SAP simulates key aspects of

neurodegenerative disease in that respiratory motor neuron (phrenic and intercostal) survival is decreased, eupneic ventilation is maintained despite deficits in ventilatory capacity, microglial number is increased, and respiratory plasticity is exhibited despite the presence of inflammation. These studies are innovative because they pursue novel ideas using a unique model, and will allow us to understand how ventilation is maintained (without complications of other functional losses) as well as the underlying mechanisms that trigger spinal respiratory plasticity following only respiratory motor neuron death.

Role of PBF Fellowship: The PBF Fellowship award enabled me to better understand the intrinsic capacity for plasticity to enable compensation for the onslaught of disease, particularly via mechanisms of spinal respiratory plasticity. This led to many publications, my K99/R00 award from NHLBI, and my first position at the University of Missouri.

Angela Rogers, MD MPH – Assistant Professor, Department of Pulmonary and Critical Care Medicine, Stanford University

Research Focus: My research is focused on using cutting-edge 'omics methods to better understand ARDS biology, identify clinically important subsets of the disease, and improve clinical trials as we move toward precision medicine in ICU.

Role of PBF Fellowship: Bridge funding from the Parker B. Francis grant was critically important for me. I was transitioning from asthma to ARDS while also moving institutions from the BWH to Stanford. Having the prestigious PBF grant on my CV helped Stanford take a chance on me even though I was switching gears to ICU research. After moving here, I got my K23 grant and recently a fundable score on my first R01. I'm not sure any of those things would have happened without PBF support.

Renat Shaykhiev, MD PhD – Associate Professor, Department of Medicine, Weill Cornell Medical College

Research Focus: My research is focused on fundamental mechanisms that underlie the development and progression of lung disease in humans, including chronic obstructive pulmonary disease (COPD), idiopathic pulmonary fibrosis (IPF) and lung cancer, as well as aging-related changes in the human lung. Our goal is to understand lung aging and disease mechanisms at the level of individual cells, genes and molecular pathways, using tissues and cells obtained from patients who suffer from lung disease and donors of different age without lung disease. We believe that the best model of human lung disease is human lung disease, each individual patient, and understanding his or her unique disease type is only possible by considering the unique changes in biology of thousands of cells in each patient's lungs. To do this, we isolate multiple cell types from the lungs of donors with and without lung disease, including tissue-specific stem cells and surrounding cells, which play important role in maintaining the structure of those regions of the lung that become affected in disease. We identify disease pathways and map them to specific cell populations by analyzing expression of thousands of genes in each individual cells, and evaluate novel therapeutic approaches to target these disease mechanisms using patient-derived models, in which specific aspects of disease are reconstructed using stem cells and various surrounding tissue cells isolated from disease areas of individual patients. We believe that these studies will help

develop novel therapies to treat and cure chronic lung diseases by targeting mechanisms responsible for disease development and progression in each individual patient.

Role of PBF Fellowship: I am particularly thankful to the PBF Fellowship Program for supporting my research in the beginning of my research career, which enabled my transition into independence. Initial studies supported by the PBF Fellowship award helped me establish an NIH-funded independent research program focused on the role of tissue-specific airway stem cells and various mechanisms that regulate their behavior in health and lung disease.

Sophie Toya, PhD – Pulmonologist, Covenant Healthcare

No longer conducting research applicable to lung disease. 100% clinical activities.

Curtis Weiss, MD MS – Head of Quality, Division of Pulmonary, Critical Care, Allergy, and Immunology; NorthShore University Health System

Research Focus: My research focuses on understanding the facilitators and barriers to the use of evidence-based practices for patients with acute respiratory distress syndrome (ARDS). I am using data science and network analysis to develop a model of implementation that considers clinical, clinician-based, professional network-based, and team-based barriers to the use of low tidal volume ventilation for patients with ARDS. We have found that the use of low tidal volume ventilation (LTVV)—a strongly recommended, evidence-based practice for patients with ARDS—is under-utilized. We have found that ICU clinicians strongly support the use of LTVV, but don't use it frequently in their practice. We are identifying several barriers to LTVV use, including under-recognition of ARDS. We are modeling ARDS recognition using clinical variables and professional-network barriers. Identifying these barriers will lead to the development of implementation strategies that improve the adoption of evidence into clinical practice, potentially improving patient care.

Role of PBF Fellowship: I received the PBF Fellowship coming out of my clinical pulmonary/critical care fellowship. This gave me the protected time and support to conduct the preliminary studies that allowed me to successfully receive NIH K award and Department of Defense grants focusing on implementation science and ARDS treatment. These grants in turn allowed me to successfully obtain an NIH R01 grant focusing on investigating LTVV use in ARDS.