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978-0-521-12673-1 - A Time to Remember: The Autobiography of a Chemist

Alexander Todd

Excerpt

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# 1

## *Early days – school and university in Glasgow*



I am often asked when I first became interested in science and when I decided to become a chemist. Questions like these are almost impossible to answer, partly because early memories are patchy and highly selective, and partly because one cannot put precise dates to such things.

I was born on the second day of October 1907 in a rather superior red sandstone tenement block known as Newlands Crescent in Cathcart, a southern suburban area of Glasgow. My father, Alexander Todd, was at the time of my birth a clerk in the head office of the Glasgow Subway Railway Company; in due course he became cashier and secretary of the company, a position which he occupied at the time it was taken over by Glasgow Corporation in 1922. Some time after the takeover, he left to become managing director of the Drapery and Furnishing Cooperative Society Limited, whose main base of operations was a substantial department store at Glasgow Cross. He had long been an enthusiastic supporter of the cooperative movement but was strongly opposed to its political affiliation with the Labour Party or, indeed, with politics in any form. His society, known locally as the D. & F. Stores, which paid a ten per cent discount to all comers, was permanently at loggerheads with the politically oriented cooperative movement in Scotland. My father's family originated in southern Scotland and was settled in the area around Strathaven. My knowledge of it is rather sparse because my paternal great-great-grandfather at about twelve years of age was, with his

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older brother, deserted by his parents at Glasgow Cross in the early nineteenth century and left to fend for himself. This he evidently did with some success for, two generations later, my grandfather was in business as a jobbing tailor living in modest circumstances on the fringe of the Gorbals area where my father was born. My maternal grandmother (née Ramsay) was the daughter of a farm worker on the Duke of Hamilton's estate at Cadzow in Lanarkshire and came to seek work in Glasgow. There she met and married Robert Lowrie, a foreman in an engineering works at Polmadie where they set up house. In Polmadie my mother (Jane Lowrie) was born within a mile or so of my father's birthplace.

Both my parents were ambitious and hard-working people. My father had only an elementary education and went to work in a Glasgow office at the age of thirteen; from then onwards he was effectively self-taught, apart from some attendance at night classes (none of them concerned with science). By sheer hard work he climbed steadily upwards from this very modest beginning. In all this he was aided and supported by my mother who, likewise, had no more than an elementary education; I believe she worked in a shoe-factory in Glasgow before her marriage to my father. She was a remarkable woman, devoted to her family and backing up her husband in his career. Their story could doubtless be paralleled by many in Scotland; they were determined to battle their way upwards out of the grim surroundings of their youth and succeeded in moving into what might be called the lower middle class. They had a passionate belief in the value of education and were determined that their children should have it at whatever cost. Our family consisted of my sister Jean (died in 1924), five years my senior, myself and my younger brother Robert, born in 1912.

The Glasgow Subway – one of the oldest of underground railway systems – was operated in my childhood by cable traction, and one of my most abiding memories is the characteristic tarry smell of the cable which pervaded not only the stations but also the company's office where my father worked and which was located above the St Enoch Square station. To this day the odour of creosote fills me with nostalgia.

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My earliest memory is, however, of a rather scantily clad black woman stirring what appeared to be a large pot of porridge suspended over an open fire; this must have come from a visit to the Glasgow Exhibition of 1910 where one of the more elaborate exhibits was an African village. I have very few other clear recollections of early childhood apart from my entry to Holmlea Public School in Cathcart in 1912 when I was placed in the kindergarten department, only to be removed to a higher form after a few days – more, I fear, because of my physical size than my mental precocity. Our home was situated within a quarter mile of the school but this convenient juxtaposition did not last for long. By early 1914 the family's circumstances had (through my father's efforts as a freelance insurance agent and house factor alongside his Subway job) improved, and we bought a new house about two and a half miles south of Cathcart in the village of Clarkston to which it was planned to extend the Glasgow Corporation tramway system. By the time war broke out in August 1914 and stopped further extension, the trams had been extended from Cathcart to Netherlee, but there they stopped, leaving about a mile and a half of open country road lined with hawthorn and dogrose hedges before one reached Clarkston and our home. Throughout the war years I traversed this road daily on foot in each direction, proceeding onwards by tram from Netherlee to my school in Cathcart, and each day took sandwiches for my lunch in a collapsible metal box. I still remember that road – the misery of walking in boots of very poor war-time quality in the depth of winter, suffering from extremely painful chilblains (doubtless a tribute to the appalling war-time diet of those days), but perhaps even more vividly those dilatory homeward journeys in summer along a dusty road with the hedges aflame with wild roses and convolvulus. All this ceased when, in 1918, I sat for and gained entrance to Allan Glen's School in Glasgow, to which I then travelled daily by train from Clarkston. At Allan Glen's I entered Form Q – the junior school – where I passed the Scottish Education Department's Qualifying Examination and in 1919 passed into the senior school. In this context I might mention that many years later, in the 1950s,

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I derived great amusement from the agitation in England about the iniquity of the 'eleven-plus examination' which was supposed to be having such adverse effects on English children. It seemed to me odd that this examination – admittedly under a different name – should have been in operation for about half a century in Scotland without apparently causing any trouble; but perhaps the Scots were a tougher breed.

In those days, Allan Glen's School occupied an old red sandstone building and an adjoining temporary wooden structure in North Hanover Street, about a hundred and fifty yards north of George Square in the centre of the city. The school had no dining hall and we therefore had to eat at lunch time in small restaurants or cafés in the area. I seem to remember being allowed a shilling a day with which I was able to buy a cheap lunch (less lavish than my parents no doubt intended) and leave enough over for hot chestnuts or ice-cream which, according to the season, were obtainable from the Italian street vendors who peddled these delicacies outside the school. One of my earliest recollections of this period is the announcement of the armistice on 11 November 1918. This was the occasion for celebrations in the city, but the school was not given a holiday to mark the occasion. As a result the pupils staged a one-day strike. Militancy is thus hardly a new phenomenon in schools! I cannot remember in detail the reaction of the school authorities – they were probably wise enough to act with restraint.

Allan Glen's School carried as its subsidiary title Glasgow High School of Science. It had been founded in 1853 under the will of Allan Glen, a Glasgow carpenter who believed in the importance of science, and considered that it could be the vehicle of a liberal education just as effectively as the arts. To mark their breakaway from the classical tradition, the first governors decreed that no Greek was to be taught in the school, an instruction which was still being obeyed at the time when I was a pupil. For the rest we were taught all the usual subjects, although mathematics, physics and chemistry were increasingly emphasised as one proceeded through the senior school. I think I was sent to Allan Glen's in preference to one

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of the other similar schools in Glasgow because I had some vague idea that I would like to take up medicine and was already showing some interest in science. The interest in science, and especially in chemistry, developed rapidly after I went to Allan Glen's, but all enthusiasm for a career in medicine vanished in the spring of 1919. At that time, while tree-climbing with some friends, I fell from an upper branch and dislocated my left elbow rather badly. The joint was set by our local doctor but unfortunately it locked and I found I was unable to straighten my arm. Various rough and ready measures were tried to straighten it without very much success and finally our doctor, with the aid of a colleague who held me down, proceeded to apply main force. As no anaesthetic was used, the operation, although partly successful, was very painful. I decided that if being a doctor meant doing such things to people I would have none of it!

I cannot recall when my interest in chemistry began but it was certainly some time before I went to Allan Glen's. I remember being given a 'Home Chemistry Set' when I was eight or nine years old and I suppose this might have started me off. It was in a pink cardboard box and contained little pill-boxes of sulphur, iron filings, charcoal, etc. with which one could make ferrous sulphide and various kinds of incendiary materials. Once at Allan Glen's my interest grew apace and with it my experimental ventures, the latter reaching a good way ahead of my detailed knowledge, which was, of course, increasing in my school classes at the usual slow and stately pace. The main school building was inadequate to house all classes, and my form used to do practical chemistry in an outlying annexe about half a mile away in Renfrew Street. This annexe was located almost directly opposite the Glasgow premises of Baird and Tatlock Limited, the laboratory furnishers. I quickly discovered that they were quite prepared to sell to me not only chemical glassware, Bunsen burners, and so on, but also (which was more surprising) all sorts of exciting chemicals from concentrated nitric and sulphuric acids to carbon disulphide and chloroform. On such delights I spent quite a bit of my pocket (and lunch!) money and was able to

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carry out some, fortunately unsuccessful, attempts to prepare nitroglycerol, and at the same time to ruin the stair-carpetts at home by dropping acid on them.

My career at school calls for no special comment. I had no great difficulty with any of the subjects except art. I was perhaps the worst performer in the school when it came to free-hand drawing. So bad was I that the art master on one occasion drew attention to my initials (A.R.T.) and observed that my parents 'certainly had a sense of humour'. We were for the most part well-taught in chemistry, which was made a live and interesting subject by the chief chemistry master, by name Robert Gillespie. I at least found the physics teaching much inferior, and I fear that as a result the subject appeared to me to be rather dull and uninspiring although not particularly difficult. I have always regretted this, for it did, in some measure, affect my attitude towards physical chemistry; it is not so much what is taught as how it is taught that determines one's attitude to a subject. In my experience over many years as a university teacher, I have often been struck by the fact that most of the really able young people I have known have been good at most subjects. I suspect that, in many cases, the choice of, say, chemistry instead of botany or indeed of languages as a specialty rests as much on the quality of earlier teaching as on natural inclination.

In the spring of 1924 I passed the Scottish Higher Leaving Certificate examination in English, French, mathematics, physics and chemistry, with German and dynamics as additional subjects at intermediate level. The school liked to encourage boys going to university to remain for a further year in the sixth form before matriculating, but I decided not to do so but to go directly to the University of Glasgow. It may be that I was unusually mature for my years, but at any rate I must confess that I never regretted this decision – I doubt very much if I would have gained anything by a further year at school. I thought it would be a good thing to save my father some money by getting a scholarship of some sort, so I began by sitting for the University Entrance Scholarship offered by the school. This was meant for those boys who had done the extra

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sixth-form year and the examination was set accordingly. I found that I could not attempt a single question in the physics paper; needless to say I did not get the scholarship. I then decided to apply for one of the bursaries offered by the University of Glasgow in a competitive examination which I duly sat. It was customary to publish the names of the first hundred candidates in order of merit and to make awards accordingly; in the 1924 competition when the list was published my name appeared in the first twenty. But my labours were in vain; had I taken the trouble to study the entry form before filling it in, I would have discovered that there were no bursaries on offer for which I was eligible. I then discovered that the Carnegie Trust for the Universities of Scotland made awards to native Scots which defrayed a large part of their university fees. I accordingly obtained the appropriate application forms. When I showed them to my father, he looked through them and almost exploded. Pointing to one of them in which the parent of the applicant was asked to sign a statement that without assistance he would be unable to send his son to university, he roundly declared that I should know better than to accept charity, let alone be so stupid as to think that he would do so under any circumstances. He then tore up the forms and threw them on the fire. So that was that! I therefore matriculated a couple of days before my seventeenth birthday at the University of Glasgow as a pensioner to read for the degree of Bachelor of Science with honours in chemistry. It is only fair to add that at the end of my first year I was awarded the Joseph Black Medal and the Roger Muirhead Prize in chemistry which did in fact provide me with a scholarship for the rest of my course.

At the time I entered the university, the school of chemistry was adequate if old-fashioned from a teaching standpoint, and not unduly distinguished in research. That is an opinion based upon hindsight, of course, for, at the time I entered, I had no idea whether the school was good or bad. In this respect I differed little from most other school-leavers then and now; in my experience, in non-academic families the choice of university, where it is not made simply on proximity grounds, is

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usually determined by schoolmasters or, where there is an academic family tradition, by parents who tend to select the institution they themselves attended. It is indeed difficult to see how it could well be otherwise. In 1924, the first-year course for honours chemistry in Glasgow consisted of two terms of lectures on general and inorganic chemistry by G. G. Henderson, the Regius Professor of Chemistry, followed by one term of organic chemistry given by T. S. Patterson, who was Professor of Organic Chemistry. Both professors were good lecturers and the courses given were interesting. This is more than could be said of the accompanying practical class which was devoted to quantitative (mainly gravimetric) and qualitative inorganic analysis. We were given virtually no preliminary instruction apart from one lecture demonstration, and then set to determine the amount of silver in a given solution gravimetrically. If the result obtained was more than two per cent in error, the demonstrator in charge simply wrote 'Repeat' in large letters across one's laboratory notebook and handed out another solution. When, eventually, one got a satisfactory answer, one proceeded to repeat the operation successively with lead, copper, arsenic, bismuth and so on through the traditional sequence of elements and acid radicals used in qualitative analysis. True, we had a few lectures on analytical chemistry on the side, but their relevance to the course was obscure. This probably taught us to become proficient in quantitative analytical procedures, but it was a soul-destroying business. My first – and only – personal encounter with Professor Henderson during my first year was on a November afternoon in 1924 when he was making a tour of the laboratory. He paused at my work bench, looked at the name-label on it, and said 'Ah! Mr Todd, and what are we doing today?' I told him I was endeavouring to determine the amount of silver in a given solution having already failed in three previous attempts. He shook his head sadly, said 'Too bad, too bad!' and passed on his way. I well remember debating with myself whether to abandon chemistry after my fifth 'Repeat' on silver! However, I weathered the storm and went on.

Our second year was given over to organic chemistry which



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I found fascinating, both as to lectures and laboratory, and after a third rather dull year given over to physical and inorganic chemistry – with (believe it or not) a further bout of quantitative analytical chemistry as applied to materials containing more exotic elements and radicals – we were able to devote our fourth and final year to one of the three branches of the subject, the practical course including a small research topic on which a thesis had to be written. I chose organic chemistry and, perhaps because I had shown up prominently in all the examinations in that branch, I was put under the professor's supervision. T. S. Patterson's field of research was optical activity. This he pursued in somewhat desultory fashion, since his primary interest was in the history of alchemy, a subject which had occupied most of the attention of his predecessor Ferguson (known for some obscure reason as 'Soda') who had bequeathed a large collection of works on the subject to the university library. It was through Patterson's insistence that the history of chemistry was made a compulsory subject for all undergraduates in their final year, and I have always been grateful to him for thus introducing me to it.

The topic allotted to me for my final year research project was the action of phosphorus pentachloride on ethyl tartrate and its diacetyl derivative. The object was to see whether the nature of the group to be replaced had any influence on the course of the Walden inversion. Needless to say, such results as I got threw no light on that problem, although they did lead to my first publication in the *Journal of the Chemical Society*. Patterson was interested in optical rotatory dispersion and sought to interest me in it also. I read up most of the available literature and began some work on the rotatory dispersion of mannitol and its derivatives which we subsequently published. In June 1928 I graduated B.Sc. with first-class honours in chemistry, being placed first in my year, and was awarded a Carnegie Research Scholarship of £100 per annum to continue research with T. S. Patterson.

I thus returned to Patterson's private laboratory in the autumn, and continued work along the same lines as before. This I did with some diffidence, for I was already getting uneasy

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about optical rotatory dispersion as a subject for research. For one thing, I did not find it very exciting; I really wanted to do natural product work, holding as I did to the Berzelius definition of organic chemistry (the chemistry of substances found in living matter) rather than the alternative one due to Gmelin (the chemistry of the carbon compounds). More serious, however, was the fact that the subject, as then pursued, seemed to me to have no theoretical basis and was unlikely to acquire one without the application to it of a great deal more mathematical insight than I, T. S. Patterson or even the Lowry group in Cambridge (the other British workers in the field) possessed. It was difficult to see how a junior research student like myself could break loose from it and remain in the Glasgow chemistry department. Furthermore, apart from T. S. Stevens, there appeared to me to be no member of the Glasgow staff with both enthusiasm for organic chemistry and real research ability with whom I would really have liked to work. The others – or so it appeared to me – got on with teaching and made only perfunctory bows in the direction of research. To cut a long story short, by the end of the autumn term of 1928 I had already decided that, if I wanted to make my way in organic chemistry I must leave Glasgow and go elsewhere. Somewhat to my surprise, when I spoke to T. S. Patterson about my feelings he agreed fully, and offered to help in every way he could. I accepted his view that it would be valuable to spend a year or two abroad, if only to learn how other people lived and to acquire real command of a foreign language. Not surprisingly, in view of his own background, he wanted me to go to Paris; I on the other hand wanted to go to Germany, where there was more going on in the natural product field, and in due course I prevailed. The problem, of course, was to decide where to go. In those days, Windaus in Göttingen and Wieland in Munich were the big names. Their laboratories, however, were crowded with foreigners (especially Americans) and English tended to be the *lingua franca* among the research groups. I was anxious to get as much German as I could as well as chemical experience, and my choice finally lighted on Walther Borsche at the University of Frankfurt a.M. Borsche,