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Torsten Teorell, the Teacher and Researcher

Address of Welcome

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Dear Ann and Eva, dear all Torsten Teorell's colleagues and friends.

We have gathered for this memorial symposium to remind us of Torsten Teorell's scientific achievement. Let us rather say that we have gathered in grateful remembrance of what Teorell meant to students of all levels within the medical faculty of Uppsala as a teacher, researcher and friend during more than half a century of busy activity and for each and every one of us as it relates to our own development.

The national and international research community will keep Teorell's memory alive today and for many years to come by referring to his still valid theories and methods. At this symposium - arranged by the oldest research member, Karl-Johan Öbrink - colleagues are presenting some of those research themes that Teorell initiated. We shall review and generally discuss Teorell's scientific contributions. We are particularly pleased that his daughter Eva will give us a very close personal view of his creativity.

When we gathered during the summer of 1980 for a Symposium on Ion and Water Movements in Membranes (1) to celebrate the then 75 year old Teorell, he himself contributed actively with an elegant review. At that time I had the opportunity as Rector (President) of the University to honour my teacher as one of the University's internationally most renowned researchers during the scientifically thriving period following World War II. Today, I wish to let Teorell himself elucidate his own achievements as a most vital and innovative scientist who in 1940 initiated a 30 year Headship of the Physiological Institution, a particularly flourishing period of the old building known as the Regnellianum.

In Teorell's obituary in August 1992, we could cite from his teacher Ejnar Hammarsten's expert opinion, presented when in 1938 Teorell applied for, was called to and received the appointment as Associate Professor of Medical Chemistry in Uppsala, the following prophetic words:

"A combination of theoretic brilliance and particularly great technical skill are characteristics of Teorell. Always prepared to use numerous, simultaneously applied, methods, partly developed by himself, he gives a multifacetted illustration of each problem. His solid and diverse approach in an increasingly obvious way has aimed at demonstrating the importance of electric effects on cell processes with regard to generation of information and magnitude, capacity, speed, location and orientation of various cell functions".

When Teorell later as a teacher of medical chemistry applied for and was appointed Professor of Physiology, as expected, this did not occur without a struggle. Academic quarrels as a rule are not scientifically promoting and the petitions submitted are hardly constructive. However, this time I have found an exception which includes many correct predictions of scientific developments giving a picture of Teorell as a scientist and scholar with which we, as his later colleagues, can agree without reservation. Most of you are familiar with that background. Three prominent physiologists did not wish to nominate Teorell for the position, while the fourth, a pharmacologist, put him in the first place. However, even the three physiologists indicated his exceptional qualifications as a primarily biologically and physico-chemically oriented researcher, but considered his expertise to lie outside the area of the subject of physiology.

In one petition Teorell himself states: "Early on, my main interest was directed towards a major physiological problem, i.e. the mechanism of hydrochloric acid secretion in the stomach. In order to accomplish a profound scientific attack on this problem, I made time consuming preparations designing suitable analytical methods. For the same purpose, in 1930, I undertook an educational trip to a reputable physiologic laboratory in London, because the necessary surgical technique in animals for work on surviving organs could not be studied at any Swedish institution. The result of these joint efforts was a medical thesis in 1933 which was of a physiological nature. This work was awarded the "laudable" grade by the medical faculty at the Karolinska Institute. The mechanism of hydrochloric acid generation remained unexplained, but a number of other related questions received renewed elucidation. While working on these physiological problems, the opinion grew increasingly stronger that a researcher who wishes to devote himself to any secretion problems in the body must have fundamental knowledge in basic science, e.g. chemistry and especially physical chemistry, of greater depth than what current physiological education provides. Therefore, over several years, to the best of my ability I tried to acquire increased knowledge in these areas. My method has largely included utilization of suitable results from my medical

thesis and elaboration on these in a physico-chemical direction. In this way many publications have been accomplished which deal with diffusion problems and ion distribution. In spite of their physico-chemical background, these works are intimately connected with physiology. They all originate from physiological questions and are intended to be connected to such problems. As this knowledge has increased, quite naturally the involved field of vision has widened. The physiological secretion problems have been found to be parts of a more general problem complex which includes tissue and cell permeability and the related bio-electricity. Against this background one should view the "paraphysiologic" (Lundsgaard) publications of recent years which deal with characteristics and electric potentials of cell membranes and surfaces. This is true also for my visit to Cambridge in 1937 to study surface chemistry. Thus I must conclude that my development and my aims have not directed me away from physiology. On the contrary, my intentions have been to undertake physiological research in the most profound interpretation of this area using methods which sooner or later must become more commonly utilized".

Today, the importance of Teorell's physical and chemical basic knowledge in cell biology to explain life processes is obvious and has made him a pioneer within modern physiology - or integrated cell and molecular biology as this field is referred to today in the United States. It is an honour to our medical faculty that this was realized already in January 1940, when Teorell was considered the most suitable candidate for this prominent position. A special report by Arne Tiselius contributed significantly to this. In this statement he included opinions which agree completely with the impression that we colleagues had of Teorell as our teacher, scholar and researcher. I would wish to quote the following from Tiselius' report.

"A profound knowledge of those components of physical chemistry that are particularly important for physiology, as demonstrated by Teorell, seems to me to be scientifically fundamental to the interested physiologist and extremely desirable as something which will become a necessity in the not too distant future".

There are also other opinions expressed in Tiselius' report which particularly well represent the picture of the enthusiastic , creative teacher we all knew at the Regnellianum. Teorell's remarkable printed discussion at an international symposium is commented upon by Tiselius in the following way. "Teorell's exceptional ability to contribute invaluably to discussions at lectures, symposia and seminars and his creativity, ability to rapidly grasp new concepts and fast moving mind are particularly obvious".

Certainly, a doctoral candidate in Teorell's department of physiology who might have lost his track among the many research problems, might have

wanted to receive a more rigid and structured guidance instead of a wealth of ideas. However, once the work was finished, most of us were extremely grateful to Teorell for his stimulating comments and for his confidence in the individual to allow him to run his study himself.

I myself experienced an example of Teorell's important but sudden appearance in my work on my doctoral thesis. It became clear to me that the term diffusion respiration did not describe the process of gas transport correctly and did not explain the alveolar build up of carbon dioxide during apnoea. Teorell immediately led me to the correct solution through his own profound knowledge of diffusion of molecules against a convection gas flow. Dealing with gases he directed me to Hertz' early works and formulas. This gave my medical thesis (2) a basic scientific background.

Certainly, some less rigidly controlled doctoral candidates sometimes were lost for a considerable time, but all of us remember the stimulating discussions at the lunch table with Teorell's encouragement and strong belief in independent and serious research activity which sooner or later would always result in rewarding personal satisfaction and new important tasks. He had an unclouded and optimistic view of the importance of research and its value in the 1930s and during the following years of World War II, at a time not particularly promising for the labour market. Surely, he was right in this respect also.

It is to the merit of Teorell and his most carefully selected collaborators' that during the time immediately after World War II our physiological institution developed into the foremost unit for education of researchers at the Uppsala School of Medicine. From his years in Stockholm, Teorell also brought great interest in basic science education. Popular publications on the application of basic science to biological problems bear clear witness to its importance. In these publications he revealed a significant educational and stylistic ability.

I myself took part in one of Teorell's earliest fundamental courses at the beginning of the 1940s. He lectured enthusiastically to the attentive audience in a most fascinating way about cardiovascular physiology. His background was his own experimental investigations of the isolated heart-lung preparation, but the peripheral and central regulation mechanisms of the intact animal were never excluded. Some thought perhaps that his problem-oriented education did not provide the simple and rigid ABC one might have desired, but most were stimulated to independent thinking.

In recent years we did not see Teorell so often in basic education as his time was more and more involved not with administration but with his own research. Professor Teorell was diligently working late at night in his own laboratory. His own spirit influenced the institution and its

enthusiastic staff of researchers and teachers. As a consequence, there was never any difficulty in recruiting new research students.

Finally, I once more wish to stress that Teorell as a teacher, scholar and researcher not only provided us with a scientific role model. His entire friendly personality provided a humane example and through Teorell the hierarchic etiquette of old times underwent significant changes. Teorell was a most stimulating scientist and man.

REFERENCES

(1) Symposium on Ion and Water Movements in Membranes. Upsala J Med Sci 85:193-342, 1980.

(2) Holmdahl, M H:son: Pulmonary Uptake of Oxygen, Acid-Base Metabolism and Circulation during Prolonged Apnea. Acta Chir Scand, Suppl. 212, 1-128, 1956.