CHIMIA **2005**, *59*, No. 5

EDITORIAL

‘Biosensors: Philosopher’s Stone or Fool’s Gold?’

This was the catchy title of a the programme at Pittsburgh Conference 1991. The title reflects how uncertain forecasts of the development of the sensor market are. This is due partly to the complexity of the sensor and bioassay market, and, partly, to the long time it takes products to reach the market.

In 1991, J.S. Schultz described biosensors as “refined modern equivalents to the caged canary used in coal mines to warn miners of dangerous collections of mine gas”. This vividly describes the fundamental reason for developing chemical sensors and bioassays: to find ways of being warned immediately if there is a specific chemical emission or a change in the complex composition of a composite source or specimen. Distinguishing between false and genuine alarms is a classic goal in information technology. Therefore, ‘chemical information technology’ was used as another name for this field of research involving the development of chemical sensors and bioassays.

The papers in this issue reflect the complexity of ‘sensor and bioassay research’ and the manifold domains of research involved. What they have in common is the principle of a molecular interaction between at least two molecules. This, however, is not the entire story. The chemical interaction must be translated into a signal that correlates with the active molality of the analyte in the specimen. On the scientific level, the chemical interactions are elucidated and the sensor response is approximated using a theoretical model. A typical example of this approach is the paper by D. Baurecht *et al.* In a more empirical procedure, the analytical characterization of the sensor and the bioassay involves the definition of parameters, such as the detection limit, the sensitivity of the calibration function, the discrimination of other compounds in a complex matrix, and so on. These parameters are evaluated in order to describe the analytical technique on the basis of a reliable dataset.

Sensor developments at CCS have shown that sensors are indeed able to support or even replace the human nose and tongue by a much more sensitive reception of dangerous emissions. This was the topic of a public talk by U. Spichiger on the occasion of the 150th Anniversary of ETH Zurich. However, during recent years, developments in sensor and bioassay research have tended to be more in the domain of bioassays, especially for the identification of DNA patterns, and there has been less interest in classical chemical sensors.

Chemical sensors have been used on a daily basis in medical technology for at least 30 years. Applications in space technology reported by I. Walther *et al.* have also proved worthwhile. Nevertheless, for general applications the lack of correlation between chemical-sensor and biosensors data and so-called ‘reference methods’ has become evident. It is a fundamental truth that classical analytical procedures do not report the identical quantity as chemical sensors and bioassays. Therefore the International Federation of Clinical Chemistry (IFCC) has published recommendations on how to transform and correct results of blood glucose measured by different analytical methods in order to report comparable results. Correction factors on the basis of an average of a number of ‘reference specimens’ are recommended. The procedure tends, however, to treat all ‘non-reference specimens’ as outliers. Therefore, it is necessary to develop and install primary standard methods to which devices on the market and quantities such as *molality* and *active molality* defined by IUPAC can be traced back.

Start-up enterprises frequently suffer from the drawback of being unable to refer the results of sensors and bioassays developed in-house to an independent primary analytical procedure. How else can anybody decide which analytical instrument and devices are right or wrong?

A previous volume, CHIMIA **1999**, vol. 53, was dedicated to ‘Chemical Sensor, Biosensor and Bioarray’ technology in Switzerland. However, research on chemical sensors and bioassays is a very specialized discipline where the international key researchers and centres working in this field are well known. This international focus of the discipline is reflected in this issue not only by the first block of eight invited publications, but also by the second block of abstracts presented at the Decennial of CCS, which celebrated the 10th Anniversary of CCS at Technopark Zurich on June 17–18, 2004.

Prof. Dr. Ursula E. Spichiger-Keller
Centre for Chemical Sensors and Chemical Information Technology (CCS), ETH Zürich

It is with great appreciation that the Editorial Board of CHIMIA warmly thanks the coordinating guest editor Prof. Dr. Ursula E. Spichiger-Keller acknowledging the enormous commitment and the interesting selection of authors and topics as well as the successful realization of the present issue on ‘Chemical Sensors and Bioassays’.