Biographical Feature: Peter H. Gilligan, Ph.D., D(ABMM), F(AAM)

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"... Our enemy is infectious diseases. Our mission has been to discern who the enemies are and raise the alarm when they are a threat. We are usually nameless and faceless to the general public. The job we do to protect them is little understood and even less appreciated. We are people who come from many nations, religions, economic circumstances, sexual orientations, and educational attainment, but we work for a single goal, to defeat disease where we find it so as to relieve and prevent as much human suffering as possible ..."
(1).

The preceding passage is a direct quotation from a paper published in 2017 by the subject of this quarter's *Journal of Clinical Microbiology* biographical feature, Dr. Peter H. Gilligan. This story-telling, sometimes larger-than-life clinical microbiologist (6'6" to be exact) has been a prominent leader in our field for nearly 4 decades. As an aspiring clinical microbiologist several years ago, this author clearly remembers Dr. Gilligan prowling around large ballrooms and auditoriums with a microphone as a panelist for the renowned Case Presentations in Clinical Microbiology sessions at the American Society for Microbiology (ASM) General Meeting, particularly when he was placed on the spot as the respondent (and subsequently scouring the audience for colleagues/past trainees/other experts to "help" him). The aforementioned quotation

Citation Munson E. 2019. Biographical Feature: Peter H. Gilligan, Ph.D., D(ABMM), F(AAM). *J Clin Microbiol* 57:e01872-18. <https://doi.org/10.1128/JCM.01872-18>.

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Accepted manuscript posted online 12 December 2018

Published 30 January 2019

from the manuscript “The Invisible Army” brings to light a number of qualities of this man that will be further described within this essay, namely, (i) overall dedication to and passion for his craft, (ii) motivation of clinical microbiologists current and future, and (iii) advocacy for the field of clinical microbiology and its utmost importance to patient care.

Peter Gilligan was born in 1951 in Great Barrington, MA. His father was a small-town practitioner (board certified in cardiology), and his mother had been a schoolteacher prior to raising a family. Gilligan reminisced about a “wonderful and privileged upbringing.” A tremendous premium was placed on education and reading books. Conversation was always had at the dinner table regarding important matters of the day. That dinner table was likely crowded at times (or very large), as Gilligan is one of nine children. This accomplished group of siblings has produced a certified public accountant, a registered nurse, and a Peace Corps volunteer (now a thought leader in national education policy) as well as five doctoral-level degrees. Gilligan related that when individuals inquired of his mother regarding the successes of her children, she would state, “We worked really hard with the first one, then let sibling rivalry take over with the rest.” According to Google Maps (Gilligan repeatedly mentioned that one of the greatest advancements throughout his career has been the rapid accessibility of data/information), Great Barrington lies 124 and 134 miles away from New York City and Boston, respectively. As such, Gilligan remembers walking around the neighborhood during his youth and hearing radio broadcasts of Boston Red Sox, New York Yankees, and (for a while) Brooklyn Dodgers games blaring from windows because a variety of allegiances existed within Great Barrington. While the far-western Massachusetts native listed Boston Celtics legend Bill Russell as his favorite basketball player, the proximity to New York City gave him the ability to admire the baseball prowess of Mickey Mantle. Gilligan chuckled that he often receives the inquiry “How can you be both a Celtics fan and a Yankees fan?”

Perhaps one of Gilligan’s greatest heroes in life is Louis Pasteur. Much of Gilligan’s impetus to study science (and subsequently microbiology) came from his reading of the book *Microbe Hunters* (2) when he was 12 years old. “Too many people have celebrities as heroes, instead of someone with real substance,” stated Gilligan. When considering the story of how Pasteur inoculated young Joseph Meister with spinal tissue from rabid rabbits to prevent the onset of rabies after an attack by a rabid dog, Gilligan further admired how Pasteur considered risking his entire career to save the boy’s life.

At this time, Gilligan thought that the only means of having a successful career in medicine was to be a physician. In 1969, he matriculated at the College of the Holy Cross in Worcester, MA, with some of the promulgated Jesuit ideals likely influencing his later clinical microbiology practice. He spent summers as a clinical chemistry technician/phlebotomist at a community hospital in Great Barrington. Upon graduation with a biology degree in 1973, Gilligan enrolled in the Department of Microbiology at the University of Kansas for graduate studies. He studied under the tutelage of Donald C. Robertson, Ph.D., who Gilligan noted was essentially his contemporary in terms of age. Gilligan described Robertson as an amazing mentor “who worked right alongside of us—just a remarkable man. He didn’t expect anyone to work harder than him.” But yet they worked; the research laboratory was in operation until noon on Saturdays and started up again after dinner on Sundays. “We didn’t know any different,” quipped Gilligan. Gilligan also deadpanned that he was the underachiever within the laboratory, as the five other students in the laboratory at that time advanced to become either chairs of microbiology departments or college deans.

During his graduate studies, Gilligan had the opportunity to meet the famous scientific writer René Dubos (who also penned the definitive biography of Louis Pasteur) and discuss the philosophy of science. The meeting was particularly noteworthy to Gilligan, as he realized that “you can really have an impact on people’s lives by being a microbiologist.” However, medical school plans were still in the works until Gilligan experienced what he cited as the “Paul-on-the-road-to-Damascus moment in

life." A 1978 meeting with Laurence R. McCarthy, Ph.D., who founded the ASM Committee on Postgraduate Educational Programs (CPEP)-approved fellowship program at the University of North Carolina Hospitals in Chapel Hill, NC, changed Gilligan's career focus. "I didn't know how to do microbiology in the context of medicine until I met Larry McCarthy," exclaimed Gilligan.

During the time of his graduate studies, enterotoxigenic *Escherichia coli* had just been discovered and Gilligan studied tissue culture in the context of its heat-labile toxin (3). Upon entering his postdoctoral fellowship, Gilligan parlayed his knowledge of toxin biology into the development of assays essential to patient care. "Toxin assays became an important tool in my toolbox," remarked Gilligan. Following completion of his fellowship in 1980, Gilligan's clinical microbiology laboratory at St. Christopher's Hospital for Children in urban Philadelphia, PA, became one of the first laboratories in the United States to develop tissue culture assays for the detection of *Clostridium difficile* toxin. This practice evolved into not only a reference laboratory service for approximately 25 hospitals in the Philadelphia area (including teaching hospitals and community hospitals) but also a revenue center for St. Christopher's Hospital at the time. Moreover, the study of *C. difficile* and its evolution of diagnostic modalities and algorithms has been an important focus throughout the entire career of Gilligan, in terms of research (4–6), implementation (7, 8), editorial (9, 10), and professional-practice (11, 12) activities.

Gilligan returned to Chapel Hill in 1984 and has since ascended to full directorship of the Clinical Microbiology-Immunology Laboratories and Phlebotomy Services at the University of North Carolina Hospitals. He is also full professor in the Departments of Pathology-Laboratory Medicine and Microbiology-Immunology at the University of North Carolina School of Medicine. A large portion of Gilligan's academic research at this institution has focused on the microbiology of cystic fibrosis (CF). J. Michael Miller, Ph.D., director of Microbiology Technical Services, LLC, remarked that "Dr. Gilligan's early work on the microbiology of cystic fibrosis was encyclopedic to me." Richard L. Hodinka, Ph.D., chair of the Department of Biomedical Sciences at the University of South Carolina School of Medicine in Greenville, added, "Peter was one of the first individuals to recognize that *Burkholderia cepacia* was an important pathogen in cystic fibrosis patients, and much of his pioneering work has formed the foundation for the current procedures used for the laboratory diagnosis of this particular human pathogen."

When asked the reasoning behind his focus on cystic fibrosis microbiology, Gilligan countered with a number of stories. (Incidentally, the phrase "This is a crazy story ... which I will tell you" was uttered a number of times during a recent interview.) The first involved a college roommate who Gilligan, at the time, observed was coughing frequently at night. It was not until after graduation that Gilligan was informed that the roommate was afflicted with cystic fibrosis and was one of the oldest surviving cystic fibrosis patients in the world at the time. He died shortly thereafter at the age of 25. "Nowadays if you have CF and die at age 25, you are one of the unlucky ones," observed Gilligan. A second story relates to Gilligan's tenure at St. Christopher's Hospital for Children. He would attend rounds every Wednesday with Sarah S. Long, M.D., pediatric infectious disease specialist. One case involved a recent high school graduate. It was noted that the young man suffered several exacerbations of respiratory compromise caused by mucoid *Pseudomonas aeruginosa* but typically recovered. It was not until the onset of infection with *Pseudomonas cepacia* (as it was known at that time) that the patient experienced full compromise and expired within 2 weeks. Gilligan participated in a retrospective autopsy data analysis and discovered that one-fourth of cystic fibrosis patients dying at the institution yielded solely *P. cepacia* from respiratory culture. This culminated in an epidemiologic investigation in collaboration with the Centers for Disease Control and Prevention (CDC) (13). Gilligan ultimately summarized, "Advances that we have made in the care of CF patients have been the most satisfying thing in my research career. Learning more about these microorganisms can be applied to caring for patients with CF." In addition to his work on pseudomonad bacteria, studies have

been devoted to the roles of *Staphylococcus aureus*, nontuberculous mycobacteria (including *Mycobacterium abscessus*), obligate anaerobic organisms, and other nonfermentative Gram-negative bacilli, as well as efficacy of novel therapeutic agents, in the clinical dynamic of cystic fibrosis.

With such accomplishments in the understanding of this complex microbiota also come more unfortunate stories. Lung transplantation has proven to be a viable treatment option for a subset of cystic fibrosis patients, with some literature espousing transplantation in patients colonized with *B. cepacia* isolates which demonstrate antibiotic susceptibility. However, Gilligan and colleagues (14) associated cystic fibrosis patients harboring genomovar III of *B. cepacia* (now known as *Burkholderia cenocepacia*) during pretransplantation status with significant cepacia syndrome-related mortality. This relationship has not been demonstrated among the other ~20 species of the *B. cepacia* complex. Gilligan reflected, "There is a huge human cost to the sterile statement, 'I cannot give you a lung transplant.' Sometimes the human misery is not thought about."

Gilligan's contributions to the scientific literature are manifested by more than 125 PubMed-indexed peer-reviewed publications (inclusive of practice guidelines, invited reviews, and invited commentaries), three Cumitech documents, and more than three dozen chapter contributions to stalwarts such as *Clinical Microbiology Procedures Handbook*, *Principle and Practice of Pediatric Infectious Diseases*, *Manual of Clinical Microbiology*, *Principles and Practice of Infectious Diseases*, and *The Prokaryotes*. Gilligan has also published four editions of the popular text *Cases in Medical Microbiology and Infectious Diseases*. Robin Patel, M.D., current chair of the Division of Clinical Microbiology at Mayo Clinic, remarked that the contents of this book "are wonderful cases; I use them with my medical students. People just do not devote the time to put this together, but Peter did it for the field of medical microbiology. Hopefully this will motivate others to make similar contributions to the field." Gilligan achieved diplomate status with the American Board of Medical Microbiology (ABMM) in 1983. Other noteworthy honors include the bioMérieux-Sonnenwirth Award for Leadership in Clinical Microbiology and the ABMM/American Board of Medical Laboratory Immunology (ABMLI) Professional Recognition Award bestowed by ASM in 2001 and 2014, respectively, visiting professorships at the Universities of Iowa and Kansas, and elected fellowship into the American Academy of Microbiology in 1989.

Gilligan opines that, other than the paradigm of information technology, the most significant changes he has experienced as a clinical microbiologist are related to "amazing disruptive technologies" and the discovery of HIV. Gilligan quipped, "In 1985, Louis Pasteur would have been comfortable in our laboratory and now he would not. For example, molecular assays now allow us to use just a tiny amount of clinical material to produce a laboratory diagnosis." Gilligan further cited robotics replacing humans and the advent of mass spectrometry (cultured organism identification in minutes) as significant paradigm shifts. In addition, Gilligan believes that with microbiome technology "we are just starting to scratch the surface in our understanding of the pathogenesis of disease." Finally, Gilligan stated that HIV has "put global health on the map" and acknowledged that his work in Africa through the UNC Project and Cambodia through the Diagnostic Microbiology Development Program would not have happened without discovery of this agent. Gilligan met his wife of 39 years, M. Lynn Smiley, M.D., during his tenure at the University of Kansas. While diagnostic advancements and the understanding of HIV/AIDS in the 1980s and 1990s to an extent mimicked advancements in the study of cystic fibrosis, Gilligan feels humbled to "have as my life partner [an infectious diseases specialist] who told hundreds of people that they had HIV and then had a hand in developing several therapeutic agents for this disease" (15).

Gilligan has fulfilled the classic academia triad by contributing heavily to the fields of teaching and service. To fully appreciate this accomplishment, one needs to examine attributes of Gilligan. Dr. Miller wrote, "Peter is a giant in our profession and our clinical community and a natural leader and communicator. Peter has that perfect combination

of knowledge, technical application, and interpersonal skills that not only engage his microbiology colleagues but also the medical staff who tend to soak in everything he has to say." Richard B. (Tom) Thomson, Jr., Ph.D., director of microbiology laboratories at NorthShore University HealthSystem (16), describes Gilligan as a "boisterous, charismatic individual. People gravitate to his charisma; people listen to him." Melissa B. Miller, Ph.D., director of the clinical molecular microbiology laboratory at University of North Carolina Hospitals and past CPEP trainee of Gilligan, states that Gilligan has a very large personality and that everyone knows when he is around. "He gets very excited about medicine and diagnostics, training and mentoring, and even birthdays. He likes to celebrate the successes of people." Dr. Hodinka, another past Gilligan CPEP trainee, wrote, "Peter has a rough and tough looking exterior and can be intimidating at times—he stands big and tall with a beard and loosely combed hair, and he has this booming voice when he speaks. However, appearances can be most deceiving, as his personality is warm and he is simply one of the kindest, gentlest, and most caring and giving human beings imaginable." Dr. Patel described him as "one of the smartest, most encouraging microbiologists I have met."

Gilligan has received a plethora of accolades for his teaching prowess in the University of North Carolina School of Medicine and is a highly sought-after speaker at the regional, national, and international levels. However, his pedagogy does not stop there. Melissa Jones, microbiology specialist at the University of North Carolina Hospitals McClendon Clinical Laboratories, noted that Gilligan has a great sense of being an educator, is encouraging toward technologists and postdoctoral fellows, and is willing to admit a deficit of knowledge on a given subject matter (and then will quickly compensate through literature searches and other means). In addition, he has established a very personal relationship with his technologists, has "broken down barriers between management and the laboratory," and has created a culture in the laboratory in which participation by all is encouraged. Ms. Jones added, "With a sometimes hidden agenda of education, you may often hear him say 'Now I've got an interesting story to tell you.' The staff knew they were in for a treat then, as Dr. Gilligan is also known for being a great storyteller both in the lab and out." Dr. Hodinka commented, "He is committed to teaching and is considered to be an outstanding educator. He is extremely knowledgeable, always well organized, and abundantly passionate and enthusiastic about the subject matter that he is presenting."

Gilligan directed the University of North Carolina Hospitals CPEP program between 1987 and 2018. He maintains a passion for this program, stating that it "gave me a chance—I want to give other people a chance." While providing scientists the opportunity for hands-on clinical microbiology training, Gilligan notes that his CPEP program reaps the benefits of discovery, training of residents, infectious diseases team rapport and interaction, clinical research, and validation study performance. "They help us do projects that the techs just do not have time to do." Ultimately the postdoctoral fellows "enrich us, but also enrich the services we can offer our patients."

In the drafting of this biographical feature, Gilligan's CPEP mentorship was lauded by a number of the 27 graduates of his program. Dr. Hodinka referred to Gilligan as the "consummate mentor and servant leader. Over his career, he has unselfishly contributed much and touched the lives of many. He has the ability and willingness to clearly communicate what he knows, and he is seriously and actively committed to engaging and helping others to succeed." Dr. Melissa Miller simply stated that CPEP fellowship graduates from Gilligan's program "are his legacy. He continues to mentor us and support us, and to celebrate our successes. Everyone will always remember that we trained with Peter Gilligan." In further noting that Gilligan's top attribute is mentorship, Dr. Miller related that his mentorship extends to medical students, graduate students, allied health science students, and even high school students. "I can't tell you the number of people coming through his office weekly; he remembers all of them. He has impacted all aspects of clinical care by the mentorship he has provided."

Another Gilligan trainee, U.S. Army Colonel (retired) David W. Craft, Ph.D. (now director of clinical microbiology at Penn State Health Milton S. Hershey Medical Center),

described how Gilligan established a novel paradigm in the context of the CPEP fellowship. For approximately 15 years, Dr. Craft was a commissioned Army officer serving as a Ph.D. microbiologist. However, at that time, there “was a gap that needed to be filled—the Army Medical Department was not participating in clinical microbiology fellowship training and certification.” With Department of Defense funding, Dr. Craft entered the University of North Carolina CPEP fellowship. In retrospect, Dr. Craft noted that Gilligan was “willing to take a risk—he had never done this before with an Army officer. The fellowship was for me; not for him. He was always reminding me that this was for myself and for the Army.” Following completion of the fellowship, Dr. Craft returned to the military as an active duty officer and went on utilization tours, with deployments in teaching medical centers (including Walter Reed Army Medical Center in Washington, DC). Dr. Craft also served as microbiology consultant to the Army Surgeon General, with his role “greatly influenced by the time that I spent with Peter.” According to Dr. Craft, military involvement in the CPEP fellowship has “really been value added. Peter has really blazed the trail for this.” Of the more than 20 officers who have completed CPEP fellowships, no fewer than five have gone through Gilligan’s program.

Dr. Craft also credits Gilligan as being “out in front” when Gilligan first began speaking about the possibility of bioterrorism-related events taking place in this country. Gilligan remembered, “I really first became aware of the problem of bioterrorism while attending the 1996 Olympics in Atlanta and read in the Atlanta newspaper about CDC deploying a larger number of scientists to make sure the water system was not purposely contaminated. Around that time, I also met a UNC faculty member who had a connection with Ken Alibek, a senior scientist at Biopreparat who emigrated to the U.S. I remember being on a conference call with Alibek. I began giving talks about bioterrorism at regional meetings in 1999 and gave [one] at the ASM General Meeting in May of 2001 just a few months before the anthrax attacks. When dealing with potential bioterrorism agents, employee safety is paramount, so we have systems in place that we use routinely to ensure that safety. Additionally, our state lab and microbiologists from large medical centers in North Carolina also have created a network that can quickly respond to any event. We were woefully unprepared in 2001 and are better prepared now.”

Gilligan’s service activities are numerous (spanning nearly nine pages of his *curriculum vitae*) and have benefited professional practice. One obvious example of this is his advocacy for and contribution to ASM. “I couldn’t do my job without ASM,” stated Gilligan. He went on to cite entities such as *Manual of Clinical Microbiology*, ASM journals, ASM meetings, and the American Board of Medical Microbiology, noting that “without ASM, none of that exists . . . but someone’s got to do the work. I grew up in a big family, so a sense of community has always been important.” With respect to publications, Gilligan has served as section editor for *Manual of Clinical Microbiology* and editor for the ASM journals *Journal of Clinical Microbiology* (2007 to 2017), *mBio* (since 2009), and *Clinical Microbiology Reviews* (since 2010). With respect to editorial service, Gilligan remarked that “working under editors-in-chief like Arturo Casadevall, Gary Doern (17), Alex McAdam, Irv Nachamkin, and Jo-Anne Young has really exercised my brain. They help ensure that published science is of high quality as it should be.” Alexander J. McAdam, M.D., Ph.D., current editor-in-chief of *Journal of Clinical Microbiology*, wrote, “Dr. Gilligan was an outstanding editor of *Journal of Clinical Microbiology*. He had very high standards for papers and strongly encouraged other editors to do the same. Peter proposed, designed, and introduced the Point-Counterpoint articles. These are among the most popular and influential features in the journal and were important in moving the journal toward increasing the number of feature articles.”

Peggy McNult, director of the Clinical and Public Health Microbiology Committee for ASM, stated that Gilligan is “very aware of the criticality of the clinical laboratory and how that is important for patient care.” As a result, Ms. McNult opined that, in addition to books and other scholarship published through ASM Press, two of Gilligan’s most lasting contributions involve his imperative that ASM begin developing evidence-based

practice guidelines and for the championship of the clinical microbiologist being heard at the level of ASM governance. Gilligan was chair-elect and chair of ASM Division C from 1993 to 1995, was chair of the ASM Presidential Task Force on Clinical Microbiology in 1997, was a member of the Interscience Conference on Antimicrobial Agents and Chemotherapy (ICAAC) Planning Committee from 2004 to 2011, served as dean of the American College of Microbiology from 2009 to 2011, and was chair of the ASM Professional Practice Committee from 2011 to 2017. In addition, Gilligan has served as a board member and chair of the election committee for the American Academy of Microbiology. Dr. Thomson noted that that Gilligan “has been a strong and influential advocate for clinical microbiologists gaining fellowship in the American Academy of Microbiology. His voice has been an important one for us.”

In light of all of this, when asked to summarize the accomplishments for which he holds most pride, Gilligan put forth an answer that likely mirrored values encountered in his Jesuit undergraduate education. He takes pride from the mentorship of “all of the people from disadvantaged backgrounds who I helped get into medical school.” Gilligan also cited “all of the training and teaching that I’ve done at this hospital, including that within the walls of the clinical microbiology laboratory.” Finally, he is humbled by being someone who serves the people of North Carolina. Gilligan reflected, “The hospital motto here is ‘By and for the people of North Carolina.’ In spite of all of the publications, talks, and books . . . the things that I have done to directly help people resonate the most.” That philosophy has additionally been ingrained into his microbiologists, who have bought into this belief system, care tremendously about what they do, and challenge themselves every day to maintain this standard. Gilligan tells his particular battalion of the invisible army, “patients’ families or patients aren’t going to come to you and thank you. If you want to have the gratitude of clinicians, you will get that.”

Dr. Gilligan is planning to retire from his directorship position in February 2019 after nearly 35 years of service to the University of North Carolina Hospitals. He is already transitioning to a postretirement position of pre-health advising (with particular focus on finding medical practitioners for the more rural areas of North Carolina). He looks to embrace a retirement freedom “to do what I want to do.” This involves family, hiking, music, enjoyment of the outdoors, and mentorship of young people. Readers of this biographical feature who lament that not enough information was presented need not worry: the story-telling Gilligan is contemplating a publication of his memoirs. He exhorts his clinical microbiology laboratory director colleagues worldwide with just three thoughts: “(i) be a good teammate because caring for patients requires a great team, (ii) teach your colleagues and trust them to apply what you taught, and (iii) with the realization that the number of human pathogens is ever expanding, remember that chance favors only the prepared mind.” Gilligan’s parting shot to his regiment of clinical microbiologists could easily be extrapolated to the entire discipline of clinical microbiology (for which he has been such a strong advocate): “Thank you . . . for all of the unsung work that you have done to help so many people and so many families throughout your careers. I am grateful for all the work you have done.”

ACKNOWLEDGMENTS

I express sincere gratitude to Peter Gilligan for his generous provision of an in-depth interview for this biographical feature. Certain content within this biographical feature would not have been possible without the tremendous assistance of David W. Craft, Ph.D., Richard L. Hodinka, Ph.D., Melissa Jones, M.T., Alexander J. McAdam, M.D., Ph.D., Peggy McNult, J. Michael Miller, Ph.D., Melissa B. Miller, Ph.D., Robin Patel, M.D., and Richard B. (Tom) Thomson, Jr., Ph.D.

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