TSEM

Texas Society for Electron Microscopy

JOURNAL
VOLUME 24, NUMBER 1, 1993
ISSN 0196-5662

INTRODUCING

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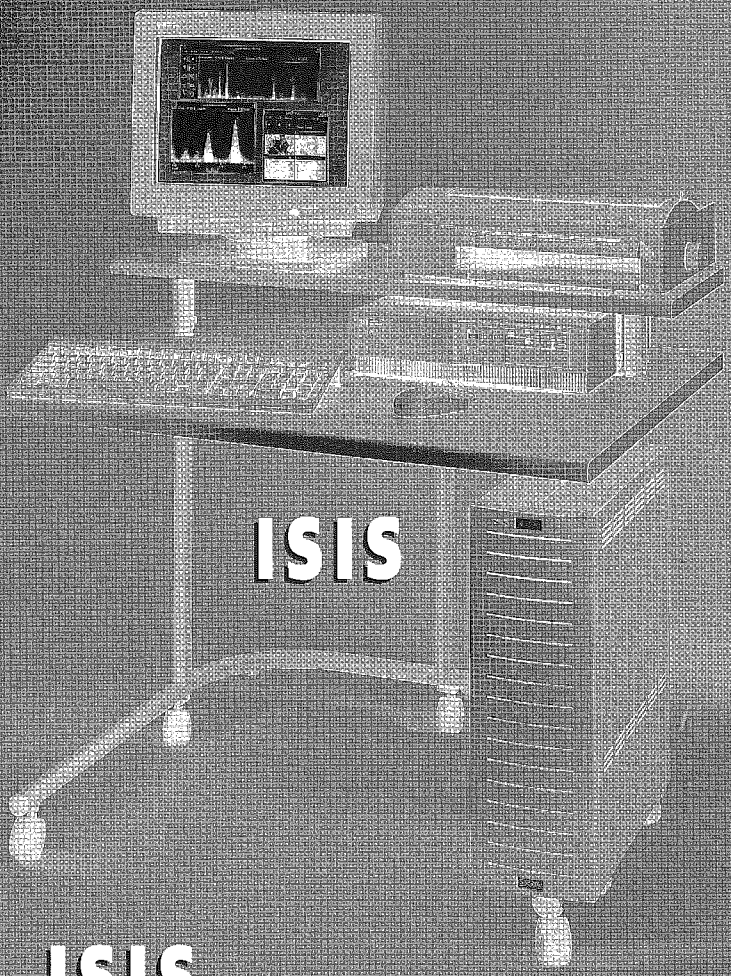

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Contents

TEXAS SOCIETY FOR ELECTRON MICROSCOPY JOURNAL
VOLUME 24, NUMBER 1, 1993
ISSN 0196-5662

Louis H. Bragg, Editor
Department of Biology, The University of Texas at Arlington, Arlington, TX 76019

Texas Society for Electron Microscopy
"For the purpose of dissemination of research with the electron microscope."

ON THE COVER
Transmission electron mircrograph of the tapetum lucidum of the Bay Anchovy. Magnification = 4950X. Photo — Howard J. Arnott, Biology Department, The University of Texas at Arlington, 76019.

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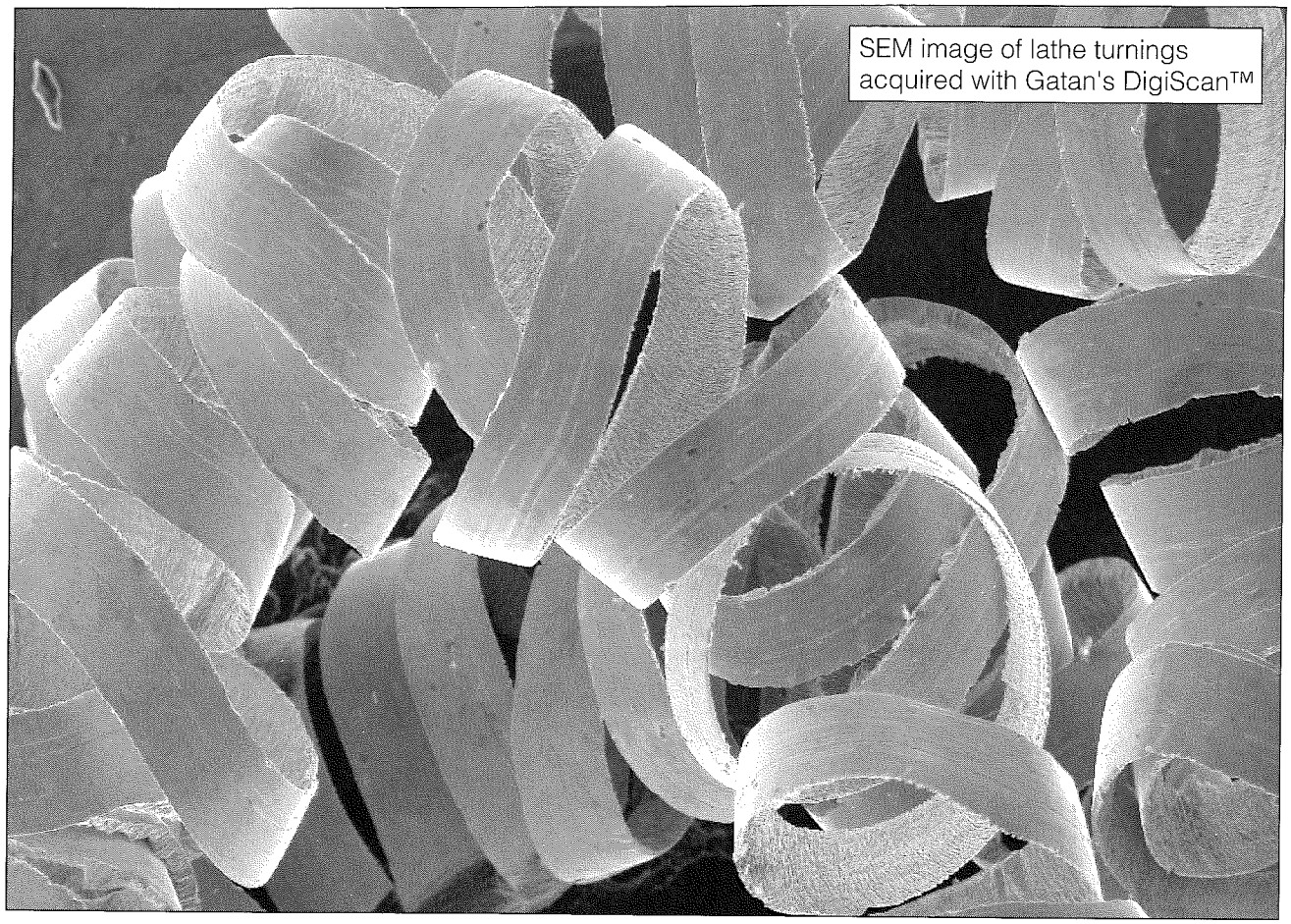

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President's Message

I can hardly believe the year has gone by so fast! As my term as President draws to a close, I want to thank the members of TSEM for allowing me the privilege of representing you. I also want to thank the officers for all of their help and hard work in putting the meetings together, getting mailouts to the membership, keeping the finances straight and producing a quality *Journal* — plus taking care of all the many details that are necessary evils of running a scientific society. Dealing with hotels and planning a quality scientific program for each meeting are tremendous jobs which involve **all** of the elected and appointed officers to some extent. I hope we've done a good job for you. Along that line, I want to encourage the membership to take an ACTIVE role in **your** Society. Let the officers know what you want in the way of programs, special events, symposia, workshops, etc. This benefits everyone and keeps us in line with the latest scientific developments. By the way, there is a lot of untapped talent out there in the membership — run for an office and make a difference!

Along a more serious line, we in TSEM owe a huge debt of gratitude to Dr. Wayne Sampson for his efforts on behalf of the Society regarding our state and federal tax exempt status. Wayne has spent a great deal of his personal time and effort in recruiting and working with attorney Michael Middleton to get the voluminous required paperwork re-filed with appropriate state agencies and the IRS. We also appreciate Mr. Middleton handling our affairs in such a timely and professional manner. Many thanks to both of these individuals for a job above and beyond.

Please note that this issue of the *Journal* contains the latest membership list. If you would, take a minute and look it over. If changes need to be made, please let Keith Fry (Secretary) know so that he can update the data base. We don't want to miss anyone!

I look forward to seeing you in Corpus Christi. We have an excellent program planned and Corpus is always a great place to meet. The Fall 1993 meeting will be at the Tremont House in Galveston, so plan ahead and keep thinking, "No hurricanes... no hurricanes..."!

Finally, I wish Hal Hawkins the best of luck in the coming year as he serves as TSEM President. I know everyone will give him their support. Remember, we need your abstracts for the meetings and your papers for the *Journal*. My best to all, I've enjoyed the year!

Sincerely,

Lynn D. Gray, Ph.D.
President, 1992-1993

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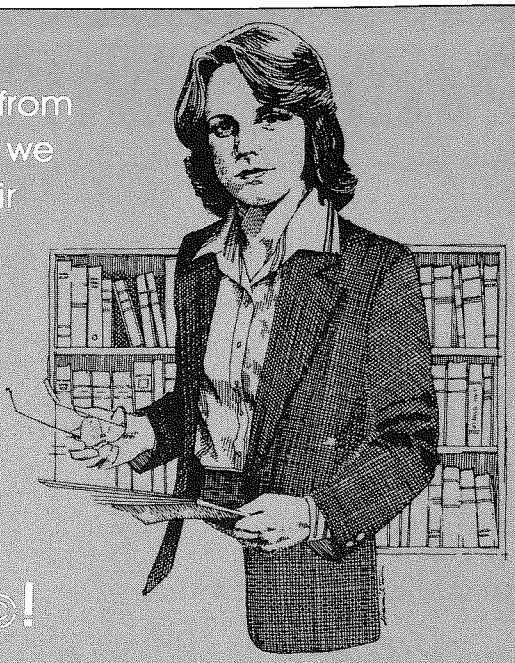

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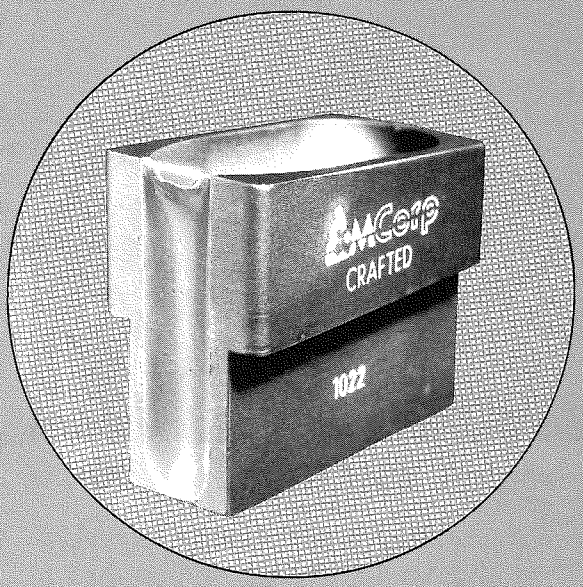

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For Period Ending December 31, 1992

ASSETS ON JANUARY 1, 1992:		
Certificate of Deposit No. 113515 (formerly CD#177576)	$3,455.96	
Certificate of Deposit No. 2414483036 (formerly CD#0014483036)	1,612.50	
Checking Account No. 44059412	5,872.62	
TOTAL		**$10,941.08**
CHECKING ACCOUNT RECEIPTS:		
Dues	$4,783.00	
Spring 1992 Meeting Registration	1,520.00	
Workshop	430.00	
Exhibitors	925.00	
Donations and Grants	850.00	
Guest	320.00	
Fall 1992 Meeting Registration	1,080.00	
Exhibitors	1,705.00	
Workshop	290.00	
Donations and Grants	180.00	
Guest	180.00	
Journal Advertisements 23:1	1,995.00	
23:2	1,750	
TOTAL		**$16,273.00**
Certificate of Deposit Interest		**381.05**
EXPENSES:		
Journal, Postage	$3,548.56	
Stationary and Office Supplies	84.05	
Mailouts	1,583.57	
Spring 1992 Meeting	4,504.53	
Workshop	513.00	
Student Competition/Travel	135.00	
Fall 1992 Meeting	3,635.28	
Workshop	206.22	
Student Travel	295.00	
Miscellaneous	254.10	
Tax and Legal Fees	1,617.65	
Checking Account Service Charge	84.40	
TOTAL		**$16,744.05**
Certificate of Deposit No. 9005997		**4,000.00**
ASSETS AS OF DECEMBER 31, 1992:		
Certificate of Deposit No. 113515 (formerly CD#177576)	$3,651.24	
Certificate of Deposit No. 2414483036 (formerly CD#0014483036)	1,688.30	
Certificate of Deposit No. 9005997	4,109.97	
Checking Account No. 44059412	1,401.57	
TOTAL		**$10,851.08**

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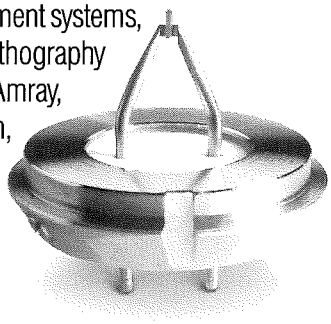

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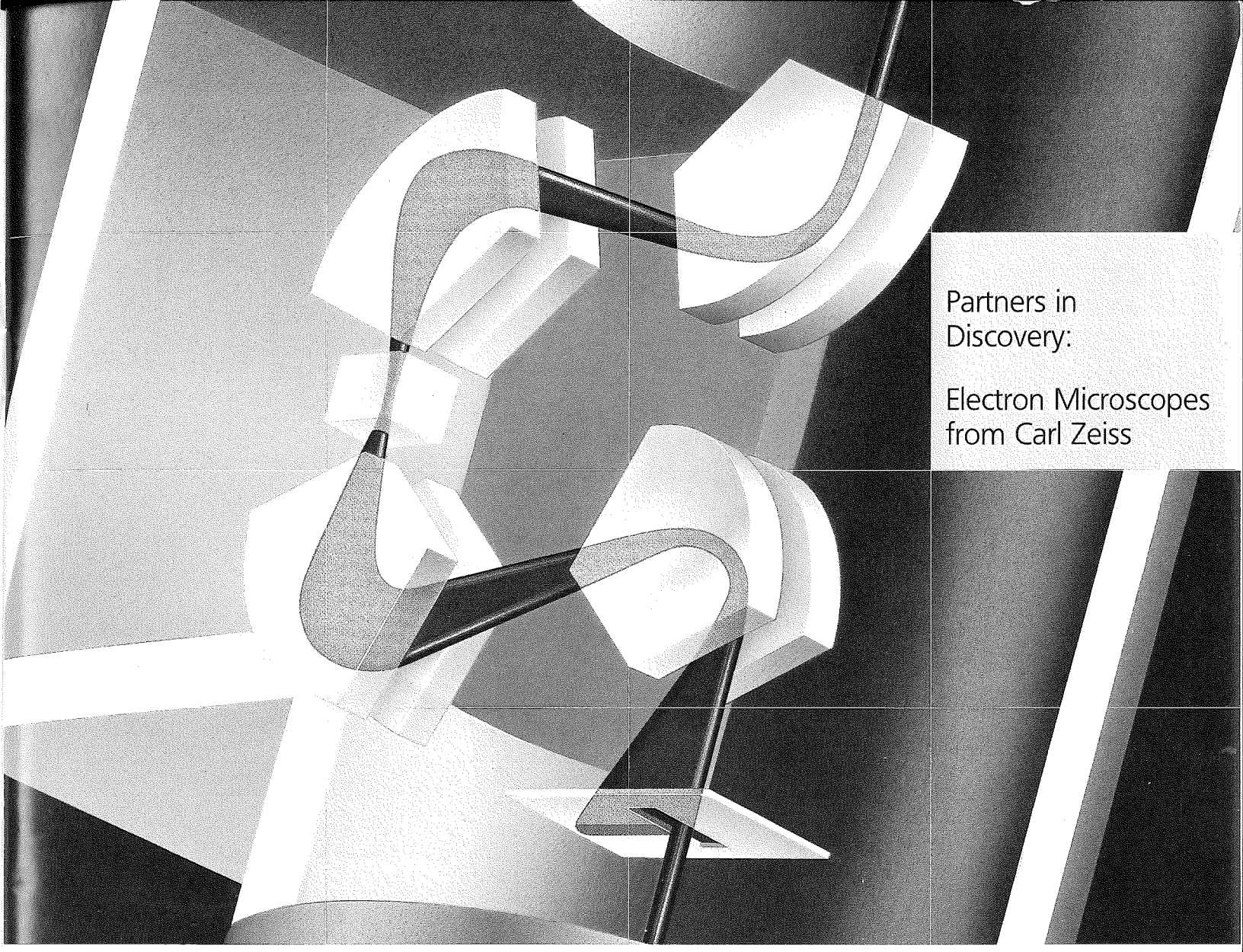

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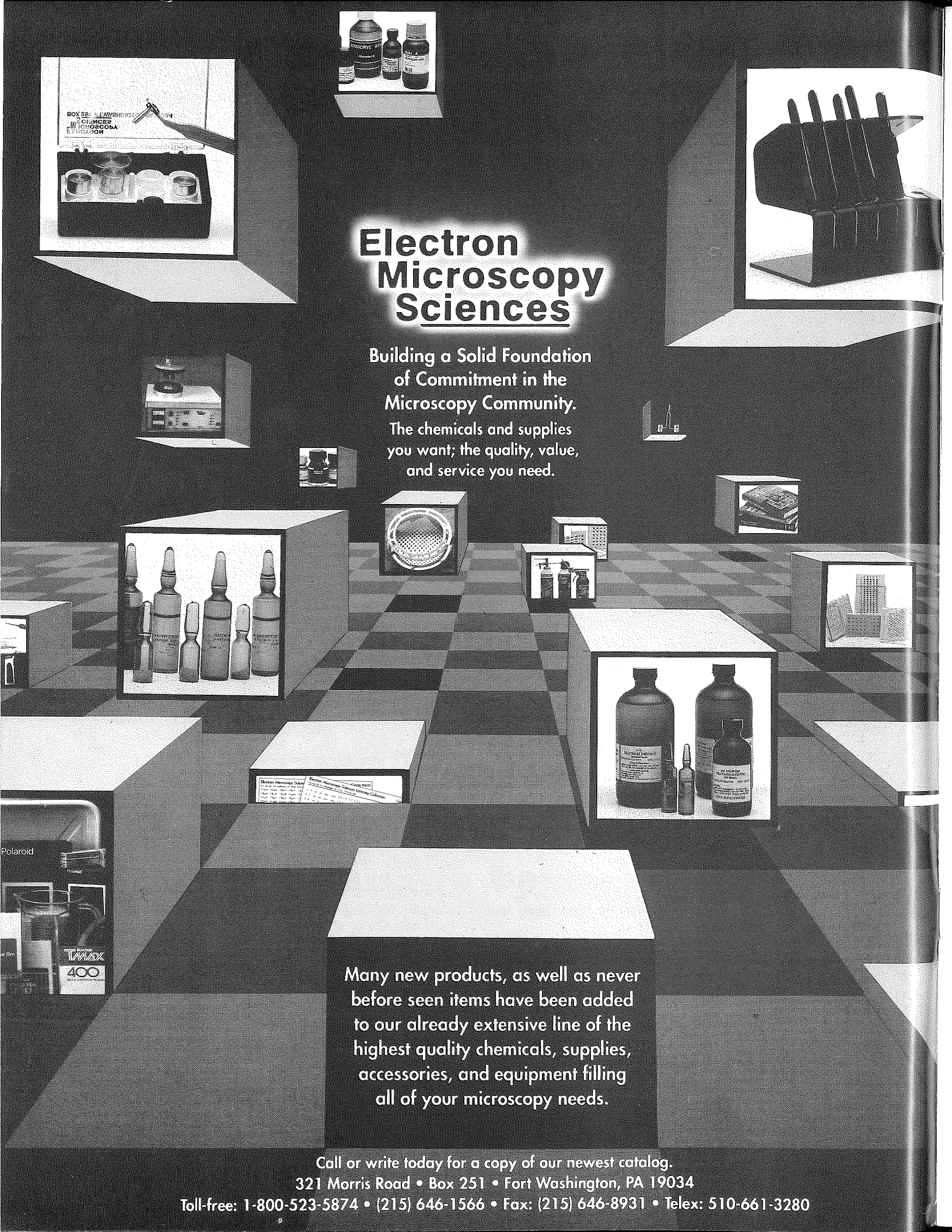
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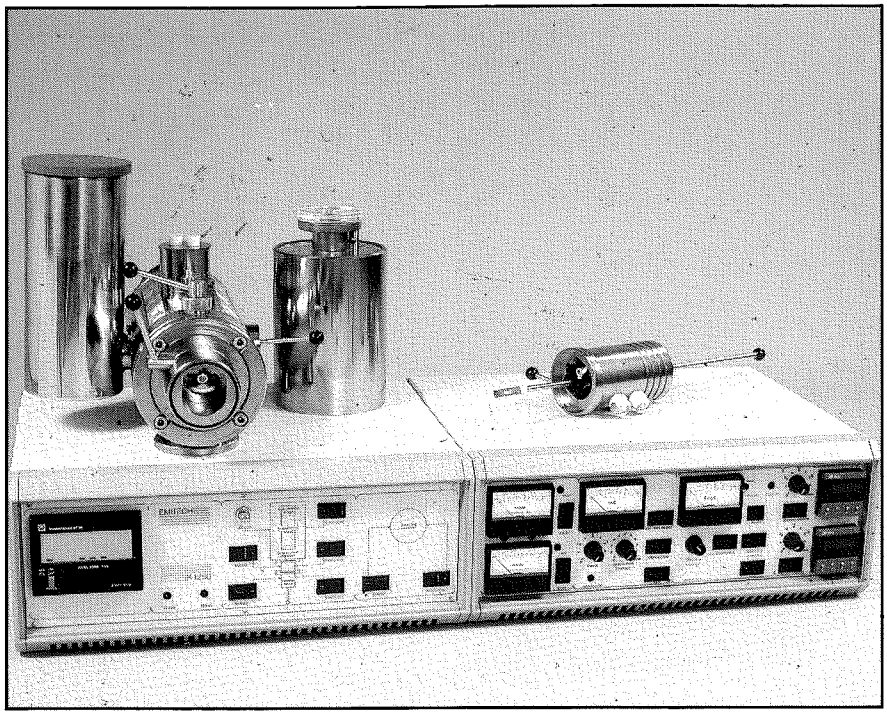
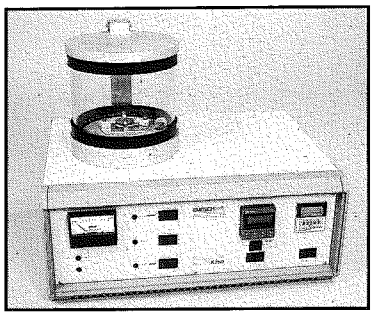
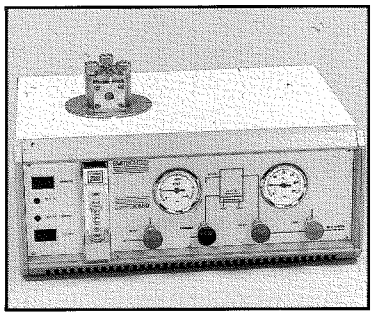


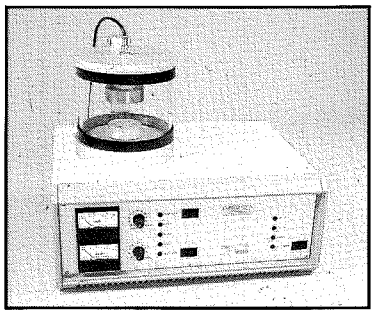
The K1250 'TURBO' Cryogenic Preparation System



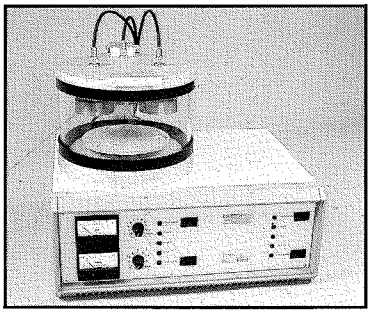
The K750 Freeze Drier



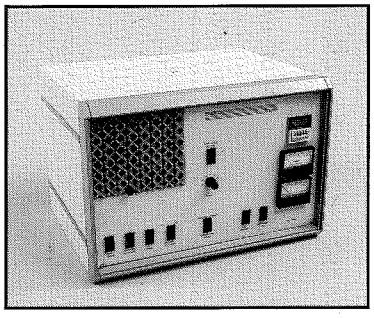
The K850 Critical Point Drier



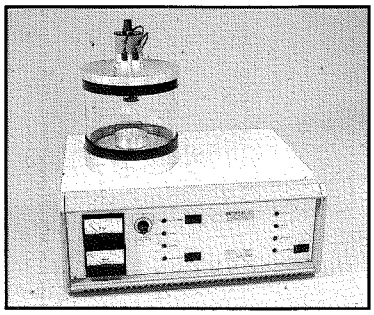
The K550 Automatic Coater



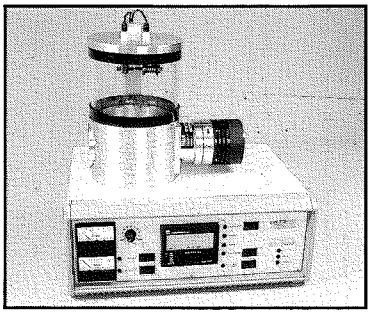
The K650 Large Sample Coater



The K1050 Plasma Asher



The K450 Carbon Coater



The K950 Turbo Evaporator

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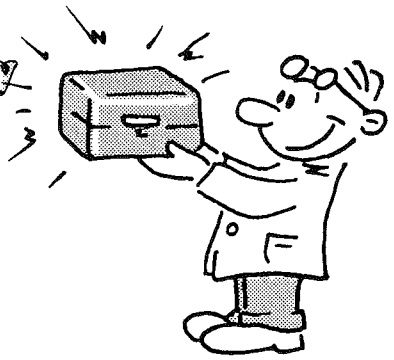

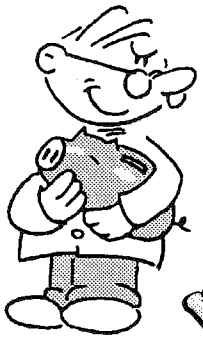

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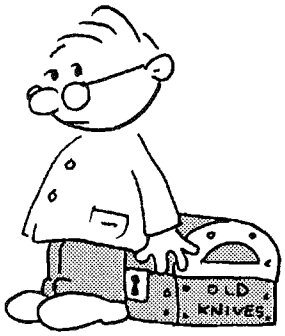

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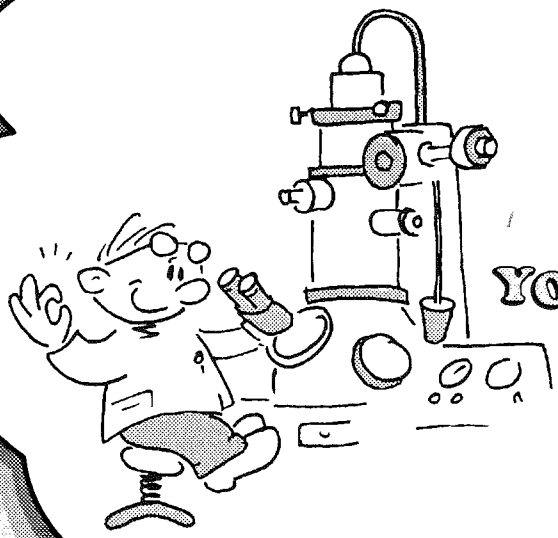

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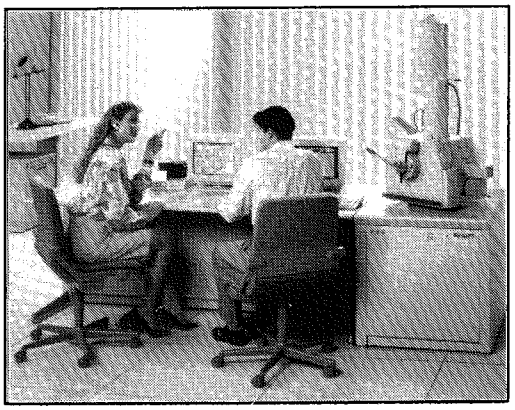

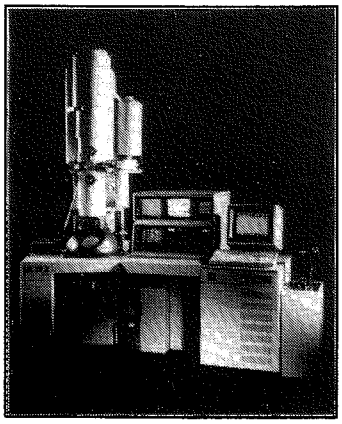

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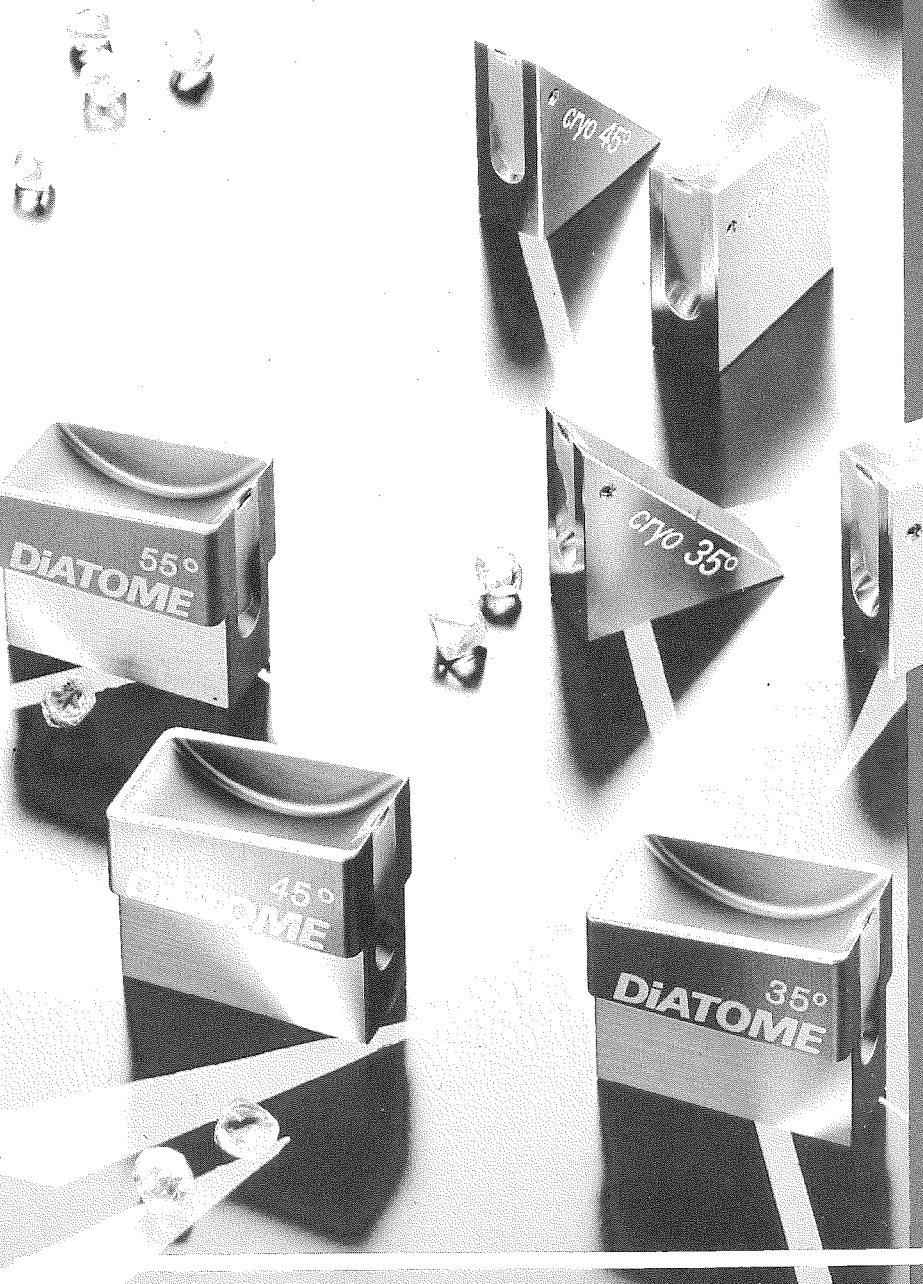

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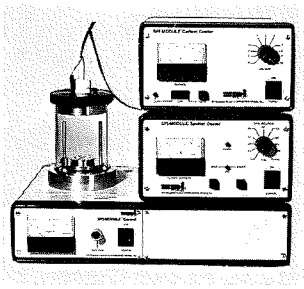

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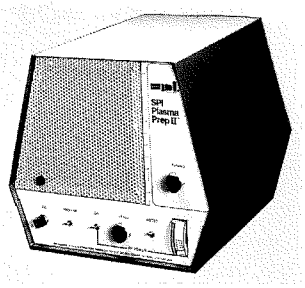

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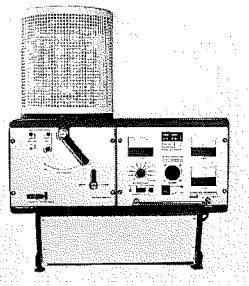

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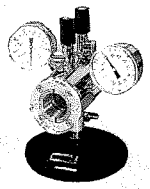

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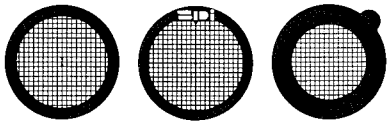

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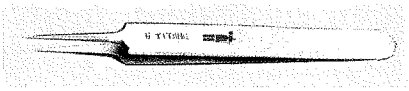

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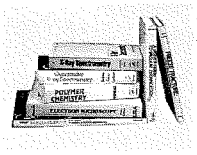

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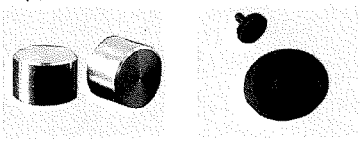

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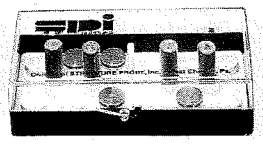

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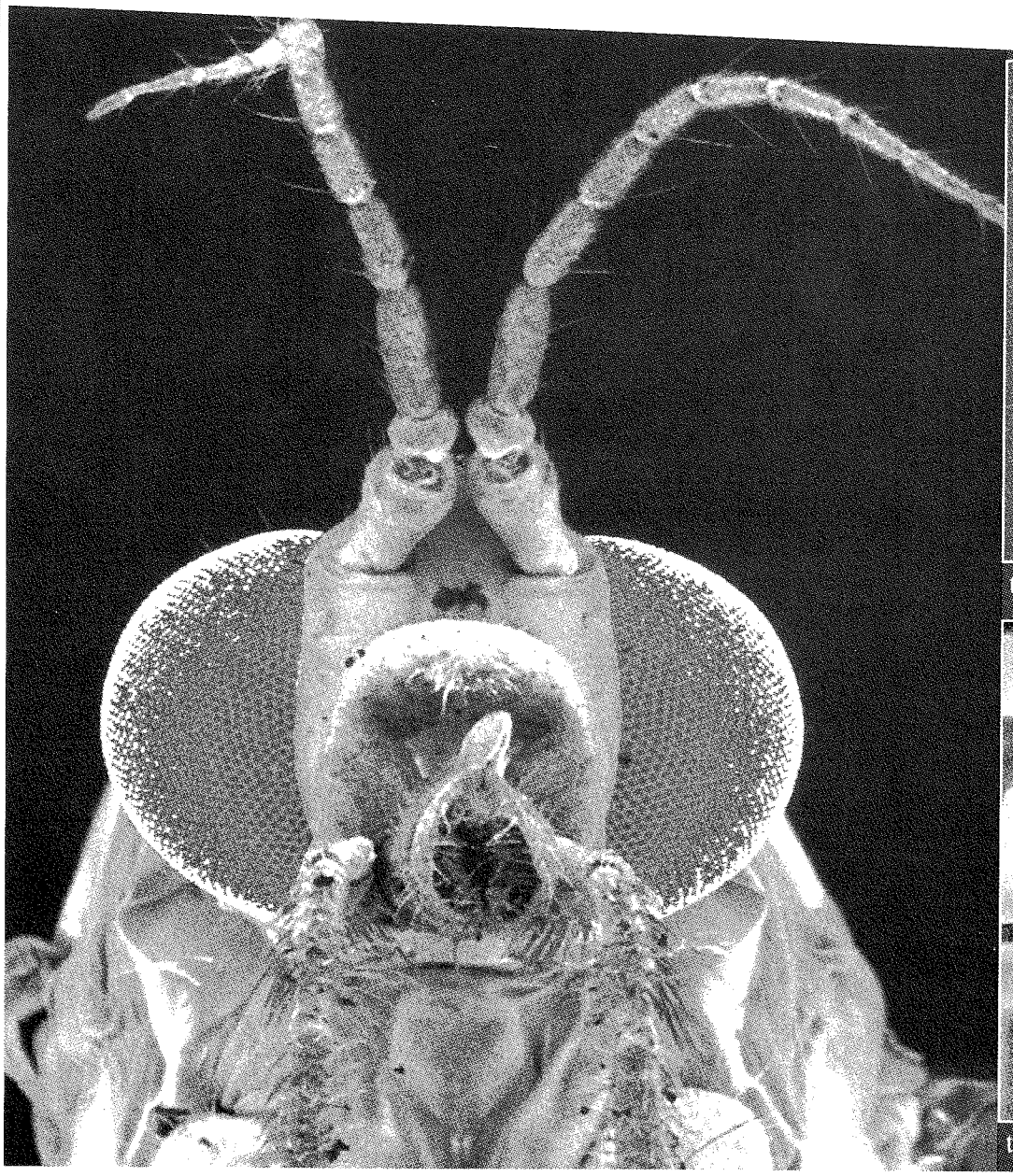

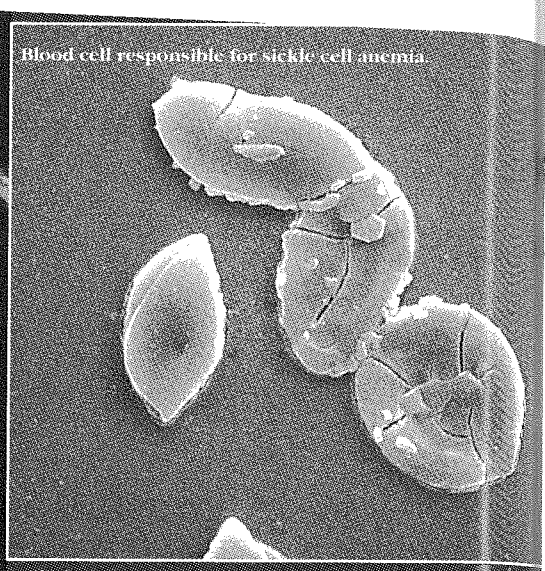

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Letters to the editor are printed as they are received in the order of their arrival. These letters reflect the opinion of the individual TSEM member and do not necessarily reflect the opinions of the editor or the society. The content of the letters should be concerned with the philosophical or operational aspects of the TSEM, the Journal and its contents, academic or national policies as they apply to TSEM and/or its members and electron microscopy in general. Editorial privilege may be evoked to insure that the LETTERS SECTION will neither be used as a political forum nor violate the memberships' trust.

ELECTRON MICROGRAPHS AND COVER PHOTOS

Micrographs submitted for cover photos should be marked as such. The choice of photographs will be made by the editor. Photograph receipt and/or dispensation will not be acknowledged. Photographs will not be returned. Electron micrographs to be used for cover photos and text fillers are welcome and should be selected with some attention to aesthetic appeal as well as excellence both in technique and in scientific information content.

REGIONAL NEWS

News items should be submitted through the regional editor in your area and made to conform to the standard format used by the regional news section. Regional contributions should be sent to the Regional News Editor. Editorial privilege may be executed for the sake of brevity or to preserve the philisophical nature of the TSEM Journal.

The JOB OPPORTUNITIES section will be comprised of a "Jobs Available" and a "Jobs Wanted" sub-section. Anonymity of individuals listing in the Jobs Wanted or Jobs Available sub-sections may be maintained by correspondence routed through the Regional News Editor's office.

TECHNICAL SECTION

The Technical Section will publish TECHNIQUES PAPERS, HELPFUL HINTS, and JOB OPPORTUNITIES. The TECHNICAL PAPERS will describe new or improved methods for existing techniques and give examples of the results obtained with methods. The format of the Technique Papers will be the same as that used for regular research reports. HELPFUL HINTS will be in the form of a brief report with an accompanying illustration, if required for clarity. Helpful Hints should embody techniques which will improve or expedite processes and/or procedures used in EM.

PUBLICATION PRIVILEGES

The right to publish in the TSEMJ is restricted to TSEM members or to those whose membership is pending. A membership application form can usually be found in each issue of the TSEMJ. Membership dues are as follows: student $2.00; regular members $15.00; Corporate members $75.00. Individuals who belong to TSEM by virtue of a corporate membership are invited to participate in Journal submissions as are our regular or student members. However, papers of a commercial nature, either stated or implied, will not be accepted for publication as a Research Report or Techniques Paper. Such papers may be acceptable as advertising copy.

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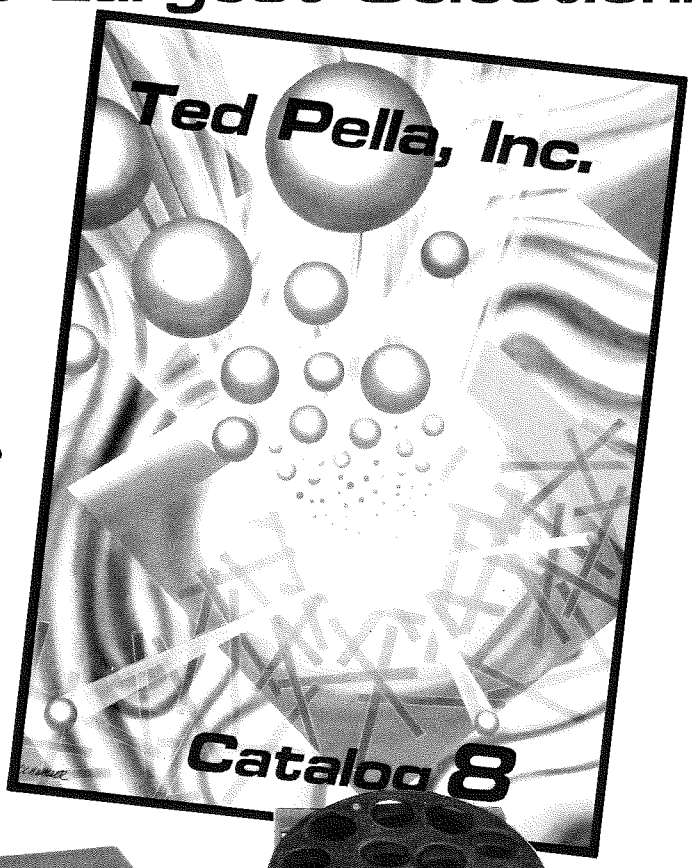

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Competition is open to all student members of T.S.E.M. who are actively seeking a degree at an accredited institution. The term student member will also include those students with a membership application pending. To be eligible to compete, all competition requirements must be fulfilled by the designated deadlines given in the first call for papers preceding the Fall meeting. In addition, to be considered for the top award you must, (1) be a student at the time of the next EMSA meeting, (2) apply for a Presidential Student Award, and (3) present your paper at that meeting.

REQUIREMENTS:
You must be the sole author, personally present your paper from the platform, and submit a student competition application signed by a regular T.S.E.M. member, if possible your supervising professor. Two abstracts must be submitted by the designated deadlines; a regular T.S.E.M. abstract following normal procedures submitted to the current *Journal* editor, and an EMSA style two page abstract with an application for student travel submitted to the current secretary. Since it is assumed that your professor has supervised your work and others may have contributed in various ways, you must acknowledge these contributions on your application as well as in your platform presentation.

SPECIAL ABSTRACT FORMAT

1. The paper must be two pages each 8½″ by 11″. Margins should be 1″ top and bottom and ¾″ left to right. Text should be 12 characters per inch IBM LETTER GOTHIC or 11 point TIMES ROMAN with 12 point spacing each font at 6 lines per vertical inch.
2. The first page will have text only. Title on first line in all capitals except chemical symbols, single spaced if more than one line is needed. Leave one line of space; then your name and address skipping one line between each. Leave one line blank and start text with no indentions and skip one line between paragraphs. Group all references at the end on the text before illustrations.
3. Page two will include pictures and text. Micrographs should be numbered, have an appropriate scale marker, and be trimmed to form a retangle with no gaps. Figure captions should follow the micrographs and come last.
4. Examples and additional guidelines may be found by consulting an EMSA call for papers.

AWARDS:
Up to 3 awards (0-3) may be given at each Fall meeting. These awards may be cash or prizes as determined by the Executive Council. The top award that can be given is substanial support towards competing in EMSA's Presidential Student Award program. This award can only be given if you meet EMSA qualifications and compete at the next EMSA meeting.

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Judging will be by a panel of regular T.S.E.M. members. You will be judged 50% on the quality of your special abstract and 50% on the quality of your presentation, including how well you answer questions from the audience. The regular abstract you submit for publication in the *Journal* will not be judged. Because of additional demands of disclosure each entrant will be given an additional 5 minutes of podium time.

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Information for Authors

GENERAL INFORMATION

PURPOSE: The goal of the TSEM Journal is to inform members of the society and the Journal's readers of significant advances in electron microscopy, research, education, and technology. Original articles on any aspect of electron microscopy are invited for publication. Guidelines for submission of articles are given below. The views expressed in the articles, editorials and letters represent the opinions of the author(s) and do not reflect the official policy of the institution with which the author is affiliated or the Texas Society for Electron Microscopy. Acceptance by this Journal of advertisements for products or services does not imply endorsement. Manuscripts and related correspondence should be addressed to Louis H. Bragg, Editor, TEXAS SOCIETY FOR ELECTRON MICROSCOPY JOURNAL, Department of Biology, The University of Texas at Arlington, Box 19498, Arlington, Texas 76019.

GUIDELINES: Manuscripts written in English will be considered for publication in the form of original articles, historical and current reviews, case reports and descriptions of new and innovative EM techniques. It is understood that the submitted papers will not have been previously published. Accepted manuscripts become property of the TEXAS SOCIETY FOR ELECTRON MICROSCOPY JOURNAL and may not be published elsewhere without written consent of the Editor. The author should retain one complete copy of the manuscript. The JOURNAL is not responsible for manuscripts lost in the mail.

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TITLE PAGE: Include:

a. Full title of the article
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d. Full name, telephone number and address of the author to whom reprint requests are to be sent.

SECTIONS: The text of each original article and technical report should be divided into four major sections entitled INTRODUCTION; METHODS AND MATERIALS; RESULTS; AND DISCUSSION.

Historical and current reviews and case reports do not need to be divided into the aforementioned sections.

ABSTRACT: Summarize the article in no more than 150 words. This takes the place of a final summary paragraph.

REFERENCES to other work should be consecutively numbered in the text using parentheses and listed at the end, as in the following examples:

(1) A. Glauert, Practical Methods in Electron Microscopy. Vol. 2 (North-Holland. Amsterdam, 1974) 82-88.
(2) P.S. Baur, Jr., G.F. Barratt, G.M. Brown and D.H. Parks. Ultrastructural Evidence for the Presence of "Fibroclasts" and "myofibroclasts" in Wound Healing Tissues. J. of Trauma. 19 (1979) 774-756.
(3) D. Gabor. Information Theory in Electron Microscopy, in: Quantitative Electron Microscopy. Eds. G.F. Bahr and E. Zeitler (Williams and Wilkins, Baltimore, 1956) 63-68.

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a. Type double-spaced each table on a separate sheet.
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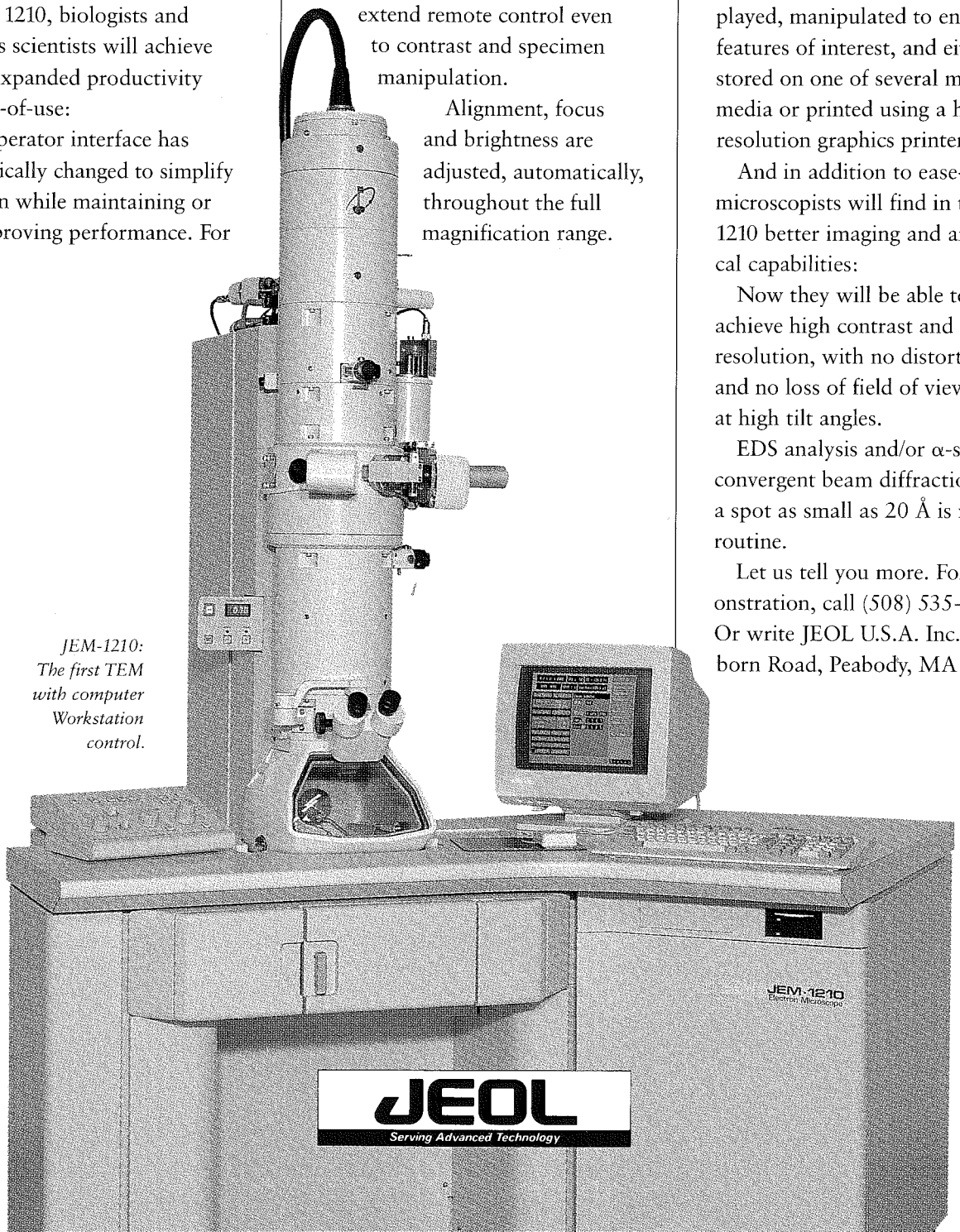

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2. Scholarships will be awarded to full time undergraduate students. Maximum total dollar amount awarded each year will be $10,000.00.
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   - **C.** A budget proposal detailing how awards will be utilized. If the proposed project will exceed the requested amount, a statement should be provided indicating sources of additional funding.
   - **D.** Two letters of reference from academic and/or industrial personnel familiar with the student's competence are required.
   - **E.** A letter from the laboratory supervisor where the proposed research will be performed indicating the applicant will be accepted in the laboratory to work on the proposed project. A laboratory must be designated in the proposal for funds to be awarded.
   - **F.** A cirriculum vitae detailing previous education and/or experience in electron microscopy, and a brief statement of career goals.
9. Complete applications, reference letters, and a letter from the laboratory supervisor where the research will be performed should be sent to:

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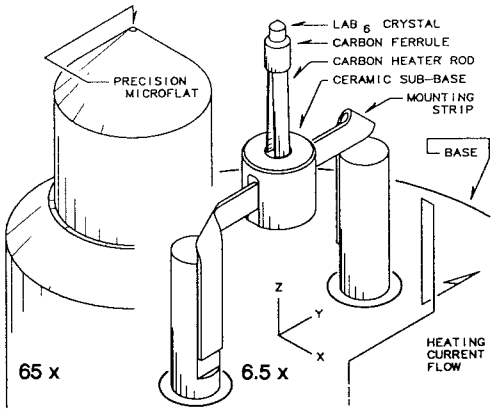

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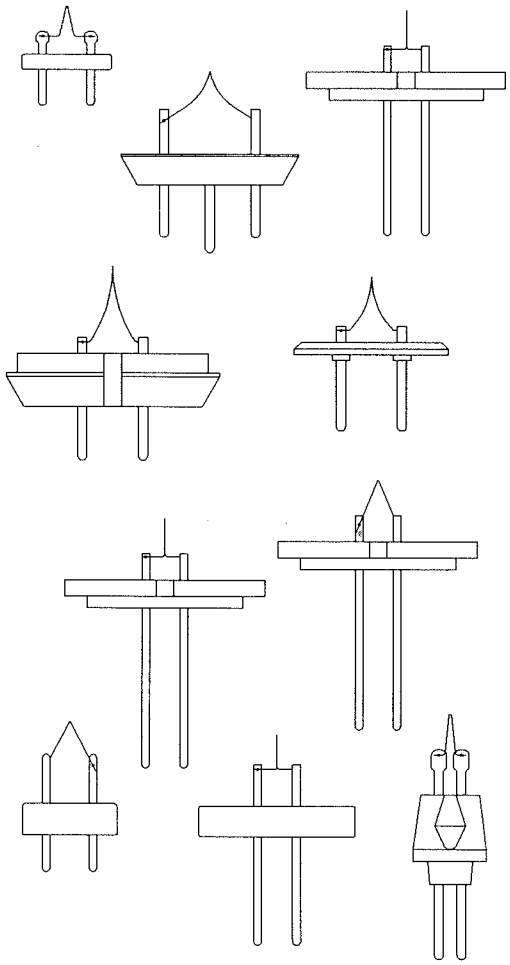

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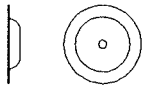

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Electron Microscopy Sciences

Abstracts

BIOLOGICAL SCIENCES

PLATFORM PRESENTATION — SPRING 1993

IMAGING PERISTOME MOVEMENT IN THE ENVIRONMENTAL SEM
J.C. Long, D.M.J. Mueller, Electron Microscopy Center, Dept. of Biology, Texas A&M University, College Station, Texas 77843-2257

The ElectroScan Environmental Scanning Electron Microscope is a powerful new tool in the study of spore dispersal mechanisms in bryophytes. The ESEM is similar in many ways to a conventional SEM, but with a few important differences. While the ESEM column remains at high vacuum (10^{-7}torr), the specimen chamber typically operates in a water vapor environment at low vacuum (1 to 20 torr). The secondary electron signal is generated by gaseous signal amplification and is collected by the Environmental Secondary Detector.

This new technology has significant implications regarding sample preparation and specimen requirements. First, there is no need to dry the sample, thus observations in the natural state are possible. Second, the water vapor dissipates charge build up, therefore a conductive coating is not necessary.

The ESEM lends itself directly to the understanding of spore dispersal in mosses, which involves the sensitivity of the peristome to changes in ambient moisture (hygroscopicity). Using conventional SEM techniques, it is not possible to view peristome movement directly, however, using the ESEM, the movements can be observed and recorded in real time.

In many mosses the peristome is an integral part of the spore release mechanism which regulates the release of spores from the capsule. Peristomes consist of the thickened portions of concentric rings of cell walls of contiguous layers of cells. These cell wall remains are responsive to changes in ambient moisture and exhibit movement with these hygroscopic changes in such a way as to effect the release of spores (facilitating the release in some mosses, hindering the too rapid release of spores in others).

Peristome movements are recorded, in real time, on videotape with sufficient magnification and resolution to view, for the first time, the intricacies of movement as it reflects the variable composition and construction of the cell wall layers making up these structures.

INTERACTION OF *PSEUDOMONAS AERUGINOSA* WITH POLARIZED EPITHELIAL CELLS. LYNN D. GRAY and ALI O. AZGHANI*, Dept. of Cell Biology and Env. Sci., *Dept. of Biochemistry, The University of Texas Health Center at Tyler, P.O. Box 2003, Tyler, TX 75710.

Pseudomonas aeruginosa, an opportunistic pathogen, causes a variety of illnesses including pneumonia, septicemia and chronic lung disease. The organism is a common cause of fatal nosocomial infections in immunosuppressed patients. Relatively little is known about how this bacterium attaches and invades host tissues and what roles its various secretory products play in pathogenicity. *In vivo* studies in our laboratories showed increased epithelial permeability in the lungs of guinea pigs that were treated with elastase (PE) from *P. aeruginosa*. The present experiments explore *in vitro* host-pathogen relationships between this organism and two types of epithelial cells. Confluent Madin-Darby Canine Kidney (MDCK) cells exhibit "tight" cell junctions (based on morphology and electrical resistance) and provide a homogeneous system to study the effects of PE and other bacterial products on epithelial cells. Primary, cultures of rat type II pneumocytes were used in some experiments because of our interest in pulmonary effects. Some monolayers were exposed to live bacteria and incubated at various time periods from 2 to 6 h. Others were treated with PBS, or PE (0.06 - 6u/ml) prior to application of live bacteria. Qualitative observations were made in a single-blind fashion. SEM of the MDCK cells revealed scattered eroded areas containing attached bacteria as early as 3 h post-exposure. Other pathologic features included alteration and reduction of microvilli and thick, mucoid secretions on affected cell surfaces. Bacteria were often found embedded in this material. Bacteria were consistently found in association with clumps of dividing cells, at cell borders and in eroded areas of the MDCK monolayers; they were located near cell junctions and in regions of lamellar body secretion in the rat type II cells. *P. aeruginosa* readily adhered to both types of epithelial cells and SEM was essential in assessing the number and location of attached bacteria. This work is supported by Grants from the American Heart Association (Texas Affiliate) and NIHLBI #HL44473.

SOFT TISSUE SARCOMAS RESEMBLING PRIMARY BONE TUMORS.
Bruce Mackay, Alberto G. Ayala, Nelson G. Ordonez. University of Texas M.D. Anderson Cancer Center, Houston, Texas.

Occasional malignant tumors arising in the soft tissues appear identical in microscopic sections to primary tumors of bone and cartilage. Extraskeletal osteosarcoma and chondrosarcoma are soft tissue neoplasms which closely resemble the corresponding bone tumors by light microscopy and at the ultrastructural level. Care must be taken to avoid mistaking myositis ossificans for an extraskeletal osteosarcoma. Electron microscopy has been of some value in the study of certain unusual soft tissue tumors within the extraskeletal category. A type of small round cell tumor originating in the soft tissues looks like Ewing's tumor of bone by light microscopy and is called soft tissue Ewing's sarcoma. The cells show the same range of appearances by electron microscopy. There has been much speculation on the cell of origin but it remains unknown. Chondrosarcoma subtypes comparable to those seen within bone occur in the soft tissues, and some extraskeletal myxoid chondrosarcomas contain large numbers of parallel microtubules within cisternae of the endoplasmic reticulum. Parachordoma is a rare soft tissue neoplasm that simulates extraskeletal myxoid chondrosarcoma by routine light microscopy but it possesses epithelial characteristics which are revealed by immunostaining and electron microscopy: its close resemblance to the sacro-coccygeal chordoma suggests that it is derived from ectopic notochord cells.

THE ROLE OF DIAGNOSTIC ELECTRON MICROSCOPY IN NEURO-ONCOLOGY: SOME OLD AND SOME NEW OBSERVATIONS WITH THERAPEUTIC IMPLICATIONS. Steven C. Bauserman, J.C. Stinson Laboratory for Electron Microscopy, Scott and White Clinic, Texas A&M University Health Science Center, Temple, Texas 76508

With the advent of immunohistochemistry the application of Transmission Electron Microscopy (TEM) in diagnostic pathology has diminished to some extent. In surgical pathology of the central nervous system, however, there is a persistent need for this adjunctive study in several specific clinical settings. In one particular type of tumor the application of TEM has identified an entity which has masqueraded in the past as **Oligodendroglioma** or **Clear Cell Ependymoma** and carries a much better prognosis. This is the newly recognized **CENTRAL NEUROCYTOMA** which usually projects into the ventricular system of the brain with a very good prognosis if surgically resected. Examples of this particular tumor are presented with their distinctive radiographic and pathologic as well as ultrastructural features. Additional applications including **Metastatic Neoplasm of Brain with unknown primary**; **Primitive Neuroectodermal Tumor (PNET)** of infancy and childhood; and some **Sarcomatous lesions of the brain and its coverings** are presented with discussion of the adjunctive role of TEM in diagnosis.

A COMPARISON OF SIX GOLD PARTICLE SIZES ON LABELING DENSITY USING GOLD CONJUGATED GOAT ANTI-RABBIT IgG SECONDARY ANTIBODIES. RICK GIBERSON, Ted Pella, Inc., Redding, CA 96049-2477

B-lactoglobulin granules found in processed cheese were indirectly labeled with six different sized gold conjugated goat anti-rabbit IgG whole antibodies. The effects of gold particle size on labeling density (particles/um^2) were determined for 1, 5, 10, 15, 20, 30nm gold particles. A relationship between gold particle size and labeling density was found with IgG conjugated gold. Immunogold labeling with the ultra small (1nm) IgG conjugated gold, followed by silver enhancement, demonstrated the lowest labeling density.

IMMUNOGOLD LOCALIZATION OF PECTIN EPITOPES IN THE CELL WALL OF BORON-DEFICIENT CALLI OF LYCOPERSICON ESCULENTUM MILL. AND OXALIS DILLENII JACQ. CAMELIA G.A. MAIER*, DON W. SMITH AND DAVID C. GARRETT, Biological Sciences Dept., University of North Texas, Denton, TX 76203.

Cell wall structure and composition are known to be affected by boron deficiency. In this study, monoclonal antibodies recognizing methyl-esterified (JIM 7) and un-esterified (JIM 5) epitopes of pectin have been used to locate these epitopes by immunogold electron microscopy in the cell walls of boron-deficient calli from tomato and oxalis.

Both antibodies labelled the cell wall of calli under study. The epitope containing methyl-esterified pectin was localized evenly throughout the cell walls of both boron-deficient and boron-sufficient (control) calli. The un-esterified epitope of pectin was located toward the inner surface of the primary cell walls, in the middle lamella, and abundantly toward the outer surface at intercellular spaces of boron-sufficient calli. In boron-deficient calli of both tomato and oxalis, the un-esterified epitopes of pectin did not have a specific location in thin cell walls. In thicker cell walls, these epitopes were found toward the outer surface but not in the middle lamella. These results indicate differences in location on un-esterified pectin epitopes in cell walls of boron-deficient and boron-sufficient tomato and oxalis calli.

BIOLOGICAL SCIENCES

POSTER PRESENTATION — SPRING 1993

SYNAPTIC ORGANIZATION OF DOPAMINERGIC AMACRINE CELLS IN THE LARVAL TIGER SALAMANDER RETINA. P.A. Glazebrook and C.B. Watt. Alice R. McPherson Laboratory of Retina Research, Center for Biotechnology, Baylor College of Medicine, The Woodlands, TX 77380.

Immunocytochemistry of tyrosine hydroxylase (TH) was used to visualize tiger salamander dopaminergic amacrine cells and determine their basic synaptic interaction. The avidin-biotin immunoperoxidase method was used to immunostain TH immunoreactive cells in vibratome-prepared sections that were routinely processed for ultrastructural examination.

A total of 168 synapses were observed that involved tyrosine hydroxylase-like immunoreactive amacrine cell processes. A large percentage (79.8%) of these synaptic arrangements were found in sublayer 1 of the inner plexiform layer, while substantially lower percentages were observed in sublayers 3 (9.5%) and 5 (10.7%). They served as pre and postsynaptic elements 63.1% and 36.9% of the time, respectively. Tyrosine hydroxylase-like immunoreactive amacrine cell processes were presynaptic to amacrine cell processes (36.9% of total synaptic involvement) and processes that lack synaptic vesicles and whose origin remains uncertain (26.2%). They received synaptic input primarily from amacrine cell processes (31.0%). Tyrosine hydroxylase-like immunoreactive amacrine cell processes also received a few ribbon synapses from bipolar cells (5.9%). Each of these synaptic relationships were observed in each of sublayers 1, 3 and 5 of the inner plexiform layer, with the majority of each arrangement being found in sublayer 1. Supported by grants from the NIH (EY05622) and the Retina Research Foundation (Houston).

SEM EVALUATION OF END-ROUNDING OF TOOTHBRUSH BRISTLES. NANCY K.R. SMITH*, DEBRA D. SMITH, AND H. RALPH RAWLS, *Dept. Cellular and Structural Biology, Dept. Restorative Dentistry Division of Biomaterials, University of Texas Health Science Center at San Antonio TX 78284.

Toothbrushes with non-rounded bristles can cause significant tissue trauma. We used scanning electron microscopy (SEM) to examine and evaluate adult-size toothbrushes for their potential to cause tissue damage. End-roundedness was measured on 15-30 specimens each of a non-end-rounded brush and eight American-made brushes. Brush bases were cut with a Jim Dandy saw into 5-tuft sections which were then cleaned and super-glued onto Al specimen stubs. The plastic bases and the bases of the nylon tufts were painted with colloidal graphite. Specimens were sputter-coated with Au-Pd. Five tufts from each brush were photographed at 50X in a JEOL JSM-35 SEM at 5kV, WD39mm. In each tuft 5 bristles were randomly selected and traced with a digitizer pad for calculation of the shape factor (SF), where SF=sq.root of tip area/perimeter. The closer a bristle tip is to being hemispherical (SF=.28), the higher its SF; the more sharp-edged, the lower. Brushes were ranked according to the % of bristles that exceeded a threshold SF value of .27, using Chi-squared analysis of variance. The ranking was: Oral-B P35 (73%) = Sensodyne (72%) = J&J Reach (70%) ≥ POH (66%) = Colgate Plus (64%) = Pycopay (63%) ≥ J&J Prevent (61%) = Butler GUM (58%) ≥ no end-rounding (52%). The proportion of bristles with the greatest potential for harm (SF<0.25, i.e., right-angled or sharper edges) were: Oral-B P35 = 1%, Sensodyne = 1%, Reach = 2%, Pycopay = 2%, POH = 3%, Colgate Plus = 5%, J&J Prevent = 5%, Butler GUM = 10%, no end-rounding = 4%. It was concluded, for the brushes examined, that Oral-B P35 had the least potential for tissue damage, Butler GUM had the most, and the others were intermediate.

SYNAPTIC INPUT TO GABAergic GANGLION CELLS IN THE INNER PLEXIFORM LAYER OF RABBIT RETINA. P.J.G. Neill and K.R. Fry. Alice R. McPherson Laboratory of Retina Research. The Center for Biotechnology, Baylor College of Medicine, The Woodlands, TX 77381.

Studies in this laboratory have identified a population of ganglion cells in the rabbit retina which utilize γ-aminobutyric acid (GABA) as a neurotransmitter. There is evidence to suggest that these cells may project to the area of the hypothalamus which is involved in circadian rhythm entrainment. Therefore, an understanding of the types of information carried by these cells and their pattern of synaptic connectivity in the retina is of great interest. Ganglion cells were first identified by pre-embedding immunoperoxidase labelling using a ganglion cell specific monoclonal antibody (AB5) developed in this laboratory. Post-embedding gold labeling was performed using an anti-GABA polyclonal antibody. Six percent of AB5 labelled ganglion cell processes also labelled with GABA, correlating well with previous light microscopy studies which indicated that 5-7% of ganglion cells were GABAergic. GABAergic ganglion cell processes received input from bipolar cell processes in the region of the inner plexiform layer (IPL) generally thought to mediate the "off" signals. The other primary synaptic input to the GABAergic ganglion cells was from GABAergic amacrine cell processes in sublaminas 1, 3, and 5 of the IPL; the frequency of synaptic input increased proportionately with closer proximity to a GABAergic ganglion cell body. These results indicate that ganglion cell processes receive direct input from the "off" visual pathway with modulation from GABAergic amacrine cells occurring thoughout the IPL. Studies have been started to examine the distribution of other neurotransmitter-specific types of input to the GABAergic ganglion cell pathway. (Supported by NIH EY06469 and the Retina Research Foundation)

A DETERMINATION OF ADULT FEEDING HOST RANGE AND LONG DISTANCE MIGRATION PATTERNS OF CORN EARWORM, CABBAGE LOOPER, AND CELERY LOOPER MOTHS UTILIZING SCANNING ELECTRON MICROSCOPY. P.D. Lingren[1], V.M. Bryant, Jr.[2], J.R. Raulston[1], M.W. Pendleton[2], J. Westbrook[1], & R.E. Murry[2]. [1]USDA-ARS-CIPMRU, Rt.5,Box 808, College Station, TX 77845, [2]Dept. of Anthropology, Texas A&M University, College Station, TX 77843.

Several species of moths feed on nectar-producing plants. Adult moths contact pollen grains during feeding activities and these grains often adhere to moth bodies. Identification of the pollen grains adhering to 400 moths captured from southern Texas and southern Oklahoma was made utilizing scanning electron microscopy. On the basis of these identifications, host plant feeding range and possible migratory activities of corn earworm, Helicoverpa zea (Boddie), cabbage looper, Trichoplusia ni (Hubner), and celery looper, Anagrapha falcifera (Kirby) moths were determined. A wide range of pollen grain taxa such as Citrus, Salix, Quercus, and Pithecollobium was observed on these moths. Eight percent of the H. zea moths captured in southern Oklahoma and 30 percent of those captured in southern Texas had Citrus pollen adhering to them. Associated weather systems and atmospheric trajectories suggest that captured moths associated with Citrus pollen had been conveyed by these forces at least 700 km northward because Citrus is not native to Oklahoma.

MATERIALS SCIENCES

PLATFORM PRESENTATION — SPRING 1993

COMPARATIVE OBSERVATIONS OF CARBIDE PRECIPITATION MORPHOLOGY ASSOCIATED WITH COHERENT TWIN BOUNDARIES AND GRAIN BOUNDARIES IN TYPE 304 STAINLESS STEEL: R. J. ROMERO, E. A. TRILLO, A. H. ADVANI, L. E. MURR and W. W. FISHER, Department of Metallurgical and Materials Engineering, The University of Texas at El Paso, El Paso, TX 79968.

When 304 and 316 stainless steels are aged at increasing times, carbides appear to occur first on high energy grain boundaries then non-coherent twin boundaries, and finally on coherent twin boundaries when selectively etched and observed by light microscopy. In order to study carbide nucleation, it was assumed that the coherent twin boundary would be invariant in structure and energy and would therefore be an ideal situation. However efforts to document carbide precipitation on coherent twin boundaries has been inconclusive because the preponderance of carbides apparently nucleate and grow from nc -coherent steps on the boundary. In addition, the precipitates tend to grow parallel to the coherent boundary strongly suggesting coincidence with {111}. By comparison, carbides growing from grain boundaries also appear to nucleate prominently on steps or ledges in the boundary, and they grow out from the boundary coincident or partially coincident, with {111} planes in one principal grain. We have made numerous comparisons of these growth features using transmission electron microscopy. Supported by NSF-RIMI Grant HRD 9105065 and EPA Cooperative Agreement CR-81 8196-01-0.

THE EFFECT OF NICKEL ON Sn-Cu INTERMETALLIC GROWTH, Y. WU, J.A. SEES, C. POURAGHABGHER, E.G. JACOBS AND R.F. PINIZZOTTO, Center for Materials Characterization, University of North Texas, Denton, TX 76203-5308.

The intermetallic compounds Cu_6Sn_5 and Cu_3Sn form and grow at the Sn-Pb solder/copper substrate interface during soldering and system use. The addition of Ni particles to eutectic Sn-Pb solder drastically increases the activation energies of formation for both Cu_6Sn_5 and Cu_3Sn. To obtain direct information about the mechanisms of Cu-Sn intermetallic formation and the effect of Ni additions on intermetallic growth at the solder/substrate interface, Cu/Sn/Ni thin film samples were observed in real time using a hot stage in the TEM.

Standard TEM grids with thin amorphous carbon were used as the substrate for deposition of thin layers of Cu, Sn, and Ni by evaporation. In one set of samples, a continuous 500 Å thick layer of Cu was evaporated onto the substrate. A 500 Å layer of Sn was then deposited using a 50 mesh TEM grid as a shadow mask. After shifting the mask grid, 100 Å of Ni was deposited. This configuration results in Ni on top of part of the isolated square Sn-islands on Cu substrates. At 250°C, intermetallic formation begins at the Sn/Cu boundary and progresses laterally from the Sn into the Cu in some areas; in other areas, there is no intermetallic growth even after annealing at 250°C for 30 minutes and 200°C for 24 hours. XEDS spectra prove that in the areas with Cu-Sn intermetallic growth, there is no Ni on top of the Sn or at the interface; in the areas without intermetallic growth, there is Ni at the Cu/Sn interface, and there is a Ni concentration gradient from the Cu/Sn interface to the Sn area. This proves that Ni acts as a barrier which prevents Sn from diffusing into the Cu substrate and results in the drastic increase of the activation energies for the formation of both Cu_6Sn_5 and Cu_3Sn in Ni composite solder.

METALLURGICAL TECHNIQUES FOR ESTIMATING MICROMETEOROID IMPACT VELOCITIES FROM CRATER GEOMETRIES: JESUS RIVAS and L. E. MURR, Department of Metallurgical and Materials Engineering, The University of Texas at El Paso, El Paso, TX 79968.

We have observed numerous hypervelocity micrometeoroid impact craters in aluminum and stainless steel samples exposed in low-Earth orbit on the NASA Long Duration Exposure Facility (LDEF) satellite using normal-view scanning electron microscopy (SEM). In an effort to examine the crater wall structure and prospects for impact-generated shock-wave induced defects below the crater base, a technique was developed to produce cross-sections and slices (~20 μm) through larger-sized craters (>0.5 mm diameter) to allow SEM views normal to the crater wall, or transmission electron microscopy (TEM) of thin regions below (or beyond) the crater wall by argon ion milling of regions about 1 crater diameter from the wall. On comparing these section views with computer simulations in half-section space as a function of impact velocity, it was observed that features of the crater geometry such as the ejecta rim width and the height of the ejecta rim also varied with crater depth and diameter. It now appears that ratios of crater ejecta rim width to crater diameter, and ejecta rim height to crater diameter (or depth), may provide some estimates of the impact velocity, and we will present some examples of estimates based on observations of cross-sections as well as normal crater views. Work supported by NASA-Johnson Space Center Grant NAG 9-481.

THE OBSERVATION OF SILICON NANOCRYSTALS IN SILOXENE, R.F.PINIZZOTTO, H.YANG and J.M.PEREZ, Center for Materials Characterization and Physics Department, University of North Texas, Denton, Texas, 76203-5308 and J.L.COFFER, Department of Chemistry, Texas Christian University, Fort Worth, Texas, 76129.

Observations of the visible photoluminescence of many silicon-based materials have recently been reported. There is strong interest in understanding the basic luminescence mechanisms both from a fundamental physics perspective and for optoelectronic applications. We have used high resolution transmission electron microscopy to examine unannealed siloxene and have observed the presence of silicon nanocrystals with dimensions on the order of a few nanometers embedded in the material. This observation is additional strong evidence that the photoluminescence properties of Si-based materials are due to quantum confinement effects. The observations stress the underlying importance of HREM evaluation of photoluminescent silicon-based materials to fully understand the nature of this phenomenon.

DIFFUSION KINETICS OF INTERMETALLIC COMPOUND FORMATION IN COMPOSITE SOLDERS. J.A. Sees, Y. Wu, J.L. Marshall, R.F. Pinizzotto, Center for Materials Characterization, University of North Texas, Denton, TX 76203-5308

The Sn/Pb eutectic alloy system is the most widely used joining material in the electronics industry. In this application, the solder provides the electrical and mechanical interconnection between integrated circuits on a printed circuit board. In an effort to improve its mechanical integrity, metallic or intermetallic particles have been added to eutectic Sn/Pb solder to form composite solder. The growth and morphology of the two intermetallic phases (Cu_6Sn_5 and Cu_3Sn) that form between a Cu substrate and Sn/Pb solder were studied under different aging and annealing conditions using scanning electron microscopy and X-ray energy dispersive spectroscopy. Activation energies for formation of these phases were determined for eutectic and four types of composite solder (20 wt.% Cu_6Sn_5, 20 wt.% Cu_3Sn, 7.6 wt.% Cu, and 4.5 wt.% Ni). Cu-containing particles increased the activation energy of Cu_6Sn_5 formation and decreased the activation energy of Cu_3Sn formation. Ni additions dramatically increased both activation energies.

EFFECT OF CARBON CONTENT ON CARBIDE PRECIPITATION IN 304 STAINLESS STEEL: E. A. TRILLO, A. H. ADVANI, and L. E. MURR, and W. W. FISHER, Department of Metallurgical and Materials Engineering, The University of Texas at El Paso, El Paso, TX 79968.

The precipitation of carbides ($M_{23}C_6$) on grain boundaries in mill-processed 304 stainless steels having carbon contents of 0.01, 0.025, 0.05, and 0.07 weight percent is being investigated using transmission electron microscopy. We have compared sensitization and precipitation after aging at 625 and 775°C for more than 10^3 hours. These temperatures represent a preponderance of precipitation and healing (ex-solution) respectively, and observations of carbide density and size along similar types of grain boundaries have been correlated with these general features. Chromium depletion is also being correlated with variations in precipitate size and density. Similar boundaries were determined by comparing misorientations for identical crystallographic orientations for neighbor grains separated by the grain boundary interface. Some preliminary comparisons of precipitation on grain boundaries having different misorientations have also been made, and these observations will be described. Depletion of chromium between precipitates along selected boundaries is also being investigated using fine focussed electron beam line scans which produce line-width resolutions less than 200 Å. Work supported by NSF-RIMI Grant HRD 9105065 and EPA Cooperative Agreement CR-81 8296-01-0.

MATERIALS SCIENCES

POSTER PRESENTATION — SPRING 1993

COMPARISON OF MICROSTRUCTURES FOR COPPER AND TANTALUM SHAPED CHARGE REGIMES: H. K. SHIH, C-S. NIOU and L. E. MURR, Department of Metallurgical and Materials Engineering, The University of Texas at El Paso, El Paso, TX 79968.

The shaped charge has been used since World War II for armor penetration as well as fracturing of rock, cutting, precision separation, and demolition. A shaped charge for armor penetration consists of a conical metal liner which is surrounded by a cylindrical explosive and detonated. The detonation collapses the cone and produces a slug which contains up to 80 per cent of the cone material and an axial jet which stretches to some instability condition and particulates into necked fragments. This jetting process involves true strains in excess of 10 at strain rates between 10^4 and 10^8 s^{-1}. Initial jet-forming pressures can exceed 200 GPa. Observations of initial and residual microstructures are indicative that this example of extreme plastic deformation also appears to represent a classic example of discontinuous dynamic recrystallization. A detailed examination of microstructures which characterize the starting cone, the residual slug, and individual jet fragments (the shaped-charge regime) has been completed for copper and tantalum shaped charges and the results illustrate interesting microstructure evolution. Light microscopy and SEM provide a metallurgical overview while TEM provides details of microstructural issues on a very fine scale. Work supported by a Murchison Endowed Chair and the Phelps-Dodge Foundation through the Phelps-Dodge Scholars Program at UTEP.

ANSWER TO "WHAT IS IT"

Fractured surface of human dentin showing an area of dentin layer. "Holes" represent dentin tubules which house odontoblastic processes. Prepared by etching with 30% HCl for 30 seconds and sputter coated with gold-pallidium. (Bar = 10 micrometers)

Micrograph — Roger D. Metcalf, D.D.S., Biology Department, The University of Texas at Arlington, 76019.

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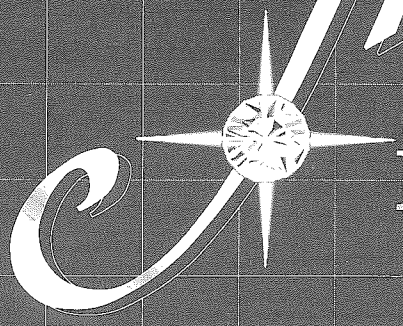

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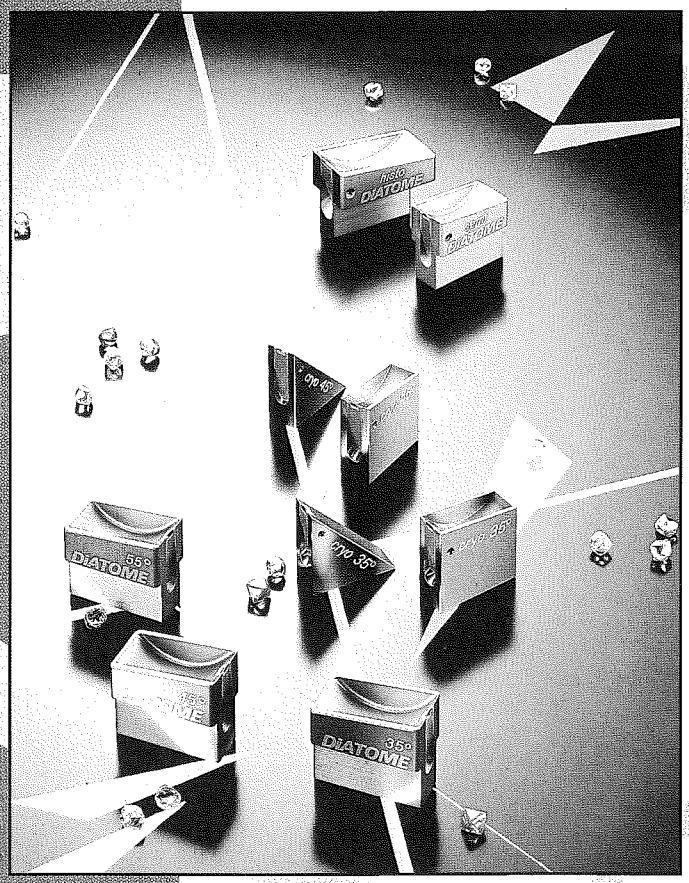

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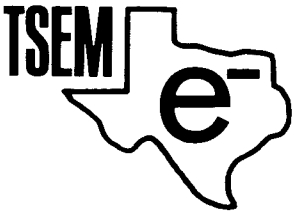

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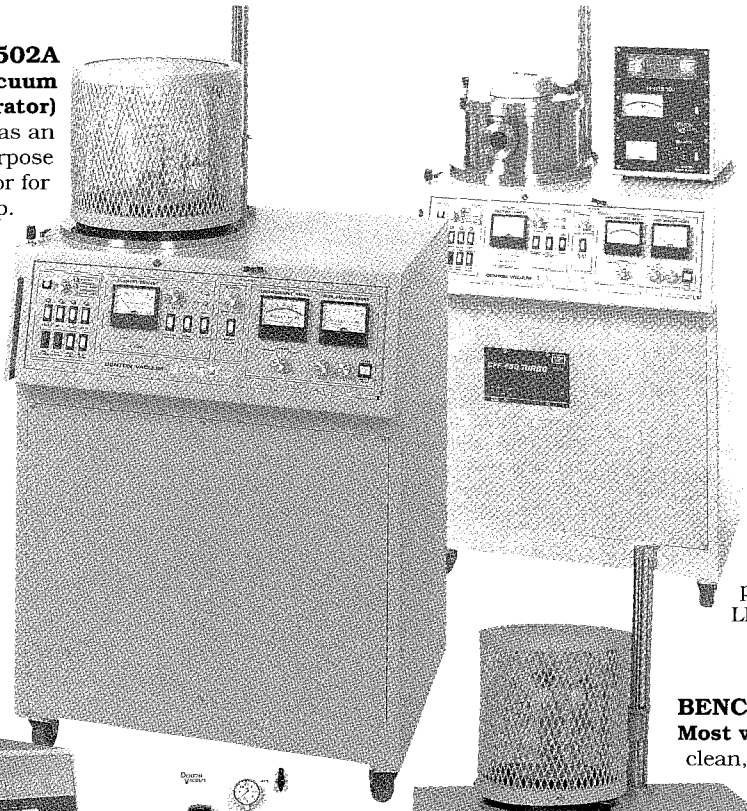

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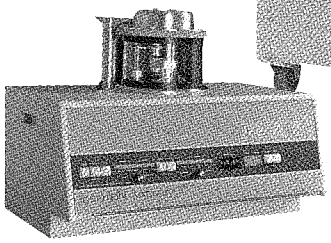

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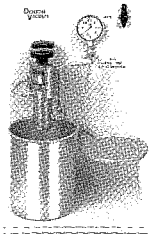

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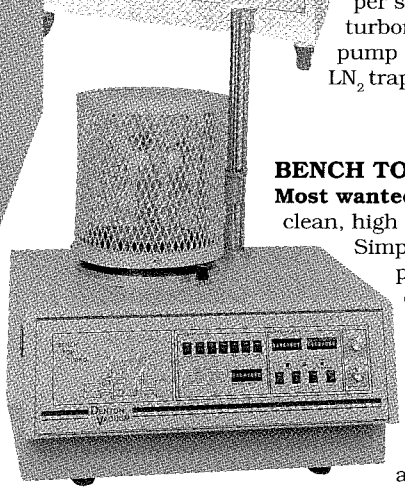

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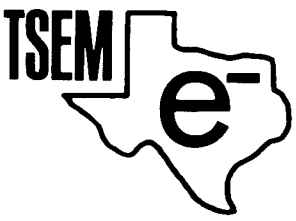

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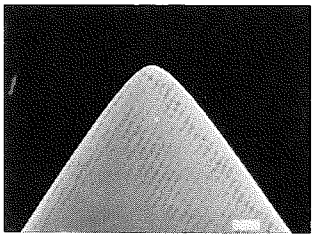
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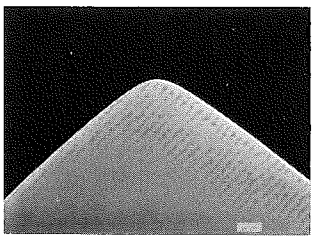
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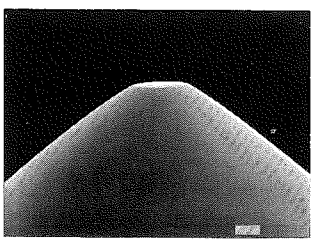
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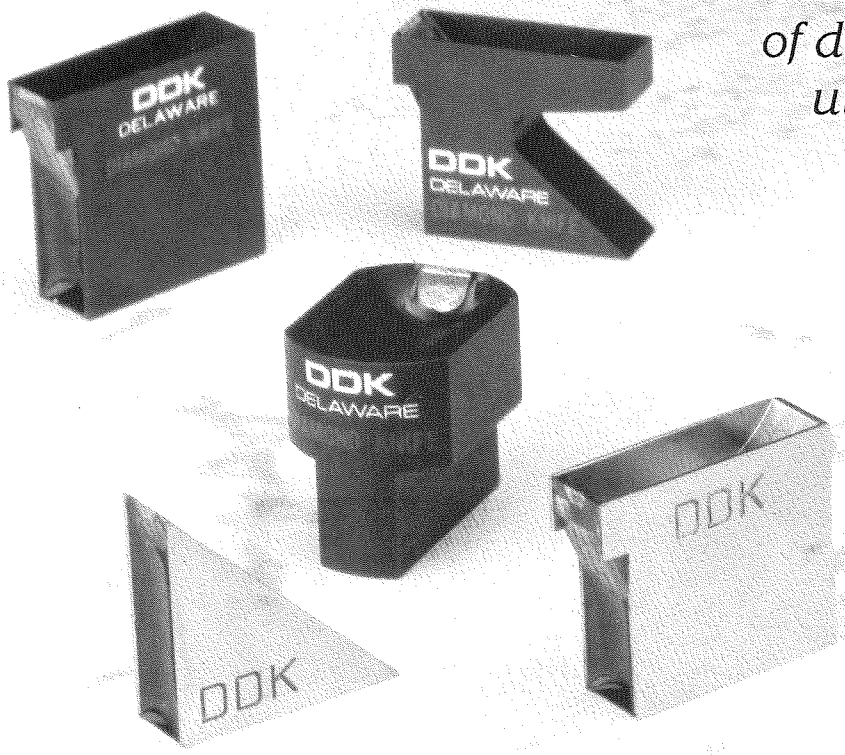

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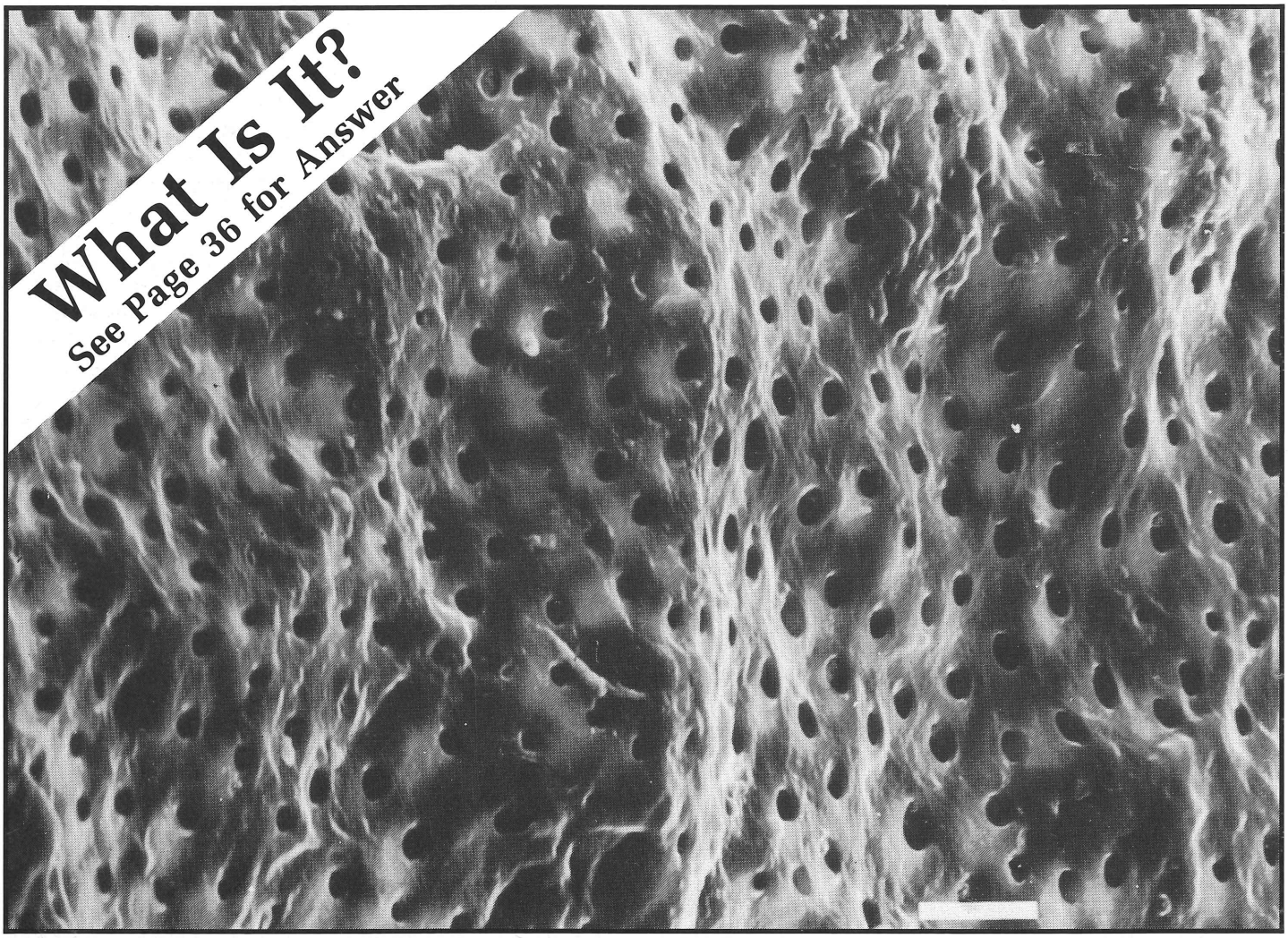

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