

## In memoriam—Mark E. Shirtliff (1969–2018)

While the final preparations were under way to launch this thematic issue on microbial biofilms, we received the horrible news that professor Mark E. Shirtliff (49) lost his life in a tragic accident while rafting on the Yellowstone river near Gardiner, Montana (US) on 12 July 2018. On behalf of the biofilm community we send our condolences to his wife (Birthe Kjellerup, co-editor of this thematic issue) and his four children, and we wish to dedicate this special issue to his memory.

Mark's passion and the focus of his scientific career was the study of microbial biofilms in chronic infections. He obtained a Ph.D. in Microbiology and Immunology at the University of Texas Medical Branch in Galveston (title of his dissertation: '*Staphylococcus aureus*: roles in osteomyelitis') in January 2001 under the late Jon Mader. From October 2000 to October 2002 he was a Post-doctoral Fellow at the renowned Center for Biofilm Engineering (CBE) in Bozeman (Montana, USA) with Dr. Anne Camper and then transitioned into an independent researcher as Assistant Research Professor at the CBE (with the late Bill Costerton as his mentor) from October 2002 to August 2003. He subsequently moved to the University of Maryland in Baltimore, where he held a primary appointment at the School of Dentistry (Department of Microbial Pathogenesis) and a secondary appointment at the School of Medicine (Department of Microbiology and Immunology).

Over the last 15 years, Mark has been one of the key figures in the biofilm field. He co-authored over 130 scientific publications on biofilm-related topics and was involved in breakthrough studies on polymicrobial infections (Peters et al. 2012; Schlecht et al. 2015) and the development of vaccines to combat biofilm-related infections (Brady et al. 2006, 2011; Harro et al. 2010). His work was solid and the kind of work that steadily moved the field forward. Importantly, he realized that there was an urgent need to translate laboratory findings into clinical practice. In 2013 he received the BioMaryland LIFE (Leading Innovative Faculty Entrepreneurs) Prize for the most promising technology from the University of Maryland for his work on developing a vaccine with activity against *S. aureus* biofilms. Mark subsequently co-founded Serenta Biotechnology to further develop this vaccine and to effectively bring it to the patients in need.

Mark also played an important role in the European Society for Clinical Microbiology and Infection (ESCMID) as member of the Program Committee of the European Conference on Clinical Microbiology and Infectious Diseases (ECCMID) from 2016 to 2018. Thanks to his efforts, novel topics in microbial pathogenesis and experimental microbiology (including biofilm formation) received a prominent position in the ECCMID program. His dedication to make the ECCMID program as attractive as possible,

and his commitment to the field, led to his appointment as an ESCMID Fellow by the ESCMID Executive Committee. Mark also played an important role in the ESCMID Study Group for Biofilms (ESGB). Not only was his input on strategic issues much appreciated, he also played an essential role in shaping the program of the biannual Eurobiofilms meeting, as a presenting faculty member in the pre-conference workshops, as session chair, as speaker and as editor for the first thematic issue on biofilms published in *Pathogens and Disease* (back then still named *FEMS Immunology and Medical Microbiology*) (Donelli et al. 2010).

Mark was a firm believer in 'spreading the biofilm message', an attribute he inherited from his former mentor Bill Costerton. Mark presented his work at a large number of both basic science and clinical conferences, was invited to speak at Institutions all over the world and was instrumental at training students on biofilm techniques in many (international) workshops. He had recently taken on the mission of opening up the field to even more of the world, and was heavily involved in the organization of the 1st International Symposium on Biofilms that took place in October 2017 in Guangzhou (China) (Fig. 1).

More recently, and together with colleagues from around the world, Mark had been discussing strategies to unite and invigorate the field of biofilm research. Mark and others (including the authors of this text) believed that the biofilm community is too scattered as a subdiscipline within many other fields and could benefit from uniting these communities of researchers. Mark believed that the level of recognition and funding for biofilm-related diseases should reflect the magnitude of people they affect, which is greater than cancer. His ultimate goals were to develop strategies that would increase biofilm research funding, facilitate training more scientists and physicians, and promote medical advances in biofilm-targeted treatments. While achieving these goals will be more difficult without Mark as a driving force, we owe it to him to succeed in these endeavours.

Mark was also a great mentor, evidenced by the fact that three of his students at the University of Maryland (Rebeca Brady, Brian Peters and Jeffrey Freiberg) won the Elaine Miye Otani Memorial Award (no other mentor at the University of Maryland has had more than a single student achieve this recognition!). Several of his former students and postdocs went on to secure independent positions elsewhere. Mark also took pride in mentoring junior faculty and was never too busy to help a colleague with a grant application, write a letter of recommendation or simply give a spirited pep talk.

Mark was a respected colleague to some, a wonderful mentor to others and a dear friend to many. He was energetic, smart, incredibly funny and believed in bringing people together—often



**Figure 1.** Some images of Mark Shirtliff. Top left: Mark fly fishing in Montana. Top right: with Paul Stoodley, Susanne Haussler and Tom Coenye in Nyhavn in Copenhagen (Biofilm Workshop at DTU in Lyngby, August 2016). Bottom left: with Zhenbo Xu (left), Janette Harro (front), Tom Coenye (back), Kendra Rumbaugh and Brian Peters (1st International Symposium on Biofilms in Guangzhou, China, October 2017). Bottom right: with Thomas Bjarnsholt and Paul Stoodley (Biofilm Workshop at DTU in Lyngby, August 2016).

over a bottle of wine, a beer or a gin-martini. He loved deep and lively conversation and could be relied upon to stay up late into the wee hours discussing or debating. Mark and Birthe welcomed many researchers from around the world into their home and many of us have very fond memories of spending time with them over the past 15 years.

Six years ago, Mark Shirtliff co-authored the obituary for Bill Costerton in *FEMS Immunology and Medical Microbiology* (Shirtliff, Post and Ehrlich 2012). It seems fitting to end Mark's obituary with the words he himself used to say goodbye to his mentor Bill Costerton: *Although sadness weighs on the hearts of the many lives he has directly affected and those of an entire scientific discipline, we hope that we can soon smile that our journey with him happened.*

**Conflict of interest.** None declared.

## REFERENCES

- Brady RA, Leid JG, Camper AK et al. Identification of *Staphylococcus aureus* proteins recognized by the antibody-mediated immune response to a biofilm infection. *Infect Immun* 2006;74:3415–26.
- Brady RA, O'May GA, Leid JG et al. Resolution of *Staphylococcus aureus* biofilm infection using vaccination and antibiotic treatment. *Infect Immun* 2011;79:1797–803.
- Donelli G, Bayston R, Costerton WB et al. The first European congress on microbial biofilms: EUROBIOFILMS 2009, Rome, Italy, September -5, 2009. *FEMS Immunol Med Microbiol* 2010;59:223–6.

Harro JM, Peters BM, O'May GA et al. Vaccine development in *Staphylococcus aureus*: taking the biofilm phenotype into consideration. *FEMS Immunol Med Microbiol* 2010;59:306–23.

Peters BM, Jabra-Rizk MA, O'May GA et al. Polymicrobial interactions: impact on pathogenesis and human disease. *Clin Microbiol Rev* 2012;25:193–213.

Schlecht LM, Peters BM, Krom BP et al. Systemic *Staphylococcus aureus* infection mediated by *Candida albicans* hyphal invasion of mucosal tissue. *Microbiology* 2015;161:168–81.

Shirtliff ME, Post JC, Ehrlich GD. Bill Costerton: leader as servant. *FEMS Immunol Med Microbiol* 2012;66:269–72.

Tom Coenye  
Laboratory of Pharmaceutical Microbiology, Ghent University, Ghent, Belgium and ESCMID Study Group for Biofilms, Basel, Switzerland  
E-mail: [Tom.Coenye@ugent.be](mailto:Tom.Coenye@ugent.be)

Thomas Bjarnsholt  
Department of Immunology and Microbiology, University of Copenhagen, Copenhagen, Denmark and ESCMID Study Group for Biofilms, Basel, Switzerland

Paul Stoodley  
Departments of Microbial Infection and Immunity and Orthopaedics, The Ohio State University, Columbus OH, USA

Kendra Rumbaugh  
Department of Surgery, Texas Tech University Health Sciences Center, Lubbock TX, USA