

Remembering Philip Coppens

Philip Coppens, SUNY Distinguished Professor Emeritus and Distinguished Research Professor of Chemistry at the University at Buffalo-SUNY, passed away on June 21, 2017, at the age of 86. Chair of Chemistry at UB David Watson said, "Philip was a giant in his field and pioneered the technique of time-resolved X-ray crystallography ... He was renowned for promoting the discipline, organizing international meetings and mentoring younger colleagues in his field." A memoir written by Philip can be found in the History Portal of the ACA (http://www.amerocrystalassn.org/h_coppens_memoir). What follows are the remembrances of several of our crystallographic community who knew him well.

Jane Griffin

I was an older graduate student in the Chemistry Department of SUNY at Buffalo in 1968 when Philip Coppens came to give a seminar for an open position in the Department. It was on his X-N work on triazine. It was exciting to see experimentally produced electron-density maps that showed bonding and lone-pair density. Philip was hired, and I took his first course in X-Ray Crystallography in 1968.

How many professors would take a mother of four young children as their first graduate student? Philip brought the world to Buffalo. He never went to a meeting that he did not return with a new collaborator, post doc, or graduate student. In my time in the lab my mentors included Finn Larsen from Aarhus University; Pierre Becker from France; Dan Jones, South Carolinian fresh out of Lipscomb's lab at Harvard; Niels Hansen, Aarhus; and Bob Blessing from University of Pittsburgh and Lund University in Sweden. Life was never dull in Philip's lab. He was a wonderful teacher, well prepared, clearly explaining the mathematics involved in every aspect of crystallography. He was an expert at using time as efficiently as possible. Every morning he walked into the lab to ask, "How's it going?", and you better be prepared to answer. When you made a presentation in his group meetings, his first question was always, "So what is your major conclusion?" What had you learned?



Philip in his office at UB. Photo by Nancy J. Parisi.

Philip never rested on his previous accomplishments; he was always looking for what new scientific question could be solved by an advance in crystallographic technology. Although recently retired and relocated to be near his sons and grandchildren, he had returned to Buffalo to work on a joint paper when he died.

Finn Krebs Larsen

I came across Philip's seminal *Science* paper entitled *Comparative X-ray and neutron diffraction study of bonding effects in s-triazine* (*Science*, vol. 158 (Dec. 22, 1967), 1577-1579) during studies for my degree in X-ray and neutron diffraction. Subsequently I very much wanted to learn more about what could be achieved by X-N studies. I got in touch with Philip and persuaded him to take me on. I arrived in Buffalo in late 1969 with my wife and small daughter and became one of Philip's first post docs after he moved from Brookhaven National Laboratory to his new chair at SUNY at Buffalo.

It was a tumultuous time there, with student demonstrations against the war in Vietnam and with groups of police patrolling campus; very exciting and a little scary for a small family from peaceful Denmark. Philip and Marguerite were extremely helpful in getting us started. Philip helped us buy a car and Marguerite drove us around town until we found an apartment.

My main project was to help develop low-temperature X-ray equipment and also to go on measuring trips to Brookhaven National Laboratory. Our collaboration continued after I, in 1971, returned to a position in the Department of Chemistry at Aarhus University, Denmark, and it endured right up to my retirement. The most important way I kept close collaborations with Philip was by stationing some of the best of my Ph.D. students in Buffalo for extended stays as part of their education. Some remarkable works and noteworthy theses resulted from these contacts with Philip. It should be mentioned that Niels K. Hansen (sadly, now deceased), during such a stay, tested aspherical atom refinements of small molecules and developed, with Philip, the MOLLY program, which later was extended to the most successful program system XD2006.

Very early on Philip realized the great potential of synchrotron radiation for crystallography. He involved himself deeply by raising funds and building a beamline at the National Synchrotron Light Source at Brookhaven and later at the Advanced Photon Source in Chicago. The very intense synchrotron X-radiation beam with variable wavelength and low-temperature capability opened new and exciting crystallographic research and made the use of such beamlines an irresistible goal for many, including myself. Fortunately it was possible even for an outsider from Denmark to be allocated beam time through application and according to scientific merit. We from the Department of Chemistry, Aarhus University have continued to benefit to this very day.

There is another extremely important side to Philip's impressive achievements that I will laud and praise, namely his never failing willingness to help educate students. Many Nordic students have benefitted greatly from this. The governments of the Nordic countries – Denmark, Sweden, Norway, Finland and Iceland – give substantial sums of money to finance Ph.D. courses, summer schools in advanced subjects. About 10 Ph.D. students

from each of these countries get all expenses paid for taking weeklong courses. I have for many years arranged such Nordic Research Training Courses, every three to four years since 1988. The subject is: *The application of X-ray synchrotron radiation in chemistry, physics and biology*. Lecturers are well-renowned scientists from the Nordic countries, but also some top experts from other parts of the world. Philip was extremely kind and came to lecture whenever I asked. He was a most popular lecturer at every single one of the courses. I want to mention that he did not – like some busy lecturers unfortunately do – just turn up to deliver the lecture and then leave immediately afterwards. In fact, every time Philip spent several days with the students and they appreciated it.

Philip has had a deep impact on my entire professional life – indeed, my life in total. My life would have been completely different had I not seen Philip's *Science* paper on the X-N study of *s*-triazine. This was a defining moment for which I am, Philip, eternally grateful.

Pierre Becker

When doing my Ph.D., I was stymied by the abstract nature of wave-functions until I saw the *Science* paper by Philip Coppens that showed the bonding density observed through X-ray scattering in *s*-triazine: so, the square of a wave-function was a reality! That's why I got in contact with Philip. In 1972-1973 I joined him in Buffalo for six months and brought my family. He immediately exposed me to the reality of scattering experiments: absorption, thermal effects, extinction, the difference between X and N atomic data, optimization of signal/noise ratio. He had me work with his young collaborators (including Bob Blessing and Jane Griffin). We had a weekly meeting where everyone shared his or her work with the whole group. This was when Philip started time-resolved research, since every 15 minutes he came to ask about our progress!

I was always impressed by Philip's chemical intuition. We solved several interesting problems. What a joy to obtain (in cooperation with Fred Ross) the experimental electron density of tetracyanoethylene showing single, double, and triple bonds and lone pairs: this gave sense to LCAO approaches in quantum chemistry.

Such a fantastic time, where we also discovered the strong human qualities of Philip and his wife Marguerite (in particular at the occurrence of two dramatic family events in France).

It was a great pleasure to continue working with Philip and his international collaborators. This strengthened my scientific life immensely. During my whole career, I kept in mind fantastic lessons from Philip: when working with other people find complementary skills and give priority to strengthening their talent, put their name first on publications, and see that they are invited to international lectures. Another valuable point: when publishing a rather theoretical model – which is often complex to read – provide a simple strategy to apply your model. This was the case with our work on extinction. Philip was a man who made his work open to the whole community. He never said or wrote, "I did," but always put emphasis on his co-workers.

And how was he able, starting in 1997, to develop a new field of time-resolved crystallography? He attracted so many young, talented scientists and structured a revolutionary time-dependent crystallography, which let us go from pictures towards molecular movies.

Philip's retirement symposium, organized by Jason Benedict last October, was an unforgettable event where we all felt as if we were members of a family!

Philip Coppens was a fantastic man and scientist. Sadly, he has left us, but his spirit is present in our lives. I personally cannot give a course or work with a scientist without having him present in me. And all my family loved him, Marguerite and their sons.

James Phillips

My professional association with Philip Coppens began when my phone rang in my office at the EMBL Outstation in Hamburg. A woman's voice announced, "United States calling," and Philip came on the line. He offered me a job to coordinate the building of a beam line for SUNY at NSLS (the old one). I had applied for the job, as advertised in the ACA newsletter, but a direct offer amazed me. I asked for an interview and to see NSLS. To say it succinctly, as I found out Philip often did, I went to New York and soon accepted the job. I did have to tell Sir John Kendrew that I was no longer working for him!

Thus began an eight-year period of working closely with Philip Coppens. Many people remember his scientific achievements, but I also saw him as a wise administrator. As part of the SUNY beam line management team, and eventually as its leader, he helped steer the project through the difficult priority decisions necessary for the construction of a facility that would serve the diverse experiments needed for five SUNY campuses. In short, he had my back. I found that he drove me hard but drove himself harder.

Philip's original scientific concept for his synchrotron radiation work was to expand the charge-density field, perhaps with anomalous dispersion techniques. Soon, though, he had the idea of time-resolved crystallography. An NSLS bending magnet line proved inadequate so his vision came to fruition with his work at APS. This illustrates Philip's determination to see his visions through. It also shows his ability to innovate the instrumentation necessary for time-resolved work.

When I moved to industry I saw Philip in a new light, as a customer. Siemens/Bruker salesmen will tell you how tough a bargainer he was. However, he did let us use the SUNY facilities to test some variations on phosphors used in the detectors of the time. Again, he showed wisdom. He knew what improvements in instrumentation would benefit all.

It is said that we all stand on the shoulders of giants. Though Philip is gone, crystallographers of the future will be standing on his shoulders.

Jason Benedict

I joined Philip's research group as a post doc in 2008. In a word, his style as a research supervisor was "demanding." It was not uncommon for Philip to request that you present at

group meeting – with only a few hours' advance notice. The first time this happens, which is often shortly after joining Philip's group, the experience is rather jarring. Only when it's over and you debrief with other group members do the intensity and high expectations of being a Coppens group member become apparent. When I had the opportunity to organize a symposium at the 2011 ACA Annual Meeting, I had the chance to meet Coppens' group members who pre-dated me by decades, all of whom assured me that this older Philip was now a real softy – I had it easy!

While I was fortunate enough to forge countless scientific memories with Philip and crew in his lab at the University at Buffalo and at the APS (he was an active member of the Scientific Advisory Committee of the ChemMatCARS beamline), some of my fondest experiences occurred outside of science, for instance, swimming get-togethers in the Coppens' pool at their Amherst home. Marguerite would prepare an amazing fruit salad and make sure we all departed with a bounty of chives, an herb that overtook much of the free space in their back yard. Many reading this will also recall the group hikes in the serene wilderness just outside of the city.

Much is omitted when my memories of Philip are distilled into a couple of short paragraphs, but the following is absolutely certain: Philip was a great friend and mentor and will be missed dearly.

Connie Rajnak

My first memory of Philip was way back when I was a novice crystallographer and my boss, Dave Duchamp, drove me to hear him speak. Philip's talk was something to do with monopoles, and he made them sound so easy to understand that I imagined I did in fact understand. From then on I admired Philip from afar until I started going to ACA meetings, and, subsequently, IUCr meetings. In 1978 Philip was President of the ACA and from 1993 to 1996 he was President of the IUCr.

We somehow became friends and when I eventually married Stan, in 2007, we put Philip and Marguerite on our Christmas letter list. Marguerite decided Stan must be British or at least have spent a long time in the UK (not true). They wrote, "*Your poem reminded us of the many limericks we heard and read and we enjoyed it equally (no Schadenfreude).*" After another Christmas letter (2011) describing our travels in South Africa they wrote, "*We were in Kruger Park and the Cape Province about 10 years ago, but did not see a quarter of what you people managed to see and photograph. What beautiful pictures. We will follow your trail next time we may get to South Africa!*"

I sent Philip congratulatory notes when he was awarded the Gregori Aminoff Prize in 1996, the Ewald Prize of the IUCr in 2005, and the Kołos Medal in 2013, which he always politely acknowledged. But what I admired most about Philip was that in his talks he always, always showed photos of the people in his lab, and gave them the credit he claimed they deserved.

When I co-edited *ACA RefleXions*, Philip was a frequent contributor so we corresponded often. In 2009 Philip provided a *RefleXions* cover based on his Plenary Lecture at the Toronto ACA meeting on *New developments in X-ray photocrystallography*. Dick van der Helm's obituary appeared in the Fall 2010 issue

and Philip helped with that – they were both Dutch and neither of them ever lost the Dutch accent. After the Boston ACA meeting in 2012, I requested and promptly received an image from Philip to include in the *Transactions* report. In the Fall 2013 issue his article *Workshop on dynamic structural photocrystallography in chemistry* appeared.

I was profoundly saddened to hear of Philip's (much too early) death.

Bob Blessing

A signal characteristic of Philip Coppens' research career was his uncanny ability to quickly see through to the central questions in a new, emerging field of research on chemical structure and energetics. As a result of an insightful focus or refocus of the work in Philip's laboratory, the lab was consistently an innovative leader at the frontier of new research areas.

Philip's lab at the University at Buffalo (UB) and at his synchrotron beamline stations at Brookhaven and Argonne were for fifty-some years strong attractors for a steady succession of international students, fellows, collaborators, and colleagues. Many in that group became and remain good friends and continuing research collaborators and colleagues. Philip was our nexus for the growth of worldwide friendships and cooperation in ongoing research. Happily, it was the good fortune for many of us to be able to assemble in Buffalo in October 2016 to salute Philip on the occasion of his UB retirement at the fest-symposium organized by Jason Benedict.

Editor's Note: This remembrance was assembled by Kay Onan.