

Giants in Sensing: A Virtual Issue to Celebrate Five Years of ACS Sensors



Cite This: *ACS Sens.* 2020, 5, 1249–1250



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As *ACS Sensors* is celebrating its first five years in publication, we want to take this opportunity to honor researchers who have been central in shaping the field. Together with *Analytical Chemistry* and *Journal of the American Chemical Society*, we present a **virtual issue** featuring the Giants in Sensing. To most scientists, chemical and biological sensing is a thoroughly modern discipline. It is unashamedly interdisciplinary, marrying fundamental insights and the foundations of analytical chemistry, state-of-the-art materials science, bioengineering, electrochemistry, optics, biology, and clinical and environmental chemistry. It addresses important measurement science challenges that face us today. This is what motivates many of us to contribute to this important field.

It would be erroneous, however, to think that sensor science is all flashy and new. Most of what we do today has been strongly influenced by the great thinkers who came before us, and who changed the world in significant ways. Over 100 years ago, Fritz Haber—otherwise known for artificial ammonia fixation—together with Zygmunt Klemensiewicz introduced the glass electrode for measuring pH. Partly thanks to Arnold Beckman and George Eisenman, the pH probe is ubiquitous today, and in many ways, the quintessential chemical sensor, directly translating chemical information into an electrical signal. For other ion sensors, James Ross, Wilhelm Simon, Erno Pungor, Richard Buck, Erno Pretsch, and others are credited with the development and commercialization of ion-selective electrodes. Within a decade, the field went from initial fundamental discovery to the realization of clinical analyzers for the fully automated detection of blood electrolytes with electrochemical sensors. Those instruments performed so well that they rapidly displaced the prevalent technology at the time, flame photometry.

Amperometric oxygen sensors were developed by Leland Clark in the 1950s, just to show that his blood oxygenation apparatus actually worked. The key idea was to use a gas permeable membrane to chemically protect the platinum electrode from the bloodstream, while allowing mass transport limited currents that stabilized the sensor readout. While today optical sensors (Dietrich Lübbbers) have become more established for oxygen sensing (also thanks to Otto Wolfbeis, and later Ingo Klimant; both are represented in this virtual issue), Clark's oxygen probe served as the technological basis for the glucose biosensor, which he also invented by embedding a glucose oxidase enzyme layer in said membrane. This sparked enormous research and commercial activity, with names such as “Jerry” Guilbault, Anthony Turner, Joseph

Wang (featured in this issue), George Wilson, and Adam Heller still ringing in the air when thinking about this field.

With chemically selective sensing using fluorescent probes, Tony James (represented also) and Seiji Shinkai have achieved the chemically selective recognition of glucose with diboronic acid receptors, which has made its way into the first FDA-approved implantable sensor that can monitor glucose continuously for months. For imaging intracellular calcium, one must credit Roger Tsien who synthesized molecules such as Fura-2 with just the right balance of affinity, selectivity, kinetic lability, and ratiometric spectral properties to achieve real-time calcium video imaging in cells. While this was a tremendous contribution, he is better known for his work on Green Fluorescent Protein (GFP), a work of enormous influence in the field of biology. Indeed, GFP allows one to visualize the expression of genes in living cells.

The names mentioned above are just a few among the giants in sensing whose contributions have paved the way for the tools and the way of thinking that make our modern way of work possible.

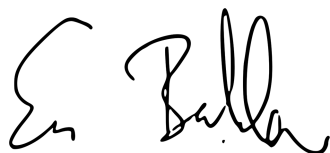
In putting together this virtual issue, we included some 50 papers from influential sensing researchers who contributed in at least one of the three journals mentioned above, in the preceding five years. As such, some of the foundations historically laid by giants earlier on needed to be mentioned above. Our list is not comprehensive, in part because the three journals do not capture all the global sensing activity. In fact, much work is done by research companies, and many influential researchers are no longer active in the current time period. Within these constraints, and necessarily omitting other significant researchers, we tried our best to highlight and honor researchers who have done important, influential work in the field of chemical and biological sensing.


Please go through the collection of papers in this virtual issue, read these excellent articles, and be sure to remember their names and those that came before when you write your next publication. It is humbling to know that we are all standing on the shoulders of giants.

Received: April 29, 2020

Published: May 12, 2020






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Notes

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