DISCURSO PRONUNCIADO POR EL NUEVO DOCTOR HELMUT WERNER

Excmo. Sr. Rector Magnífico
Estimado Claustro Universitario

LA Facultad de Química y Farmacia de Wurzburgo ha concedido en los últimos 20 años 940 tesis con el título de *Doctor*, pero sólo ha otorgado en el mismo período tres títulos *Doctor Honoris Causa*. En el reglamento de doctorado de la Universidad de Wurzburgo esto significa que las personas a las que se tributó dicho homenaje contribuyeron de una manera especial al desarrollo de la ciencia.

Yo sé que la Universidad de Zaragoza posee una larga y vigorosa tradición como alma máter, a la cual ofrezco mis servicios de enseñanza e investigación, por lo que considero hoy un grandísimo honor por su parte, Sr. Rector, ser nombrado con el título de Doctor Honoris Causa. Dicho nombramiento es al mismo tiempo un honor para la Universidad Julius-Maximilians de Wurzburgo, que en el próximo año celebrará el sexto centenario de su fundación, y en la que no sólo han trabajado e investigado reconocidos teólogos, abogados, filósofos y médicos, sino también famosos científicos como los premios Nobel Conrad Wilhelm Röntgen, Emil Fischer, Eduard Buchner, Wilhelm Wien, Johannes Stark, Klaus von Klitzing y Hartmut Michel. Ambas universidades, la Universidad de Zaragoza y la Universidad de

Wurzburgo, han contribuido conjuntamente a que la Química ocupe un lugar importante en el campo de la ciencia y, sobre todo, haya adquirido en los últimos treinta años una alta reputación internacional. Por lo tanto, no es ninguna casualidad que se hayan desarrollado en este período numerosos lazos de cooperación entre químicos de Zaragoza y Wurzburgo, y me siento muy satisfecho de haber promovido y llevado a cabo dichos contactos científicos. Ustedes han sido para mí y para mis colaboradores un gran premio, y estoy seguro también de que los químicos y químicas españoles que colaboraron en nuestro equipo de trabajo comparten dicha opinión.

Although the two cities are more than 1000 kilometers apart, it is by coincidence that historically the University of Zaragoza and the University of Würzburg developed in a rather similar way. At the end of the 14th century, a college for a "Studium Generale" was founded at Würzburg and this new institution, up-to-now entitled "University," was priviledged in 1402 by Pope Bonifaz IX. Owing to a series of conflicts between the Rector, the professors and the students (being obviously characteristic not only for modern times), the Würzburg University was partly closed and, after the privileges were renewed and the founding approved by Emperor Maximilan II, reopened in 1582. Almost exactly at the same time — in 1583 — the School at Zaragoza for the "Estudio General de Artes," founded already in the 15th century, was raised to the rank of a University and despite the political and social turmoil kept its position as the leading academic institution until now.

In the years of foundation, chemistry at both universities at Zaragoza and Würzburg was not a separate and independent discipline. It did belong to the "fine arts" and had to give support to the studies of medicine. At Würzburg, the first chemical laboratory was set up in 1749 at the main hospital of the university and by order of the Prince Bishop (who was also the Rector) it was "the primary duty of the corresponding professor to teach the students how to do an experiment." It is reported that the medicine students were so impressed that the University decided in 1782 (when it celebrated the 200th anniversary of the refoundation) to establish a chair of chemistry. The laboratory of the new professor was still in the hospital and it took until 1885, when Professor Emil Fischer (who received the Nobel price in 1902) accepted the call to Würzburg, that the ministry at the Bavarian capital in Munich agreed to build a modern "Institute of Chemistry" which still exists. At that time, and this situation was typical for most German universities, chemistry as well as physics and mathematics was part of the Faculty of Philosophy and this continued until 1937. In this year, the first Dean was appointed for the Faculty of Science which was still rather small compared to the Faculties of Philosophy, Laws and Medicine. The situation changed after the Second World War and due to the rapid revival of the chemical industry in Germany, beginning in the 1950s, more and more students of science chose chemistry as the major discipline.

However, like in Spain at that time, at most of the German universities chemistry was dominated by organic chemists and it needed an inspiring and foresighted professor to realize that a renaissance in inorganic chemistry had begun. Completely new ideas were brought up by chemists such as Walter Hieber, Egon Wiberg and Ernst Otto Fischer at Munich, Wilhelm Klemm and Harald Schäfer at Münster, Oskar Glemser at Göttingen, or Karl Ziegler and Günter Wilke at the Max-Planck Institute at Mülheim, and these ideas were eagerly accepted by numerous students. As a consequence, a new chair of Inorganic Chemistry was established at Würzburg in 1965 whereas at Zaragoza a chair of Inorganic Chemistry existed already since 1895.

But the parallel lines between the chemistry departments at both universities became rather close when Professor Rafael Usón was appointed Professor of Inorganic Chemistry and Head of Department at Zaragoza in 1967. After finishing his doctorate studies, Professor Usón spent two years from 1950 to 1952 at the University of Munich working in the laboratories of Professor Egon Wiberg. At the same time, Professor Max Schmidt, who became the first Professor of Inorganic Chemistry and Head of the Inorganic Institute at Würzburg in 1965, did his Ph. D. with Professor Wiberg also at Munich and this fact illustrates quite nicely that inorganic chemistry at Zaragoza and Würzburg has common roots. Due to the strong personalities of Rafael Usón and Max Schmidt, inorganic chemistry became an attractive subject at both places with the consequence that research developed on a broad basis including a direction which was quite new in the 1960s and very challenging indeed. This new direction was *organometallic chemistry* and it

should be emphasized that, due to the activity and the visions of Rafael Usón and Max Schmidt, it got a home both at Zaragoza and at Würzburg. In Spain, Zaragoza became really *the* center of organometallic chemistry and therefore it is not by chance that I consider, at least since my first visit in 1985, Zaragoza to be my second scientific home.

My own fascination for organometallic chemistry, however, and my contacts to Zaragoza go further back. You learnt in the laudatio that I started my studies at the University of Jena in 1952 and continued at the Technical University of Munich in 1958. At Jena I worked with Franz Hein (a scientific "grand-son" of Alfred Werner, the founder of coordination chemistry) and at Munich with Ernst Otto Fischer. Both scientists belong to the discoverers of the so-called "sandwich complexes," although Franz Hein at his time (before 1950) did not realize the absolutely new type of structure which the compounds isolated in his laboratory have. Ernst Otto Fischer (26 years younger than Franz Hein) had a clear inspiration and it was his creativity, together with that of his competitor Geoffroy Wilkinson at London, that brought organometallic chemistry in less than a decade from almost point zero to the top of the scientific interests. Ernst Otto Fischer, who received the Nobel price together with Wilkinson in 1973, was a highly demanding, but very inspiring supervisor and I still think with great respect and admiration of him.

But it were not only the personalities of Franz Hein and Ernst Otto Fischer which fascinated me and made me a strong companion in this field. As a student, I was mainly interested both in coordination chemistry and in organic chemistry and before finishing my undergraduate studies I came in a conflict to decide in which area I should work for the Diploma and the Ph. D. thesis. Organometallic chemistry apparently offered a compromise since on one hand organometallic compounds of the elements, named the transition-metals, are relatives of the well-known "Werner-type" coordination compounds and on the other hand the species bonded to the metal (the so-called ligands) mostly are organic molecules. Therefore, organometallic chemistry can be considered to form a bridge between the classical disciplines of organic and inorganic chemistry and if I am sometimes asked by people, who are non-familiar with scientific terms, what I am doing my answer is "I am building bridges."

This statement is also correct if I report more precisely about the subjects my research group investigated in the last 35 years and which we are studying at present. In the thesis for my "Habilitation" (a barrier which has to be passed at German universities in order to become a professor) I mainly studied the kinetics of substitution reactions of organometallic compounds and thus worked in a field being at the borderline between preparative and physical chemistry. Therefore, in the habilitation I built a bridge between these two research disciplines. After I accepted the call to Zurich and founded a new research team, we became more interested in synthesis and were able to isolate the first representatives of a completely novel type of sandwich complexes, called "triple-decker sandwiches." In these compounds, a five-membered ring of carbon atoms behaves as a bridging unit between two metal atoms and this bonding capability of the ring was not only new but also absolutely unexpected. Later at Würzburg, we extended this work to other bridging moieties derived from hydrocarbons, halogens or carboxylic acids and following this route prepared compounds containing even three different metal atoms. Most recently, we could confirm — again for the first time — that organophosphorus compounds, for decades considered to be typical terminal (that means non-bridging) ligands, are building bridges between two electron-rich transition-metal atoms. This result will be highlighted in a review article published by a well-known French scientist quite soon.

As mentioned above, I have not only a long-standing interest in organometallic chemistry but also long-standing contacts to the organometallic community in Spain. It was during the International Conference on Organometallic Chemistry at Atlanta in 1983 that I first met Professor Luis Oro and it took only a very short period of time to find out that regarding our research we had a variety of common goals. We both were convinced that to exchange students and to start a cooperation would be of mutual benefit. One year later, Miguel Ángel Esteruelas (now a professor titular at the University of Zaragoza) joint my research group and in 1986 Uwe Meyer was the first of my Ph. D. students who stayed at Zaragoza for some months. Since then, about ten young scientists from Aragón came to Würzburg and nearly the same number of students from my Alma mater went to Zaragoza to collaborate with Professor Oro, Doctor Esteruelas and their groups. From

1986 up to now, we published 24 scientific papers together and I am convinced there will be some more. Initiated by the links between my laboratory and the groups at Zaragoza, also several young organometallic chemists from Oviedo, Murcia, Valencia and Sevilla came to Würzburg and the exchange equally proceeded in the reverse direction. By this way, bridges both on a personal and a scientific level were built and I am especially happy that even two marriages resulted.

I had good fortune in many parts of my life. My parents (both without an academic background) supported me in a wonderful way and the same is true for my teachers at the primary school and the gymnasium. The professors, who taught and supervised me at the university, developed my interest in basic research and convinced me to stay in academia. After I started my own research, I was lucky from the very beginning to get excellent students from Germany as well as from abroad. They created an international and inspiring atmosphere in my laboratories and I am convinced that this was extremely important for the success of our studies. In the last 34 years, 110 young chemists working under my supervision received a Ph. D. degree, and while the majority started a career in industry, I am very proud that five of them got a professorial position at a German or foreign university.

I am not only extremely grateful to my family (first of all to my wife), my teachers and my coworkers but also to those institutions which financially supported our investigations. Due to the support and the encouragement, that I received mainly from the German National Science Foundation now for 36 years, I had the great privilege to do basic research without being forced that our results had to find applications in industry immediately. We were of course not blind and did not refuse the collaboration with some of the big chemical companies but despite the granting of twelve joint patents my main concern was to keep independent. I am aware that presently, in many countries wordwide, it is rather difficult getting support for non-applied research but I hope that politicians, managers and administrators will recognize that without fundamental studies the further development of science *and* technology would not be as bright as it should.

The last bridge to be built is directed into the future. I hope that despite the temptations arising from the so-called "new technologies" and the various money-making branches the challenge to study science and to do basic research will remain. I am quite optimistic that young people in Germany and in Spain will find their professional love in chemistry and I would like to remind them what the British Prime Minister Winston Churchill once said that "going from failure to failure without any loss of enthusiasm" is the main source of success. I am also rather optimistic that the cooperations between Spanish and German scientists will be further developed and that new personal and scientific contacts will be created. I would be very pleased, indeed, if I could support those contacts also in the future. I am enthusiastic about this idea in particular since it might give me the opportunity not only to return to Spain but especially to this wonderful city of Zaragoza. It would be a great pleasure for me to stay again in *apartamento* B in the Pedro Cerbuna guest house and, together with my hosts and friends, to discover some new *tapas* bars.

Finally, I would like to emphasize that it is a great honour for me to be awarded with the title "Doctor Honoris Causa" by this famous university. I am most grateful to you, Excelentísimo Señor Rector Magnifico, and to all people who were involved in the ceremony and supported the nomination. Thank you so much, Professor Oro, for the extensive and virtuous laudatio and for your friendship all over the years.

Muchas gracias.

Helmut Werner