

Autobiography



I grew up in an academic middle-class family. In 1926, when I was 3 years old, my father was appointed professor of history at the University of Lund, Sweden, and moved there with his family from Uppsala, Sweden. My mother had passed a master-of-arts examination and my father a Ph.D. degree at the University of Uppsala. My mother had a keen interest in research throughout her life but gave priority to raising her children and to assisting her husband in his research. However, when her husband died at the age of 76 she, then 71 years old, started to devote herself entirely to her favorite area of research, that is the legal status of women in the Middle Ages in Sweden. She published a couple of books and a number of articles on this subject in Swedish, which rendered her an honorary Ph.D. degree at the University of Uppsala several years later.

We were four children in the family, and we were all to take academic degrees at different levels. The family had a strong orientation toward humanities. However, in contrast to my elder brother and sister, who also chose humanities, I decided to study medicine, and my 7 years younger brother later joined me. The reason for this deviating behavior of mine was partly the kind of opposition often occurring in youngsters, partly some vague idea of science being more "useful than arts.

My childhood and youth were characterized by a happy life in a stable environment with loving and supportive parents. I was probably just about average in terms of disobedience and escapades. At school, which I found fairly endurable, I had very good marks without too much effort.

At the age of 16, in June 1939, I took a hitch-hiking trip to Germany for two weeks together with a boy of the same age. This was to be my only trip outside the Nordic countries until the age of 32. It occurred only two and a half months before the outbreak of World War II. We had then the opportunity to talk to many Germans of varying social standing. Most of them felt convinced that a war would begin as soon as the harvest was done, and they seemed to accept that, though reluctantly. In Berlin I spent one night in a hospits run by an Evangelic foundation and inhabited by obviously very poor people. I especially remember several Jews with long beards and sad faces, mumbling while reading a heavy book that could have been the Talmud, apparently searching for an answer and a solution in a desperate situation. Otherwise I was not aware of the terrible actions against Jews that were probably ongoing around me.

My medical studies started in 1941 and went on smoothly, apart from several interruptions due to altogether a couple of years of military service. Lund was, and still is, a fairly typical small university town somewhat reminiscent of Oxford. The quality of research and teaching, including that of the medical school, was good. Among the professors of that school a couple of prominent names may be mentioned. Torsten

Thunberg, professor of physiology, had discovered "the tissue respiration", i.e. the dehydrogenases, and had developed a method to measure their activity. His work was simultaneous but independent of [Warburg's](#) research on the same subject in Berlin. Warburg, but not Thunberg, was awarded the Nobel Prize. Ernest Overton, professor of pharmacology, was famous for his revolutionary theories regarding the structure and lipid properties of the cell membrane and on the mechanism underlying narcosis. However, Overton had died before I started my medical studies, and Thunberg was already emeritus at that time. Sadly Overton became mentally ill in his later life; he was said to propose himself repeatedly for the Nobel Prize, which he like Thunberg certainly deserved but did not get. Among the most innovative of my contemporaries at the medical school of the University of Lund was Nils Alwall, although his seminal contributions were not generally recognized at that time. Alwall is one of the pioneers in the development of the "artificial kidney". He successfully ran a department of kidney dialysis in the Medical University Clinic. The internationally renowned Gambro Company developed out of this work. It is still quite successful in kidney dialysis and other biomedical technology. Another major innovation created at the University of Lund at this time was the ultrasonar cardiography, developed by Helmuth Hertz and Inge Edler. Finally Jörgen Lehmann may be mentioned as the most prominent among Thunberg's students. In the 1940s, then in Göteborg, Sweden, he discovered para-aminosalicylic acid (PAS), which together with streptomycin, discovered by [Waksman](#), provided the first effective drug treatment for tuberculosis. Waksman, but not Lehmann, was awarded the Nobel Prize for his discovery.

During the first five years of my medical studies World War II was going on, rendering Sweden almost entirely isolated. During my first year, however, five Danish medical students were allowed to leave Denmark, then occupied by Germany, to do their anatomy studies together with us in Lund. I became especially friendly with one of them: Ib Munkvad. Among other things we played check together. Munkvad later became a psychiatrist with an orientation towards biological psychiatry. He was instrumental in developing biological psychiatry in Denmark and is also known for formulating the hypothesis that the dyskinesias induced by dopaminergic agonists could make a model of psychosis.

Another remarkable contact with the war occurred during a few nights in October, 1943, when thousands of Jews managed to escape in small fishing boats across the sound between Denmark and Sweden. This happened because one of the top members of the German occupation establishment had informed Danish authorities that a major deportation of Jews from Denmark to Germany was forthcoming. Among the Jews who came to Sweden at this time were a number of prominent medical researchers. These people were immediately enrolled and became an important acquisition as teachers and researchers at our medical school.

An even sadder contact with the war occurred in the spring of 1944, when I was in my first year of clinical training. At this time Count Folke Bernadotte, a member of the royal Swedish family, had managed to persuade German authorities to allow him to go from Sweden into Germany with a number of "white busses" and to pick up prisoners at

concentration camps. These transportations turned out to be successful, allowing about 30,000 prisoners, among them 11,000 Jews, to escape. Some of the prisoners were taken to Lund, where a big tent was erected in a park to house them. As a medical student I was given the task to examine several of these prisoners. Many of them were children, suffering from undernutrition. Tuberculosis was not uncommon. However, most shocking was their mental status. They behaved like wild animals, obviously suffering from severe anguish and suspiciousness and trusting nobody.

Starting in pharmacology

Already at the outset of my medical studies I had decided to try to go into research, and in 1944, I was offered a modest position as "amanuens" (initially without salary) at the Department of Pharmacology, after I had passed a successful examination in that discipline. The head of that department, and at that time the only professor, was Gunnar Ahlgren. He had been Thunberg's favorite student and apparently been an asset in the group around Thunberg. However, when on his own as professor of pharmacology he was not scientifically productive. But he managed to attract a number of talented students, who were to make successful careers in various medical disciplines. One of these people was the already mentioned Nils Alwall.

Ahlgren gave me and another student, named Georg Theander, a topic to investigate, i.e. to measure the duration of action of pentylenetetrazol (Cardiazol), a convulsant at that time frequently used as an "artaleptic" to wake up people who had taken an overdose of a hypnotic or sedative, and also used as a forerunner of electroconvulsive therapy. Nowadays this drug has a modest use as a diagnostic and experimental tool. To measure the action of pentylenetetrazol Ahlgren proposed to employ its awakening action against central depressants. At first we tried nitrous oxide, but to our surprise the drug was unable to antagonize its anesthetic action. We then added a subhypnotic dose of barbital and found that the combined action of this drug and nitrous oxide could be antagonized, and the increase in partial pressure of nitrous oxide needed to inhibit the righting reflex could be used as a measure of pentylenetetrazol action. The result of this study was that the duration of action of pentylenetetrazol was much longer than expected from observations on its effect in animals not treated with central depressants. We published our results (Carlsson and Theander, 1946), and this first publication of ours was awarded a modest prize, intended for young medical scientists at the University of Lund. One might wonder why Ahlgren was interested in the duration of action of this drug. He never explained that to me, but when I told him about our results, he was obviously pleased, but not surprised. A plausible reason for this was that he had actually tried it on himself to antagonize a sedative and thus discovered its long duration of action.

Together with another, five years older pharmacologist, named Folke Serin, I studied the action of another "analeptic", i.e. nikethamide, and discovered a circadian rhythm in its lethal action. The publication of these findings (Carlsson and Serin, 1950) appears to have been the first describing a circadian rhythm of a drug's action, according to a review article on chronobiology, that was published much later when this subject became fashionable in connection with space research.

Work on calcium metabolism

In 1948 Gunnar Ahlgren persuaded me to go into an entirely different area of research, i.e. calcium metabolism. At that time radioactive tracers, among them Ca^{45} , had become commercially available, and a Swedish drug company wanted us to test a number of calcium salts regarding their oral availability. I accepted to do this research. The testing of different calcium salts did not disclose anything of interest, but I utilized this opportunity to investigate the absorption of calcium as well as its metabolism in the skeleton by means of the new technique. That work resulted in my thesis for the M.D. degree (corresponding to the American Ph.D. degree) and in several subsequent papers, including the doctoral theses of two students of mine, namely Bertil Lindquist and Göran Bauer, who later became professors of pediatrics and orthopedic surgery, respectively. Briefly, what we found was that it is possible, contrary to the current opinion at that time, to use tracer techniques for measurement of the uptake (or "accretion") and the resorption of the bone mineral differentially (for review, see Bauer *et al.*, 1961). Among other things we discovered that vitamin D in physiological doses can stimulate not only the intestinal absorption and "accretion" but also the resorption of bone mineral. Our findings aroused some international interest and resulted in an invitation to a Gordon Conference in the summer of 1955.

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