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Celebration of Inorganic Lives: Interview with Egon Uhlig (University of Jena, Germany)

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A portrait of Egon Uhlig.

1. Biography

Egon Uhlig was born on 8th November 1929 in Neundorf, a village in the southern part of Saxony. He obtained the high school certificate in 1948 and studied chemistry at the University of Leipzig. He obtained the degree 'Diplom-Chemiker' in 1952 and that of Dr rer. nat. in 1955 (supervisor Professor Leopold Wolf). In 1960, he finished his 'Habilitationsschrift'. In 1960, he was appointed Docent at the University of Jena and in 1962, Professor of Inorganic Chemistry. From 1962 to 1967, he was head of the Institute of Inorganic Chemistry; from 1976 to 1990, head of the Faculty of Sciences; and in 1990, head of the Faculty of Chemistry.

In 1978, Egon Uhlig was elected as corresponding member of the Academy of Sciences of the GDR. In 1983, he received the Clemens–Winkler Medal of the Chemical Society of the GDR; in 1985, the Medal of Honour of the Slovak Technical University Bratislava; and in 1993, the Hanůs-Medal of the Czech Chemical Society. He was the head of the Organizing Committee of the 28th ICCC, 1990, in Gera and from 1970 to 1996, member of the advisory board of the 'Zeitschrift für Anorganische und Allgemeine Chemie'. From 1992 to 1996, he was a referee for the Deutsche Forschungsgemeinschaft. He retired in 1995.

2. Interview

H.H. *You were the most respected coordination chemist in the GDR, dear Egon, and it is my great pleasure to interview you, one of my academic teachers at the University of Leipzig. Among other things, you were responsible there for the advanced lab practice in inorganic chemistry. I remember the critical control on the quality of the inorganic compounds we had to synthesize during that practice. Later on, I was always impressed by your engagement to develop a coordination chemistry family in the GDR. Particularly, your activities to find worldwide contacts were very helpful for us coordination chemists. Of particular meaning, were the micro symposia on coordination and organometallic chemistry organized every two years by you and your group at Jena University with many participants and invited speakers not only from the east European countries. As Corresponding Member of the Academy of Sciences, you always felt responsible for the development of teaching and research in transition metal chemistry and coordination chemistry. Your worldwide reputation led the International Scientific Board of ICCC to select you as the chairman of the 28th ICCC in 1990. To your scientific*

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engagement, we will come back later. First, let me ask you for some details on your childhood and on the ways leading you to chemistry.

My father worked in the building trade as roadmaker, iron-worker and brick-layer. My mother was a tailor. I was born in 1929 in a small village in the southern part of Saxony, where I attended the elementary school from 1936 to 1944. We learned elementary things, sang a lot of ballads, learned German history and geography. However, natural sciences scarcely played any role. The only thing I picked up about chemistry was the formula of water. With the beginning of the Second World War in 1939, more and more teachers were sent to the front. This led to considerably reduced teaching. In spring 1944, I changed to a teacher's training college at Annaberg, a small city in the Erzgebirge. The education there, not so much the teaching, was strongly Nazistic, and we were obliged always to wear the uniform of the Hitlerjugend. No wonder that I was not able to conceive that Germany would lose the war. Saxony was the part of Germany that was occupied last by the Allied forces. On 17th April 1945, at the age of 15 years, I was drafted into the fascist army. Fortunately, I was obviously not robust enough; this protected me from becoming a 'child soldier'. Fortunately, the end of the war came soon and since that time my motto is "Do not believe any institution that may force you".

After the war, the teacher's training college was closed. My highly appreciated teacher, Arno Rietzschel, who introduced me to German literature, recommended me to change to a high-class secondary school and he helped me very much to find a way to do so. Also after the war, it was very important in German schools to learn Latin. However, I had never been instructed in that language. Only a hard training in the summer of 1945 helped me to survive. With the beginning of the classes in October 1945, I had no further problems with Latin. As far as teaching was concerned, we lived under a kind of martial law. At the end of 1945, all teachers who were members of the Nazi Party were removed. In our school, only three teachers from the original 20 were left. Instead, young people were hired, new teachers, who began to study before the war, but had their studies interrupted. Our new English teacher lived before the war in the United States. His colloquial language was perfect, but the level in English literature was rather low. As usual, there were born teachers among the new teachers, but also born non-teachers. In winter 1945/46, the schools received no coal and therefore there was again no teaching at this time. In the beginning there were no lessons in chemistry. Obviously, it was the aim of the Soviet administration to keep young people at a distance from a science that had enabled the production of TNT, sarin, synthetic rubber, etc. However, they soon changed their philosophy: in the Soviet zone there were a lot of chemical plants like Leuna, Buna, Agfa Wolfen and IG Farben Wolfen, etc. These plants again needed chemists and that considerably influenced the situation in the schools. In the years 1946–1948, I had my first lessons in chemistry. We heard more about chemistry under these exceptional conditions than in most schools in Germany today. Further, there was no ideological pressure in the school. This, however, soon changed.

H.H. *I see that there was no real chemical background in your childhood which influenced you to become interested in chemistry, to do chemical experiments and so on. Hence, what was the reason for studying chemistry and for selecting the University of Leipzig?*

It is curious, but my decision to study chemistry was already made before I received instruction in chemistry. It has to do with the great credit chemistry had in Germany. Chemistry was always present in newspapers, books, etc. and the gigantic chemical plants impressed me very strongly. In 1948, it was really like an award to get a chance to begin study at any university. Among 61 people of my class, only two got a place at a university. I was one of these and very happy, of course. I had finished my examinations with excellence and it was particularly meaningful that I stemmed from a worker's family. In 1948, there were 30 beginners in chemistry at the University of Leipzig. Most of them were older than me because they were soldiers.

The University of Leipzig was the State University of Saxony and it was my first choice. Another point was that I could reach Leipzig rather comfortably by railway. You should consider that 100 km required 9 h at that time; Jena or even Berlin would need a whole day! A curiosity from that time: since 1949, I needed special permission to visit my parents, because the Soviet administration declared the southern part of Saxony a prohibited area. A kind of 'uranium rush' had broken out, and the Soviets did not like a view behind the scenes. This could already be seen from the name of the uranium mining company, which was called 'Wismut Mining AG'.

The University of Leipzig had a great reputation particularly in the natural sciences. The Nobel Prize winners Wilhelm Ostwald, Werner Heisenberg and Peter Debye had worked there. The chemists Burkhardt Helferich, Franz Hein and Karl F. Bonhoeffer taught there during the time of the Second World War. In 1945, American troops occupied Leipzig for a short period. Leaving Leipzig for the Soviet troops, they arrested the most distinguished scientists of Leipzig University and passed them into the Western part of Germany. Among the chemists were B. Helferich, F. Hein (who already taught at Jena University, but still lived in Leipzig), Leopold Wolf and Hans Kautsky. L. Wolf escaped from the camp for East German scientists in Weilheim and returned to Leipzig. After his return, he took responsibility for the new beginning of chemistry teaching at Leipzig University after the war. Later, Wilhelm Treibs (organic chemistry) and Herbert Staude (physical chemistry) were appointed. Among them, W. Treibs was the most productive. He came from the industry and his main interest was oriented to natural products. He belonged to the pioneers in azulene chemistry.

H.H. *The University of Leipzig also had a long tradition in teaching chemistry. What were your first impressions there?*

At this time, qualitative and quantitative analysis were the main aspects of chemistry teaching in Germany. Our laboratory practice required about 30 h per week. We had to solve 38 qualitative analyses including eight full analyses, which contained so-called rare elements like titanium, vanadium, uranium, cerium and others. The final analyses were a rock sample and an alloy. Compared with that, the preparative exercises were rather limited. Thus, for example, I had to synthesize $TiCl_4$ and $[Cr(NH_3)_6]Cl_3$. After five terms, I finished the inorganic lab practice. Before getting the so-called 'Vordiplom' we had to make 20 organic preparations according to the well-known textbook of Gattermann. Examinations occurred in inorganic, organic and physical chemistry as well as in physics. The result of these examinations was very important for the amount of the grant. I was able to finish the lab practice in organic chemistry after six terms. This was the end of the basic study.

H.H. *Can you tell us a little bit more about the general conditions for studying chemistry at that time? How would the lab practice be organized in a time shortly after the Second World War?*

The chemical institutes at Leipzig had been severely damaged by bombs. Only the Institute of Applied Chemistry, founded already in 1860, survived. In this lab, W. Ostwald worked during his early years ($\approx$ 1890) and later Ernst Beckmann guided it. No wonder, the restrictions there were extreme. Thus, a lab place for the beginners was some 80 cm only, and there were no lab cabinets. We worked in a lab in the basement with scarcely any ventilation. The hoods there still worked with gas flames instead of exhausters. A smog of ammonium salts filled the lab. The windows were always open. In 1949, two boys looked from the street into our basement lab and said, "What do they do there?" "Surely they make atom bombs!" The study of chemistry was rather expensive: we had to pay for chemicals we needed for gravimetric analyses, like $(NH_4)_2HPO_4$, dimethyl glyoxime, $(NH_4)_2C_2O_4$, etc. Much more expensive was glassware, which we had to buy. The grant was therefore very important. At the beginning, the grant given b^y the state amounted to 120 Marks.

H.H. *Egon, it is of particular interest to hear why you resisted the lure of organic chemistry and were attracted to inorganic chemistry.*

You are right. At that time, most of the students went to organic chemistry. However, I was strongly impressed by the diversity of all elements and not only by the marvel of the one, carbon. Later I learned how colourful inorganic compounds could be. That led me to the d elements.

Due to my Doctor father, I came into an exquisite chemical society. L. Wolf was one of the last students of Arthur Hantzsch. He had worked with Hantzsch on the water-free system $HNO_3/HClO_4$ (it was the reason that now and then he let his students work with water-free perchloric acid) and prepared NO_2ClO_4 for the first time. As you know, Alfred Werner was the first student of A. Hantzsch, and F. Hein who detected in 1919 the first π-complex of chromium, was his student in Leipzig. You see, I really grew up in a family of coordination chemists. But A. Hantzsch was mainly an organic chemist and only to a small extent, an inorganic chemist. In that sense, the orientation of L. Wolf was comparable. Thus, my dissertation was more organically oriented: "Salt formation with esters and ethers of triethanolamine and tetraethanolammonium hydroxide". I finished in November 1955. I had no examination in Marxist–Leninist philosophy. Only later did that examination take on a strict form up to the end of the GDR.

H.H. *Your comment, Egon, brings me back to my question, because I see that your dissertation did not have too much to do with inorganic or coordination chemistry.*

On the one hand this is true, but I dealt with salt formation of a class of compounds that may behave also as ligands with transition metals. Working in anaerobic conditions had not been introduced in Leipzig at that time. Compared to it, physical chemistry was highly developed. Therefore, it was natural to begin with physical coordination chemistry, a field developing very strongly in the 1950s due to the contributions of Janik Bjerrum, Gerold Schwarzenbach, Arthur Martell, LeGrand Van Uitert, Lars G. Sillèn and others. My first project dealt with 2,5-diamino-terephthalic acid. This is a ligand with two equivalent coordination spheres, which cannot interact with the same central atom because of steric reasons. The aromatic spacer, however, leads to an electronic interaction. Consequently, the pK_S values belonging to the protonation of amine nitrogen atoms differ very strongly. This difference decreases in going from primary to tertiary amine functions. The substituents force a rotation of the amino groups producing a hindrance of electronic interactions. I found correlation in the complex formation with Co^{2+}, Ni^{2+}, Cu^{2+} and Zn^{2+} ions and was able to characterize the influence of secondary factors on complex formation, which is due to the protonation

Egon Uhlig, Eberhard Hoyer and Gerold Schwarzenbach during a visit of G. Schwarzenbach at Jena University.

within the second coordination sphere or to substituents on the aromatic ring [1]. The studies were performed preferably by means of potentiometric, polarographic and also calorimetric measurements. A remarkable result from the associated field: anthranilicacid-*N*,*N*-diacetic acid, a simple model of polycarboxyeic acids derived from 2,5-diamino-terephthalic acid, forms very stable complexes with 3d metal ions (log K_1 of the copper(II) complex 10.93) exclusively due to entropy stabilization, as shown by positive ΔH values! (See Ref. [2].)

H.H. *In 1960, you changed from Leipzig to the University of Jena. Could you give some comments on your beginning at the Institute of Inorganic Chemistry of that university? Which new projects were you able to begin there?*

My complex chemical studies with 2,5-diamino-terephthalic acid led in 1960 to the 'Habilitation', still at the University of Leipzig. At the same time, I was offered a university lecturership at the Institute of Inorganic Chemistry at the University of Jena. Lothar Kolditz was the head of that institute. F. Hein was still active and worked very successfully with his group in the field of σ-organo-chromium compounds. I had more students and co-workers and was able, therefore, to start a second project, preferably oriented synthetically. It concerned the influence of steric factors on complex formation. Chelates of the late 3d elements with pyridine(2) derivatives as bidentate ligands were selected as examples. It was expected that the constant pyridine residue would cause sufficient crystallization tendency and the other point was the manifold variation of the pyridine side chains [3,4]:

- Variation of the chelate rings (five- or six-membered)
- Variation of the donor groups (amine, phosphine, arsine)
- Variation of the substituents on the donor, as secondary or tertiary amine, for example

In the very beginning, six-membered rings with β-pyrid(2)yl-ethylamine and its substitution products were studied. 1,2-chelates could be obtained with nickel(II), but in no case did 1,3-chelates form. 1,1-chelates were dominating, showing a tetrahedral structure, which was rather unusual at this time. Besides reddish violet monomer complexes, we also obtained yellowish brown 'associated' species, primarily described as polymer octahedral species, consistent with $\mathrm{Nipy_2Cl_2}$ with known structure. However, X-ray crystal structure analyses, performed later, showed a dimeric structure with coordination number 5 for both central atoms. Detailed studies of the influence of all ligands showed that weakly basic ($\mathrm{NHC_6H_5}$) and not so bulky amine functions ($\mathrm{NHC_2H_5}$), and also chloro ligands, favour the dimeric form. Iodo ligands led to monomers only. Pyrid(2)yl-methylamine as the former of five-membered chelate rings is comparable with appropriate formers of six-membered rings. But it is also possible to synthesize 1,3-complexes. In contrast with the amine-substituted pyridines, the appropriate *tert*-phosphine-substituted ligands behave like hybrid ligands with a soft donor function. This leads to square-planar, diamagnetic 1,2-complexes, when six-membered chelate rings are formed. The behaviour of pyrid(2)yl-methyl-di(ethyl)-phosphine ($\mathrm{N^\frown PEt_2}$) is very different. Surprisingly, we were able to synthesize the 1,3-complex $\mathrm{[Fe(N^\frown PEt_2)_3](ClO_4)_2}$. However, the formation of 1,2-chelates like

$[Ni(N^\frown PEt_2)_2]X_2$ is dominating and coordination numbers 4 (ClO_4^-), 5 (I^-) or 6 (NCS^-) can be achieved depending on the anion coordination. We believed in the synthesis of a 1,1-complex $[Ni(N^\frown PEt_2)_2]X_2$, but in reality the ion pair $[Ni(N^\frown PEt_2)_2]NiCl_4$ forms.

Tertiary arsine groups show only a weak tendency to interact with nickel(II) or cobalt(II). Depending on the anions, ligands with the donor set NAs coordinate usually through nitrogen as monodentate ones. But, if the occasion arises, bidentate coordination can be observed. The conditions change principally when palladium(II) complexes are considered: $[Pd(N^\frown PPh_2)_2](ClO_4)_2$ is characterized by the donor set P_2N_2, whereas the P_2Cl_2 donor set was observed in $[Pd(N^\frown PPh_2)_2]Cl_2$. Here, the chloro ligands push away the pyridine nitrogen atoms from the first coordination sphere of palladium(II)! A particular kind of coordination was observed with copper(II) complexes of N substitution products of β-pyrid(2)yl-ethylamine (N_2NHR): $[(N_2NHR)Cu(OH)ClO_4]_2$ forms, characterized by a central Cu_2O_2 four-membered ring. The temperature dependence of the magnetic moment of that complex was particularly interesting. In some cases antiferromagnetic behaviour could be observed. $[(N_2NHMe)Cu(OH)ClO_4]_2$ exists in two isomeric forms: the α-form with ClO_4^- as the bridging ligand between both central atoms and the β-form with monodentately coordinating perchlorate [5].

The home-made magnetic balance equipped with a low-temperature device for liquid nitrogen forced us to study further some copper(II) complexes characterized by reduced magnetic moments, particularly aminoethanolo complexes of $[(R_2NCH_2CH_2O)CuX]$ constitution ($X = Cl, Br$). In the case of the bromo complexes we obtained olive-green dimeric compounds of tetrahedral structure. Again, a central four-membered Cu_2O_2 ring leads to super exchange, yielding antiferromagnetic behaviour [6]. We obtained a further interesting result with the complex $[(Et_2NCH_2CH_2O)CuCl]$. In benzene, this compound shows equilibrium between dimers and tetramers. The structure of the tetramer is remarkable: as shown later, it is distinguished by a cubane-like Cu_4O_4 centre. The magnetic moment is quite normal or only weakly reduced.

H.H. *Your endeavour to combine synthetic coordination chemistry with structural and thermodynamic aspects always impressed me. Which equipment did you use to obtain these results?*

At this time we had good possibilities for synthetic work, despite the fact that the level of our lab equipment was rather low. The equilibrium studies were performed with pH meters and by means of polarography. The data analysis was very troublesome, because there was no computing technique at that time. The Gouy balance was hand-made in the same way as an anisothermal calorimeter and a thermobalance. A big handicap was that there was no X-ray diffractometer until 1985.

However, my students were not much affected by these circumstances. I would like to emphasize particularly for Dieter Herrmann, Dirk Walther, Rainer Krannich, Arno Martin and Wolfgang Achilles who dealt principally with coordination chemistry in solutions. Manfred Maaser, Konrad Staiger, Manfred Schäfer, Stephan Keiser and Marie-Luise Martin studied the pyridine ligands. Today, D. Walther and W. Achilles are distinguished professors.

In Jena, was one of the first German university labs with a highly developed anaerobic lab technique, due to F. Hein whose students were still working in the institute. The main fields of their studies were now the very sensitive σ-phenyl and σ-methyl complexes of chromium(III)/(II) and molybdenum. Later I could take over that technique. Thus, the synthesis of phosphine ligands, for example, required working under argon. Our studies with nickel(0) complexes also required this technique.

H.H. *Egon, now we have some impressions of your fascinating work in coordination chemistry. The other points relate to your teaching activities. What are your experiences as a university teacher? How was the general atmosphere during the 1950s at the University of Leipzig and later in Jena?*

In the years after 1950, the chemical industry in the GDR had a great demand for chemists. Therefore, the number of chemistry students at Leipzig University increased dramatically—1948: 30, 1951: 130, 1953: 350, in the first year. This led to another exceptional situation: there were not enough lab places, despite the rebuilding of the chemical institute, which was originally projected by Hermann Kolbe. Further, there were not enough lecture halls and classrooms and especially there was not enough teaching staff. As a consequence, after finishing my basic study (at age 22 years), I had to teach 30 beginners in basic lab practice. The payment was rather low (150 Marks), but it improved after finishing the diploma examinations (675 Marks).

In the 1950s, the political situation in Germany was not very stable. Some university teachers and assistants left the University of Leipzig without any prior announcement to get lucrative positions in the chemical industry of the Federal Republic. Thus, one day after my dissertation in 1955, L. Wolf called and told me that, beginning from the next day, I had to teach basic chemistry for medical students. This concerned 600 students. Because the capacity of our lecture hall was limited to 250 students only, I had to teach the same lesson three times, 12 h in the week. Of course, I was completely unprepared and was occupied for one term only with teaching. Most important for me, the students gave me good quotes. This, however, did not impress an important Party man, who only three years later stated that I was not very much suited to being appointed as a university teacher. But, at the end of the 1950s there were not enough qualified inorganic chemists and in 1960 I got a call to the University of Jena. Lothar Kolditz, the successor of F. Hein, was the head of the institute and worked in halogen chemistry. In 1962, I became his successor in Jena.

After 1967 rather incisive changes occurred in the universities of the GDR. The university structure was changed and the institutes were disbanded. The faculties had only symbolic functions for conferring academic degrees. The 'power', that is, the responsibility for the budget, the personnel and the undergraduate students, went to the 'Sektion'. The 'Sektion' structure can be considered as the eastern model of the department system. The dominating leading instrument in Jena was the 'service conference'. Members of that body were the director, the vice-director for research, the vice-director for education and teaching, the Party secretary, and representatives of the trade unions and the youth organization. In this way, a strong political influence was secured. The new position of a vice-director for *education* and teaching shows the newly defined role of the university teachers. They were now not only responsible for teaching chemistry but also for the 'socialist education' of the students. However, that function remained a rather formal one.

H.H. *The reformation of the universities of the GDR in 1969 also had considerable influence on the research activities there. How did the stronger orientation towards applied research touch your work at Jena University? How would you comment on the general meaning of applied research at universities?*

Research should remain preferably oriented to basic research, but with stronger consideration of applied aspects. The ratio between basic and applied research was expected to be about 60:40. Upon considering local possibilities, the topics of research at the 'Sektion Chemie' of Jena University were connected with glass, polymers, photographic recording materials and surface chemistry. We, as coordination chemists had to play with bad cards. Fortunately, it was the era of homogeneous catalysis. We oriented our interest to the study of pre-catalysts for stereospecific butadiene polymerization. Because of the applied aspects, we needed a positive evaluation (and partially also a grant) from a partner from the industry. Our partner was the producer of elastomers in the GDR, the Chemical Plants Buna. The name of our group changed to 'Special Coordination Chemistry'. Nevertheless, we were able to show that electron-rich nickel complexes like [(bpy)Ni(cod)] and $[(bpy)Ni(PPh_3)_2]$ are suitable pre-catalysts yielding catalytically active systems after addition of $AlEtCl_2$. This result gave us the possibility to study the broad field of electron-rich complexes of the nickel triad, preferably with regard to synthetic aspects [7]. Thus, we were able to show the antagonistic effect of donor (bpy, $P(C_6H_{11})_3$) and acceptor ligands (cod) on the reactivity of nickel(0) complexes with the intermediate position of PPh_3. Here, I have particularly to thank Eckhard Dinjus, Dirk Walther, Heinrich Walther, Bernd Hipler, Eckhard Bartsch, Wolfgang Poppitz, Reinald Fischer and Bernd Nestler, my enthusiastic co-workers in this field.

In the 1980s, I came back again to coordination chemistry in solutions. At this time the GDR looked for autarky in the field of non-ferrous metals. Since ancient times, copper was mined and smelted in the Mansfeld area. There are many old dumps containing copper in concentrations comparable with ores mined in the 1980s. The question was, is it possible to extract copper from these old dumps? This led to our interest to metal extractants [8]. The intention was to find extractants selective for copper and other 3d elements but not for iron(III). Sulfonamido-substituted pyridine or sulfonyl thiourea derivatives are convenient for that purpose as shown by the $pH_{1/2}$ values [9]. These studies, considerably activated by Ute Dinjus, Bernd Undeutsch, Manfred Döring and Annette Heppner, sharpened my view towards the differences in the complex chemical behaviour of 3d metal ions in solution. This is particularly true with respect to results, which we obtained rather occasionally in studying the use of metal organic reagents in organic synthesis. An example may illustrate it: we studied the reaction of $[Ni(acac)_2]$ with $MgBr_2$ in thf and obtained the mixed ligand complex $[(thf)_2Mg(acac)_2NiBr_2]$ with octahedral magnesium and tetrahedral nickel(II). Magnesium ions disturb the octahedral surrounding of Ni(II) which remains in an uncommon tetrahedral structure [10]! This result was really surprising, particularly when compared with the classical investigations of W. Conard Fernelius [11,12]. The complex formation in thf, however, depends strongly on anions in the solution that are present besides $acac^-$. In the presence of halide ions, it is obvious that a reversal of the coordination behaviour may occur, when compared with perchlorate ions, usually used in solutions [13].

In 1990 we obtained a further nice result in another area of applied chemistry. It had to do with epoxide polymerization. Here, efficient catalysts are imidazole (imH) and its derivatives. The requirement was to find a compound showing no activity at room temperature but able to initiate a polymerization at 80 °C or even higher. We studied imidazole adducts of cobalt(II) diketonates and among them we found a very different behaviour: *trans*-$[Co(acac)_2(imH)_2]$ splits off acetylacetone thermally and $Co(imH)_2$ remains. On the other hand, *trans*-$[Co(bzac)_2(imH)_2]\cdot 2CH_3OH$ eliminates imidazole besides methanol and is very suitable for initiating the polymerization mentioned above. Today it is used industrially for that purpose. I do not fail to

The local Organization Committee of 28th ICCC, Gera 1990.

realize that the demand for applied research gave a lot of ideas in basic research.

Presently I feel almost as if I have returned to the GDR times, because bodies responsible for research funding again demand a stronger orientation to applied research. During the period of four years (1992–1996), when I was a referee for the ' Deutsche Forschungsgemeinschaft—DFG', I could see that many proposals contained applied aspects used like a ritual. I was never impressed by empty talks like "the new electron-rich complexes to be synthesized are useful as catalysts for important syntheses, which cannot be performed well without such compounds". Such headings may impress officials but not insiders. I had to read numerous proposals for calls or research projects, but the publication lists hardly contained any patents. This seems to be a clear signal: patents and results of applied research are without any value with respect to an academic career in Germany. It requires changes, therefore, to improve this situation.

H.H. *Egon, let us come back again to the family of coordination chemists in which you grew up.*

Walter Hieber said one day (≈ 1960): "There are two coordination chemists in Germany, the other one is Mr Hein." Unambiguously, Hieber is the hero in carbonyl chemistry; Hein cultivated organometallic chemistry (particularly of transition elements) and the chemistry of Werner-type complexes. Both these names represent the specific situation in Germany; it is the close relation between coordination chemistry and organometallic chemistry. I myself always felt integrated into that specificity. However, I belong to the coordination chemists of the next generation and lived in the GDR until the age of 60; since 1970 there has been a strong demand in the direction of applied research, an aspect that Hieber and Hein never had to consider.

My coordination chemistry family consisted of colleagues in the neighbourhood of Jena. Thus, over the years, I had excellent contacts with Eberhard Hoyer and you from Leipzig University, with Rudi Taube and Karl-Heinz Thiele from the Technical University at Merseburg and Alfred Tzschach and Helmut Köhler from the University of Halle; both passed away so suddenly. It was really a very exciting and friendly cooperation with them. The restrictive visa policies of the GDR administration rendered contacts with appropriate groups in the Federal Republic of Germany and in Western countries very difficult. Hardly one of my co-workers had the opportunity to take a postdoc position in one of these countries. Thus, D. Walther, the secretary of the Organizing Committee of the 28th ICCC (now my successor at the University of Jena), could travel for some months to Sweden only in 1989. At this time he was already aged 50!

There were no problems in cooperating with colleagues in East Europe. I would like to stress the friendly contacts with Jan Gazo (Bratislava), Kalman Burger (Szeged), Jozef Ziolkowski (Wroclaw), Kasimir Jatsimirskii (Kiev) and Juri Kukushkin (Leningrad). We had excellent relations with the Kurnakov Institute in Moscow, particularly with Igor Moisejev and Vadim Nefedov. V. Nefedov performed a lot of ESCA studies for our group. This helped us very much in solving structure and bonding problems. Our joint publications show how efficiently that cooperation worked. It was particularly important in so far as we had no X-ray diffractometer at this time, as already mentioned. Therefore, ESCA studies were of principal significance for our group.

The cooperation with our colleagues in Moscow was also of political significance. Until the 1980s the Soviet Union passed for a great ideal in the GDR. This meant that if there is excellent coordination chemistry in that country, then it should not be so different in the GDR.

Only after 1980, was there some alleviation in the travelling situation for scientists. Many colleagues from the Western countries were invited for seminars, etc. I myself could participate in most of the ICCC meetings. We were appointed by the Organizing Committee of the ICCC to organize the 28th conference. It was not so easy to organize such a big conference in the GDR. It required permission of the government, for example. The second, more serious problem was that it was impossible to hold the conference in Jena because of too little hotel capacity there. We therefore had to change to Gera. Generally it became a very unusual ICCC meeting. The organization still took place in the GDR, but the conference itself happened after the currency change in the almost unified Germany. It brought a lot of additional trouble. However, I believe, finally we were able to solve all problems. Only a short gloss: initially we had 355 applicants from the Soviet Union and finally 102 came. So many from that country will hardly ever again participate in any ICCC.

H.H. *After discussing the family of coordination chemists, may I ask you, Egon, to tell us a little about your own family.*

Christa Beyer and I myself were in the same school class for the last two years of the high school. We jointly finished our examination (the German 'Abitur'). Immediately after examination, Christa went to work as a so-called new teacher in school. Christa is a born teacher, as everybody who knows her will confirm.

During school days itself we became deeply attached to each other. Our sympathy grew in times of local separation. In 1953 we got married. Christa finished her teacher examination in the same year, but she saw her future in taking care of the family. Preferentially she took the responsibility for the education of both our sons, Wolfram and Ronald, and she was able to create such conditions that allowed me to follow my scientific interests. Further, when anybody was engaged in an honorary capacity, Christa was there. As a representative of the parent–teacher association in the school, on the parish council or for cultivating the surroundings of our accommodation area, she was always active.

My son Wolfram followed me. He works at the Institute of Inorganic Chemistry of the ETH Zürich in the field of silicon chemistry. Ronald is the cultural leader of our family. Very recently he finished his examination as concert pianist.

H.H. *Your life, dear Egon, is unique in so far, as you went through four different social systems in Germany. You were born in the 'Weimarer Republik', you got your schooling in the Nazi era, your academic career was connected with the socialist experiment in the GDR and now you have returned to a democratic system. What are your feelings after the unification of Germany?*

In general, life becomes steadier after the age of 60. However, I myself needed nerves like wires. The unification of Germany brought a tremendous change at our university. Most of the human science institutions were closed, and also the small technical departments. Medicine, natural sciences and mathematics, not so strongly touched ideologically, remained mainly with the original staff. However, there was a rigorous political and scientific evaluation. I was not so delighted when the new administration at Jena University asked me, who had been active working for that University for more than 30 years, for my diploma certificate. I gave them my school certification in the bargain.

From 1990 up to 1992, I was the Dean of the Faculty for Chemistry and Earth Sciences. I contributed to a continuation of teaching and research at a high standard. It was possible to improve the level of our equipment in a very short time, and we became able to compete with the other chemistry departments in Germany.

H.H. *More than five years have passed now since you finished your academic career. Since then you have more time for your hobbies. What are the hobbies of the retired coordination chemist and university teacher Egon Uhlig?*

In 1995 I retired. I have dealt further with the scientific literature and have more time now to look into some details of the history of chemistry. Thus, I learned what difficulties the great Berzelius had with the realization of the element character of chlorine and particularly nitrogen. Further, I made some studies of errors in chemistry [14]. In 1999, there was a celebration of the 150th anniversary of the death of Johann Wolfgang Döbereiner, who had worked at Jena University. Within the frame of this celebration, I gave a lecture entitled "Döbereiner and his contemporaries—chemists and philosophers". During the preparation of that talk I realized how Justus Liebig had to fight against the romantic natural scientists of his days. To improve my own knowledge in that area, I read in more detail the papers of Lorenz Oken. Oken, who sometime later became the founding rector of the University of Zürich, taught at the same time as Döbereiner in Jena. I summarized my conclusions in an article entitled "Lorenz Oken—romantic scientist and liberal—tensed relationship to the contemporary chemists and to the feudal regime". It was not so easy to read Oken's textbook of natural sciences (Reclam, Leipzig, 1813). The ideas I met there are far from those of a chemist today. I am able now to understand much better the reasons for Liebig's controversies.

And finally, I enjoy very much classical music, and also modern music having, according to my feeling, a clear expression. This is the reason for my engagement with the Philharmonic Orchestra of Jena. For many years I was the president of the Philharmonic Society, to support that orchestra and its friends.

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