

SEAC Newsletter

Volume 3, No. 3, October 1986

Society for Electroanalytical Chemistry

PROGRAM FOR THE SYMPOSIUM ON "ELECTROCHEMISTRY IN PHARMACEUTICAL SCIENCES"

American **Pharmaceutical** Scientists National Meeting
November 5, 1986
Washington, D.C.

Dr. G.R. Padaanabhan (Ciba-Geigy Corp.) Introduction to "Symposium on Electrochemistry in Pharmaceutical Sciences"

Dr. P.T. Kissinger (Purdue University and Bioanalytical Systems) Overview: The Role of Electroanalytical Chemistry and Liquid Chromatography/Electrochemistry in the Pharmaceutical Sciences.

Dr. G. Dryhurst (Univ. Oklahoma) Electrochemistry in the Understanding of Biological Oxidation Processes.

Dr. P. Zuman (Clarkson Univ.) Reaction Mechanisms and Structural Effects.

Dr. D. Radzik (American Cyanamid) Applications of Liquid Chromatography/Electrochemistry in the Study of Aromatic Xenobiotic Metabolism.

Dr. P. Gutierrez (Univ. of Maryland) Electrochemistry and Electron Spin Resonance Spectroscopy of Quinone Containing Antitumor Agents.

Dr. R.M. Wightman (Indiana Univ.) In vivo Detection of Dopamine Release and Uptake with Voltammetry.

Dr. K. Bratin (Pfizer Inc.) Photochemical Derivatization for LCEC.

Dr. N. Bodor (Univ. of Florida) Redox Concepts in Novel Experimental Drug Delivery Systems.

Dr. W. Heineman (Univ. of Cincinnati) Electrochemical Enzyme Immunoassay

Dr. D. Hall (Lilly Research Labs) Electrochemical Synthesis of Pharmaceuticals

Dr. M. Brooks (Merck, Sharp & Dohme) Electrochemistry in Pharmaceutical Analysis

Dr. R. McCreery (Ohio State Univ.) Spectroelectrochemistry of Oxidation Products of Pharmaceuticals.

Reilley Award Winner BOB OSTERYOUNG

As announced in the June newsletter, the winner of the 1987 Reilley Award is Professor Robert Allen Osteryoung. Professor Osteryoung is being given this award for his ground-breaking work in the application of computers to electrochemistry, in the development of the highly successful class of techniques known as pulse polarography and his important investigations into electrochemistry in molten salts.

Professor Osteryoung received his Ph.D. from the University of Illinois under the direction of Professor Laitinen. Following his graduate work he joined Rensselaer Polytechnic Institute as an assistant professor. He left RPI as an associate professor in 1959 and proceeded to hold increasingly important positions in a variety of research laboratories, among them the **Atomics** International Division of North American Aviation, North American Aviation Science Center, California Institute of Technology and North American Rockwell Corporation. In 1968, he joined the faculty of Colorado State University as Professor and **Chairman**. In 1979, he moved to the State University of New York at Buffalo where he remains a Professor of Chemistry. He has held a number of prestigious positions as a leader in the field of electrochemistry and analytical chemistry. He has been the **chairman** of two Gordon Research Conferences; one on Electrochemistry and one on Fused Salts. He was the Chairman of the Division of Analytical Chemistry of the ACS in 1974-75 and has been quite active in the **Electrochemical** Society, being the Chairman of the Physical Electrochemical Division and a Divisional Editor of the Journal of the Electrochemical Society. He is an Elected fellow of the American Association for the **Advance-**



ment of Science and was the Program Chairman for the recent Electroanalytical Chemistry Surer Symposium held at the National Bureau of Standards in 1984.

Professor Osteryoung's accomplishments in electrochemistry have touched all who work in or near that field. He has contributed to the fundamental understanding of chemistry in molten salts and has developed much of the basic theory for a variety of mass transport and kinetics problems in interfacial electrochemistry. His applications of theory to the development of novel techniques have yielded extremely important results. Square wave voltametry developed by Professor Osteryoung and his colleague/wife, Professor Janet Osteryoung, is quickly being recognized as a very powerful technique for electroanalysis even in flowing streams and for the understanding of heterogeneous and homogeneous kinetics. Finally, Professor Osteryoung's boundless enthusiasm for the science of electrochemistry has helped inspire other workers in their endeavors in this important and timely discipline.

Bulletin Board

DR. HARRY O. FINKLEA is moving from Virginia Polytechnic Institute to West Virginia University in Morgantown. Telephone no. 304-293-3068.

DR. PETER VANYSEK was awarded a starter grant from the Society for Analytical Chemists of Pittsburgh. Congratulations!

It's a banner year for Buffalo! DR. JANET OSTERYOUNG has won the Garvan Medal, a 1987 ACS award sponsored by Olin Corporation. This award recognizes distinguished service to chemistry by women chemists who are U.S. citizens. The award will be presented in April 1987 during the 193rd ACS National Meeting in Denver.



Marcin Majda to Marry!



An inforaed source has advised the SEAC newsletter that Professor Karcin Majda is planning to marry on March 20, 1987. Dr. Majda will be entering into a marital collaboration with Professor Whaley, also of the University of California, Berkeley.

ANALYTICAL SUMMER INTERNSHIPS

Bob Osteryoung announces that the ACS Division of Analytical Chemistry will once again operate a program of 'Summer Internships', aimed at introducing talented undergraduates to the modern analytical chemistry area. Students chosen to participate in the program will be employed by industrial, government or academic laboratories, where they will carry out various phases of fundamental or applied research in the analytical area. Participating laboratories agree to hire one or more students during the summer. Applicants are screened and evaluated by the Professional Status Committee of the Analytical Chemistry Division, and those students most qualified have their applications and reference letters sent to several of the participating laboratories. These organizations then select those individuals they deem suited for their particular needs and, via the Professional Status Committee, make contact with the students. The Professional Status Committee acts as a broker, soliciting applications from both students and organizations willing to hire the students for the summer; salary and details of employment are between the organization and the student.

Ideally, to qualify for the program, students should be attending a four year college and be between their junior and senior years at the start of the summer of 1987 and have completed a course on Instrumental Analysis. We are also seeking applications from seniors graduating in 1987 who have specifically demonstrated their interest in analytical chemistry by applications to graduate school with the intention of majoring in that area. Graduate students in analytical chemistry will also be considered for the program.

For the 1986 Summer Intern Program, fifty-three completed student applications were received. Some of these were rejected on the basis of low grade point average, insufficient backgrounds in analytical chemistry, or rather restrictive geographic requirements, but efforts were made to place thirty-nine students. Nineteen organizations (industrial, government, and academic) initially indicated an interest in participating in the program. Of these, ten eventually placed one or more students, five were obliged to withdraw for budgetary reasons and four were simply unable to make contact with an appropriate student. The final results were that fourteen students were placed with ten different organizations. Not all of the students who received offers accepted, of course. A number had found positions on their own, or were otherwise occupied for the summer.

The main purpose of this communication is to ask those of you who are SEAC members to 1) consider participating in the program by agreeing to hire one or more students during the Summer of 1987 and 2) request those of you in the academic world to solicit your good undergraduates to apply to this program. THE DEADLINE FOR STUDENT APPLICATIONS WILL BE FEBRUARY 15, 1987.

More information regarding the program, as well as student applications forms, can be obtained from Dr. Robert A. Osteryoung, Chairman, Professional Status Committee, c/o Department of Chemistry, State University of New York, Buffalo, NY, 14214. Telephone: 716-831-3820.

THANKS!

CONTRIBUTIONS TO THE REILLEY AWARD ENDOWMENT FUND

I would like to acknowledge the kind donations of those who have contributed recently to the **Reilley Award Endowment** fund. Thanks to:

Richard Reiss	I.M. Kolthoff
Robert V. Dilts	Jerry Koontz
Chi-Woo Lee	Fred B. Haukridge
Thomas R. Edgway	Joseph B. Norris
John F. Evans	Herbert P. Silverman
Stephen G. Yeber	Karl Camman
Sam P. Perone	William R. Heineman

Persons or organizations **wishing** to contribute to the endowment fund should **make** their contributions payable to SEAC and submit them to:

Professor Larry Faulkner
SEAC Treasurer
c/o Dept. of Chemistry
University of Illinois
1209 W. California St.
Urbana, IL **61801**

Letters

RAPID SCANNING SPECTROELECTROCHEMISTRY

In the early **seventies**, Harrick Scientific received support **from electrochemists** at a number of universities to build Rapid Scanning Spectrometers following the design of Strojek, Gruver and Kuwana (Anal. **Chem.** 41, **481** (1969)).

Since then, there have been two basic design changes, **more** than fifty publications, and over three dozen **RSS's** in use. In **many** respects (speed, flexibility, etc.), the RSS outperforms instruments of other designs, and I think it is still basically a good approach. It is only due to our lack of marketing that there aren't any more in use.

You would like to know if there is sufficient interest to continue building these instruments. Currently, we have four complete units in stock which we can offer at a bargain price. If interested, please send for our data/reference sheet.

N.J. Harrick
PO Box 1288
Ossining, NY 10562

ELECTROANALYTICAL SYMPOSIUM IN BEIJING

This meeting will be held in association with the Second Beijing Conference and Exhibition on Instrumental Analysis (October 20-23, **1987**) and provides a possibility to combine this meeting with the Electrochemical

Society/Japanese Electrochemical Society (October **18-23**) joint meeting in Honolulu. It is proposed that the Beijing Electroanalytical Symposium be on the 23rd to permit **some** overlay between the two meetings. Details are sketchy at this point, but **more** information will be available from:

Professor Wang Erkang
Changchun Institute of Applied Chemistry

If you are interested in this meeting, please contact Pete Kissinger at BAS or Purdue. He is the organizer/coordinator for USA participation.

SOME PERSONAL RECOLLECTIONS OF MY EXPERIENCES IN ELECTROANALYTICAL CHEMISTRY

by Fred C. Anson

Ralph **Adams'** engaging personal account of the people and events that were helping to shape electroanalytical chemistry in the early fifties has prompted **me** to respond to the Editor's request for a short article describing some of the people and events that contributed to **my** interest in electroanalytical chemistry and those who practice it. **My** first electroanalytical **mentor** was Ernest H. Swift who introduced a naive young sophomore to the rigors of quantitative analysis and to the elegance of **coulometric** titrations and **amperometric** end points. I spent considerable time as an undergraduate pursuing **small** research projects in Prof. Swift's laboratory and when it **came time** to choose a graduate school I naturally talked with **him** about **my** interest in electroanalytical chemistry. As I recall, Prof. Swift **recommended** that I consider carefully joining the research groups of I.R. Kolthoff at **Minnesota, N.H. Furman** at Princeton and H.A. Laitinen at Illinois. The first edition of J.J. Lingane's book 'Electroanalytical Chemistry' had been published the previous year and had **impressed** Prof. Swift quite favorably. He said that it would also be well for **me** to consider going to Harvard to work with Lingane. Lingane's book appealed to **me** as did the thought of attending a hoary ivy league university in the east after four years at a west coast institute of Technology, so I boarded a Greyhound bus in California and rode it all the way to Boston.

The atmosphere in the Harvard-KIT environment in general, and in Lingane's group in particular, proved to be quite interesting and stimulating. Arnold Hartley and Ray Iwanoto were the senior Lingane students who taught three new group **members** (Don Davis, John Kennedy and **me**) what Prof. Lingane expected us to **accomplish**. There was also considerable interaction with the groups of Buck Rogers and Dave Hune at HIT and I remember **my** first encounter with a brilliant and cocky young **MIT** student named **Reinmuth**. He became good friends and spent many hours arguing about electroanalytical topics. Paul Delahay's book, 'New Instrumental **Methods** in Electrochemistry' had just **come** out and we all read it, reread it and helped each other through the more difficult parts.

Lingane's laboratories were housed in the oldest building in the Harvard chemistry department. The old wood cabinets contained original chemical **samples** purified by T.W. Richards and that conveyed a convincing feeling of what it must have been like to do chemical research in the first half of the century. The lack of air conditioning was annoying during **humid** weather but the lack of **modern instrumentation** was **more** difficult to aanaage. Prof. Lingane believed that the construction of one's own apparatus was invaluable training and we all received **ample** oportunites to be trained. The only pen and ink recorder available was that on the Sargent **Model XXI** Polarograph and the only oscilloscope was an old **DuMond X-Y model** that required an auxiliary time-base and was unbearably unstable. Me students eventually persuaded Prof. Lingane to purchase a general purpose recorder and **Istillrecall** the excitement with which we ail witnessed the arrival of the group's first Varian **G-10** strip chart recorder.

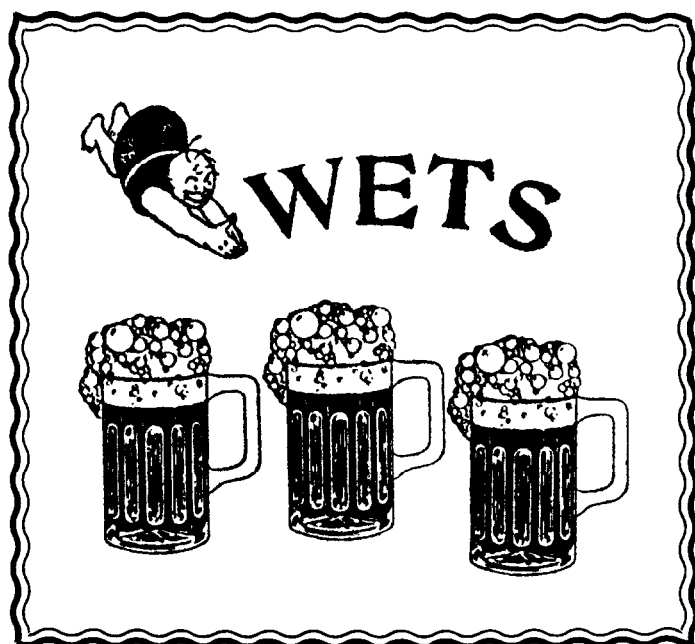
If **we** felt **somewhat** deprived in tens of equipment, the richness of the interactions with other students and colleagues more than **compensated**. Allen Bard joined Lingane's group a year later when his original intentions **were** thwarted by Harvard's decision not to retain a young inorganic **chemist** named Yilkinson. Al was a **spicey** addition to the group and subsequent discussions of research, the current literature and the future of **electroanalytical** chemistry benefited accordingly.

The first technical reeting **I** remember attending was the Pittsburgh Conference in 1955 which was held in Pittsburgh! A group of Harvard and **MIT** analytical students drove to Pittsburgh to attend the meeting. The **instrumentation** on display **was** stunning and **I'm** sure this experience **was** partly responsible for our efforts to persuade Prof. Lingane to add to his store of newer instruments.

In the **summer** of 1956, Prof. Lingane encouraged **me** to attend the Gordon Conference on Analytical **Chemistry** at New Hampton School in New **Hampshire**. It was a revelation for me. Almost all the "**famous**" electroanalytical **chemists** attended and the informal discussions were wonderful to witness and even, occasionally, to join. This experience was so rewarding that **I** have always regretted the lack of opportunities for **more** than a few graduate students to attend Gordon Conferences these days.

I was lucky enough to be completing **my** studies at Harvard at just the time that **Caltech** was seeking an Instructor to assist Professors Pauling and Davidson uith the **freshman** chemistry lectures and laboratory. **I** was delighted to be able to return to **my** alma **water** and **I** have been very fortunate in the co-workers who have spent **time** in the group over the years, **many** of whom have gone on to become prominent **members** of the electroanalytical **community**. **I** have taken considerable pride in the **accomplishments** of these former group **members**.

It has also been satisfying to see what has become of the **WESTERN ELECTROANALYTICAL THEORETICAL SOCIETY (WETS)** that flowed into existence because of a craving for more opportunities for **informal**, unstructured, uninhibited, computation-assisted discussions among electroanalytical chemists in the early sixties. The society first achieved this goal on the sand, at **SanClemente**, California, and the



results **were** so appealing (if slightly notorious) that the senior distinguished member of the founding group, Ralph (**'Buzz'**) Adams, was conissioned to approach the AAAS in an effort to institutionalize (and dignify) the discussions in the form of a Gordon Conference on **Electrochemistry**. As we all know, Buzz, ably assisted by Dick Buck, was successful; the first such conference held in 1964 at Santa Barbara, has been followed by 22 subsequent conferences.

The success of these yearly conferences reduced the **impetus** for subsequent discussions under the auspices of WETS although the origins and reputation of the Society continued to be recalled at informal METS gatherings. SEAC **seems** to be a natural successor to BETS that is ably serving the objectives of those who created WETS almost 25 years ago. I'm sure that Charlie Reilley, who attended the seminal San **Clemente** meeting, would agree and it is highly appropriate that an award bearing his name should have been established for administration by **SEAC**. It also seems fitting that the first four recipients of the Reilley award (Bard, **Adams, Anson, Osteryoung**) were all active participants in the identification and nurturing of the original objectives of **WETS**. It is very nice to see the field of electroanalytical chemistry, that **I** joined 32 years ago, continuing to thrive and attract growing numbers of truly talented young scientists. Professors Swift and Lingane steered **me** in the right direction three decades ago and **I** am pleased that both remain emeritus members of the **elec-**troanalytical community to whoa **I** can express **my** gratitude.

Fred C. Anson



Finances

THE TREASURER'S REPORT
Fiscal Year 1986
July 1, 1985 - June 30, 1986

In the year just ended, SEAC established its finances on a **much firmer** basis and **made** considerable progress toward its financial goals. The basic facts are revealed in the Balance Sheet and the income Statement presented below.

In its meeting last January, the Board of Directors established two policies with long-term financial **implications**. First, there was a decision to create an endowment to support the Reilly Award. SEAC has a **commitment** from Bioanalytical Systems inc. (BAS) to sponsor the Award for ten years by contributing the annual cash honoraria. Three years of this term have already passed, so the Board set a goal that an **endowment** large enough to support the Award be established within seven additional years. The Board acted toward this goal by transferring \$2000 from the Society's **Working Fund** into the **new Reilly Endowment**, by **mandating** that half of all collected 1986 dues be devoted to the **Endowment**, and by making arrangements to solicit specific contributions toward this fund from individuals and organizations. The Reilly Endowment grew to **\$3,496.96** by year's end: hence there was substantial progress toward the seven-year goal.

The second of the Board's actions with long-term **implications** was to establish a life membership option. The financial policy underlying it is essentially to ask each participating **member** to **make** a contribution, by **lump sum** or in five annual **payments**, sufficient to create an endowment capable of supporting the anticipated dues of the **member** indefinitely **from** endowment **income**. As contributions were received, they were collected into a life **Membership Endowment**, which had a balance of \$732.89 by the end of the fiscal year.

All of the Society's **remaining** cash resides in a Yorking Fund, from which operating expenses are **met**. At year end, its balance **was \$1,269.00**.

At present, all three asset accounts have their funds placed jointly in an interest-bearing checking account at the Lafayette National Bank, Lafayette, Indiana. All interest **income** is distributed on a prorata basis to the two **endowment** accounts. SEAC now has a large enough block of **endowment money** to justify its separate **placement** in a higher-yielding **investment**, and **recommendations** will be made to the Board at its next **meeting** that it authorize such action.

The **Income Statement** below gives a clear picture of the Society's sources of **income**, except perhaps for the category **labelled** Yorking Fund Contributions. This item **mainly includes two sizeable** donations toward specific operations. The Pittsburgh Conference assisted us by contributing **\$2,500.00** toward the expenses connected with the Reilly Award **Symposium**. Also in this accounting

category is the contribution of \$1000.00 that was **made** by BAS in sponsorship of the Reilly Award for 1986.

The expenses of the Society fall mainly in three categories. The largest concerns the Reilly Award and its **Symposium** at the Pittsburgh Conference. There are also significant costs associated with publishing the SEAC newsletter and with servicing the **membership** (which includes collecting dues). SEAC has benefitted in the past from contributions of **materials** and services **from** various **sympathetic** organizations, and we anticipate useful continuation of such support. However, SEAC will probably have to bear a larger fraction of the cost of publishing its newsletter in the coming year.

Dues collection for 1986 took place relatively later in the year because the dues policy was reviewed at the Board meeting in January. Beginning in 1987, we anticipate doing annual billing regularly on January 1.

If any of you have questions about SEAC finances, please feel free to contact **me** at **any time**.

Respectfully **submitted**,
Larry R. Faulkner, Treasurer
September, 1986

SEAC BALANCE SHEET As of June 30, 1986

<u>ASSET ACCOUNTS</u>	
Yorking Fund	\$1,269.00
Reilly Endowment	3,496.96
Life Membership Endowment	732.89

TOTAL ASSETS	\$5,498.85
<u>LIABILITY ACCOUNTS</u>	
Newsletter Payable	\$ 444.10
Membership Expense Payable	372.33

NET WORTH	\$4,682.42

SEAC INCOME STATEMENT FY 1986

<u>INCOME ITEMS</u>	<u>TOTALS FOR YEAR</u>
Interest	\$ 157.35
Endowment Contributions	500.00
Work Fund Contributions	3,510.00
Collected Dues	1,877.00
Life Dues Payments	800.00

TOTAL INCOME	\$6,844.35

<u>EXPENSE ITEMS</u>	<u>TOTALS FOR YEAR</u>
Symposium Expense	\$2,843.17
Reilly Award Expense	1,760.31
Membership Expense	385.33
Newsletter Expense	444.10
Pittsburgh Conference booth	160.00
Miscellaneous Expense	57.20

TOTAL EXPENSE	\$5,650.11

INCREASE IN NET WORTH	\$1,194.24

1987 Pittsburgh Conf Reilley Symposium

CHARLES N. REILLEY AWARD SYMPOSIUM
ON ELECTROANALYTICAL CHEMISTRY

Pittsburgh Conference: Wednesday afternoon, **March 11, 1987**

arranged by
Prof. G.S. Wilson
University of Arizona

INTRODUCTORY REMARKS - G.S. Wilson

INTRODUCTION OF PROF. R.A. OSTERYOUNG, C.N. REILLEY AWARDEE. P.T. Kissinger, **Bioanalytical Systems Inc.** and Dept. of Chemistry, Purdue University, W. Lafayette, IN 47906 (317-463-4527)

Award Address - HOW DO WE PULSE THEE? LET US COUNT THE WAYS. R.A. Osteryoung and J.G. Osteryoung, Dept. of Chemistry, State University New York, Buffalo, NY 14214 (716-831-3820)

VOLTAMETRIC INVESTIGATIONS OF SOLUTION ELECTRON TRANSFER REACTIONS. Dwans, A.G. G. Ilicenski, T. Matsue and D. G. Williams, Dept. of Chemistry, Univ. of Delaware, Newark, DE 19716

ELECTROCHEMISTRY IN LIQUID CRYSTALS. H.D. Abruna, R.D. Ilariani, J. White, and **M. Albarelli**, Dept. of Chemistry, Cornell Univ., Ithaca, NY 14853 (607-256-4720)

NEW ENZYME ELECTRODES. Y.J. **Albery**, Dept. of Chemistry, Imperial College, London, W 2AY, UK (011-44-1-589-5111, ext. 4508)

ELECTROCHEMICAL DETECTION IN IMMUNOASSAYS. W.U. de Alwis and **G.S. Wilson**, Dept. of Chemistry, Univ. Arizona, Tucson, AZ 85721 (602-621-6337)

1987 PITTSBURGH CONFERENCE
Electrochemistry Sessions
Presiders

(with thanks to Prof. J.F. Coetzee, Univ. of Pittsburgh)

Monday, March 9, 1987

Prof. R. A. Osteryoung
SUNY at Buffalo

Prof. **M.D.** Ryan
Marquette University

Tuesday, March 10, 1987

Prof. A. **Ewing**
Pennsylvania State Univ.

Prof. R.L. **McCreery**
Ohio State Univ.

Thursday, March 12, 1987

Prof. R.P. Buck
Univ. of North Carolina

Prof. **D.C.** Johnson
Iowa State University

MEASUREMENT OF HETEROGENEOUS AND HOMOGENEOUS KINETICS WITH FAST-SCAN CYCLIC VOLTAMETRY.

D. Wipf, **N. Wightman**, Indiana University

SQUARE WAVE VOLTAMMETRY IN THE INVESTIGATION OF ELECTRODE KINETICS.

W. Go, **J. O'Dea**, J. Osteryoung, SUNY Buffalo

ELECTROCHEMISTRY OF FERROCENE-SUBSTITUTED PHOSPHAZENES AND POLY PHOSPHAZENES.

A. Saraceno, A. **Ewing**, Penn State Univ.

STUDY OF THE DIRECT ELECTRON TRANSFER REACTIONS OF CYTOCHROME C AT SILVER ELECTRODES.

D. Reed, **F. Hawkridge**, Virginia Commonwealth Univ.

ELECTROCHEMICAL INVESTIGATION OF THE BIOLOGICAL DEGRADATION OF A PURINE DRUG: TUBERCIDIN-5-MONOPHOSPHATE.

T. Childers-Peterson, A. **Brajter-Toth**, Univ. Florida

ELECTROCHEMISTRY AND SPECTROELECTROCHEMISTRY OF IRON-PORPHYRIN NITROSOLS.

M. Ryan, **D. Feng**, I. Choi, **Marquette** Univ.

ANALYZING KINETIC CONTROL OF TWO ELECTRON HOMOGENEOUS ELECTROCATALYSIS.

J. **Rusling**, J. Arena, T. Connors, C. Shi, Univ. Connecticut

EFFECTS OF LIGAND REDUCTION ON ELECTROCATALYSIS OF THE REDUCTION OF CARBON DIOXIDE.

T. **Comeau**, R. Durand, Jr., Univ. Rhode Island

REACTION OF CARBON DIOXIDE WITH REDUCED PORPHYRIN LIGANDS.

D. Gangi, R. Durand, Jr., Univ. Rhode Island

EQUIVALENCE OF STAIRCASE AND LINEAR SCAN VOLTAMMETRIES.

M. Seralathan, R. Osteryoung, J. Osteryoung, SUNY Buffalo

SQUARE WAVE VOLTAMMETRY AT HYDRODYNAMIC ELECTRODES.

M. Wojciechowski, Univ. Maryland

ANODIC STRIPPING MICROANALYSIS WITH SQUARE WAVE VOLTAMMETRY AND CYLINDRICAL GRAPHITE FIBER ELECTRODES.

J. Balcerzak, **M.** Wojciechowski, Univ. Maryland

THE ANALYTICAL UTILITY OF MERCURY FILM ELECTRODES IN SQUARE WAVE VOLTAMMETRY.

M. Schreiner, J. Osteryoung, SUNY Buffalo

SQUARE WAVE VOLTAMMETRY OF MERCURY SOLUBLE METALS.

S. Kounaves, J. Osteryoung, SUNY Buffalo

CHEMICAL ANALYSIS OF SINGLE CELLS BY OPEN-TUBULAR LC WITH VOLTAMETRIC DETECTION

R. Kennedy, R. St. Claire III, J. Jorgenson, J. White, Univ. North Carolina

VOLTAMMETRY AT ULTRAMICROELECTRODES USING A COMPUTERIZED MULTI-TIME DOMAIN MEASUREMENT METHOD.

W. Thormann, J. Bixler, A. Bond, T. Mann, Univ. Arizona

ULTRA-SHALL CARBON-RING ELECTRODES: THE EFFECT OF SHIELDING GEOMETRY ON LIMITING CURRENT.

A. Ewing, R. Saraceno, Y. Kim, Penn State Univ.

INTRACELLULAR VOLTAMMETRY WITH ULTRA-SHALL CARBON-RING ELECTRODES.

Y. Kim, A. Ewing, R. Saraceno, Penn State Univ.

IN VIVO VOLTAMMETRY: PREPARATION OF ULTRAMICRO CARBON FIBER ELECTRODES AND THE APPLICATION IN THE STUDY OF ACUPUNCTURE ANALGESIA MECHANISM.

J. Deng, Z. Ge, L. Shen

EXAFS SPECTROELECTROCHEMISTRY OF COORDINATION COMPLEXES IN NON-AQUEOUS SOLUTIONS.

H. Dewald, W. Heineman, R. Elder, Univ. Cincinnati

SHALL SPECTROELECTROCHEMICAL PROBES BASED ON FIBER OPTICS: DEVELOPMENT AND INITIAL APPLICATION TO BIOCHEMICAL SYSTEMS.

D. VanDyke, H. Cheng, Smith Kline and French Laboratories

CAPILLARY ZONE ELECTROPHORESIS: ANALYSIS BY COMPUTER SIMULATION AND EXPERIMENTAL VALIDATION OF APPLICABILITY OF THE PLATE THEORY.

W. Thormann, R. Noshier, 1. Firestone, Univ. Arizona

CAPILLARY ISOELECTRIC FOCUSING: EFFECTS OF CAPILLARY GEOMETRY, ELECTRODE ASSEMBLY AND VOLTAGE GRADIENT.

W. Thormann, R. Noshier, M. Firestone, Univ. Arizona

CONTROLLED-GROWTH MERCURY DROP ELECTRODE.

K. Wong, Z. Kowalski, J. Osteryoung, R. Osteryoung, SUNY Buffalo

WAVELENGTH AND POWER DENSITY EFFECTS ON LASER ACTIVATION OF CARBON ELECTRODES.

R. McCreery, N. Poon, Jane McCreery, R. Bowling, Ohio State Univ.

LIQUIDLESS VOLTAMMETRY.

R. Reed, L. Geng, R. Murray, Univ. North Carolina

THE EFFECT OF NON-CONDUCTING SPECIES ON ELECTRICAL CONDUCTIVITY MEASUREMENTS.

K. Queeney, The Foxboro Company

NEW DEVELOPMENTS IN MICROCOULOMETER TECHNOLOGY.

W. Robinson, Y. Takahashi, Dohrmann Div. of Xertex

HYDROGEN CHLORIDE SATURATED DIMETHYLSULFOXIDE AS A PROTONATING SOLVENT FOR POLAROGRAPHIC ANALYSIS.

H. Doanquez, D. Gouzales-Arjona, E. Roldan, Illinois State Univ.

APPLICATION OF EXAFS SPECTROELECTROCHEMISTRY TO STRUCTURAL STUDIES OF ELECTROACTIVE SPECIES IMMOBILIZED ON POLYMER COATED ELECTRODES.

D. Caster, H. Dewald, R. Elder, W. Heineman, Univ. Cincinnati

FLUORESCENCE EMISSION AS A PROBE TO INVESTIGATE ELECTROCHEMICAL POLYMERIZATION PROCESS.

P. Kamat, Univ. Notre Dame

EFFECTIVE IMMOBILIZATION OF REDOX MEDIATORS IN A POLY VINYL ALCOHOL MATRIX BY USING GAMMA-IRRADIATION CROSS-LINKING.

C. Galiatsatos, J. Nark, W. Heineman, Univ. Cincinnati

INVESTIGATION OF ENZYME ELECTRODES AS POSSIBLE BIOSENSORS.

G. Barone III, C. Lunte, W. Heineman, Univ. Cincinnati

COMPUTER-CONTROLLED IN VIVO VOLTAMMETRY: SYNCHRONIZATION OF MEASUREMENTS WITH STIMULATED NEURONAL EVENTS.

W. Kuhr, R. Wightman, Indiana University

AMPEROMETRIC ENZYME MEMBRANE ELECTRODES WITH CONDUCTING ORGANIC SALTS AS ELECTRODE MATERIALS.

K. McKenna, A. Brajter-Toth, Univ. Florida

STABLE POLYMER FILM ELECTRODES FOR METAL MICROPARTICLE ELECTRODEPOSITION WITH ELECTROCATALYTIC APPLICATIONS.

D. Bartak, K. Kost, T. Kuwana, B. Kazee, Univ. North Dakota

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