Hamish and I both worked at the Dow Chemical Company in Midland, Michigan. I started in 1974 in the manufacturing division, designing process analyzers. At the time, Hamish was already a senior scientist at the Central Research Laboratories of the company. Hamish came to Dow from Ireland in 1955 because of his great admiration for Dow's Bill Bauman, already a luminary in the then emerging technology of ion exchange. I was twenty years his junior.

Among the 8,000 employees of Dow on the Midland site, our workplaces were far separated, with little likelihood of running into each other. I had heard of Hamish's reputation but had never actually met him in person. I was, however, quite active in relevant professional societies, especially The Instrument Society of America (ISA, now called International Society for Automation). The big annual meeting of ISA was held in Philadelphia in 1978 and I happened to be in the audience to see him receive the highest honor bestowed by the Society – the Sperry Medal – for ion Chromatography. So, I first encountered Hamish in that far-away city, not in Midland, Michigan, which both of us called home - as he accepted the award in a huge arena. The headquarters of DuPont, then the largest competitor to Dow Chemical is in Wilmington, DE, just to the southwest of Philadelphia. With his charming Irish accent, Hamish began, “I feel fortunate that our flight made it safely here to Philadelphia through DuPont air space.” It got a huge laugh. His talk was a smash hit as well. I resolved then and there to go see him in Central R&D and to see if I can somehow strike up a working relationship. I made a case to Hamish that I already had some patent activities and that I could contribute electronics design capabilities to his efforts. It worked! I was transferred to Central Research to be his junior collaborator in July of 1979.

We worked together and crafted multiple publications [1, 2, 3] and patents [4, 5, 6] from then until he retired from Dow in July 1983. The publications were all in the top journal in the field and altogether have been cited more than 500 times, the result in an important publication [7] and a patent [8].

Optical detection in capillary electrophoresis today is often based on the indirect photometry technique.

On July 29, 1981, the daily news could only talk about the wedding of Lady Diana Spencer to Prince Charles, the over-to-do with it irked him to no end, as it would any good Irishman. That very same day Dow's patent department notified us that there may be potentially problematic prior art regarding a publication in some French pharmaceutical journal [9]. He was not having a good day! It eventually turned out to be calling wolf over nothing; the patent was granted in due time with a citation of the said work incorporated. And long before that, Dionex licensed IPC from Dow on December 21, 1981. Coincidentally this was the same day that we sent back the galley proofs of the IPC paper to Analytical Chemistry. I still remember meeting Hamish years later at a Pittsburgh Conference, by which time he has officially retired, he happily conveyed to me this paper had been selected for the prestigious “Milestones in Analytical Chemistry” compilation [10]. With his 1975 seminal paper on IC [11] in the same volume, he was one of the few people to have two or more milestones in that one collection. To his credit, the fact that IPC was potentially competitive to IC did not stop Hamish from pursuing the science.

Our other invention, the Thermal Pulse flow meter became a commercial product [12]. Even before that, it garnered the Vaaler Award (Chemical Processing Magazine, 1982) and the R&D100 Award (1983). The idea is that a heat pulse is initially generated upstream, and the detection of the same pulse after it has traveled to a downstream sensor triggers a new upstream pulse. The time-of-flight of the pulse between the transmitter and the receiver is thus inversely related to flow rate, which is then also directly reflected by the frequency of the upstream heater pulses. Hamish's experience with rheology in developing hydrodynamic chromatography (HDC) [13] guided us to realize why the effective volume between two probes placed at the radial center of a flow tube was exactly half the physical volume: at laminar flow conditions as in our chromatographic experiments, fluid behavior is Newtonian, i.e., the viscosity is independent of the shear rate. In this case, the centerline velocity is twice the mean velocity. Later work showed that for non-Newtonian solutions, the effective volume predictably varies and follows a universal “power law,” suggesting it can be used to characterize rheology [14].

Collaborating with Hamish

Hamish sought my thoughts in scientific and nonscientific matters. As to the latter, he quickly discovered that I was a bit of a language and grammar nut, as was he. So, he started a game of editing each other's draft write-ups. The agreement was to pay a quarter to the other if a correction/change by the other was mutually agreed on as valid or at least, preferred.
will tell you here one of my rare victories for which I did not get paid. This was about the title of his book on IC published in 1989 [15]. He wanted a lengthier descriptive title, citing eluent suppression, etc. I argued that he, of all people, was entitled to call it generically “Ion Chromatography.” He was reluctant because a book of that title was already in its second edition at the time [16] but was focused on systems that did not use eluent suppression. I told him that as the inventor of the field he was entitled to call his book “Ion Chromatography”; the users have already decided which mode of IC was being practiced. Although very reluctant initially, he finally gave in. A lot later he admitted that this was the right decision; he liked it the way it turned out. But I forgot to collect my quarter!

After he retired, I was his designated contact as Dow requested his consulting services frequently over the next several years. I had meanwhile formed a “Sensor Systems” group which allowed me to stay on at central R&D. Over the next 15 years, the group created several useful inventions that were not only used internally at Dow, but several were also patented and licensed for external commercial use. The group patented and commercialized under license a Dynamic Surface Tensiometer (Kruss USA BP-2), and an Electrothermal Pump (Rayfran, Inc.), among others. But truth be told, none of these came close to the wide scope and applicability of Hamish’s crown jewels, IC and HDC. Although some of these developments were not only used internally at Dow, but several were also licensed for external commercial use. The group which allowed me to stay on at central R&D was always being contacted by interested internal users. The individual businesses bore the cost of having us supply them with prototypes (often quite crude). We had the benefit of their feedback to learn how to improve them, long before filing patents or seeking prospective licensees.

A fun person to be around

You already have had an inkling from the beginning lines of his Sperry Award speech that Hamish had a ready wit and a deep sense of humor that affected all around him. Some of them I had to repeat to myself before it penetrated and a minute or two later, I would burst out laughing so hard that it would hurt. Some of them related to accounts of real-life events, others were his observations distilled into one-liners that finally compelled me to start a journal to write them down.

Technical quantum jumps are our goal, Ted; however, you can get a hernia making a quantum jump, or rip your pants...

He and I were both working in the lab. Soon as he opened a particular drawer, an actual mouse jumped out. He didn’t miss a beat. He looked at me and said, See? I told you we need to build a better mousetrap.

As his 25th year of employment approached, he was getting obviously upset. A little prodding revealed that he hated the prospect of getting a watch from Dow as a 25-year service gift, which was the norm then. Terribly unimaginative. After 25 years, you either have bought a watch or you’d rather not know what time it is. It was apparently continuing to bug him, though. A couple of days later, he showed me an elaborate drawing.

Figure 1. The military version of the Boeing Stratocruiser 377 that brought Hamish Small and his family to the US at the end of 1955 some 62 years after the original journey.
It depicted an apparatus, vaguely resembling a guillotine, that was
designed to crush the imaginary watch he would receive.

I made sure he did not receive one.

Hamish had just returned from a major national meeting. I met Kirkland, a real pioneer of LC. He’s a high priest of LC, he said. “So, what are you? An archbishop?”, I asked. No. I’m more like John the Baptist wandering in the wilderness.

He was back at Dow as a consultant and regaling me about his gala evening at the recent national ACS meeting. He had received the Chromatography award there. It’s quite a fancy affair, Ted, he said. One wears a gown or a tuxedo. At this one, I chose to wear a tuxedo.

We were both on the lab management team that evaluated people’s job performance. When the discussion lingered on a guy who was often seen sleeping at his desk, Hamish decided to interject. Perhaps he just needs curtains.

After overhearing parts of his conversation with an obviously pompous individual, I asked him, “Why do you go out of your way to be so modest?” I have so much to be modest about, he said. Then with a twinkle in his eye, he started taking medallions from his office shelf (he most certainly had a generous supply) and dropping them one at a time, on his desk. Compare the sounds, Ted! See this one makes a clunky sound. This one? Ah, much better. Now THAT’S an award!

We had our annual lab dinner party at a nearby lodge. Dinner was somehow late but the wine was flowing and it was good wine. Hamish liked good wine. Later during dinner, I saw him in animated conversation with the Director, brandishing his dinner fork like a sword. Next day at work I said “Hamish, I saw you talking to the director of research quite a bit last night.” His reply was immediate: Oh? What did I say?

One morning he came in clearly disturbed about something. I asked him what, if anything, was bothering him. At Dow, we had young interns called co-ops. After a while he volunteered: Ted, a while back I had a co-op, I liked him. I gave him a really good recommendation. Guess what? He showed up at the house last night. He is selling vacuum cleaners, door-to-door.

(I have to confess that this story frightened me!) But he never quite forgave me for my announcement to a big gathering and celebration at his major promotion to Senior Research Scientist. I told the crowd that the adjacent rear building was being renamed in his honor – The Small Building Out Back.

Hamish very much lives in my memory. After 30 years, I retired from Dow myself in 2004. I then taught at Hillsdale College in Michigan until recently moving to Georgia. Hamish had a laboratory at home and kept working on various projects until he had to be hospitalized. Indeed, one of his last projects was an improved version of the flow meter, as you can read elsewhere.

I have formed a company with some like-minded others and have just filed a patent application that I hope will blossom into something of utility. Hamish will always live on in my mind as my inspiration!

Epilogue

In April, 2018 I received an Email from Hamish. It was titled How Time Flies and had photographs attached depicting him (Figure 1), with his wife Beryl and daughter Deb, with the following text:

On Dec 2, 1955, three people - two adults and an infant girl - left the U.K. for a new life in the USA. They flew in what was called a Boeing Stratocruiser. A military version of this old plane is parked permanently at the Rogue Valley International-Medford Airport in Medford OR. On Dec 26, 2017, a picture was taken of these same three people, with the Boeing in the background.”

It took overnight for me for the clever play on the title to sink in. I admitted as such in my reply and said, “So fly back there but going west to reverse time. You will land there as a young man!”

He quickly replied:

“I don’t think I want to do that. I am very content with where that plane has brought me.”

Front of that airplane was a favorite spot for Hamish (Figure 2).

Theodore E. Miller*
Telligent Metrics LLC, PO Box 1703, Dacula, GA 30019, Georgia
* Corresponding author.
E-mail address: Tellmetllc@yahoo.com.
References

[1] H. Small, T.E. Miller, Indirect photometric chromatography, Anal. Chem. 54 (1982) 462–469.
[2] H. Small, T.E. Miller, Thermal pulse time-of-flight liquid flow meter, Anal. Chem. 54 (1982) 907–910.
[3] T.E. Miller, H. Small, Thermometric ion exchange: an approach for measurement of acid or base concentration above 1N, Anal. Chem. 57 (1985) 1591–1594.
[4] H. Small, T.E. Miller Jr., Ion Exchange Chromatography with Indirect Photometric Detection, US Patent 4,414,842, November 15, 1983.
[5] T.E. Miller Jr., H. Small, Apparatus for Metering Sub-10 Cc/minute Liquid Flow, US Patent 4,532,811, August 6, 1985.
[6] T.E. Miller Jr., H. Small, Apparatus for Metering Sub-10 Cc/minute Liquid Flow, US Patent 4,628,743, December 16, 1986.
[7] Z. Iskandarani, T.E. Miller, Simultaneous independent analysis of anions and cations using indirect photometric chromatography, Anal. Chem. 57 (1985) 1591–1594.
[8] T.E. Miller Jr., Z. Iskandarani, Independent Analysis of Anions and Cations Using Indirect Photometric Chromatography, US Patent 4,567,753, February 4, 1986.
[9] A. Laurent, R. Bourdon, Assay of anions by ion-exchange chromatography, Ann. Pharm. 36 (1978) 453–460.
[10] M. Warner, L. Voress, G.K. Lee, J.A. Rice (Eds.), Milestones in Analytical Chemistry, American Chemical Society, Washington D. C., 1994.
[11] H. Small, T.S. Stevens, W.C. Bauman, Novel ion exchange chromatographic method using conductimetric detection, Anal. Chem. 47 (1975) 1801–1809.
[12] Molytek Inc., 0.1 to 50 ml/min low-flow meter, Anal. Chem. 58 (1986) 61, 815A.
[13] H. Small, Hydrodynamic chromatography: a technique for size analysis of colloidal particles, J. Colloid Interface Sci. 48 (1) (1974) 147–161.
[14] G.A. Hoffman, T.E. Miller, Effect of non-Newtonian solutions on the behavior of the thermal pulse time-of-flight flowmeter, Anal. Chem. 56 (1984) 1682–1685.
[15] H. Small, Ion Chromatography, Springer, 1989.
[16] D.T. Gjerde, J.S. Fritz, Ion Chromatography, second ed., Alfred Hüthig, Heidelberg, 1987.