**Tell us about your education and experiences at university**

Following graduation from Virginia Tech with a B.S. in biology, it was my great fortune to be chosen to participate in a multinational, NSF-funded research project in Antarctica as an environmental monitor for the Dry Valley Drilling Project during the 1973–74 austral summer. My team leader was Frank Morelli, a seasoned microbiologist from the Cal Tech Jet Propulsion Laboratory and the Darwin Research Institute who had spent several field seasons in the Antarctic. I had limited training and experience in microbiology (a single four credit course in general microbiology and a summer work/study job in the clinical microbiology lab of the City of Norfolk, Virginia Department of Public Health). Under Frank’s guidance and patient instruction, I quickly came up to speed and was given opportunities to travel from McMurdo Station to remote drilling sites in the Dry Valleys for several weeks at a time, collecting air, soil, and water samples to assess the environmental impact of drilling operations on these environmentally sensitive areas. During whatever free time I had I’d spend in the small McMurdo Biology Lab library, reading the scientific literature, trying to broaden my understanding of the geology and biology of the Antarctic Dry Valleys. My level of interest didn’t go unnoticed and Frank suggested I take the next step in my career and consider graduate school in microbiology. I returned to Virginia Tech and spent the next three years (with another three-month interlude in Antarctica) working toward a Master’s degree in microbiology. The microbiology faculty at Tech were outstanding, and my training was exceptional. I think I came away from this program with a solid foundation in microbiology, a great appreciation for the scientific literature, and a good understanding of experimental design.

**What was your first position after university?**

After graduating from Virginia Tech I was offered a microbiologist position with Philadelphia Suburban Water Company (now Aqua America). PSWC was one of the larger private water companies in the United States with a state-of-the-art water quality lab, and in addition to running the microbiology lab, I was given opportunities to pursue my research interests in drinking water microbiology. At that time, PSWC had several large surface water treatment facilities and an extensive water distribution system. The finished water quality was consistently well within federal drinking water standards, but there were occasional fluctuations in the turbidity and iron levels in the water collected from dead ends or small diameter unlined cast iron drinking water pipes in the distribution system. In one case we also detected elevated counts of heterotrophic bacteria in a small section of the distribution system that could only be eradicated by flushing and cement-lining the affected unlined cast iron pipes. This suggested to me the role of surfaces in the persistence of bacteria in the distribution system. A review of the literature revealed that microbial communities had been observed on the walls of distribution system water pipes and I speculated that these bacteria were associated with these pipe wall microbial communities (that we now know to be microbial biofilms). I contacted Dr. Wesley Pipes, a professor of Civil Engineering at Drexel University in Philadelphia, who had published extensively in drinking water microbiology and he suggested I look into the PhD program in the Environmental Studies Institute at Drexel. Kenneth Shull, the Vice President of Research and Environmental Affairs, not only encouraged me in this endeavour but arranged for PSWC to cover all my tuition costs! My PhD research investigated the effect of the physical, chemical, and microbiological characteristics of the water distribution system on the growth of microbial biofilms.

**What is your position at your institution and what do you like most about your work?**

I work in the Division of Healthcare Quality Promotion at CDC as a research microbiologist and principal investigator, directing a research laboratory investigating the role of microbial biofilms in public health. I’ve been in...
About Rodney Donlan. Dr. Donlan is the head of the Biofilm Laboratory at the Division of Healthcare Quality Promotion, National Center for Emerging and Zoonotic Infectious Diseases, US. Centers for Disease Control and Prevention. He received his BS and MS degrees from Virginia Tech (1973, 1977) and his PhD from Drexel University (1987), and has held various positions in industry and public health agencies, including as a Microbiologist at the US. Environmental Protection Agency (1978–9), Chief Microbiologist and Supervisor of Laboratories and Technical Services at the Philadelphia Suburban Water Company (1980–9) and Research Associate at Calgon Corporation (1989–98). He joined the CDC in 1998. Dr. Donlan’s lifelong research interest has been microbial biofilm formation in potable water systems and in healthcare settings. He has co-authored >60 papers and patents in the field, and received numerous awards and honors, including Antarctic Service Medal of the United States (1980), Sigma Xi membership (1999), the Alice Hamilton Award for Occupational Safety and Health (2015), and the Sigma Xi Walter R. Dowdle Award (2016).

this position for almost 18 years, and still find the work interesting and inspiring. What I enjoy most about this job is being able to work with and mentor research fellows and graduate students to perform research that can actually have an impact on the public’s health. I read somewhere that you should always try and work with people who are smarter than you. The young scientists awarded the training and postdoctoral fellowships at CDC are among the brightest and best, and as a result I think I receive as much as I give from every one of them. I am also very appreciative of the support I’ve received from the DHQP management and the close working relationships I’ve developed with medical officers and medical epidemiologists in the Prevention and Response and Surveillance Branches. This has helped me to continually focus our research agenda, making sure it is translational, directly impacting healthcare delivery.

What areas or topics does your lab currently focus on?

The Biofilm Lab’s mission is to investigate the role of microbial biofilms in healthcare-associated infections and to evaluate new methods for their detection and control. Rather than focus on a particular organism or disease, as is the case with many other CDC labs, we focus our applied research in two primary areas. One is to investigate the role of water-associated biofilms in the survival and dissemination of pathogens in the healthcare environment. In collaboration with the Legionella Laboratory in the Respiratory Diseases Branch at CDC we have investigated the role of biofilms in the survival and disinfection of Legionella pneumophila. We developed a model system that could simulate biofilm growth in a hot water system and demonstrated that the association of L. pneumophila with free-living protozoa in biofilms could reduce its susceptibility to disinfectants. Recently we have begun to investigate the interaction of multidrug-resistant-organisms with biofilms in healthcare facility plumbing systems, using similar biofilm reactor systems.

We have also been very active in investigating biofilms on indwelling medical devices, particularly intravascular catheters, catheter needleless connectors, and urinary catheters. One example that comes to mind is a collaborative study with Emory University in which we characterized biofilm formation on needleless connectors of central venous catheters from patients in an acute care hospital. In addition to using culture-dependent methods to characterize biofilms on these devices, we also used culture-independent methods in which the 16S rRNA genes from needleless connector biofilm samples were amplified, providing evidence for highly diverse microbial communities on these devices. We’ve also been interested in novel methods for preventing or eradicating biofilms in indwelling medical devices. John Curtin, a postdoctoral fellow in the Biofilm Lab from 2003–2005 hypothesized that catheters coated with lytic bacteriophage could mitigate bacterial attachment and biofilm formation. His work, and that of several other research fellows in our lab demonstrated that catheters pretreated with single phage strains and combinations of phages could, in fact significantly reduce biofilm formation on catheters in laboratory models. In collaboration with Dr. Barbara Trautner at the Baylor College of Medicine, we also demonstrated that phage are synergistic with bacterial interference for the prevention of biofilm formation by Pseudomonas aeruginosa on urinary catheters. And in collaboration with Dr. Matthew Lungren and others at Duke University, we showed that a bacteriophage lock treatment could significantly reduce Staphylococcus aureus biofilms in a catheterized rabbit model. Over the past 2 years, we have begun to investigate novel approaches for detecting biofilm formation on catheters and other indwelling medical devices. We’re particularly very interested in identifying biomarkers that would allow us to detect and identify biofilm organisms on indwelling medical devices in situ and in real time.
What was your most significant scientific accomplishment?

I think we have raised awareness in the healthcare community of the importance of biofilms in public health. One of the ways that this happened was through the publication of several important review papers on biofilms intended for an audience of clinical microbiologists and infectious disease practitioners. It’s always interesting to talk to healthcare providers about our work at CDC, and observe their response when I say I do research on microbial biofilms. Most have some familiarity with the term and can appreciate the importance of biofilm formation on an intravascular catheter or prosthetic knee or hip. I’d like to think our efforts are at least part of the reason for this awareness.

We have also developed new methods for characterizing and evaluating biofilm formation and biofilm control strategies which in my opinion have moved the field of biofilm research forward. One example that comes to mind is the CDC Biofilm Reactor, designed by Ricardo Murga, Wayne Kirby, and me. This device is unique in that it can be used to grow and characterize biofilms of various microorganisms on different materials under flowing conditions. We’ve used the CDC Biofilm Reactor in many different studies in our lab and in collaborative studies with colleagues at the Center for Biofilm Engineering at Montana State University. There is now an ASTM method available for the operation of this device (E2562-07. Standard Test Method for Quantification of Pseudomonas aeruginosa Biofilm Grown with High Shear and Continuous Flow using CDC Biofilm Reactor), and it is commonly used by the biofilm research community.

I’ve been privileged to mentor many postdoctoral fellows, guest researchers, and PhD students in the Biofilm Lab. Each has contributed significantly to the lab, and most have gone on to pursue PhD degrees or to careers in government or private industry. I would consider this to be my most important accomplishment—to have influenced each of these individuals to pursue careers in science and medicine.

What do you do for fun?

I try and spend as much time as possible in the outdoors. I’ve been a lifelong hiker of the Appalachian Trail and of many wild areas throughout the United States, and enjoy nothing better than hitting the trail with my wife, children, and now, grandchildren.

Disclaimer

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