1989 Program

A.M.

9:00 **Registration and Coffee—Room 137, Chemistry-Physics Building**

9:30 **Welcome by President David P. Roselle, University of Kentucky, Room 139, Chemistry-Physics Building**

9:35 **Introductory Remarks**

9:40 **Garry A. Rechnitz, University of Delaware**

"Molecular Recognition Elements for Biosensor Design"

The needs of biotechnology and biomedicine require improved measurement devices for purposes of analysis, monitoring, and control, with specific applications in fermentation, antibody production, drug testing, and patient monitoring. Electrochemical biosensors provide a possible means of meeting such needs if the capabilities of such sensors can be extended to a wider range of biomolecules and more complex matrices. Several recent initiatives suggest that some new approaches to the development of potentiometric and amperometric biosensors may be effective for this purpose. Such initiatives for the development of novel biosensors require a synthesis of biological and analytical concepts. Possible strategies involve the use of chemoreceptor structures, immunoagents, and cellular materials from plant or animal sources.

10:40 **Break**

10:50 **Jerome S. Schultz, University of Pittsburgh**

"Optical Fiber Biosensors"

Recent advances in biosensor development have been made possible by utilizing optical wave guides which provide the potential for miniaturization of spectrophotometric analytical methods for very small samples and for the monitoring of biochemical analytes on-line. There are some inherent advantages to spectrophotometry, fluorometry and light scattering for analytical purposes because of the higher information content of optical domain compared to electrochemical phenomena. Thus, spectral features, i.e. absorption or fluorescence at selective frequencies, provide additional degrees of freedom to characterize and quantify a given analyte within a mixture of other substances. In addition, new developments in membranes, molecular biology and cellular biology have made possible a new generation of miniature biosensors which are sensitive (fiber optics), selective (bioreceptors), and protected from the environment (membranes).

We have utilized these technologies for the development of continuous biosensors which have immunoassay-like properties. Bioreceptors are entrapped within a miniature hollow dialysis fiber along with an appropriate fluorescently labeled analyte-analog. The extent of binding of the fluorescent analog to the bioreceptor is inversely related to the external analyte concentration, and is measured by an optical fiber based spectrofluorimeter. The system is "reagentless," in the sense that all the reactive components are conserved and no renewal of reagents are needed for each assay.

P.M.

12:15 **Lunch, Faculty Club (See enclosed card)**

1:15 **R. Mark Wightman, Indiana University**

"Detection of Neurotransmitters with Voltammetry"

Neurotransmitters are small molecules which are secreted by neurons to provide information to adjacent neurons. They provide the major route of communication between neurons in the brain. Some of these neurotransmitters such as dopamine, serotonin and norepinephrine are easily oxidized and thus can be detected by voltammetry. We have developed carbon fiber electrodes which have a radius of ~10μm which can be inserted into the brain for such measurements. The electrodes are coated with polymer films to reject electroactive species which are not neurotransmitters. In the brain of anesthetized rats dopamine has been detected at submicromolar levels and with subsecond time resolution. The measurements are sufficiently fast that the kinetics and mechanism of the factors which regulate dopamine concentration in the spaces between neurons can be determined. These techniques can be used to unravel the actions of various drugs on dopamine neurotransmission. The technique can also be combined with those used by electrophysiologists to correlate the chemical and electrical activity of the brain.

2:15 **Break**

2:30 **Lemuel B. Wingard, University of Pittsburgh**

"New Molecular Structures for Biosensors"

The development of biosensors that have unique advantages over alternative sensing schemes may require more innovative approaches for the design and fabrication of the biorecognition-transduction interface. Two such approaches being investigated in this laboratory and elsewhere are 1) the incorporation of neuroreceptor elements as components of biosensors and 2) the synthesis of molecular wires for direct electron transfer between the analyte and the electrode surface. Although several neuroreceptor systems will be described, the emphasis will be on our work in characterizing and cloning the gene for the two subunits of the GABA receptor and our subsequent strategy for eventual incorporation of this ion channel receptor in a biosensor configuration. Our work with flavin cofactors and electron transfer with the flavin or with glucose oxidase immobilized on an electrode surface also will be discussed.

3:30 **Informal Discussion, Room 137, Chemistry-Physics Building**

We encourage symposium participants, especially students, to take this opportunity to meet with the speakers.

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Fifteenth Annual Symposium on

Chemistry & Molecular Biology

established in the memory of
Anna S. Naff

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SPEAKERS

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Jerome S. Schultz
R. Mark Wightman
Lemuel B. Wingard

Monday, April 24, 1989
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