Singh Chhatwal: a magical scholar and exceptional *Streptococcus* researcher

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Microbial infections of humans have traditionally been considered a mainstream component of human medicine, and research on infection biology tends to be published in medical journals. However, human infections are simply parasite:host relationships, a classic element of ecology - the interaction of organisms with one another and with their environment - and disease is simply the consequence of such ecological interactions. An ecological journal is thus a perfectly appropriate vehicle for the reporting of research advances in infectious disease in general, and human infections in particular. For this reason, Environmental Microbiology and Environmental Microbiology Reports regularly publish research on the ecology, epidemiology and pathogenesis mechanisms of human pathogens (see, e.g. Environmental Microbiology Volume 18, issue 3: http://onlinelibrary.wiley.com/doi/10.1111/emi.2016.18.issue-3/issuetoc), so it is entirely appropriate that EMIR elects to honour and bid farewell to one of the leading figures in *Streptococcus* infection biology, Singh Chhatwal, who died on August 4, 2016.

In 1987, the then National Research Centre for Biotechnology, GBF, in Braunschweig decided to establish a new research group on streptococcal pathogenesis and had the exceptionally good fortune to recruit Gursharan Singh Chhatwal, then working at the University of Giessen, to lead it. Up to that time, Singh had been using mainly biochemical approaches to study streptococcal components that bind blood and matrix proteins, such as fibronectin (e.g. Chhatwal, GS et al. 1985, 1986, 1987). Once he was installed in the GBF, a biochemistry-genetics centric multidisciplinary team was assembled around him that rapidly allowed unambiguous establishment of functional causality of streptococcal components and infection processes. Over the following quarter of a century, this team made impressive fundamental discoveries on how streptococci interact with the host (e.g. Jerlström, et al., 1991; Talay et al., 1991), on how some infections become recurrent and unresponsive to antibiotic treatment (e.g. Molinari et al., 1997, 1998, 2000; Kaplan et al., 2006), and on the diversity of interactions of different streptococci with different racial groups (e.g. Haidan et al., 2000; Gillen et al., 2002; McKay et al., 2004; Haggar et al., 2012).

Singh was a creative, lateral thinker, always coming up with original ideas, new approaches to existing problems, new aspects for investigation, and a hands-on, can-do ultra optimist. While seemingly relaxed and easy-going, he was competitive and in a hurry, collaborating with anyone who could contribute to progress. He pioneered multidisciplinary infection research at the GBF and demonstrated how progress can be accelerated by collaboration and inclusiveness. While this is rather normal in these days of EC-funded research, it was the exception in those days. Singh showed the way!

A beautiful example of his original ideas combined with strategic partnerships resulting in major findings is his work on rheumatic fever (RF), a serious sequella of pharyngitis caused by some serotypes of Group A *Streptococcus*. RF is almost unknown in most countries, because rapid treatment of Group A strep pharyngitis
with antibiotics cuts short the infection process and prevents the development of autoimmune sequellae. Exceptions are Indians and Australian aborigines. Beautiful detective work by Singh and his collaboration partners provided new epidemiology, new disease profiles and, especially importantly, new insights into the mechanism of creation of the heart muscle cross-reactive M-protein-collagen complexes that trigger the autoimmune reaction leading to rheumatic fever (e.g. Haiden et al., 2000; Dinkla et al., 2003, 2007, 2009; Barroso et al., 2008; Reissmann et al., 2012).

In the mid-2000s, it was decided that the GBF should realign its research focus and concentrate on infection biology, and in 2006 the GBF changed its name to the Helmholtz Centre for Infection Research. The quality, productivity and international prestige of Singh’s research was an enabler of this transition, became a main plank of the research profile of the newly-branded national research centre, and to a significant extent determined the trajectory of its research profile.

Singh was a very special, inspirational person who positively influenced all those with whom he had significant interactions. He was charming, exceptionally positive, helpful, highly social, and his hospitality is legendary. He organised memorable parties, both at work and in his home with his beloved wife Inge, who are both are consummate cooks of delicious curries and of traditional bbq food, like Holzfällersteaks.

Singh’s hospitality and love of India were, to the pleasure of many of his friends and colleagues, combined in the visits to India which he regularly organised down to the last detail and for which he acted as personal guide. After such trips, we always did a diarrhoea incident count: he invariably maintained that any cases of diarrhoea were not due to infections but to appreciation of the food he arranged and a resulting spice overload.

One quality of Singh that immediately became apparent after his arrival in the GBF was his star quality as a magician. Over and above his professional-quality skills as a magician, he brought both high drama and humour to magic shows. His performances were outstanding and memorable - in fact magical! In the early days, when he had more time, he was in great demand for the annual Christmas parties and for many ad hoc children’s parties and symposium dinners, and always generously and graciously agreed to such requests.

Singh’s legacy is multidimensional and multilayered. He was a beacon for excellence in streptococcal research and has breathed new life into research on pyogenic cocci. Though his energetic engagement and persuasiveness, he managed to promote and contribute to strategic infection research goals in all continents. He played a key role in developing research alliances between Germany and India and other countries, and the subsequent success of these alliances. He mentored several generations of young scholars, the first of which are now heads of labs and mentoring young people themselves. He taught us all by gentle word and example - scientists, students, support staff, administrators, politicians, union personnel, friends and neighbours, and many others - important lessons relating to our professional and personal lives.

Singh Chhatwal was a truly exceptional human being in all respects: as a scholar, teacher, mentor, collaborator, science ambassador, magician, party-goer, husband
and father. He radiated sunshine yearlong in Braunschweig; his friendship was unique and irreplaceable. Singh’s legacy is also a massive hole in our lives, a constant reminder of a wonderful person we have had the pleasure of knowing and having as a friend and colleague.


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