

## Personal Reminiscences

BY P.P. EWALD

The Editor insists on my writing for this issue rather more personal reminiscences than are scattered throughout *Fifty Years of X-ray Diffraction*. Remembering the pleasure I got when reading the personal reminiscences of my friends and colleagues written for that book, I reluctantly comply.

I was born in Berlin in January 1888, and, by the time of my first birthday, had lived under all three emperors that the short-lived German Reich has seen. Berlin was then still a comfortable city, where it could happen that the widowed Empress Frederick on a morning stroll through the Tiergarten Park, seeing my mother taking the toddler to the side of the road, stopped, patted me on the head and said: 'Nice little chap'. This was the last Royal compliment I received.

I was lucky to be born in a family of moderate wealth and ambition, of academic training, and widespread interests. My father was a promising young historian, lecturer at the University of Berlin and collaborator of the *Monumenta Germaniae Historica*, pupil and friend of Waitz, Wattenbach, Mommsen and other leading German historians. He died, shortly before I was born, at the age of 37 within a few days of appendicitis, the clinical picture of which was then not yet fully recognized; it was in the same year, 1887, that the first successful appendectomy was performed by an American doctor.

So I grew up in the care of my mother, a remarkable woman of great gifts. When a child she would have loved to study Latin – but that was not done for fear of turning a girl into a bluestocking; later, she longed to study medicine – but it was too early for that, though I believe Clara Tiburtius, the first, and for a long time only female student of medicine in Germany, was her contemporary. With her strong desire for independence she became a portrait painter, the arts being the only professional activity a woman could enter into without social disgrace or an endless fight.

I loved the familiar fragrant atmosphere of oil, turpentine and varnish in the studio, but I never even attempted to paint. (I also failed to find any interest in history, until quite late in my life, though surrounded by a fine historical library; my marks at school in history were without exception 'utterly unsatisfactory'!)

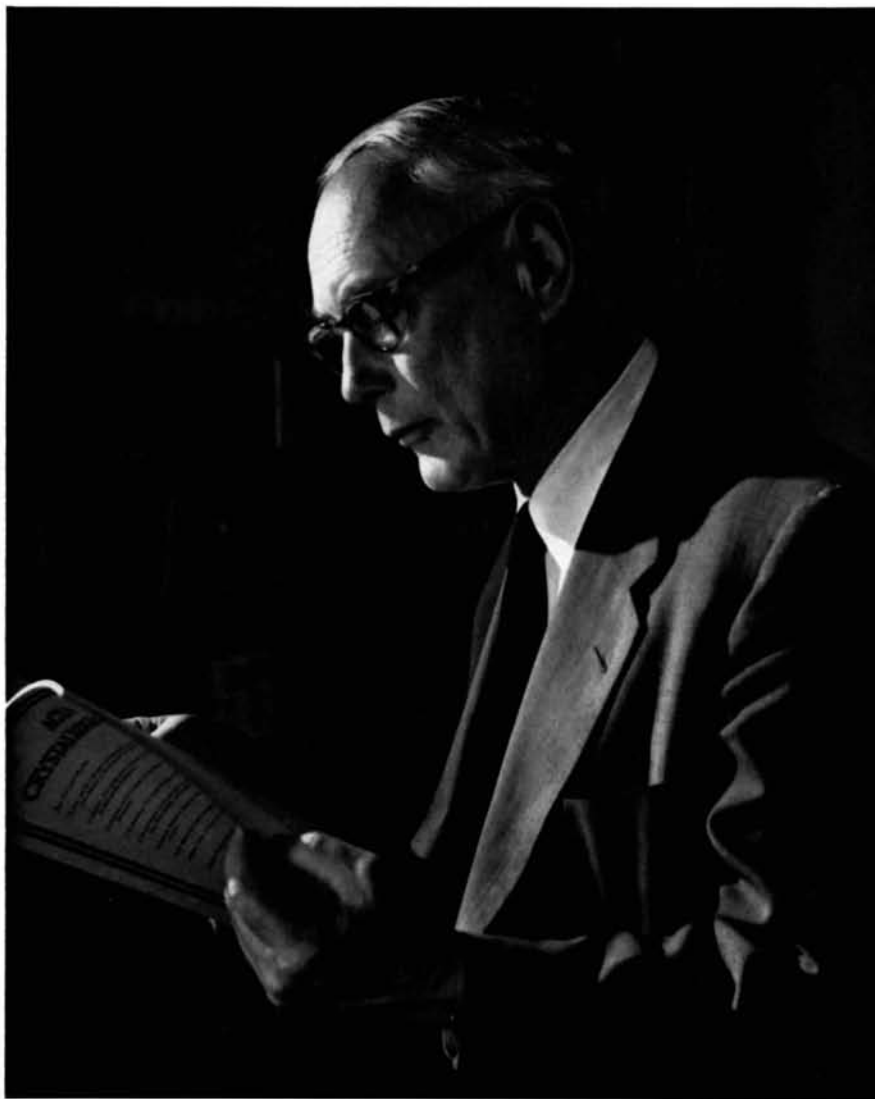
Not having to look after a husband my mother was free to travel, and she took me on extended visits in England, where her parents and she had many friends, and to Paris where she renewed her studies in portrait painting. By the time I was five I spoke a rudimentary English and French, and my mother kept this alive by often speaking to me in these languages. She was also fluent in Italian, but this, unfortunately, I did not learn from her.

My uncles, on my father's side, were, the elder a well-known physician and Head of one of Berlin's big clinics, and the other Professor of Physiology at the University of Strassburg, then belonging to Germany. Naturally I had closest contact with the Berlin family, and in particular with the two cousins who were only a little older than I was. We met for private gym and dancing lessons, made occasional excursions to replenish our aquaria, and, in some years, joined forces on the seaside in the summer vacations.

My real interest in Science began when I was 11 years old. We were staying with friends in Cambridge in whose house we met Dr S. Ruhemann, a pupil of A. W. Hoffmann, who held a Caius College chair of organic chemistry, the first such chair existing in a British University. He took me to his laboratory and I admired the endless rows of small flasks and bottles with colourful chemicals, the Bunsen burners, all the glassware. My enthusiasm came to a climax, however, when Dr Ruhemann blew a perfect four-inch diameter glass sphere over the Bunsen burner, cooled it down and silvered it on the inside. A few days later, on boarding the Hoek boat for the return journey late at night, the sleepy boy, holding the precious object safe in front of him, stumbled on the gangway – with the result that to his great chagrin instead of the perfect sphere only a fragmentary small silver star remained attached to the glass tube. After arriving in Berlin, while my mother was still unpacking, I dismantled the (Auer) gas light over the dining table, attached a long piece of rubber tubing that turned up conveniently, opened the tap and struck a match. There was a loud bang, a two meter flame shot out of the open end of the tubing and a heavy plush curtain that concealed a door was full aflame. Luckily I closed the tap instinctively, and there was a can of water standing on the table, so that the fire was prevented from searing more than the surface of the curtain. Retrospectively I admire the reaction of my mother who, rather than prevent me from further attempts at experimenting, arranged for an old table to be put in an adjoining room and let me continue my glassblowing there in a more cautious way.

In 1900 we moved from Berlin to Potsdam and to a more spacious setting. There I had a small room to myself and soon shared my chemical interests with two friends. For my confirmation the Strassburg uncle gave me a simple chemical balance, and I invested my pocket money in chemicals and glassware. There was no difficulty in obtaining chemicals, except the really poisonous ones, from the corner drugstore, because the 'Drogerie' in those days sold chemicals and not hot-dogs.

The 'Gymnasium' I attended, first in Berlin, then in Potsdam, was a classics school with very little science



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on the program. I obtained the latter mainly from private reading of journals subscribed to as Xmas gifts, like *Prometheus*, *Revue Rose*, later *Nature*, and from an excellent synopsis of the technical achievements of mankind in ten volumes, one of which appeared as the standard Xmas and birthday present from an aunt and her husband, the *Buch der Erfindungen, Gewerbe und Industrieen*. Besides, I found in my grandfather's study a series of volumes of *Reports of the Smithsonian Institution*, in which I read eagerly, stretched out on the carpet. Obviously it helped my mental development that I read German, English and French with nearly equal ease (including, of course, Captain Marryat and Jules Verne).

Of the languages taught at school I disliked Latin for its formality and boring literature, and loved the adaptable, warm-hearted Greek. Without my even trying hard, the sound of the epic-lyrical parts of Homer, Sophocles and Euripides (N.B. in the German or Erasmic pronunciation!) stuck to me, and even now I sometimes recite such passages when I cannot readily fall asleep. I believe strongly in knowing poetry by heart so as really to possess it.

I ended the Gymnasium with the final exam which I passed in spite of zero production in history. It so happens that this was the only strict and formal examination I was ever subjected to. The oral exam for my Dr. phil. degree was a soft and friendly affair, and since I received *summa cum laude* for my thesis work, no further examination was required for my habilitation as Privatdozent in Munich.

I started my studies wanting to become a chemist. Through Dr Ruhemann's good offices I was accepted, though a latecomer, as an undergraduate student at Gonville and Caius College in Cambridge. It was there I spent a very happy winter, 1905-1906, trying, in vain, to understand Calculus (Gallop), Inorganic Chemistry (Fenton) and Physics (Bevan); I rowed and later did ju-jitsu, then new at Cambridge, and was an avid reader, listener and sometimes debater at the Cambridge Union Society. The formative value of this two-term experience far exceeds any academic gain. In fact, when I began studying in Göttingen in the spring of 1906 I tried the subjects all over again, with the result of rejecting Chemistry – in particular inorganic chemistry (Wallach) – as being utterly unsystematic; of not being too keen on Physics (Riecke, Voigt); and of not being able to follow Herglotz's course on analytical geometry.

Laboratory work in Chemistry and Physics and exercises in Mathematics were marked, but there were no formal term exams, and a student was left largely to his own evaluation. Evidently I did not do well, but it did not worry me. A friend of the family, the Privatdozent for Philosophy Leonard Nelson, kept an eye on me. He knew that I was waiting for the course on Calculus in order to understand what I had been unable to get from the course in Cambridge. The course, fall 1906 and spring 1907, was to be given by

David Hilbert, and Nelson suggested to Hilbert that he should appoint me as the official 'Ausarbeiter', *i.e.* make me write out a weekly account of the lectures as they were being given, to be deposited in the mathematics reading room for the benefit of the other students – an arrangement which the great organizer of the Mathematics Department, Felix Klein, had instituted for most of the courses given in Göttingen. For this work I received my first pay, namely 100 Marks per semester (then £ 5), but the much greater value lay in the weekly help I received from Hilbert's assistant, E. Hellinger, who himself was a devoted teacher. Hilbert's lectures were often garbled, signs wrong or trigonometric functions interchanged, and this had to be straightened out in the written account. These minor blemishes came from the fact that Hilbert prepared his lectures only in a vague way; he created them while delivering them. Usually he spoke at great length of the problem, its difficulties, of various modes of attack one might think of, rejecting one or the other – and finally, when you began to grow impatient with this wasting of the precious time of the period, suddenly there appeared the answer to the problem standing out like a marble statue in a dark park lit up by a ray of sun. What a difference between this and a hackneyed utility course in Calculus! The idea of mathematical invention never left the lecturer and the student became witness to the working of a mathematical mind. In choosing illustrations for the general theorems and methods, Hilbert was not afraid of high-level examples taken from all parts of mathematics and, even in this beginner's course of mentioning recent developments. With the tuition by Hellinger, and through my own intensive occupation with it, I learned nearly all the analysis I know from Hilbert's course.

By now, I had decided to make mathematics my goal.

I had been much intrigued hearing my philosopher friends discuss an approach to mathematics which differed from the one offered in the Göttingen courses. This went back to Weierstrass and they called it *epsilon*tics. Its aim was to eliminate geometrical interpretation in the proofs of analysis by basing them on the firmer ground of algebra. The main proponent of this idea was at the time Alfred Pringsheim in Munich. I enrolled at the University of Munich in the fall of 1907, not heeding the warning of a motherly Frau Professor in Göttingen that ever so many of her young friends had been lured away to Munich by the easy-going life in Southern Germany, never again to return to the citadel of virtue and learning, Göttingen. I must confess that for the next ten semesters I too enjoyed life, friendship and company in Munich without a thought of returning north.

Pringsheim's lectures, delivered with humor and wit and in a very forcible manner, impressed me deeply. Down to the writing on the blackboard they were strictness and neatness themselves. It was an aesthetic pleasure to listen. For two or three semesters I did not miss a single one. But there was something

lacking, and to my own dismay I never grew really warm, the way it had been in Hilbert's course.

This happened, however, quite unexpectedly in a course I would never have dreamt of taking in my endeavour to study 'pure' mathematics. An experienced friend, my senior by some years, the Greek physicist D. Hondros, half dragged me to a short two-hour course on Hydrodynamics which A. Sommerfeld had announced. From the first few lectures on, I was captured. The parallelism between the physical motion of a liquid and the vectorial analysis for describing it, the interplay between mathematical formalism and the simple application of Newtonian force and acceleration arguments, opened to me new perspectives in the understanding of Nature and the interpretation of mathematical operations. This I could visualize and remember or recall at will. I felt strongly that *this* was akin to my style of thinking, rather than the algebraic convergence proofs in Pringsheim's lectures. From then on my heart was set on Mathematical Physics, and Sommerfeld's courses and seminars were my main preoccupation; henceforth I considered myself a Theoretical Physicist.

The story of my thesis work with Sommerfeld on the double refraction produced by the anisotropic lattice arrangement of optical resonators in a crystal, and how discussion of this with Max Laue started in him the train of thought leading to his X-ray diffraction experiment – this has been told in *Fifty Years* and need not be repeated. I would like to tell, however, how it came about that I devoted much of my life's work to Crystallography, and in particular to crystallographic publication.

I had always thought of Astronomy as my minor subject and had taken several courses with H. v. Seeliger, the Professor of Astronomy. I never bothered much about my examination, but again my friends were wiser. A year before my thesis work neared its end they told me: 'Look, you know hardly anything of Astronomy, and Seeliger is known to be a stiff examiner. Your thesis has to do with crystals; you still have two semesters time to attend old Groth's course on Crystallography and take his practical class – that will make this friendly old gentleman your examiner'. I followed the advice, with the result that my oral in crystallography consisted of a friendly chat on Bravais,

Haüy, Sohncke, Schönflies and Fedorow. This was before Laue's experiment, and before I went back to Göttingen as 'Physics Tutor' to Hilbert. In 1913 I returned to Munich and took over Friedrich's equipment in Sommerfeld's institute for the short period before the outbreak of World War I. I often went for a chat to the crystallographers, Steinmetz and the ever interested and inquisitive Groth.

In 1920 Groth, who was then 76 years old and had edited 55 volumes of his creation, the *Zeitschrift für Kristallographie und Mineralogie*, handed over the editorship to Paul Niggli, with the suggestion of forming an editorial board in the near future. This was put into effect by Niggli in 1924 by appointing M. v. Laue, myself and K. Fajans as co-editors. To celebrate the occasion, Groth invited the four editors and the publisher K. Jacoby to a solemn dinner at his home in Munich. In addressing us, he charged us with keeping alive his endeavour of providing a central, international journal for the publication of crystallographic work. As a sequence to the Munich meeting, reference to mineralogy was omitted from the title of the *Zeitschrift*, and in a leaflet distributed with the next issue and signed by the four editors, the scope of the journal was defined as 'to collect all those papers which attempt to elucidate the Solid State by means of a study of the Crystalline State'. Three years later (1927) the *Zeitschrift für Kristallographie* stressed its international character by accepting manuscripts in English and French. These were often sent to me, and at times more than half the papers in an issue had gone through my hands.

When at the end of World War II there appeared no hope for a speedy revival of the *Zeitschrift*, and on the other hand great pressure developed for publication of held-up research, the old master's plea to safeguard international crystallographic publication could best be fulfilled by the creation of a new journal. It was not without weighing my old obligation to Groth that I undertook the launching of *Acta Crystallographica*. I like to think how Groth, who was always ahead of his times, would be happy to observe the modern development of his favourite subject, and especially its close companionship with chemistry. I am sure he would also be satisfied with the international scope of the progress which takes place.