Preface

Sensors play an important role in man's investigation of himself and his physical, chemical and biological environment. Chemists and biochemists have made and used sensors for almost a century, i.e. since the early works of Kohlrausch (1) and Nernst (2) on two-electrode cell and ion-sensitive and redox electrodes, respectively. One of the most successful chemical sensors – a membrane glass electrode sensitive to activity of H^+ ions – was invented by Cremer (3) at the beginning of this century. Dropping mercury electrode has been used as an excellent electrochemical sensor since Heyrovský discovered polarography (4). These are only a few of many examples of important chemical sensors and principles used during decades in laboratory research, field monitoring and process monitoring and control, which clearly show that there is practically no experimental research field where physical, chemical or biochemical sensors are not used.

The explosion of research in the field of chemical and, especially, biochemical sensors in the last two decades is impressive. Many excellent books and specialized journals published in this period confirm the increased interest in investigation of sensors. The scientists, who thus far have been using sensors in their investigation only as a passive element, are changing the focus of their interest to the sensor/analyte interface, improving this interface in terms of sensitivity, selectivity, response time and stability, together with signal conversion or transduction. In this way, instead of the passive use of sensors, the scientists converted their interest into the active and systematic investigation of the sensing principles and functioning, design of new sensing devices and their application to investigate different complex samples. There are, of course, many reasons behind this increase of the interest in chemical and biochemical sensor development and applications. Only the most important ones are:

a) The demand for reliable, sensitive and target analyte selective information from our physical, chemical and biological environment has increased. This demand triggered the interest for investigation of the systems and devices, and more specifically surfaces where the chemical and biochemical information is sensed and converted into a measured analytical signal.

b) Technological advances, especially in microelectronics, material science, and instrument computerization enabled the acquisition of large amounts of data in a relatively very short time, and the natural way of taking full advantage of computerized systems was to develop chemical and biochemical sensors, computer comparable, able to detect and transmit for further processing large amounts of information about the investigated system. To extract information from large amounts of data collected by sensors new multivariate methods for data processing have been developed and a new discipline – chemometrics – resulted from this development.

c) Automation of industrial processes is achieved using the chain sensors – microelectronics – actuators. New sensors are giving more detailed information about the kinetics and equilibrium in chemical and biochemical reactors, which is subsequently used to control the process in each of its stages augmenting the productivity and improving the quality.

d) Increased concern for polluting the environment either by human negligence or overexploiting some old »dirty« industrial technologies, uncontrolled wastes, etc., led to development and applications of chemical and biochemical sensors for environmental pollution monitoring, which have to fulfill special requirements for field applications and measurements of different pollutants in complex samples of soil, water and air.

e) Total quality control of industrial processes and products sets higher and higher standards to be met, which also open a wide application for biosensors.

f) Biosensors in life sciences help to understand the functioning of systems within life species, including humans, discovering the very essence of life, sources of diseases, and preventing the spread of illnesses capable of decimating the human race. The nature offers a large amount of biochemical principles for desing of a »perfect« biosensor and many biosensors today in use are just imitating the natural biochemical reactions. The interaction between the field of basic biochemical and biological investigations and the field of biosensors investigation is very fruitful, because new principles of bioreactions help to design new class of biosensors, which in turn give new information on biochemical and biological functioning.

g) The increase of knowledge in general led to interdisciplinary approach in solving different problems. The barriers between different fields are falling down and scientists are more willing to bridge the gap between the most different research fields. The excitement in research of chemical and biochemical sensors is due to its interdisciplinarity, hardly found in any other field, where chemists, biochemists, physicists, chemical and biochemical engineers and technologists, electrical and mechanical engineers, biologists, doctors of medicine, mathematicians etc. are working together in development and applications of new chemical and biochemical sensors.

h) Commercial interest is also an important factor which stimulates research of sensors. This field is one of the fastest growing and sales of biosensors only on the U.S. market have been projected to be US$ 10^9 by the year 2000 according to EEC Report on Biosensors (1992). The largest market for chemical and biochemical sensors are clinical and health care applications, food industry, chemical and biochemical engineering process monitoring and control and environmental monitoring. Glucose determination in blood, as well as in sugar and syrup, alcohol determination in wines, penicillin in milk, biogenic amines as indicators of food freshness, pesticides, toxins and microbes determination in soil, water and food products, etc. are uncountable assays performed daily by many institutions around the world.

These are only some of the very convincing arguments and reasons which explain why the field of chemical and biochemical sensors research is so important today, although many of the principles used in chemical sensing were discovered 50 to 80 years ago.

In this issue of Food Technology and Biotechnology on Chemical and Biochemical Sensors there are some reviews together with some original scientific papers in order to give more or less representative cross-section of the field. In the reviews there might appear some overlapping of the covered subject. Nevertheless, even in such cases the authors' angles of view upon the field are different and reflect experience of scientists from several important world groups in this field.

This issue of Food Technology and Biotechnology on Chemical and Biochemical Sensors is published in a very difficult time for Croatia and Croatian science. Croatian science is struggling to reach the level of the pre-war period, and, therefore, this publishing project has several important goals. One is to show different principles of chemical and biochemical sensor operations, in order to stimulate their acceptance in different industrial applications, which is very important in the process of recuperation of the industrial power, partially destroyed during the war. The other important task, is to animate younger researchers for this exciting interdisciplinary field of investigation. Finally, through this international publishing project with international contributions Croatian science and scientists would like to show their conviction to belong to the world's scientific community where the frontiers, and political, ethnical and religious differences do not exist. Therefore, the Guest Editor and the Editorial Board thank very much indeed to all authors and referees who kindly contributed to make this special issue possible.

Due to technical reasons, all the contributions for the special issue of Food Technology and Biotechnology on Chemical and Biochemical Sensors are published in two separate volumes, A and B.

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