

EDITORIAL

Celebrating the life and career (to date) of George Somero

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If you had to predict the best start in life for a budding marine biologist, growing up in a remote Minnesota community founded on timber and mining near the Canadian border probably wouldn't rank high. But for George Somero, the isolation and winters spent fishing in ice holes with cousins, friends and his father was probably the best preparation that he could have had for his PhD studies. 'I have always enjoyed ice and snow', says Somero, whose career is firmly associated with the frozen expanses of Antarctica. Yet, Somero recalls that as a high school student his academic career was far from assured. Only two males out of his class of 112 students went to college. He admits, 'I was thinking of staying at the community college and not migrating too far from home'. Fortunately, a family friend convinced him to broaden his horizons – recommending that he consider a good college offering longer degrees – launching a career that has inspired and motivated the study of biochemical adaptation for more than half a century.

Yet, Somero struggled during his freshman year at Carleton College, Minnesota, eventually being called into the Dean's office to discuss his poor grades. 'He said, "The bad news is your grades are not that good; the good news is that you probably had the worst high school preparation of anybody in your class, you'll need to work more"', Somero recalls. Despite the rocky start, Somero was lucky to stay on the campus at the end of his second year to work in a laboratory, 'That summer was a turning point that got me very interested, not just in becoming a biologist, but in becoming an academic', he says. By the time he applied to graduate school his focus was clearly set: 'I was interested in stress physiology and in how low temperatures might affect organisms', he recalls. Having applied to several top-ranking graduate schools, Somero's letter eventually crossed the desk of Donald Wohlschlag at Stanford University. Somero remembers the reply that Wohlschlag sent. 'He made it sound like the people in his programme were following in the footsteps of Scott, Amundsen and Shackleton: like Shackleton's recruiting ad., "Just a few good men, dim prospects of success"', chuckles Somero.

Within a year of arriving in California, Somero found himself on a US military aircraft bound for Antarctica to scope out possible PhD projects at the McMurdo Station. 'It was only a few years after they had opened a research lab down there, so things were quite primitive,' Somero recalls, adding that the only drinking water was melted snow. And he soon realised that so little was known about how the Antarctic notothenioid fish maintained metabolic rates at extremely low temperatures that he was likely to reveal something new with almost any experiment that he could devise. Returning to Antarctica in the autumn of 1964 for 10 months on the ice, Somero found the environment liberating. 'If we decided we wanted to cut an ice hole because it was a nice clear night in the middle of winter, we'd just get in the truck and do it. We didn't have to fill out forms or ask anyone's permission', he reminisces. Cutting and blasting



Fig. 1. George Somero on a perfect day at work. Photo credit: George Somero.

8-foot-deep holes in the ice with his friend Art DeVries, Somero caught Antarctic notothenioid fish to measure their tissue respiration rates and enzyme kinetics. He also quantified the temperature ranges tolerated by the fish. 'All we did was heat fish until they lost equilibrium and jotted down the temperature,' says Somero, describing his first paper in *Science* (Somero and DeVries, 1967), which reported that the fish only survive over an exceptionally narrow temperature range, dying from heat at 4°C. 'It still amazes me that such simple work could yield a paper in *Science*', he says with a smile.

While Somero was winding-down his thesis research at McMurdo, the American Association for the Advancement of Science (AAAS) held a meeting in San Francisco dedicated to thermal biology and, despite missing the meeting, Somero contacted several of the speakers to ask about postdoc opportunities. 'Peter Hochachka, who was then a postdoc at Duke University, knew my girlfriend at the time and asked her for a letter of reference', recalls Somero. Fortunately, her response must have been positive and Somero found himself heading to the University of British Columbia in the spring of 1967 to join Hochachka. 'At that time, Peter's lab was rapidly becoming the epicentre of environmental biochemistry and biochemical adaptation', he remembers. And soon after, Tom Moon joined them as a graduate student. 'George showed me basically how to do biochemistry', says Moon, recalling his arrival at UBC. He adds that Somero's gentle nature set the lab's tone: 'His quiet demeanour kept the lab moving forward. I never recall harsh words – George always seemed to have a positive impact', he says. In addition to training students and setting up much of the new equipment in the lab, Somero switched focus from thermal tolerance in Antarctic species to adaptation in rainbow trout. He also joined Hochachka on the 1968 *Alpha Helix* expedition to the Bering Sea to investigate temperature adaptation of enzymes in invertebrates such as the Alaskan king crab.

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Fig. 2. George Somero surrounded by some of his students. Photo credit: Lars Tomanek.

However, after three and a half exciting and happy years in Vancouver, it was time for Somero to set up his own lab, returning to California to take his first faculty appointment at the Scripps Institution of Oceanography. Paul Yancey describes how Somero was a great mentor during his thesis studies: ‘Whenever any of us students were stuck on a scientific problem, George always seemed to find a key paper to read that would spark a solution’, he says. But the relocation was not the end of Somero’s collaboration with Hochachka. During one of Hochachka’s frequent visits to Scripps, both scientists realised that they were thinking of writing a book. ‘I was teaching a class at Scripps and it was basically a biochemical adaptation class. I thought there are a lot of themes that run through adaptations to temperature, to pressure, to oxygen, and it would be nice to put them together in a book’, says Somero, vividly recalling the animated discussions that culminated in the publication of *Strategies for Biochemical Adaptation* in 1973.

After teaching and leading a team of scientists at Scripps for 21 years, Somero moved next to Oregon State University as a member of the faculty for 4 years before returning to Stanford in 1994. In addition to his research and teaching duties, Somero also served as the Director of the Hopkins Marine Station from 2000 to 2008. Paying tribute to the young scientists that he has worked with over the years, Somero says, ‘I have been very fortunate in having excellent students and postdocs’, attributing much of his success as a mentor to allowing them to follow their own interests and instincts.

Talking to Somero’s students and colleagues, it is clear this affection is returned equally, with many mentioning his wit and humour. ‘He brings a whole lot of fun to just about everything he does’, says Jonathon Stillman from San Francisco State University, adding, ‘He showed us how being a scientist is really a lot of fun’. For many, Somero’s gentle guidance during the early stages of their careers can still be seen in the questions that inspire them today. ‘I have a letter from George written to me in 1992... he suggested then I should work on the biochemistry of mussels in the intertidal zone, which has been the focus of my research for the majority of my career’, recalls Lars Tomanek from California Polytechnic State University.

With an ever-growing publication record in several branches of comparative physiology, it was almost inevitable that Somero would serve as an Editor at some stage in his life. When the call

came from Charlie Ellington to join the Editorial team at *The Journal of Experimental Biology* in 1994, Somero jumped at the opportunity. Considering how reviewing and editing has evolved over the decades, Somero says, ‘I can remember being up late in the night typing FedEx slips to mail these big bulky things [manuscripts] around the world; it was a different era’. And, although Somero stepped down as a journal Editor in 2000, his association with JEB’s publisher – The Company of Biologists – did not end there. Invited to join the company as a Director, Somero was soon appointed to head the team assigned the task of identifying the next Editor-in-Chief after Bob Boutilier’s untimely death. ‘I was making three or four trips a year to England for several years; that was physically hard, but I used to enjoy the summer meetings in Cambridge when the whole Company of Biologists gang would be around’, he says.

After a research career spanning more than half a century, Somero took the decision in 2014 to make way for the next generation of scientists. However, friends and collaborators that he had worked with were not going to let him slip away and retreat quietly into the laboratory. Collaborating with Jonathon Stillman and Jason Podrabsky, Lars Tomanek invited over 30 of Somero’s contemporaries and colleagues to participate in a symposium dedicated to the theme of biochemical adaptation, in Pacific Grove, California. ‘I didn’t want there to be such a gathering’, the shy scientist admits, ‘but it turned out to be one of the best times of my life’, he says. And one of Somero’s long-standing colleagues, Trish Schulte, admits that she was delighted when her invitation came through. ‘For me, George is the ultimate role model for a comparative physiologist’, she says. Remembering the inspirational 3 days, Lars Tomanek describes the symposium as an intellectual spa treatment, saying ‘It was a rare opportunity to reconnect with a community of like-minded intellects who are part of George’s academic family’.

However, the self-confessed workaholic is keen to emphasise that although he has stepped down from his administrative responsibilities, he has not retired. ‘I am still in the office 6 days per week’, he says, adding that he prefers to think of himself as unsalaried. And, far from slowing down, Somero has accepted an honorary position at Xiamen University, China, where he teaches and advises students. ‘It has been a lot of fun to engage with the Chinese faculty and students, they are just wonderful people’, he says. Embracing a new challenge, to understand how tropical intertidal snails tolerate body temperatures in the mid-50s (°C), Somero has also returned to one of his earlier passions, recently teaming up with his former Oregon State University student Lars Tomanek to produce a new edition of his classic textbook *Biochemical Adaptation*. Grateful to Stanford for providing him with lab space, Somero is relishing the new opportunities that he is exploring in his eighth decade, as he continues doing what he does and loves best: discovering the physiological and biochemical mechanisms that allow animals to adapt and survive in almost every environment on the planet. ‘I may sometimes be tired, but I am not retired’, he concludes with a humorous twinkle.

References

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