

The scientific legacy of Howard Vincent Malmstadt [☆]

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Abstract

Howard Malmstadt was a true giant of Analytical Chemistry and clearly one of the most influential analytical chemists of the last 50 years. Howard, through his own work and that of his students (first generation) and their students (second generation) and their students' students (third generation) changed the course of Analytical Chemistry. His research interests were broad and ranged from analytical solution chemistry (titrimetry and reaction rates) and electrochemistry to atomic and molecular spectroscopy, chemical instrumentation, clinical chemistry and automation. Howard was also one of the most innovative and influential educators of our time. He changed forever the analytical curriculum through his many books on *Electronics for Scientists*, most written in conjunction with Chris Enke and Stan Crouch. Their texts and short courses went from pioneering the application of tube-based analog electronics (servo systems and operational amplifiers) in scientific measurements to the impact that integrated circuits and digital electronics would have on laboratory measurements. He strongly believed in the importance of "hands-on" in education. To this end, he expended considerable personal effort and time to see not only the development and commercialization of an effective laboratory infrastructure to support education in analog and digital electronics, but also oversaw the development of modular instrumentation for spectroscopy. Over the years he received many awards from the Analytical Chemistry community for his outstanding efforts and contributions to teaching and research. Many of Howard's students went on into academia. They and their students now represent the ongoing legacy for analytical chemistry that evolved from Howard's laboratory at Illinois. A remarkable diversity of research programs are underway in their laboratories. Topics range from atomic, laser, mass, and Raman spectroscopy to detection technology, analytical education, micro-fabricated instrumentation, and intercellular analytical measurements.

Keywords: Howard V. Malmstadt; Chemical instrumentation; Chemical education

1. Introduction

At the Pittsburgh Conference held in Chicago, Illinois in March of 2004, a symposium was held in honor of Howard V. Malmstadt. The symposium was entitled "Howard V. Malmstadt: His Ongoing Legacy for Analytical Chemistry". Planning for the symposium was well underway a year earlier, in March of 2003, with the full intent that Howard would be present at the symposium. Unfortunately, Howard passed away on July 7, 2003 in Hawaii.

Howard Malmstadt had that hard-to-define component of leadership that fostered independence, creativity and great enthu-

siasm in those that worked with him and many truly innovative research ideas and papers emanated from his laboratory at the University of Illinois. Through his own work and that of his students (first generation), their students (second generation) and ongoing generations, the course of Analytical Chemistry was changed. He was a true giant of Analytical Chemistry and clearly one of the most influential analytical chemists of the last 50 years.

In this paper (based on a presentation at the symposium for Howard [1]) some highlights of Howard's career will be presented along with an outline of the legacy for Analytical Chemistry that has evolved from the research of the first and ongoing generations that make up the Malmstadt family of students.

2. The beginning (Wisconsin and the Navy)

First, a brief look at the past. The scientific family tree for Howard V. Malmstadt is shown in Fig. 1. The tree extends back

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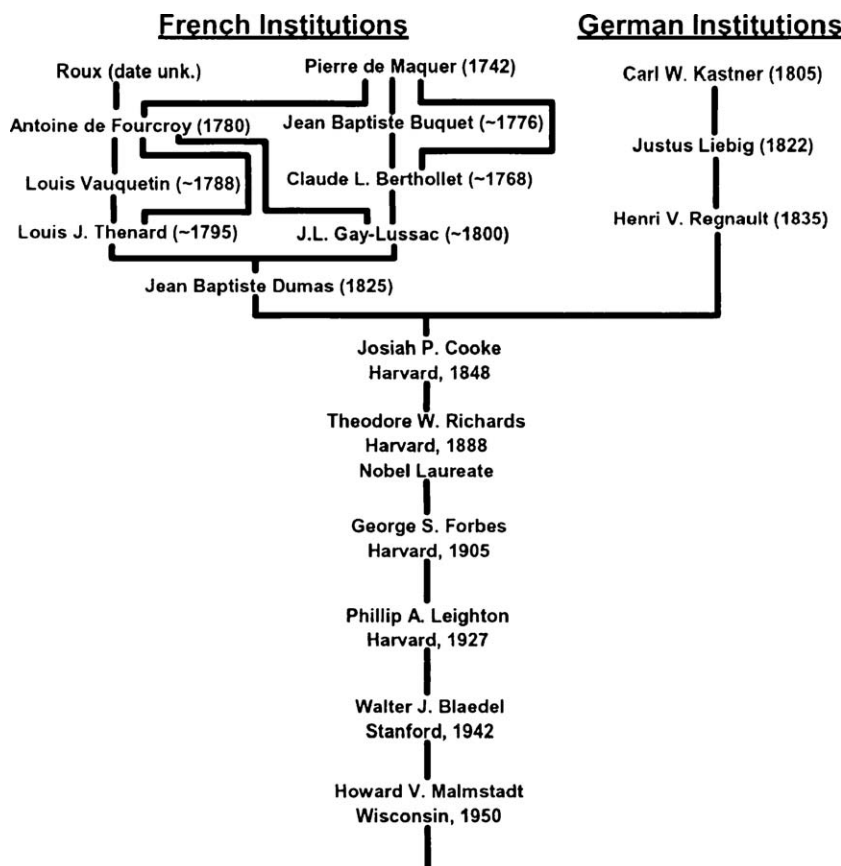


Fig. 1. Historical scientific family tree for Howard V. Malmstadt.

through T.W. Richards (Harvard University), to both French and German institutions. Richards, regarded by many as the first Analytical Chemist in North America, received the Nobel Prize for his accurate determinations of atomic weights. Brief accounts of his research and that of Vauquelin, Thenard, Berthollet, Liebig, and Guy-Lussac can be found in reference [2] along with images of these scientists as they have appeared on postage stamps.

Howard attended the University of Wisconsin, Madison for both his undergraduate and graduate degrees. However, this beginning to his scientific career was interrupted by World War II. After graduation with his undergraduate degree he was

commissioned in the U.S. Navy. He attended navel electronics and radar schools and served, from 1944 to 1945, as a navy lieutenant (radar officer) on a destroyer in the Pacific Fleet. Upon returning, he was supervisor for the Department of Electronic Fundamentals at the Naval Radar School on Treasure Island, California.

As a result of this military service during W.W. II, he became highly trained in the state-of-the-art electronics for the era. This expertise that he gained in electronics provided him with unique insight into the impact that the development of modern electronics would have on how scientific measurements would be carried out. In many ways this experience set the

HIGH-FREQUENCY TITRATIONS

A Study of Instruments

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High-frequency titrimeters that measure frequency changes during the course of a titration are described. These instruments are stable, sensitive, easy and convenient to use, and suitable for differential titrations. Titration curves for acid-base, precipitation, soluble complex, and oxidation-reduction reactions are presented. A mechanism to explain observed frequency changes is discussed.

Fig. 2. Abstract for Malmstadt PhD research paper (Anal. Chem. 22 (1950) 734–742).

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