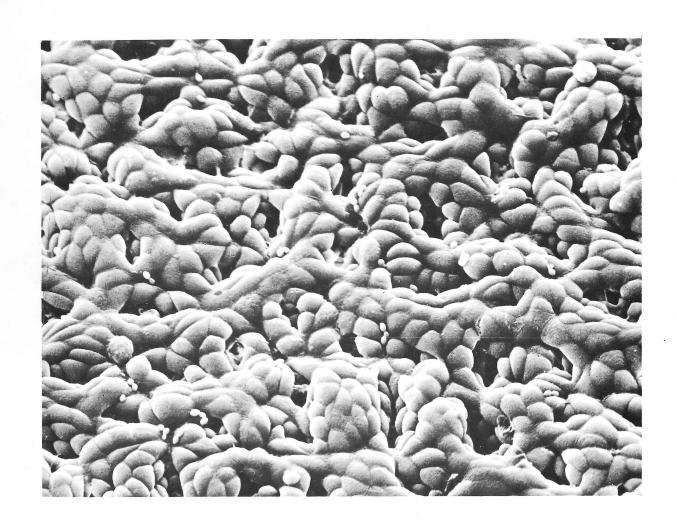
TSEM Texas Society for Electron Microscopy Topic Texas Society fo





OCULAR HISTOLOGY: A Text and Atlas

By Ben S. Fine, M.D., Armed Forces Institute of Pathology, and The George Washington University — both in Washington, D.C.; and Myron Yanoff, M.D., Medical School and Hospital of the University of Pennsylvania

276 Pages, 490 Illustrations (19 in full color), 1972, \$27.00

This new book provides a detailed introduction to contemporary histology and cytology of ocular tissues, emphasizing the human tissues. The approach is also new in that the structure of the eye is discussed from the three-tissue concept (a cytologic approach) which is complimentary to the older three-layered concept. Transmission electron microscopy of all the ocular tissues is described, a collated group of pertinent references in the field is provided, and correlation is made with clinical observation wherever possible. Scanning electron microcopy is also included.

DERMAL PATHOLOGY

With 17 Contributors. Edited by James H. Graham, M.D., College of Medicine, University of California at Irvine; Waine C. Johnson, M.D., Temple University School of Medicine; and Elson B. Helwig, M.D., Armed Forces Institute of Pathology.

830 Pages, 879 Illustrations, 1972, \$47,75

This highly illustrated book presents basic and modern concepts of dermal pathology including related anatomy, histology, electron microscopy, and histochemistry. Diseases which show similar histopathologic features are placed next to each other in order to stress the differential diagnosis and emphasize the differentiating features between these diseases. The scope includes cytodiagnosis, inflammatory dermatoses, granulomatous dermatoses, nevi and neoplasms, and reticuloendothelial and alternative dermatoses.

ELECTRON MICROSCOPY OF HUMAN BLOOD CELLS

By Yasukazu Tanaka, M.D., Veterans Administration Hospital, San Francisco; and Joseph R. Goodman, Ph.D., School of Medicine, University of California.

430 Pages. 349 Illustrations. 1972. \$25.00

In an atlas-like presentation, this book illustrates and discusses the normal and pathologic aspects of the human blood cell. Presenting all human blood cell types with a description, morphology and cytogenesis of each, the text relates current concepts of function and disease, and includes techniques and solutions applicable specifically to hematological specimens prepared for the electron microscope.

ATLAS OF NEUROPATHOLOGY

By Sumner I. Zacks, M.D., University of Pennsylvania School of Medicine

416 Pages, 341 Illustrations, 1971, \$18.00

One hundred and fifty-one plates, representing over three hundred photographs of gross specimens, photomicrographs and electron micrographs, survey the world of neurologic diseases. All the plates have been carefully chosen to make the pathologic lesions readily evident. Brief case summaries, placing each lesion in clinical perspective, are also included.

AGENTS OF BACTERIAL DISEASE

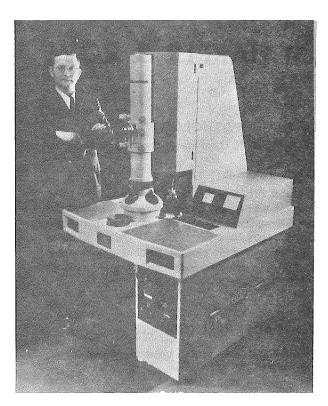
By Albert S. Klainer, M.D., West Virginia University Medical Center; and Irving Geis, Medical Illustrator.

192 Pages. 93 Illustrations. 1973. \$9.95

This new text presents a unique visual approach to the study of the common bacteria which cause human disease. It is profusely illustrated with scanning electron photomicrographs and detailed diagrammatic illustrations in order to permit rapid assimilation of the subject matter with a minimum of textual material. The photomicrographs provide stunning visual insight into the morphology of numerous bacteria.

HARPER & ROW Publishers, Inc. Medical Department 2350 Virginia Ave. Hagerstown, Md. 21740 Rush the following books to me on 30-day approval: DERMAL PATHOLOGY Graham, Johnson, & Helwig \$47.75 OCULAR HISTOLOGY ATLAS OF NEUROPATHOLOGY AGENTS OF BACTERIAL DISEASE ELECTRON MICROSCOPY OF HUMAN BLOOD Tanaka & Goodman 25.00 Bill me Check enclosed (Harper pays postage & handling) Address City State Zip TSEM-123

world's two easiest-to-operate Electron Microscopes.



The EM 9S-2 is known as the easiest-to-operate EM, absolutely reliable, and most compact. Its features are:

Resolution - 7 % point-to-point guaranteed

Magnification 0-60,000, steps and zoom

Accelerating Voltage - 60 kV

Foolproof Airlock - safe and fast to operate

Specimen Handling Facilities - with standard

specimen holder + 6° tilt for stereophotography

Fully Automatic Camera System - pioneered by Zeiss

offering spot reading, electronic densitometer

in screen's center -
correct exposure every time -
automatic negative advance -
empty-magazine indicator activated by single

control -
In short -- The most EM for the price

The EM 10 -- a new approach to high-resolution electron microscopy. In addition to its 3.5 % point-to-point guaranteed resolution, it incorporates outstanding features every electron microscopist and researcher would want to have at his fingertips:

Resolution - 3.5 % point-to-point guaranteed, due to precision electron optics and utmost electronic and mechanical stability of the advanced, modular design Magnification - from 100x-200,000x digitally displayed, selectable by single control, with reproducibility better than 1.5%

Acceleration Voltage - in four steps from 40-80 kV Specimen Airlock - pre-pumped. Specimen insertion time 30 secs.

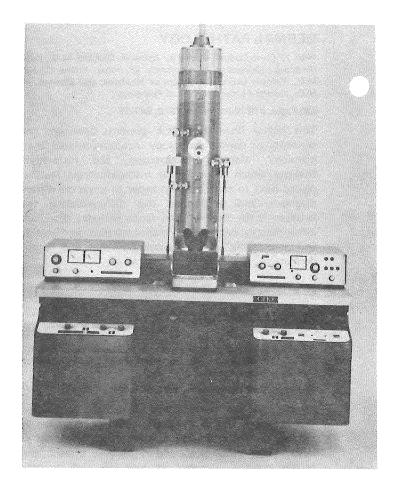
Specimen Handling Facilities - for tilt and rotation, eucentric goniometer stage

Photographic System - The most advanced on the market.

Fully automatic, single-control-operated exposure.

3 fully automatic cameras for instant switch-over and total capacity of 145 frames -- automatic raising and lowering of fluorescent screen -- 5-character automatic negative identification -- override possibilities --

Automatic Vacuum - single push-button operation
X-ray Radiation Protection System -- leakage-proof under
all working conditions
And Many More...



Your local ZEISS office: Carl Zeiss, Inc. 3131 West Alabama Houston, Texas 77006 (713) 524-3895.



designed for totally flexible specimen handling

Now the world's most versatile scanning electron microscope — the Etec Autoscan — can be tailored to meet your most exacting biological research requirements.

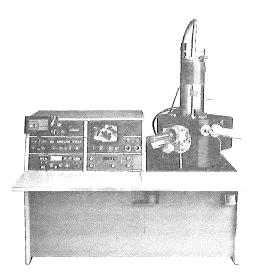
Etec Corporation has developed a system, Biosem, that will allow you to transfer a frozen biological specimen into your Autoscan for examination, sublimation and coating with a minimum of atmospheric contamination or unwanted temperature variation.

For complete information, write for the free booklet, Biosem: The Biological Scanning Electron Microscope.

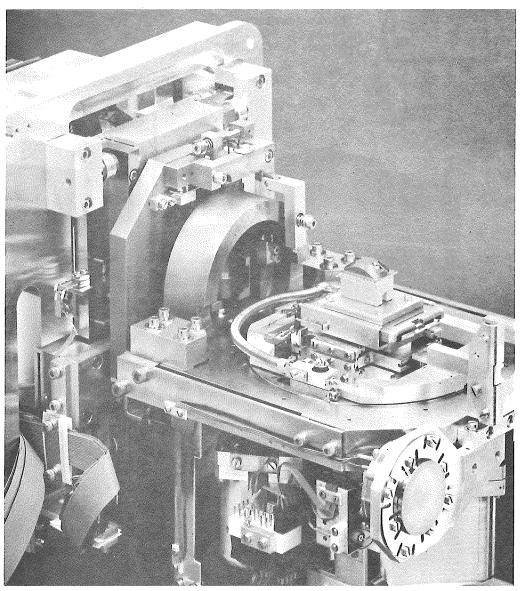


3392 Investment Blvd. Hayward, CA 94545 Telephone (415) 783-9210





PSEM500



Eucentric goniometer stage provides five degrees of freedom

Philips PSEM500

The new quantitative SEM

Quantitative because:

Specimen position is accurately indicated by digital displays

Stepping motor drives are smooth, reproducible, backlash-free

Eucentric goniometer stage provides five degrees of freedom, and is accurate and reproducible

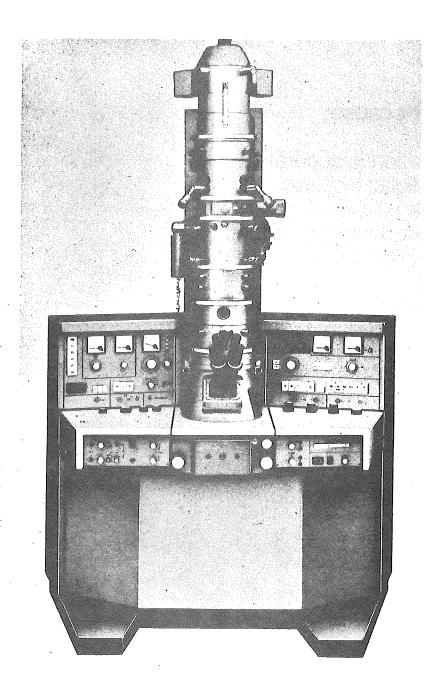
All controls are mounted directly in front of operator, below viewing monitor

. . . computer adaptable, too.

Call us at our Houston, Texas office 713-782-4845 Ask for George Brock, District Sales Manager



ELMISKOP 102



Specifications:

- *Resolution: 3 AU point-point
- *Accelerating Voltages: 20-40-60-80-100-125 KV
- *Filament: DC heated
- * Magnification:
 200 X to 1.000.000X

 Picture brightness and focus
 are retained when magnification
 is changed.
- * Vacuum System:
 Automated single push button operation.
- *Anticontamination Device:
 Standard

TEXAS SOCIETY FOR ELECTRON MICROSCOPY -



" FOR THE PURPOSE OF DISSEMINATION OF RESEARCH WITH THE ELECTRON MICROSCOPE"

FOUNDED IN 1965

VOLUME 5

NUMBER 2

SPRING 1974

Officers 1973-1974:

Bob Turner,
President
Department of Pathology
Scott & White Clinic
Temple, Texas
817-778-4451 ext. 438

Terry Hoage, Vice President Biology Department S.H.S.U. Huntsville, Texas 77340 713-295-6211 ext. 1666

Ernest Couch,
Treasurer
Department of Biology
Texas Christian University
Fort Worth, Texas 76129
817-926-2461 ext. 461

Jerry Berlin, Secretary Department of Biology Texas Tech University Lubbock, Texas 79409 806-742-3169

Ivan Cameron,
Newsletter Editor
The University of Texas
Health Science Center at
San Antonio
San Antonio, Texas 78284
512-696-6537

Larry Thurston,
Program Chairman
Department of Biology
Texas A & M University
College Station, Texas 77843
713-845-1129

Dimitrij Lang,
Immediate Past President
Department of Molecular Biology
The University of Texas
Dallas, Texas 75230

Send Letters and Inquiries to:

William A. Pavlat,

Managing Editor of Newsletter

Department of Anatomy
The University of Texas

Health Science Center at San Antonio

San Antonio, Texas 78284

512-696-6537

Editorial

Graduate Students and the Texas Society for Electron Microscopy

With this issue of the Newsletter and the spring workshop-graduate student meeting at Texas A & M University on May 24th and 25th, the Texas Society for Electron Microscopy once again proclaims its role in the training and stimulation of students in the field of ultrastructure and electron microscopy.

The Society is proud to be able to financially support those students who wish to present papers at our spring meeting and to be able to offer an awards program to be given for outstanding student presentations. Clearly TSEM has put its money where it counts most, and the entire membership is pleased to offer students these opportunities. No other society, local or national, has made a stronger commitment to students.

Students who make presentations before our society can expect that the distinguished members of TSEM will offer suggestions, constructive criticism and will demonstrate real interest in their work and training.

Do not think for a minute that TSEM is an altruistic society when it comes to students, not in the least, it is simply that we recognize that students are the life blood and vitality of the Texas Society for Electron Microscopy. We feel that TSEM is the best regional or local organization of its kind in the country and we aim to keep it that way.

IVAN L. CAMERON

Newsletter Editor

PRESIDENT'S MESSAGE

It is very difficult to believe that this year, as your president, is almost over. It has been a truly inspirational and exciting year for me personally. It seems like only yesterday (last September) that we were kicking up our heels, floating down the river and generally having a good time at the Mayan Dude Ranch in Bandera. Out of that meeting came perhaps a lot of new ideas and innovations for future TSEM meetings. Perhaps a precedent was set, in that a lot of people have expressed desires to have more meetings of this type, at least one a year.

The winter joint symposium with LSEM in San Antonio last February, in my opinion, was an overwhelming success. There were many favorable comments from many people including the exhibitors (15), members from both Texas and Louisiana and especially the EMSA Council. We had over two hundred in total attendance and everyone I talked to seemed like they got a lot out of the meeting. The success of this symposium was a direct effort of a lot of hard work on many people's parts. Thanks to all of you.

With this, the Graduate Student Meeting, being our last this year, I would like to take a brief moment to personally thank all of the Executive Committee members for working so diligently and hard this past year. It is only through their unselfish works and personal efforts that we have had such a successful year in TSEM. These men are of course: Terry Hoage, President-Elect; Jerry Berlin, Secretary; Ernest Couch, Treasurer and Larry Thurston, Program Chairman. Once again, thank you all very much for making my job easier.

On behalf of the entire TSEM Executive Committee, I would like to express my personal thanks to all the TSEM membership for an extremely rewarding year.

ROBERT A. TURNER

President

T.S.E.M. MINUTES - BUSINESS MEETING

The T.S.E.M. business meeting was held Friday, February 8, 1974, at 8:30 P.M., at the Menger Hotel, San Antonio, Texas. President Robert Turner presided. The minutes of the last meeting were read and approved. The treasurer's report was read and approved.

Bob Turner and Larry Thurston discussed the two types of graduate student awards to be given at the May 24-25, 1974, meeting at Texas A & M. A \$300 travel award will be prorated to students giving papers to help defray their expenses. The actual expenses must be validated by the student's major advisor. Also, there will be one best paper award of \$200. The selection of the best graduate student paper will be based on a 800 word paper with a maximum of four 8 X 10" plates and the oral presentation.

Turner reported that the results of a membership poll to determine the number of T.S.E.M. meetings per year was to remain the same, i.e., three meetings in Texas every other year and two meetings in Texas when the Joint T.S.E.M. -L.S.E.M. meeting is held in Louisiana.

Turner reported the Executive Committee's decision to limit the editions of the Newsletter to two per year unless more news was forthcoming from the membership. If sufficient news is available there will be three editions as in the past. If only two editions are to be published they will coincide with the winter and spring meetings of the society.

Berlin reported the Nominating Committee's recommendation for the two offices to be filled for the upcoming year. Arthur Cole and Ward Kischer will be on the ballot for President-elect and Venita Allison and Jim Stinson for Program Chairperson.

Turner mentioned that a committee will be named to determine what changes would be appropriate for the societies by-laws.

The meeting adjourned at 9:00 P.M.

JERRY BERLIN

Secretary

FINANCIAL REPORT

Texas Society for Electron Microscopy

through April 26, 1974

Total As	\$3,830.44			
Allocation of Funds:				
	 Checking account University Bank at Fort Worth 	2,800.10		
	2. Certificate of deposit plus interest	1,030.44		
Receipts:				
A.	Registration fees and dues at San Antonio	\$1,197.00		
В.	Corporate member security fees	240.00		
C.	Dues since San Antonio meeting	30.00		
D.	Corporate support of Newsletter	100.00		
	Total	\$1,567.00		
Disbursements:				
Α.	Hotel Menger 1. luncheon 2. rooms for speakers	\$600.00 36.04 248.07		
	Total	\$883.11		
В.	Corporate member exhibit security at San Antonio meeting	240.00		
C.	Executive committee planning meeting at Dallas	214.54		
D.	Winter Newsletter	292.74		
E.	Program chairman's expenses for Bandera and San Antonio meetings	285.00		

F.	Secretary's expenses (mailouts,	etc.)	120.38
G.	Honoraria (Barrnett and Humphr	ies)	100.00
		Total	\$2,135.77
Checking prior to meeting:			\$2,708.00
Checking after San Antonio meeting:			\$2,800.10

The last two bibliographies were collected by graduate students in Botany - 394, a course on freeze-etching and scanning electron microscopy given by Dr. G. T. Cole at The University of Texas at Austin.

Jim Marlowe, Department of Microbiology compiled the bibliography on applications of freeze-etching techniques to microbiology. Randy Moses, Department of Zoology compiled the references for applications of freeze-etching to ultrastructural studies of biological membranes published in the last Newsletter (TSEM, 5, 1974).

The bibliographies were formatted, edited and processed by Ruben Ramirez-Mitchell, Cell Research Institute, The University of Texas, using the CDC 6600/6400 computer system at The University of Texas. The references are part of a data base on scanning electron microscopy and freeze-etching for future use with a retrieval system of limited capabilities being written in Fortran IV and Basic.

The bibliographies will be made available to any interested party in the form of printed computer output, or punched cards.

References already published by Dr. G. L. Colborn (TSEM, 4, 1973) and keywords present in the original bibliographies are not included in the present listing.

- ALLEN, J, Va, WaMa HESS, AND D, J, WEBER, ULTRASTRUCTURAL INVESTIGATIONS OF DORMANT TILLETIA CARIES TELIO- SPORES, MYCOLOGIA, 63: 144-156, (1971)
- BACHI, T., W. GERHARD, J. LINDENMANN, AND K. MULETHALER. MORPHOGENESIS OF INFLUENZA A VIRUS IN EHRLICH ASCITES TUMOR CELLS AS REVEALED BY THIN SECTIONING AND FREEZE-ETCHING. J. VIROL. 4: 769=776. (1969)
- BAILEY, A. AND T. BISALPUTRA. A PRELIMINARY ACCOUNT OF THE APPLICATION OF THIN-SECTIONING, FREEZE- ETCHING, AND SCANNING ELECTRON MICROSCOPY TO THE STUDY OF CORALLINE ALGAE. PHYCOLOGIA, 9:83-101, (1970)
- BARNETT, J.R. AND R.D. PRESTON. ARRAYS OF GRANULES ASSOCIATED WITH THE PLASMALEMMA IN SWARMERS OF CLADOPHORA, ANN. BOT., 348 1011-1017, (1970).
- BAUER, HEINZ, INTERPRETATION OF FROZEN#FRACTURED MEMBRANES OF LIPOMYCES LIPOFER, JOURNAL OF BACTERIOLOGY, 96: 853#854, (1968)
- BAUER, HEINZ AND KENJI TANAKA. ULTRASTRUCTURE OF MITOCHONDRIA AND CRYSTAL-CONTAINING BODIES IN MATURE BALLISTOSPORES OF THE FUNGUS BASIDIOBOLUS RANARUM AS REVEALED BY FREEZE-ETCHING. JOURNAL OF BACTERIOLOGY, 968 2132-2137. (1968)
- BAUER, HEINZ AND ELSIE SIGARLAKIE., ULTRATHIN FROZEN SECTIONS OF YEAST CELLS, J. ULTRASTRUCT, RES,, 40: 197-204. (1972)
- BAYER, MANFRED, AND CHARLES REMSEN, BACTERIOPHAGE TO AS SEEN WITH THE FREEZE-ETCHING TECHNIQUE, VIROLOGY, 408 703-718, (1970)
- BAYER, M.E., AND C.C. REMSEN, STRUCTURE OF ESCHERICHIA COLI AFTER FREEZE-ETCHING, JOURNAL OF BACTERIOLOGY, 1018 304-313. (1970)
- BERERHI, A., AND K. MALKANI, STUDY OF HELA CELLS IN CULTURE BY FREEZE-ETCHING ULTRASTRUCT, RES. 328 23-31, (1970)
- BRANTON, D. AND DARLENE SOUTH WORTH, FRACTURE FACES OF FROZEN CHLORELLA AND SACCHAROMYCES CELLS, EXP., CELL RES., 478 648-653. (1967)
- BRONCHART, R. AND V. DEMOULIN. REVELATION BY FREEZE ETCHING OF LOMASOMES IN THE BASIDIOSPORE OF HYPHOLOMA FASCICULARE (HUDS. EX FR) KUMMER, PLANTA, 94% 229-332, (1970)
- BROWN, D.L. AND T.E. WEIER. ULTRASTRUCTURE OF THE FRESHWATER

- ALGA BATRACHOSPERMUM: I, THIN- SECTION AND FREEZE-ETCH ANALYSIS OF JUVENILE AND PHOTOSYNTHETIC VEGETATIVE CELLS. PHYCOLOGIA, 9: 217-235. (1970).
- COLE, GARRY T. AND HENRY C. ALDRICH, DEMONSTRATION OF MYELIN FIGURES IN UNFIXED FREEZE-ETCHED FUNGUS SPORES, J. CELL BIOL., 51: 873-874. (1971)
- COLE, GARRY T. AND H.C. ALDRICH. ULTRASTRUCTURE OF CONIDIOGENESIS IN SCOPULARIOPSIS BREVICAULIS, CAN. J. BOT., 49: 745-755. (1971)
- DEMSEY, A.E. AND E. KENNEDY, A FREEZE-ETCH STUDY OF THE CELL WALL AND CYTOPLASMIC MEMBRANE OF STAPHYLOCOCCUS AUREUS. J. MICROS., 13: 343-348. (1972)
- DEVDE, I.W., J., COSTERTON, AND R. MACLEDD. DEMONSTRATION BY FREEZE-ETCHING OF A SINGLE CLEAVAGE PLANE IN THE CFLL WALL OF A GRAM-NEGATIVE BACTERIUM, JOURNAL OF BACTERIOLOGY, 106: 659-671. (1971).
- EASTERBROOK, K.B. CRYSTALLINE AGGREGATES OBSERVED IN THE VICINITY OF FREEZE-ETCHED POX VIRUS INCLUSIONS. CAN. J. MICRO., 18: 403-406. (1972).
- EASTERBROOK, K.B. STEREOMICROGRAPHY OF FREEZE-ETCHED POX VIRUS. J. MICROS., 15: 13-20, (1972).
- EASTERBROOK, K,B, STRUCTURAL ANALYSIS OF A FREEZE-ETCHED CRYSTALLINE AGGREGATE, J. MICROS, 15: 337-342, (1972),
- EASTERBROOK, K.B. THE USTRASTRUCTURE OF CRITHIDIA FASCICULATA:
 A FREEZE-ETCHING STUDY, CAN, J. MICRO., 17: 277-279,
 (1971).
- EASTERBROOK, K.B. AND K.R. ROZEE. THE INTRACELLULAR DEVELOPMENT OF VACCINIA VIRUS AS OBSERVED IN FREEZE-ETCHING PREPARATIONS. CAN. J. MICROBIOL., 17: 753-757. (1971).
- EASTERBROOK, K.B. AND K.R. ROZEE. THE ULTRASTRUCTURE OF THE REOVIRUS INCLUSION: A FREEZE-ETCHING STUDY. J. ULY. RES., 34: 303-315. (1971).
- ELLIS, ANN AND M, BROWN, JR, FREEZE-ETCH ULTRASTRUCTURE OF PARMELIA CAPERATA (La) ACH, TRANS, AM, MICROS, SOC, 91: 411-421, (1972),
- FIKHTE, B, A, AND E, I. ZAICHKIN, DETECTION OF ELEMENTARY PARTICLES ON THE INNER MEMBRANE OF MITO- CHONDRIA BY THE CRYOCLEAVAGE METHOD DUKL, AKAD, NAUK, SSR SER, BIOL, 205: 961-962, (1972).
- FLOWER, N.E. COMPLEMENTARY PLASMA MEMBRANE FRACTURE FACES IN FREEZE-ETCH REPLICAS, J. CELL SCI., 128 445-452, (1973)

- FORGE, A., J. COSTERTON, AND K. KERR, FREEZF-ETCHING AND X-RAY DIFFRACTION OF THE ISOLATED DOUBLE TRACK LAYER FROM THE CELL WALL OF GRAM-NEGATIVE MARINE PSEUDOMONADS, JOURNAL OF BACTERIOLOGY, 113: 445-451. (1973).
- GHIORSE, W.C. AND M. EDWARDS, ULTRASTRUCTURE OF ASPERGILLUS FUMIGATUS: CONIDIA DEVELOPMENT AND MATURATION. PROTOPLASMA, 76: 49=59. (1973).
- GICQUAD, C.R., ET. AL. STUDY OF THE STRUCTURE OF TRIURET CRYSTALS IN AMOEBA PROTEUS BY FREEZE-ETCHING J. MICROS., 12: 51-58, (1971).
- GILLELAND, H.E., J. STINNETT, I. ROTH, AND R. EAGON. FREEZE-ETCH STUDY OF PSEUDOMONAS AERUGINOSA: LOCALIZATION WITHIN THE CELL WALL OF AN ETHYLENE DIAMINE TETRAACETATE-EXTRACTABLE COMPONENT, JOURNAL OF BACTERIOLOGY, 113: 417-432. (1973).
- GOODENOUGH, URSULA AND LaA, STAEHELIN, STRUCTURAL DIFFERENTIATION OF STACKED AND UNSTACKED CHLOROPLAST MEMBRANES: FREEZE-ETCHE MICROSCOPY OF WILD-TYPE AND MUTANT STRAINS OF CHLAMYDOMONAS, J, CELL, BIOL, 48: 594-619, (1971).
- GOULD, G., J. STUBBS, AND W. KING. STRUCTURE AND COMPOSITION OF RESISTANT LAYERS IN BACTERIAL SPORE COATS, J. GEN. MICROBIOL., 60: 347-355. (1970).
- GRIFFITHS, D.A. THE FINE STRUCTURE OF BASIDIOSPORES OF PANAEOLUS CAMPANULATUS RE- VEALED BY FREEZE-ETCHING. ARCH. MIKROBIOL., 76: 74-82. (1971).
- GRIFFITHS, D.A., PARAMURAL BODIES IN HYPHAE OF VERTICILLIUM DAHLIAE KLEB, REVEALED BY FREEZE ETCHING, ARCH., MIKROBIOL., 73:331=336, (1970), PLASMALEMMA
- GRUND, S. FLAGELLA AND CELL BOUNDARIES OF ESCHERIA COLI AFTER FREEZE ETCHING. ZENTRALBLAT, VETERINAERMED, REIHE B., 18: 113-134. (1971).
- GUNASEKARAN, M., W.M., HESS, AND D.J.WEBER, THE FATTY ACID COMPOSITION OF CONIDIA OF ASPERGILLUS NIGER V. TIEGH, CAN., J. MICRO., 18: 1575-1576, (1972),
- GUTH, E,, T, HASHIMOTO, S,F, CONTI, MORPHOGENESIS OF ASCOSPORES IN SACCHAROMYCES CEREVISIAE, JOURNAL OF BACTERIOLOGY, 109: 869-880, (1972),
- HASHIMOTO, TADAYO, J. MORGAN AND S.F. CONTI, MORPHOGENESIS AND ULTRASTRUCTURE OF GEOTRICHUM CANDIDUM SEPTA, JOURNAL OF BACTERIOLOGY, 1168 447-455, (1973),
- HEMMES, DON, E, KOJIMA-BUDDENHAGEN, AND H, HOHL, STRUCTURAL

- AND ENZYMATIC ANALYSIS OF THE SPORE WALL LAYERS IN DICTYOSTELIUM DISCOIDEUM, J. ULT, RES., 418406-417, (1972).
- HESS, W.M. ULTRASTRUCTURAL COMPARISONS OF FUNGUS HYPHAL CELLS USING FROZEN ETCHED REPLICAS AND THIN SECTIONS OF THE FUNGUS PYRENOCHAETA TERRESTRIS, CAN. J. MICROBIOL., 148 205 210, (1968).
- HESS, W.M., J. BUSHNELL, AND D. WEBER. SURFACE STRUCTURE AND UNIDENTIFIED ORGANELLES OF LYCOPERDON PERLATUM PERS. BASIDIOSPORES. CAN. J. MICROBIOL. 18: 270=271. (1972).
- HESS, W,M,, M, SASSEN, AND C,C, REMSEN, SURFACE CHARACTERISTICS OF PENICILLIUM CONIDIA, MYCOLOGIA, 608 290=303.(1968)
- HESS, W.M., M. SASSEN, AND C.C. REMSEN. SURFACE STRUCTURES OF FROZEN ETCHED PENICILLIUM CONIDIOSPURES, NATURWISSENSCHAFTEN, 53: 708. (1966).
- HESS, W.M., AND DAYNA STUCKS. SURFACE CHARACTERISTICS OF ASPERGILLUS CONIDIA. MYCOLOGIA, 61: 560-571. (1969).
- HOLT, STANLEY C., AND A,I. STERN: THE EFFECT OF 3-(3,4-DICHLOROPHENYL)-1,1-DIMETHYLUREA ON CHLOROPLAST DEVELOPMENT AND MAINTENANCE IN EUGLENA GRACILIS, I. ULTRASTRUCTURAL CHARACTERIZATION OF LIGHT GROWN CELLS BY THE TECHNIQUES OF THIN-SECTIONING AND FREEZE-ETCHING, PLANT PHYSIOL., 45: 475-483. (1970)
- ILES, G.H., P. SEEMAN, D. NAYLOR, AND B. CINADER. MEMBRANE LESIONS IN IMMUNE LYSIS: SURFACE RINGS, GLOBULE AGGREGATES, AND TRANSIENT OPENINGS. J. CELL BIOL., 56: 528-539. (1973).
- JAMES, ROBERT, AND D. BRANTON, B. WISNIESKI, AND A. KEITH. COMPOSITION, STRUCTURE, AND PHASE TRANSITION IN YEAST FATTY ACID AUXOTROPH MEMBRANES: SPIN LABELS AND FREEZE-FRACTURES. J. SUPRAMOL. STRUCT., 18 38-49. (1972).
- JANISCH, ROMAN. PELLICLE OF PARAMECIUM CAUDATUM AS REVEALED BY FREEZE ETCHING. J. PROTOZOOL., 19: 470-472. (1972).
- JONES, D. FROZEN-ETCHED SPORES OF TRICHODERMA VIRIDAE, TRANS. BR. MYCOL. SOC., 57: 348-350- (1971)
- JONES, D., AN UNUSUAL FEATURE OF THE NUCLEAR MEMBRANE IN FREEZE ETCHED SPORAN- GIOSPORES OF MUCOR PLUMBEUS, TRANS, BR. MYCOL, SOC., 598175-178, (1972).
- JONES, D. AND R.P.C. JOHNSON. ULTRASTRUCTURE OF FROZEN FRACTURED AND ETCHED PYCNIDIOSPORES OF CONIOTHYRIUM MINITANS, TRANS. BRIT. MYCOL. SOC., 55: 83-87. (1970).

- KIERMAYER, O. AND L. STAEHLIN, FINE STRUCTURE OF THE CELL WALL AND PLASMA MEMBRANE IN MICRASTERIAS DENTICULATA BREB. AFTER FREEZE ETCHING PROTOPLASMA, 748 227#237. (1972).
- KOPECKA, MARIE, DICTYOSOMES IN THE YEAST SCHIZOSACCHAROMYCES POMBE. ANTONIE LEEUWENHOEK J. MICROBIOL SEROL., 38: 27=31. (1972)
- KOPP, FRIEDRICH, MEMBRANE STRUCTURE: LOCALIZATION OF MEMBRANE LIPIDS IN THE PLASMA LEMMA OF YEASTS, CYTOBIOLOGIE, 6: 287-317, (1972)
- KOURI, JUAN, C. FINLAY, AND G. STARK, STUDY OF RABBIT ALVEOLAR MACROPHAGE BY FREEZE ETCHING, J. MICROS. 98 177-184. (1970).
- LEAK, L, V. AND J, F, BURKE, THE APPLICATION OF FREEZE FRACTURE REPLICATION IN STUDYING THE FINE STRUCTURE OF A BLUE GREEN ALGA (ANABAENA VARIABILIS), EXP, CELL RES, 48: 300-306, (1967),
- LICKFIELD, KARL AND M₀ ACHTERRATH₀ POLYMORPHISM OF THE STAPHYLOCOCCUS AUREUS MESOSOME: FINE STRUCTURE ANALYSIS BY MEANS OF ULTRAMICROTOMY, FREEZE-ETCHING AND MODELS CYTOBIOLOGIE, 6: 74-85 (1972)
- LICKFIELD, K.G., M. ACHTERRATH, F. HENTRICH, L. SEVEUS, A. PERSSON. THE FINE STRUCTURE OF PSEUDOMONAS AERUGINOSA IN ITS PRESENTATION USING FREEZE ETCHING, ULTRAMICROTOMY, AND CRYO-ULTRAMICROTOMY J. ULT. RES., 38: 27-45. (1972).
- LIU, T.P. A FREEZE ETCHING STUDY ON THE NUCLEAR ENVELOPE DURING DEVELOPMENT IN MICROSPORIDIAN THELOHANIA BRACTEATA (STRICKLAND, 1913). J. PARASITOL., 58: 1151=1161. (1972).
- LIU, T.B., J. DARLEY, AND D. DAVIES. PRELIMINARY OBSERVATIONS ON THE FINE STRUCTURE OF THE PANSPORO BLAST OF THE LOHANIA BRACTEATA (STRICKLAND, 1913) AS REVEALED BY FREEZE ETCHING ELECTRON MICROSCOPY. J. PROTOZOOL., 18:592-596. (1971).
- LIU,T,P, AND D,M,DAVIES, FINE STRUCTURE OF DEVELOPING SPORES OF THELOHANIA BRACTEATA (STRICK= LAND, 1913) EMPHASIZING POLAR FILAMENT FORMATION, J, PROTOAOOL, 198 461-469, (1972),
- LIU, T.P. AND D.M. DAVIES. ULTRASTRUCTURE OF THE CYTOPLASM IN FAT BODY CELLS OF THE BLACKFLY SIMULIN VITATUM WITH MICROSPORIDIAN INFECTIONS A FREEZE ETCHING STUDY, J. INVERTEBRATE PATHOL., 198208=228. (1972).
- LIU, T.P. AND D.M. DAVIES. ULTRASTRUCTURE OF THE FROZEN ETCHED POLAR FILAMENT IN A MICROSPORM IDIAN THELOHANIA BRACTEATA (STRICKLAND, 1913). CAN. J. ZOOL., 518 217

- LIU, T.P. AND D.M. DAVIES. ULTRASTRUCTURE OF THE NUCLEAR ENVELOPE FROM BLACKFLY FAT BODY CELLS WITH AND WITHOUT MICROSPORIDIAN INFECTION. J. INVERT. PATHOL, 20: 176-182. (1972).
- LOTT, JOHN, G. HARRIS, AND C. TURNER. THE CELL WALL OF COSMARIUM BOTRYTIS. J. PHYCOL., 8: 232-236. (1972).
- MACKENZIE, C.R., W. VAIL, AND D. JORDAN. ULTRASTRUCTURE OF FREE LIVING AND NITROGEN FIXING FORMS OF RHIZOBIUM MELILOTI AS REVEALED BY A FREEZE ETCHING. J. BACT. 113:387=393. (1973).
- MALKANI, KANAYA, AND ABDEZHAK BERERHI, FREEZE ETCHING OF KB CELLS INFECTED BY THE TYPE 7 ADENOVIRUS J. MICROS. 9: 671-674. (1970).
- MCVITTLE, ANN, H. WILDERMUTH, AND D. HOPWOOD, FINE STRUCTURE AND SURFACE TOPOGRAPHY OF ENDOSPORES OF THERMOACTINO MYCES VULGARIS. J. GEN. MICRO, 71: 367=381. (1972).
- MEZDON, EDWARD, AND HEINZ BAUER. STRUCTURAL FEATURES OF VACCINIA VIRUS REVEALED BY NEGATIVE STAINING, SECTIONING, AND FREEZE ETCHING. VIROLOGY, 40: 860≈867. (1970).
- MOOR, HANS, CONTRIBUTION TO THE FREEZE ETCHING METHOD FOR THE EXPLANATION OF THE STRUCTURE AND FUNCTION OF BIOMEMBRANES, BER, DEUT, BOT, GES, 82: 385-396, (1971).
- MOOR, HANS, ENDOPLASMIC RETICULUM (ER) AS THE INITIATOR OF BUD FORMATION IN YEAST SACCHAROMYCES CEREVISIAE), ARCH, MIKROBIOL, 57: 135-146, (1967),
- MOOR, HANS, FINE STRUCTURE OF MICROTUBULI IN YEAST AFTER FREEZE ETCHING, PROTOPLASMA, 64: 89=103, (1967),
- MOOR, HANS, ULTRASTRUCTURES IN THE CELL NUCLEI OF BAKERS YEAST, J. CELL BIOL, 208153-155, (1966),
- NANNINGA, N. PRESERVATION OF THE ULTRASTRUCTURE OF BACILLUS SUBTILIS BY CHEMICAL FIXATION AS VERIFIED BY FREEZE FTCHING. J. CELL BIOL., 42:733-744. (1969).
- NANNINGA, N. ULTRASTRUCTURE OF THE CELL ENVELOPE OF ESCHERICHIS COLI AFTER FREEZE ETCHING. J. BACT. 1018 297=303.(1970)
- NECAS, O. AND J. KARASER. OUR EXPERIENCES WITH THE PREPARATION OF SPECIMENS FOR ELECTRON MICROSCOPY BY THE FREEZE FRACTURE REPLICATION METHOD. FOLIA MORPHOL., 19:1-4. (1971).
- NECAS, O, M, KOPECKA, AND J, BRICHTA, INTERPRETATION OF

- SURFACE STRUCTURES IN FROZEN ETCHED PROTOPLASTS OF YEASTS, EXP. CELL RES. 58:411-419, (1969),
- NEI, TOKIO, T. MATSUSAKA, M. ASADA. LOW TEMP, SCI. SER. B. BIOL. SCI. 29191=105. (1971). INVESTIGATIONS ON THE COOLING CONDITIONS IN THE FREEZE ETCH TECHNIQUE.
- NERMUT, M.V., AND H., FRANK. FINE STRUCTURE OF INFLUENZA AZ (SINGAPORE) AS REVEALED BY NEGATIVE STAINING, FREEZE DRYING AND FREEZE ETCHING. J. GEN. VIROL. 10:37-51. (1971).
- NERMUT, M.V., H. FRANK, AND W. SCHAEFFER. PROPERTIES OF MOUSE LEUKEMIA VIRUSES & III. ELECTRON MICROSCOPIC APPEARANCE AS REVEALED AFTER CONVENTIONAL PREPARATION TECHNIQUES AS WELL AS FREEZE DRYING AND FREEZE ETCHING. VIROLOGY, 498345=358. (1972).
- NEUSHUL, M. A FREEZE ETCHING STUDY OF THE RED ALGA PORPHYRIDIUM, AM. J. BOT. 578 1231-1239. (1970).
- NEUSHUL, M. AND A. DAHL/ ULTRASTRUCTURAL STUDIES OF BROWN ALGAL NUCLEI, AM. J. BOT. 59:401-410. (1972).
- NEWMAN, H,N, FREEZE ETCHING AND DENTAL RESEARCH, J, PERIODONTAL RES. 7:91-101, (1972), BACILLUS, STREPTOCOCCUS, BACTERIUM
- PACKER, LESTER AND M₀ WILLIAMS, AND R₀ CRIDDLE₀ FREEZE FRACTURE STUDIES ON MITOCHONDRIA FROM WILD TYPE AND RESPIR ATORY DEFICIENT YEASTS, BIOCHIM₀ BIOPHYS₀ ACTA 292892 104, (1973)₀
- PINTO DA SILVA, PEDRO. FREEZE FRACTURE OF DIPALMITOYL LECITHIN VESICLES. J. MICROS. 12:185-192. (1971).
- PLATTNER, H₀, W_n FISCHER, W₀ SCHMITT, L₀ BACHMANN₀ FREEZE ETCHING OF CELLS WITHOUT CRYOPROTECTANTS, J₀ CELL BIOL₀ 53: 116-126, (1972)₀
- REITH, A. AND R. OFTEBRO, STRUCTURE OF HELA CELLS AFTER TREATMENT WITH GLYCEROL AS REVEALED BY FREEZE ETCHING AND ELECTRON MICROSCOPIC METHODS, EXP. CELL RES. 66:385=395. (1971).
- REMSEN, CHARLES C. THE FINE STRUCTURE OF BACILLUS CEREUS SPORES, ARCH, MIKROBIOL, 54:266=275, (1966).
- REMSEN, CHARLES C, FINE STRUCTURE OF THE MESOSOME AND NUCLEOID IN FROZEN ETCHED BACILLUS SUBTILIS, ARCH, MIKROBIOL, 61:40-47, (1968).
- REMSEN, CHARLES, AND D, LUNDGREN. ELECTRON MICROSCOPY OF THE CELL ENVELOPE OF FERROBACILLUS FERRO» OXIDANS PREPARED BY FREEZE ETCHING AND CHEMICAL FIXATION TECHNIQUES. J.

- BACTERIOL. 92:1765-1771. (1966).
- RICHMOND, D.V. AND R.J. PRING. THE EFFECT OF BENOMYL ON THE FINE STRUCTURE OF BOTRYTIS FABAF, J. GEN. MICRO. 66879-94, (1971).
- RICHMOND, D.V. AND R.J. PRING. FINE STRUCTURE OF GERMINATING BOTRYTIS FABAF SARDINA CONIDIA. ANN. BOT. 35:493-500, (1971).
- ROBINSON, D.G. AND R.D. PRESTON. FINE STRUCTURE OF SWARMERS OF CLADOPHORA AND CHAETOMORPHA, I. THE PLASMALEMMA AND GOLGI APPARATUS IN NAKED SWARMERS, J., CELL SCI. 98581-601. (1971).
- ROBINSON, DAVID G. AND R.D. PRESTON. STUDIES ON THE STRUCTURE OF GLAUCOCYSTIS NOSTOCHINEARUM ITZIGS. J. EXP. BOT. 221635=643. (1971)
- ROBINSON, D.G., R. WHITE, AND R. PRESTON. FINE STRUCTURE OF SWARMERS OF CLADOPHORA AND CHAETOMORPHA. III. WALL SYNTHESIS AND DEVELOPMENT. PLANTA 107:131=144. (1972).
- ROZEE, K.R. AND K.B. EASTERBROOK. APPLICATION OF FREEZE ETCHING METHOD TO THE STUDY OF REOVIRUS- INFECTED LLC-MK2 CELLS. APPL. MICRO. 19:997-1000. (1970).
- SASSEN, ANDRE, ET. AL. CELL WALL FORMATION IN CHLORELLA PYRENOIDOSA: A FREEZE ETCHING STUDY. CYTOBIOLOGIE 1:373=382. (1970).
- SCOTT, ROBERT, AND V. MARCHESI. STRUCTURAL CHANGES IN MEMBRANES OF TRANSFORMED LYMPHOCYTES DEMON- STRATED BY FREEZE ETCHING CELL. IMMUNOL. 3:301-317. (1972).
- SEED, THOMAS, R. PFISTER, J. KREIERA AND A. JOHNSON. PLASMODIUM GALLINACEUM: FINE STRUCTURE BY FREEZE ETCH TECHNIQUE. EXP. PARASITOL. 30:73-81. (1971).
- SLETYR, UWE, FRACTURE FACES IN INTACT CELLS AND PROTOPLASTS OF BACILLUS STEARO— THERMOPHILUS: A STUDY BY CONVENTIONAL FREEZE-ETHCING AND FREEZE-ETCHING OF CORRESPONDING FRACTURE MOIETIES, PROTOPLASMA 71:295-312, (1971),
- SLETYR, UWE, AND MILOSLAV KOCUR, STRUCTURE OF MICROCOCCUS CRYOPHILUS AFTER FREEZE ETCHING, ARCH, MIKROBIOL, 78:353=359, (1971).
- SLEYTR, UWE, AND BERNHARD KREBS, PROTOPLAST FORMATION AND INTERPRETATION OF THE FREEZE ETCH IMAGE OF MEMBRANE STRUCTURES OF CLOSTRIDIUM NIGRIFICANS ARCH, MIKROBIOL, 771377-389, (1971),
- SPETH, VOLKER AND FRANK WUNDERLICH, MEMBRANES OF TETRAHYMENAS

- II, DIRECT VISUALIZATION OF REVERSIBLE TRANSITIONS IN BIOMEMBRANE STRUCTURE INDUCED BY TEMPERATURE, BIOCHIM, BIOPHYS, ACTA, 291:621=628, (1973),
- STAEHELIN, L.A. ULTRASTRUCTURAL CHANGES OF THE PLASMALEMMA AND THE CELL WALL DURING THE LIFE CYCLE OF CYANIDIUM CALDARIUM. PROC. ROY. SOC. SER. B. BIOL. SCI. 17:249=259. (1968).
- STAEHELIN, LaA, AND OSWALD KIERMAYER, MEMBRANE DIFFERENTIATION IN THE GOLGI COMPLEX OF MICRASTERIAS DENTICULATA BREB, VISUALIZED BY FREEZE ETCHING, J, CELL SCI, 7:787-792. (1970)
- STREIBLOVA, EVA. SURFACE STRUCTURE OF YEAST PROTOPLASTS SACCHAROMYCES CEREVISIAE, SCHIZOSACCHAROMYCES POMBE, SACCHAROMYCES LUDWIGII, ENDOMYCES MAGNUSII J. BACTERIOL. 951700-707. (1968).
- SWANSON, JOHN, STUDIES ON GONOCOCCUS INFECTION: II, FREEZE FRACTURE, FREEZE ETCH STUDIES ON GONOCOCCI, J. EXP. MED. 136:1258=1271, (1972).
- SWIFT, ELIJAH, AND CHARLES REMSEN. THE CELL WALL OF PYROCYSTIS SPP. (DINOCOCCALES), J. PHYCOL, 6:79-86, (1970).
- TAKEO, K, I. UESAKA, K. UEHIRA, AND M. NISHIURA, FINE STRUCTURE OF CRYPTOCOCCUS NEOFORMANS GROWN IN VITRO AS OBSERVED BY FREEZE ETCHING, J. BACTERIOL, 113:1442=1448, (1973).
- TAKEO,K, I. UESAKA, K. UEHIRA, AND M. NISHIURA. FINE STRUCTURE OF CRYPTOCOCCUS NEOFORMANS GROWN IN VIVO AS OBSERVED BY FREEZE ETCHING, J. BACTERIOL, 113:1449=1454, (1973),
- TAUSCHEL, H. AND V. SPETH. THE FLAGELLAR APPARATUS OF RHODOPSEUDOMONAS PALUSTRIS: V. DEMONSTRATION OF THE POLAR ORGANELLE BY THE FREEZE ETCHING METHOD, CYTOBIOLOGIE 2:403-407. (1970).
- TEWARI, J.P. S. MALHOTRA, AND J. TU. A STUDY OF THE STRUCTURE OF MITOCHONDRIAL MEMBRANES BY FREEZE ETCH AND FREEZE FRACTURE TECHNIQUES. CYTOBIOS, 4897-119. (1971).
- TEWARI, J.P., J. TU, AND S. MALHOTRA. STRUCTURE OF THE MITOCHONDRIA OF NEUROSPORA CRASSA AS REVEALED BY THIN SECTIONING AND FREEZE ETCH TECHNIQUES. CYTOBIOS, 5:261-273.(1972)
- THOMPSON, J. AND I. DEVOE. PHYSIOLOGICAL AND MORPHOLOGICAL EFFECTS OF PHENETHYL ALCOHOL UPON A GRAM NEGATIVE MARINE PSEUDOMONAD, CAN. J. MICROBIOL. 18:841=852. (1972).

- TILLACK, T,W. R. CARTER, AND S. RAZIN. NATIVE AND REFORMED MYCOPLASMA LAIDLAWIIMEMBRANES CUMPARED BY FREEZE ETCHING. BIOCHIM. BIOPHYS. ACTA 219:123-130. (1970).
- TILLACK, T.W. R. SCOTT, AND V. MARCHESI. THE STRUCTURE OF FRYTHROCYTE MEMBRANES STUDIED BY FREEZE ETCHING: III. LOCALIZATION OF RECEPTORS FOR PHYTOHEMAGGLUTINATION AND INFLU- ENZA VIRUS TO THE INTRAMEMBRANOUS PARTICLES. J. FXP. MED. 135:1209=1227. (1972).
- TOURTELLOTTE, MARK, D., BRANTON, AND ALEC KEITH, MEMBRANE STRUCTURE: SPIN LABELLING AND FREEZE ETCHING OF MYCOPLASMA LAIDLAWII, PROC. NAT. ACAD. SCI. USA 66:909=916. (1970).
- TOURTELLOTTE VAN GOOL, A.P. ULTRASTRUCTURE OF NITROSOMONAS EUROPAEA CELLS AS REVEALED BY FREEZE ETCHING, ARCH, MIKROBIOL, 82:120-127, (1972).
- VAN GOOL, A,P., J. MEYER, AND R. LAMBERT. THE FINE STRUCTURE OF FROZEN ETCHED CONIDIOSPORES. J. MICROS. 98653-660. (1970).
- VELTRI, B,J. AND J, MCALEAR, WALL AND PLASMA MEMBRANE STRUCTURES OF HYDROGENOMONAS EUTROPHA AS REVEALED BY STEREOGRAPHY OF REPLICAS FROM COMPLEMENTARY FREZE ETCHED SURFACES, J, GEN, MICRO, 70:31-41, (1972).
- VERKLEIJ, A.J., P. VERVERGAERT, L. VAN DEENEN, AND P. ELBERS. PHASE TRANSITIONS OF PHOSPHOLIPID BILAYERS AND MEMBRANES OF ACHOLEPLASMA LAIDLAWII B VISUALIZED BY FREEZE FRACTURING ELECTRON MICROSCOPY. BIOCHIM. BIOPHYS. ACTA 288:326=332. (1972).
- VERKLEIJ, A.J., ET AL. FREEZE ETCH ELECTRON MICROSCOPY OF ERYTHROCYTES, ACHOLEPLASMA LAIDLAWII CELLS, AND LIPOSOMAL MEMBRANES AFTER THE ACTION OF FILIPIN, AND AMPHOTERICIN B. BIOCHIM. BIOPHYS. ACTA 291:577-581. (1973).
- WEIGAND, R.A. ET AL. ULTRASTRUCTURAL PROPERTIES OF THE EXTRA MEMBRANES OF ESCHERICHIA COLI Ø111A AS REVEALED BY FREEZE FRACTURING AND NEGATIVE STAINING TECHNIQUES. J. BACTERIOL. 113:433=444. (1973).
- WILLISON, J. AND E. COCKING. FREEZE ETCHING OBSERVATION ON TOBACCO LEAVES INFECTED WITH TOBACCO MOSAIC VIRUS. J. GEN. VIROL. 4:229-233. (1969).
- WILLISON, H.H.M. AND E.C. COCKING. THE PRODUCTION OF MICROFIBRILS AT THE SURFACE OF ISOLATED TOMATO FRUIT PROTOPLASTS. PROTOPLASMA 75:397#403. (1972).
- WUNDERLICH, F., V. SPETH, W. BATZ, H. KLEINIG. MEMBRANES OF TETRAHYMENA: III, THE EFFECT OF TEMPERATURE ON MEMBRANE

- CORE STRUCTURES AND FATTY ACID COMPOSITION OF TETRAHYMENA CELLS, BIOCHIM, BIOPHYS, ACTA 298#39=49, (1973)
- ZAICHKIN, E.I. AND B.A. FIKHMAN. A SIMPLE APPARATUS FOR FREEZE ETCHING OF BIOLOGICAL OBJECTS. LAB DELO 12:741-742.(1971)
- ZINGSHEIM, H.P. MEMBRANE STRUCTURE AND ELECTRON MICROSCOPY: THE SIGNIFICANCE OF PHYSICAL PROBLEMS AND TECHNIQUES, BIOCHIM. BIOPHYS. ACTA 265:339=366. (1972)

ONE TISSUE SPECIMEN FOR TRANSMISSION AND SCANNING ELECTRON MICROSCOPY AND LIGHT MICROSCOPY

William B. Winborn
Department of Anatomy
The University of Texas Health Science Center at San Antonio

How many times have you asked yourself these questions? What is the surface morphology of this sample of tissue that I am observing in the transmission electron microscope? How can I remove the epoxy from this thick section that I am observing in the light microscope in order to perform an immunochemical or cytochemical stain on the tissue? If you have posed these questions to one of your colleagues, the reply would probably have some reference to having your cake and not being able to eat it. Not so any more. At least, we feel that some degree of success has been achieved toward using a single specimen for transmission and scanning electron microscopy and light microscopy. In fact, thick epoxy sections mounted on pieces of glass slides may be studied in the scanning electron microscope.

This is all accomplished by utilizing a commercial solvent, Epox-E-Solv, a product of Ernest F. Fullam, Inc., Schenectady, New York, and an epoxy dissolving apparatus. The latter is easily constructed by making use of a hand-operated vacuum pump, plastic and glass tubing, fine mesh wire, rubber stoppered glass jars, and a stirring bar (Figure 1). After assembling these items, select a sample of tissue embedded in epoxy, preferably one with an exotic cell surface modification such as cilia or microvilli. Cut a few thin sections for transmission electron microscopy and several thick sections for light microscopy. Take some additional thick sections and mount them on small pieces of glass slides. Bond these sections to the glass slides by heating the slides on a hot plate. In our hands, the best results were achieved by following the procedure indicated below:

- 1. Remove the sample of tissue from a block of epoxy by trimming around the tissue with a razor blade. Take care not to damage the surface of the tissue.
- 2. Place the sample of tissue, surrounded by a thin layer of epoxy, and the thick sections, mounted on small pieces of glass slides, in the fine mesh wire basket in the dissolving jar of the epoxy dissolving apparatus (Figure 1).
- 3. Place the entire dissolving apparatus on a magnetic stirring plate and introduce the epoxy solvent into the dissolving jar through the filling inlet.

- 4. Activate the stirring plate and allow the stirring bar to spin freely beneath the specimen for 15 minutes.

 Aspirate a portion of the solvent into the waste jar by means of the hand-operated vacuum pump. Repeat the process for two additional periods of time at 15 minutes for each period. Take care not to allow the level of the epoxy solvent to drop below the specimens.
- 5. While continuing to stir the solvent, introduce absolute methanol into the dissolving jar thereby mixing the methanol with the epoxy solvent. Allow this solution to mix for 2 minutes. Aspirate a portion of the mixture into the waste jar. Repeat the process for four additional periods of time at 2 minutes for each period. Take care not to allow the level of the methanol to drop below the specimens.
- 6. Remove the specimens from the dissolving jar and transfer through graded absolute methanol-amyl acetate solutions (50, 70, 90% amyl acetate). Transfer to 100% amyl acetate. Freon 113, an intermediate fluid, may be substituted for amyl acetate for the appropriate critical point drying apparatus utilizing Freon 13 as a transition fluid. Take care not to allow the specimens to air-dry during the transfer process.
- 7. Transfer specimens to a critical point drying apparatus in a small piece of gauze saturated with amyl acetate or Freon 113. Process specimens through critical point drying apparatus according to the manufacturer's directions.
- 8. Remove blocks of tissue and sections mounted on small pieces of glass slides from the critical point drying apparatus. Coat specimens with gold-palladium alloy and examine in the scanning electron microscope.

Figures 1-4 show a diagram of the dissolving apparatus and the results obtained after blocks and thick sections of tissues are exposed to the epoxy dissolving process.

Figure 1. This figure is a diagram of the apparatus used for the removal of the epoxy embedding media from the tissue samples. The filling bottle (A) is used to add the epoxy solvent to the dissolving jar (B). The sample of tissue (C), surrounded by a small amount of epoxy, is placed in a fine mesh wire basket (D). The entire apparatus is placed on a magnetic stirring plate and the stirring bar (E) is allowed to spin freely beneath the specimen. Portions of the epoxy solvent are aspirated into the waste jar (F) by means of the hand-operated vacuum pump (G). The

epoxy solvent is partially exchanged three times at 15 minute intervals. The specimens are washed in fresh absolute methanol. The methanol is also partially exchanged five times at 2 minute intervals. During the process of epoxy removal and washing with methanol, the level of the epoxy solvent and methanol is not allowed to drop below the level of the specimens in the dissolving jar. The specimens are transferred from the dissolving apparatus to the critical point drying apparatus after processing through amyl acetate or Freon 113.

Figure 2. This is a scanning electron micrograph of the luminal surface of the trachea of the rat. The fine filamentous structures throughout most this field are cilia which project from the apical surface of the columnar cells. Two cells lacking cilia occupy the center of the field. This sample of tissue shows no residue of polymerized epoxy embedding media. There is no evidence of damage or distortion to the delicate modifications of the cell surface after exposure to the epoxy removal process. X7, 400.

Figure 3. This is a scanning electron micrograph of the luminal surface of the stomach of the rat. Each of the dome-like structures in this field represents the apical portion of the mucous surface cells which line the luminal surface of the stomach. The irregular contours of the apical surface of the cells are due to the very short microvilli which project from the free surface of these cells. No epoxy residue or cellular damage is evident following exposure of this tissue to the epoxy dissolving process. X 3, 750.

Figure 4. This is a scanning electron micrograph of a section, one micron in thickness, of the gastric mucosa of the rat. The plane of section is parallel to the long axis of the gastric glands thereby revealing the lumen (L) of the gland. In this region, the gland is composed of chief (C) and parietal (P) cells. The zymogen granules (Z) of the chief cells appear as craters in the supranuclear portion of the cell. The mitochondria (M) of the parietal cells are evident as rounded elevations throughout the cell. This thin section was cut from a block of tissue embedded in epoxy, mounted on a small piece of glass slide, and exposed to the epoxy dissolving solvent. X 3, 800.

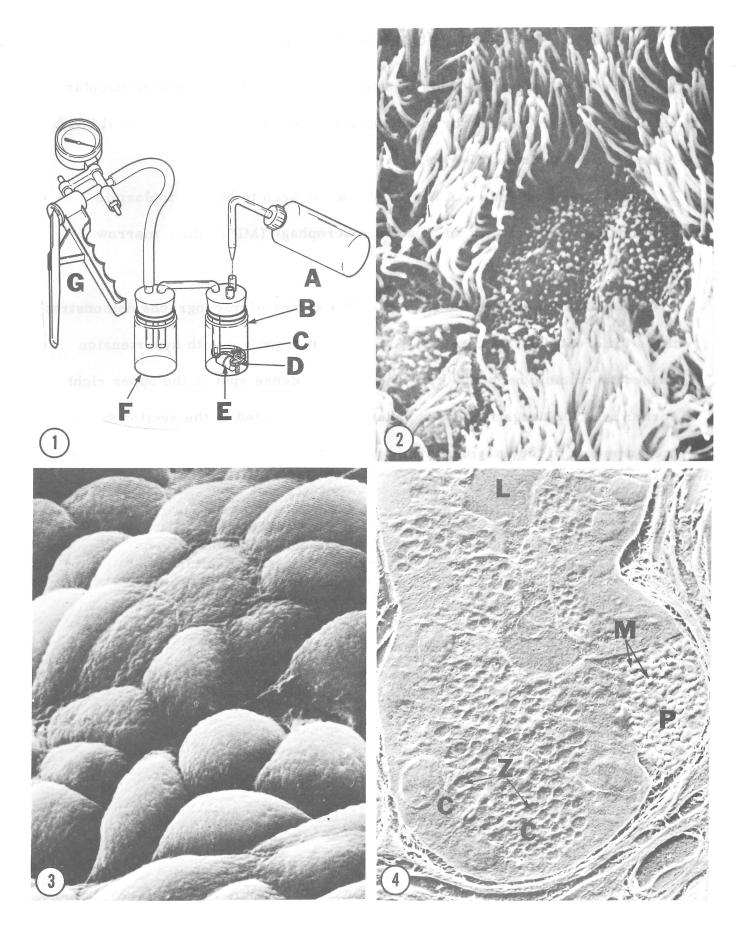
The present report has described a method for using the same specimen for both transmission and scanning electron microscopy. This technique is accomplished by cutting thin sections from blocks of tissue embedded in epoxy media and examination of these sections in the transmission electron microscope; this same sample of tissue is then removed from the polymerized block of epoxy and placed in a solution of epoxy solvent for 45 minutes. After this exposure and a thorough washing in methanol for additional periods of time, the epoxy is completely removed thereby permitting the sample of tissue to be examined in the scanning electron microscope.

It is apparent from the results that delicate cell surface modifications, such as cilia, are preserved in a natural state. No distortion due to surface pressure or destruction of the cytoplasm due to the epoxy solvent is evident after exposure of the samples to the preparation process for scanning electron microscopy.

A further appreciation of the epoxy removal can be gained by examination of one micron sections after exposure to the dissolving process. Epon 812 is a stable polymer and is usually resistant to dissolving by many chemical agents. However, the present report demonstrates how a solvent can remove the polymer from the sections revealing the tissues in bold relief in the scanning electron microscope. Since the technique removes the epoxy from the sections thereby exposing the interior of the cells and the extracellular compartments; this method appears to have more value than a novel way of viewing sections in the scanning electron microscope. It is likely that both immunochemical and cytochemical techniques may be easily performed on the sections after removal of the polymer. Indeed, these reactions on the sections might well be viewed in both light and scanning electron microscopy.

The best results are achieved, in the removal of the epoxy polymer from the sections and blocks of tissues, by keeping the samples of tissue totally immersed in the epoxy solvent and methanol during the dissolving and washing procedures. Allowing the level of the epoxy solvent to drop below the specimen, when transferring from the solvent to the methanol wash, results in a thin powdery film over the surface of the specimen; this coating is apparently a fine residue of the dissolved epoxy embedding media. However, the residue of epoxy appears adequately removed by the end of the methanol washing process. Allowing the methanol to drop below the level of the specimen during the washing process or air-drying of the specimens during the transfer from the methanol wash to the drying chamber of the critical point drying apparatus result in distortion of surface structures of the tissue.

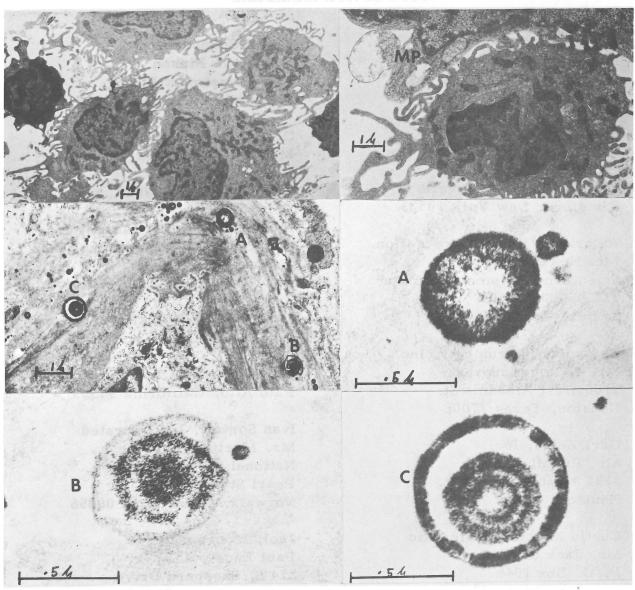
The present report has described a method for removal of the polymerized epoxy from tissue; this technique enables the investigator to use a single specimen for transmission and scanning electron microscopy and light microscopy, thereby achieving a total morphological concept of the particular tissue under investigation. This technique has the potential for application in other methods of tissue study. However, additional research is required to confirm this speculation.



CONTRIBUTED MICROGRAPHS

- 1. Hairy Cell Leukemia This is a neoplastic disorder of lymphoreticular cells. It is characterized by the cytoplasmic projections from the cell body. Bone marrow aspirate. X-3974.
- 2. Hairy Cell Leukemia A hairy cell can be seen to have cytoplasmic connections (arrows) with an adjacent macrophage (MP). Bone marrow aspirate. X-8508.
- 3. Bowman's Capsule of the Kidney This series of micrographs demonstrates three different calcium crystals (A, B, C) from a patient with hypertension caused by calcium nephropathy. The electron dense spot in the upper right corner is a 5000 angstrom latex sphere which is added to the section for rapid measurement of the basement membranes of the glomerulus (after Michael Titford). X-8508 (ABC 53, 266).

Alan B. Weckerling
Department of Pathology
Brooke General Hospital
Brooke Army Medical Center
Fort Sam Houston, Texas 78234



macro (creis

CORPORATE MEMBERS

Advance Metals Research, Inc. Mr. Tom Baum Southwest District Office 125 West Main Street Humble, Texas 77338

AEI Scientific Apparatus, Inc. B. E. P. Beeston 500 Executive Boulevard Elmsford, New York 10523

American Optical Corporation Mr. Howard Hayden Scientific Instrument Division 711 So. St. Paul St. Dallas, Texas 75201

Brinkman Instruments, Inc. Mr. Helmut Schares 3100 West Alabama St. Houston, Texas 77006

Carl Zeiss, Inc. Mr. Rudolf Dietter 3131 West Alabama St. Houston, Texas 77006

Curtin Matheson Scientific Mr. Jack Classon P. O. Box 1546 Houston, Texas 77001

EDAX International Mr. Charles Walsh P. O. Box 135 Prairie View, Illinois 60069

Elektros, Incorporated Mr. Lawrence H. Weiss 10500 Southwest Cascade Drive Tigard, Oregon 97223

Ernest F. Fullam, Inc. Mr. Thomas P. Turnbull General Manager, EFFA Division P. O. Box 444 Schenectady, New York 12301 ETEC Corporation Mr. Steve Pinson 3392 Investment Blvd. Hayward, California 94545

George Lange, Inc. Mr. William Lange P. O. Box 20150 Houston, Texas 77025

Harper & Row Publishers, Inc. Mr. David P. Miller, Publisher 49 East 33rd Street New York, New York 10016

International Scientific Instruments Mr. Don Evins
Suite 5
970 San Antonio Rd.
Palo Alto, California 94303

Ivan Sorvall, Incorporated Mr. Martin Wannberg National Sales Manager Pearl Street Norwalk, Connecticut 06856

Jeol, Incorporated Paul Enos 214 S. Sheppard Drive Euless, Texas 76039

Kent Cambridge Scientific, Inc. Mr. Michael J. Orvis 8020 Austin Avenue Morton Grove, Illinois 60053

Ladd Research Industries, Inc. Mr. Ted Willmorth 1209 Dogwood Dr. Kingston, Tenn. 37763

LKB Instruments, Inc. Mr. Al Doty 6600 W. Irving Park Road Chicago, Illinois 60634 Olympus Corporation Mr. Richard O. Geist 4023 Shady Hollow Dallas, Texas 75233

Perkin-Elmer Corporation Mr. Mike Mullin 411 Clyde Avenue Mountain View, California 94040

Philips Electronic Instruments Mr. George Brock 7302 Harwin Drive Suite #106 Houston, Texas 77036 Polysciences, Incorporated Mr. B. David Halpern, President Warrington, Pennsylvania 18976

Siemens Corporation Mr. Dietrich Voss 4101 San Jacinto Houston, Texas 77004

William H. Talley Company Mr. William H. Talley P. O. Box 22574 Houston, Texas 77027

AREA NEWS

Arlington

THE UNIVERSITY OF TEXAS AT ARLINGTON:

Department of Biology

Recent Publications:

Butler, James K. 1974 A precision hand trimmer for electron microscope tissue blocks. Stain Tech. (In press).

(The hand block trimmer described in the above paper is now offered commercially by Ernest F. Fullham, Inc.)

Other News:

J. K. Butler has been invited by the Harvard School of Public Health to serve as a Visiting Scientist in Dr. John Little's laboratory during June and July. He will be conducting ultrastructure studies on cultured cells.

Austin

THE UNIVERSITY OF TEXAS AT AUSTIN:

Department of Botany

Grant:

G. T. Cole for ultrastructural studies of hyphomycetes (Fungi imperfecti), from the National Science Foundation.

Seminars:

Presentation by G. T. Cole on ultrastructural studies of conidiogenesis in hyphomycetes (Fungi imperfecti) at Heidelberg, West Germany (University of Heidelberg); Baarn, Netherlands (Centraalbureau Voor Schimmelcultures); Geneva, Switzerland (University of Geneva); and Nancy, France (University of Nancy).

Seminar presented on Ultrastructure of endocytosis of Microcystis aeruginosa (blue-green alga) by Ochromonas danica (golden-brown alga) by G. T. Cole at Bremerhaven, West Germany (Institut für Meeresforshung).

Recent Publications:

Cole, G. T. and R. V. Hardcastle 1974 <u>Subbaromyces</u> splendens: Development and ultrastructure. Can. J. Botany 52: (In press).

Cole, G. T. and R. R. Mitchell 1974 Scanning electron-microscopic and freeze-etch studies of <u>Penicillium conidia</u>: a correlative approach. Proceedings of the Seventh IITRI Symposium on Scanning Electron Microscopy, Chicago, Ill., April, 1974.

Cole, G. T. and M. J. Wynne 1974 Endocytosis of Microcystis aeruginosa by Ochromonas danica. J. Phycology, (In press).

Cole, G. T. 1974 Ultrastructure of conidiogenesis in Spegazzinia tessarthra. Can. J. Bot. 52: (In press).

Corpus Christi

PPG INDUSTRIES

New Members:

Charles L. Holifield

New Equipment:

Jeol Jem 7 (TEM) and AMR-1000 (SEM)

Fort Sam Houston

BROOKE ARMY MEDICAL CENTER:

Department of Pathology

New Faces:

Alan B. Weckerling has recently joined the EM lab as chief microscopist.

Houston

BAYLOR COLLEGE OF MEDICINE:

Department of Cell Biophysics

Visitors presenting Seminars:

Dr. R. John Solaro from the Department of Physiology, Virginia Commonwealth University, Richmond, Virginia presented a seminar on "Nature of the Calcium Switch in Cardiac Muscle: Functional Implications".

Dr. Sergio Estrada-O, Professor of Biochemistry of Centro de Investigacion Y de Estudios Avanzados, Del Instituto Politecnico Nacional, Mexico, D. F. presented a seminar on "The Use of Model Ion Translocators as Tools for Elucidating the Mechanism of Ion Transport in Membranes".

Dr. Robert S. Adelstein, Head of the Section on Molecular Cardiology, National Heart and Lung Institute, NIH, presented a seminar on "Actin and Myosin from Non-muscle Cell".

Dr. Robert M. Berne, Chairman and Professor of Physiology, University of Virginia School of Medicine, presented a seminar on "Metabolic Vasodilation in Different Vascular Beds--Possible Role of Adenosine".

Dr. H. Ping Ting-Beall, of the Departments of Physiology and Pharmacology at Duke University presented a seminar on "The effect of Peptide PV on the Ionic Permeability of Lipid Bilayer Membranes".

Dr. Harry Clark-Beall of the Department of Physiology and Pharmacology at Duke University presented a seminar on "The Utilization of a Method of Light Deffraction for the Measurement of Length-Tension Relationships during Cardiac Muscle Contractions".

Recent Publications:

Van Winkle, W. P., A. Schwartz, R. Munsan and J. C. Allen Relationship between positive ionotropism and ovabain-Na⁺ K⁺ ATPase interaction in different species. Abstr. FASEB meeting.

Poster Presentation at FASEB Meeting:

Ultrastructure of Normal Ischemic and Anoxic Myocardium. Margaret A. Goldstein, David Z. Murphy and Arnold Schwartz.

M. D. ANDERSON HOSPITAL AND TUMOR INSTITUTE:

Department of Virology

Grant:

Immunological Studies on Animal and Human Breast Carcinoma, NCI-CP-VO-73-102.

Recent Publications:

Chan, J. C., N. Vera, J. L. East, S. Hiraki, and L. Dmochowski. 1974 Lack of syncytium formation of a C-type virus-producing XC cell line in the mixed culture cytopathogenicity test. Cancer Research 34(3): 468-473.

Hiraki, S., K. J. Ranadive, and L. Dmochowski. 1974 An electron microscopic study of spontaneous and experimentally induced leukemia in ICRC mice. Cancer Research 34(3): 474-483.

Seman, G. and L. Dmochowski. 1973 Electron microscope observation of viruslike particles in comedocarcinoma of the human breast. Cancer 32(4): 822-829.

Dmochowski, L. and J. M. Bowen. The search for a virus in human cancer. Seventh National Cancer Conference Proceedings, pp. 697-710.

THE UNIVERSITY OF TEXAS DENTAL SCIENCES INSTITUTE:

New Members:

F. E. Summers, Jr.

Visitors:

Professeur Maurice Panigel, M.D., Ph.D., Universite de Paris VI, Paris, France.

Huntsville

SAM HOUSTON STATE UNIVERSITY:

Department of Biology

Visitors presenting Seminars:

Dr. Joe G. Wood of the Department of Neuroscience, M. D. Anderson, Houston, presented a seminar on Neuron Membrane Identification.

Dr. Patu N. Rao of the Department of Developmental Therapeutics, presented a seminar on Mammalian Cell Fusion.

Dr. H. H. Mollenhauer, USDA, College Station, presented a seminar on Plant Membranes.

Dr. Robert S. Decker of the Department of Anatomy, The University of Texas at Dallas presented a seminar on Gap Junctions in Neuralution.

Dr. Larry Thurston, EM Lab, Texas A & M, presented a seminar on Scan of Membrane Surfaces.

San Antonio

SOUTHWEST FOUNDATION FOR RESEARCH AND EDUCATION:

Visitors:

Dr. M. Panigel, University of Paris, has visited several times. We have an ongoing study in collaboration with him concerning C type particles in placentas.

Dr. H. Ackermann, University of Cologne, is now visiting in our laboratory and initiating studies on LCM in pregnant baboons.

Recent Publications:

Kalter, S. S., R. L. Heberling, R. J. Helmke, M. Panigel, G. C. Smith, D. C. Kraemer, A. Hellman, A. K. Fowler and J. E. Strickland. A comparative study on the presence of C-type viral particles in placentas from primates and other animals. In Comparative Leukemia Research 1973. Y. Ito (ed.), University of Tokyo, (In press).

Dalton, A. J., A. Hellman, S. S. Kalter and R. J. Helmke. An ultrastructural comparison of placental virus with several type C oncogenic viruses. J. N. C. I. (In press).

Kalter, S. S., R. L. Heberling, A. Hellman, G. J. Todaro and M. Panigel. Viruses in the transmission of cancer: C-type particles in the baboon placenta. Proc. Roy. Soc. Med. (London), (In press).

Waco

BAYLOR UNIVERSITY:

Recent Publications:

Jerrigan, D. L. and J. Y. McAtre Jr. 1973 New complex transition metal carbides formed on an electron microscope heating stage. Thermochem. Acta. 7: 183.

TSEM PLACEMENT SERVICE

Position wanted - Two years experience with RCA EMU 4 including specimen preparation, operation and routine maintenance. Also extensive experience in medical photography. B.S. in Microbiology. Contact Robert Swain, U.S. Army Medical Laboratory, Fort Sam Houston, Texas 78234. Phone (512) 221-4463.

Position available-B.S. or M.S. Some experience and working knowledge of basic EM techniques required. Salary negotiable. Apply to: Dr. Ronald Dodson, Department of Neurology, Baylor College of Medicine, Houston, Texas 77025, (713) 790-4753.

Position available-An opening for a tumour immunologist. Must be experienced in humoral and cellular immunology with an interest in RNA and DNA virus tumor induction in primates. Apply to: Dr. S. S. Kalter Microbiology and Infectious Diseases, Southwest Foundation for Research and Education, P. O. Box 28147, San Antonio, Texas 78284.

CHANGE OF ADDRESS

If you have difficulty receiving your TSEM mail, if you have moved or if your institution has changed names, please supply the following information.

Send to:	Jerry Berlin
	Department of Biology
	Texas Tech University
	Lubbock, Texas 79409

Name			
Dept			
Institution			
City	State	Zip	
	hadiffrey demography to the contract of the co		

Abstracts of Papers in Competition

presented at the

Spring 1974 Meeting of the TEXAS SOCIETY FOR ELECTRON MICROSCOPY

College Station, Texas May 24-25, 1974

ABSTRACT

Tumor (HEp-2) and non tumor (Vero) cells were exposed to varying concentrations of TPPS $_{ij}$ and examined under SEM. Both cell types exhibited alterations in their surface topography. The greatest changes in cellular architecture occurred in the TPPS $_{ij}$ tumor cells, whereas the treated non tumor cell exhibited only minor surface alteration. The complex structure of the HEp-2 cell surface was destroyed as a result of the TPPS $_{ij}$ exposure, and both cell types became more firmly attached as evidence by the pronounced appearance of filopodia. There was no disrupted effect on the filopodia due to treatment with TPPS $_{ij}$

THE TOPOGRAPHICAL EFFECT OF MESOTETRA (P-SULFOPHENLY) PORPHINE (TPPS $_{4}$) ON CELLS IN CULTURE.

Jack Austen, Department of Microbiology, College of Veterinary Medicine. Texas A&M University, College Station, Texas.

A Comparative Study of the Foraging Strategies of Social, Semi-social, and Solitary Bees

bу

Robert C. Henderson Department of Zoology The University of Texas Austin, Texas 78712

Abstract

have adopted various mechanisms for differentiating between In every community, animals are subjected to an array animal is often forced to evaluate the possible food types and decide which yields the greatest reward. In order for a certain food type is always somewhat unpredictable, the specialized chemo-sensory hairs on parts of the bodies of analysis of social, semi-social, and solitary bees in the most energetically rewarding. Since the availability of the animal to select the best food type, it must be able detect differences in the chemical content of a food recertain chemical compounds than semi-social and solitary Through natural selection, an animal will utilize only those food resources which are to detect differences between types. Animals therefore field and in the lab indicate that (1) bees are able to source and (2) social bees have a higher sensitivity to bees and are therefore less selective in choosing food possible foods. Scanning electron microscopy reveals flower-visiting bees which are likely associated with chemical evaluation of pollen and nectar. Behavioral of potential food types.

BSTRACT

Light and electron microscopy studies were conducted on the female reproductive tract of the hymenopteran parasitoid, <u>Campoletis sonorensis</u> (Cameron), of the family Ichneumonidae. Emphasis was placed upon the formation and structure of egg chorion, because of the latter's possible role in preventing haemocytic encapsulation within the habitual host.

The endochorion displays a high degree of periodicity involving alternation of membranes, while the exochorion is composed of rather long double membranous projections which extend perpendicular to the chorion. Located on top of the projections and forming the outer region of the exochorion is an amorphous layer. Large nuclei of the calyx cells actively synthesize particles which contain an electron-dense inner core enclosed by a double membrane. The particles migrate to the cell periphery and enter the calyx lumen via microvilli. Particle synthesis was not found among cells which form the lateral oviduct.

AN ULTRASTRUCTURAL STUDY OF CHORION SYNTHESIS AND CALYX MORPHOLOGY OF CAMPOLETIS SONORENSIS (HYMENOPTERA).
William N. Norton, Department of Entomology, Texas A&M University, College Station, Texas.

WITTOICHT STATESTED TON DETERMINENT THE DIMMETER OF THIN

Shutioned Uniform Spheres From Measurements of Biological MATERIAL. Garnett Relsoe, Department of Biology, Southern Methodist University, Dallas, Texas 75275.

The difficulty in obtaining accurate diameter measurements of thin sectioned organelles is well known. This difficulty is due to the extreme tenuity of the sectioned material as compared to the size of the intact organelle. For example, thin sections showing light grey interference colors could pass 100-200 times through a 54 sphere. Therefore, the chance that any one thin section would contain the equator of the sphere is very slight.

this difficulty. An apparent solution is to increase the section thickness and measure diameters from data gathered by light optics However, the solution is limited by the resolution of the light optics strem and is of little value when the sphere to be measured is small. Another method measures those diameters of profiles within thin sections which are arbitrarily chosen as largest and their mean is described as representative of the "approximate maximal diameter". This method, however, biases the result in the direction of some value less than the true diameter, as the data utilized will consist predominantly of sub-diameteric profiles.

This communication describes a statistic which is an accurate estimator of sphere diameters. It is workable using data entirely from thin sectioned material. The estimator is designed to determine accurately (± 2 % W/95% conf.) from repeated measurements made on small numbers (± 2 0) of sectioned spheres.

The Fine Structure of Centriolar

Specializations Isolated from Cnidarian Spermatids

Maurice G. Kleve

Department of Biology, University of Houston,

Houston, Texas 77004

bue

National Marine Fisheries Services

Gulf Coastal Fisheries Center, Galveston Laboratory

4700 Avenue U, Calveston, Texas 77550

Abstract

Distal centrioles with intact satellites and pericentriolar processes were isolated from Hydractinia sp. spermatids. Spermatids were subjected to swelling in hypotonic buffer (10 mM NaCl, 10 mM NgCl, 10 mM tris HCl, pH /.2) and ultrasonicated. Isolation by sucrose density centrifugation was performed and isolates of centriolar complexes were prepared for whole mount electron microscopy by negative staining with 0.2% uranyl acetate.

Pericentiolar processes of Hydractinia consist of nine primary processes radiating from the centriolar matrix between triplets. Three secondary processes per primary processes were observed. Evidence for tertiary processes were presented and similarities between these and microfilaments were noted. Hydractinia pericentriolar processes when observed in whole mount demonstrate an asymmetry and striated periodicity that is difficult to visualize in thin section. Similarities between the striations of processes the processes were discussed with reference to their possible role in centrialar and flagellar function and chemotactic behavior of sperm.

ABSTRACT

Thin crystals of ten layer silicates have been examined by SAD. The crystals were thin enough that only kinematical effects were observed. Eight distinctive patterns were obtained. These patterns can be used for the identification of well crystalline impurities often found in bentonites. The beidellite SAD pattern is especially distinctive.

SAD EXAMINATION OF LAYER SILICATES.

R. Pease, Department of Biology, Texas Tech University, Lubbock, Texas.

ABSTRACT

The Toxic Marine Dinoflagellate

Gonyaular catenella Whedon and Kofold
Thecal Ultrastructure and
Supra-ultrastructure.

Michael Thomas Postek, Jr., Department
of Blology, College Station, Texas

The toxic marine dinoflagellate Gongaulaz catenalla Whedon and Kofoid was studied at the ultrastructural level in order to elucidate its thecal morphology and more accurately define the taxonomic criteria of this species. The combination of the tools of scanning and transmission electron microscopy enabled the elucidation of the supra-ultrastructural aspects of the plate arrangement and ultrastructural details of plate junctions. The apical pore and closing platelet were neveraled to be disassociable and found in proximity to an obscured apical platelet. Two previously unreported sulcal plates were characterized and described. Trichocyst pores were seen to be randomly dispersed upon plate surfaces. The thecal plates appeared extremely thin in sectioned material and three types of plate junctions were found which were characteristic of the sulcus, girdle and intercalary plate restons. The entire complement of thecal plates were disassociated and there were found to be a total of 33.

ADRENAL INNERVATION OF THE ADRENAL MEDULLA. F. David Prentice, Neurobiology, The University of Texas Medical School at Houston, Texas Medical Center, Houston, Texas 77025 Previous experiments have revealed nerve fibers in the adrenal medulla that do not conform to the accepted pattern of preganglion-ic (cholinergic) innervation. Thus, the precise nature of the nerve supply of the adrenal medulla has remained unclear. Experiments were designed to specifically elicit adrenergic nerve axons and terminals, istics and 2) their spatial relationships to norepinephrine (NE) and/or epinephrine (E) cells. The methodology was threeford: 1) intrapertioneal administration of 5-hydroxydopamine (5-OHDA) to label bioperitoneal administration of 5-hydroxydopamine (5-OHDA) to label bioperitoneal administration of 5-hydroxydopamine (6-OHDA) to relective degeneration of adrenergic components, 3) to fix control tissue in a manner as to prevent diffusion loss of BA from adrenergic nerve elements. Adrenal glands were from mature male cats. Tissues were fixed by immersion in 4% glutaraldehyde-1% sodium molybdate in 0.2m cacodylate buffer (pH 7.2, 2 hrs) followed by treatment with 1% 0.2m cacodylate buffer fer, dehydration in scaled alcohols and embedding in Epon. To preferve ablances and paraformaldehyde- Each method consistently demonstrated adrenergic fibers. This localization assumes particular significance since adrenergic fibers are observed only in NE containing cell areas. When found, the adrenergic nerves are in a "bouton en passage" configuration and are not seen in the typical symptic configuration of cholinergic endings. The ultrastructural characteristics of the 5-OHDA labelling and 6-OHDA degeneration methods are consistent with the 5-OHDA and 6-OHDA methods. These findings suggest a dual innervation for NE medullary cells. The particulars of this adata and the implications for the control of adrenal medullary secretion are evident and will be discussed.

A STUDY OF THE FIRE HORPHOLOGY OF THE SCOLEX OF HYGENOLEPIS DIMINUTA

(CESTODA). R.D. Specian, Department of Biology, Southern Methodist Galversity, Dallas, Texas 75275.

The recomment of cestudes is a metabollically active surface which is of great importance to the host-parasite relationship. Since the anterior specialized holdiast, or scoles, represents that region in most intimate contact with the host and is the site of an accumulation of nervous tissue (Horseth, J. Parasit, 5): 492-500, 1967), the fine morphology of thit region merits a detailed study.

Controlled to the first based of the first based of

The surface of the tegument is extended as unique microvilli called microtrienes which are revealed by both SEM and TEM. In the rostellar region of the scelex, transmission electron microscopy reveals sensory structures and prominent secretory cells from which cytoplasmic processes provide intrusions into the surface, or distal, tegumental cytoplasm.

The nature of the secretory product is not well defined. Although neuroscenetion has been previously reported, the cell type presently studied is more likely one which contributes a secretion to cover the outer surface of the helmindh. The sensory structure probably consists of a sensory bipolar neuron in close association with the distal cytoplasm. It may serve either a ractile or chemoreceptive function.

MEMBERSHIP

TSEM

GERTRUD M. ADAM ELECTRON MICROSCOPY LAB. TEXAS AGM COLLEGE, STATION, TEX. 77940

ERLE ADRIAN
DEPT. OF ANATOMY
UNIV. OF TEX. MED. SCHOOL
SAN ANTONIO, TEX.
78229

M.J. AHEARN
DEPT. CF PATH.
M.D. ANDERSCN
HOUSTON, TEX.
77025

VENITA F. ALLISON DEPT. OF BICLOGY SOUTHERN METHODIST UNIV. DALLAS, TEXAS

DR. BETTY ALTENBURG
DEPT. OF VIRGLOGY & EPIDEMIOLOGY
BAYLOR COLLEGE OF MEDICINE
HOUSTON, TEXAS
77025

F. GLENN ANDERS 217 LOUTIT HALL OF SCIENCE GRAND VALLEY STATE COLLEGE ALLENDALE, MICHIGAN 49401

RONALD D. ARNESON DEPT. CF BIOLOGY TEXAS A&M UNIV. COLLEGE STATION, TEX. 77840

NANCY J. ARNGLD 6357 ORIOLE DRIVE DALLAS, TEX. 75209

HOWARD J. ARNOTT DEPT. OF BOTANY UNIV. OF SOUTH FLORIDA TAMPA, FLORIDA 33620 W.J. ARNOULT 7218 CAMBRIDGE ST. HOUSTON, TEX. 77025

ROBERT M ATHERTON DEPT. CF PICLOGY TRINITY UNIV. SAN ANTONIO, TEX.

JACK AUSTEN
DEPT. OF VETERINARY MICROBICLOGY
TEXAS A&M UNIVERSITY
COLLEGE STATION, TEXAS
77843

J. F. BAILEY
DEPT. CF PIOLOGY
TEXAS TECH UNIVERSITY
LUBBOCK, TEXAS
79409

DENNIS BALSAM DEPT. OF PATHOLOGY, RM. B-112 SOUTHWESTERN MEDICAL SCHOOL DALLAS, TEXAS 75235

DR. W. J. BARCELLONA DEPT. OF BIOLOGY TEXAS CHRISTIAN UNIVERSITY FT. WORTH, TEXAS 76129

VIRGIL J. BARCZAK DEPT: TECHNICAL CENTER KERR-MCGEE CORP OKLAHOMA CITY, OKŁAHOMA

STEVEN S. BARHAM DEPT. OF CELL PIOLOGY UNIV. OF TEXAS MEDICAL BRANCH GALVESTON, TEXAS 77550

DENNIS B. RARR AMMRC ARSENAL ST. WATERTOWN, MASS. 02172

DR. PAUL S. BAUR JR.
DIV. OF CELL BIOLOGY
DEPT. HUM. BIO. CHEM. AND GEN.
UNIV. OF TEXAS MED. SCHOOL
GALVESTON, TEXAS 77550

GERALD A BEATHARD
DEPARTMENT OF PATHOLOGY
UNIV. OF TEXAS MEDICAL BRANCH
GALVESTON, TEXAS
77550

MR. BEESTON
PRODUCTS MANAGER
AEI SCIENTIFIC APPARATUS, INC.
500 EXECUTIVE BLVD.
ELMS FORD, NEW YORK 10523

D. C. BENEFIEL DOW CHEMICAL CC. BLDG. P-1218 FREEPORT, TEXAS 77541

SUE BENNETT BAYLOR UNIV. MEDICAL CENTER DEPT. OF PATHOLOGY DALLAS, TEXAS 75149

BILLIE BENTINCK DEPT. OF PATHOLOGY BAYLOR MEDICAL SCHOOL/METHOUIST HOUSTON, TEXAS 77025

DAVID C: BENTINCK DEPT. CF PATHCLOGY BAYLOR MEDICAL SCHOOL HOUSTON, TEXAS 77025

RICHARD & BERGENS DEPT. OF BICLOGY NORTH TEXAS STATE UNIVERSITY DENTON, TEXAS 76203

JACQUES A BERLIN 584 DELAWARE AVE. NEW YORK STATE DEPT. CF HEALTH BUFFALC, NEW YORK 14202

JERRY D. BERLIN DEPT. CF BIOLCGY TEXAS TECH UNIVERSITY LUBBOCK, TEXAS 79409

V. K. BERRY
P.O. BCX 3904
EASTERN NEW MEXICO UNIVERSITY
PORTALES, NEW MEXICO
88130

JOHN J. BIESELF DEPT. CF ZCGLCGY UNIVERSITY CF TEXAS AUSTIN, TEXAS

ROBERT V. BLYSTONE DEPT. OF PICLOGY TRINITY UNIVERSITY SAN ANTONIO, TEXAS 78212

ANNA H. BCPAK DEPT. CF CELL BIOLOGY BAYLOR COLLEGE OF BIOLOGY HOUSTON, TEXAS 77025

ALFRED C. BODFNMAN
DEPT. OF MICRCHIOL. & INF. DISEA
SOUTHWEST FOUNDATION FOR RES. &
P.O. BCX 26147
SAN ANTONIO, TEXAS 78284

DR. MATTIE I. BOSSART 2613 MARILEE L.H. #1 HOUSTON, TEXAS 77027

CHARLOTTE L. POUDREAU
DEPT. CF PATHCLOGY
SOUTHWESTERN MEDICAL SCHOOL
DALLAS, TEXAS
75235

RANDY PRACKEEN
3600 LINK VALLEY #5
HOUSTON, TEXAS 77025

BILL BRINKLEY
DEPT. OF CELL BIOLOGY
UNIV. CF TEXAS MEDICAL PRANCH
GALVESTON, TEXAS
77550

META S. BROWN
DEPT. CF SOIL & CRCP SCIENCES
TEXAS A&M UNIVERSITY
COLLEGE STATION, TEXAS
77843

SIDNEY C. BROWN DEPT. CF RICLOGY TEMAS A&M UNIVERSITY COLLEGE STATION, TEXAS 77843

JEAN-PIERRE ERUNSCHWIG DEPT. CF VIRCLOGY BAYLCR COLLEGE CF MEDICINE HOUSTON, TEXAS

GEORGE W. BUCKALOU MEDICAL SERVICE VETERANS ADMINISTRATION CENTER TEMPLE, TEXAS 76501

KENNETH H. BURK 6300 CUMFRIES #378 HOUSTON, TEXAS 77035

PHYLLIS BURK TEXAS TECH UNIVERSITY SCHOOL OF MEDICINE LUBBCCK, TEXAS 79409

CLINTON L. BURNS TEXAS COLLEGE OF OSTECPATHIC MED FORT WCRTH, TEXAS 76107 LINDA C. PURKS CELLULAR ANALYTICAL LAP. NASA/MSC HOUSTON, TEXAS 77058

JUDITH F. BURGIS
METALLURGICAL LAB. SECTION/MAGCE
KELLY AFR, TEXAS 78241

NOLA BUSBY
GYNECOLOGY - RI406
M. D. ANDERSON HOSPITAL
HOUSTON, TEXAS
77025

WILHELMINA I. PUTCHER VETERINARY PATHOLOGY (VSP) SCHOOL OF AERCSPACE MEDICINE BROOKS AB, TEXAS 78235

JAMES K. BUTLER
DEPT. OF BIOLOGY
UNIV. CF TEXAS AT ARLINGTON
ARLINGTON, TEXAS
76010

ALINE BYRNES DIV. OF BIOL. GOOWTH & DEV. SOUTHWEST FCUNC. FOR RES. & ED. P.O. BOX 28147 SAN ANTONIO, TEXAS 78228

GERALD CALLAS
DEPT. OF ANATOMY
UNIVERSITY OF TEXAS MEDICAL BRAN
GALVESTON, TEXAS
77550

IVAN L. CAMERON
DEPT. OF ANATOMY
UNIV. OF TEXAS MEDICAL SCHOOL
SAN ANTONIO, TEXAS

MARION M. CAMPBELL UNIV. OF TEXAS DENTAL SCIENCE IN 1018 BLODGETT HOUSTON, TEXAS 77025

THOMAS H. CAPERS VETERANS ADMINISTRATION HOSP. 4500 S. LANCASTER RD. DALLAS, TEXAS 75216

SONYA CARDENAS DEPT. OF PATHOLOGY UNIV. OF TEXAS MEDICAL BRANCH GALVESTON, TEXAS

JAMES CARNES NORTH TEXAS STATE UNIV. DEPT. CF RIOLCGY DENTON, TEXAS 76201

FREIDA L. CARSON DEPT. OF PATHCLOGY BAYLOR UNIV. MEDICAL CENTER DALLAS, TEXAS 75246

JEFFREY P. CHANG DIVISION OF CELL BIOLOGY UNIV. OF TEXAS MEDICAL BRANCH GALVESTON, TEXAS 77550

EDWARD R. CHEVALIER 7186 HICKORY GROVE DRIVE SAN ANTONIO, TEXAS 78227 MARIE LIN CHU EM LAB UNIV. OF TEXAS MEDICAL BRANCH GALVESTON, TEXAS

WALLIS H. CLARK, JR. DEPT. CF PIOLOGY UNIVERSITY CF HOUSTON HOUSTON, TEXAS 77004

GENE L. COLBORN
DEPT. OF ANATOMY
UNIV. OF TEXAS MEDICAL SCHOOL
SAN ANTONIC, TEXAS
78229

ARTHUR CCLE
DEPARTMENT OF PHYSICS
M. D. ANDERSON HOSPITAL
HOUSTON, TEXAS
77025

DONALD R. COLE
DEPT. OF ENTCMCLOGY
TEXAS AGM UNIVERSITY
COLLEGE STATION, TEXAS
77843

GARY CCLE
DEPT. OF BOTANY
UNIV. CF TEXAS
AUSTIN, TEXAS
78712

PETER M. CORRY
DEPT. CF PHYSICS
MD ANDERSON HOSPITAL
HOUSTON, TEXAS
77025

ROBIN COTTON
DEPT. OF BIOLOGY
SOUTHERN METHODIST UNIV.
DALLAS, TEXAS
75222

ERNEST F. COUCH DEPT. OF RICLEGY TEXAS CHRISTIAN UNIVERSITY FORT WORTH, TEXAS 76129

ELENOR R. CCX DEPT. CF BICLOGY TEXAS AGM UNIVERSITY COLLEGE STATION, TEXAS 77843

JOYCE E. COX ANATOMIC PATHOLOGY RM. 6308 M.D. ANDERSON HOSPITAL HOUSTON, TEXAS 77025

BARTIE P. CCYLE VEECO INSTRUMENTS 4717 SHANDS DR. MESQUIRE, TEXAS 75149

CHARLES W. CRAWFORD SCOTT & WHITE HOSPITAL TEMPLE, TEXAS 76501

MRS. JANE CRICK DIVISION OF NEUROSCIENCE UNIVERSITY OF TEXAS MEDICAL SCH HOUSTON, TEXAS 77025

THOMAS E. CRGLEY
DEPT. OF ANATOMY
L.S.U. MEDICAL CENTER
NEW ORLEANS, LOUISTANA
70119

LLOYO CROSTHWAIT SEMICONDUCTOR RESEARCH AND DEVEL TEXAS INSTRUMENTS DALLAS, TEXAS 75222

CLAUDIA A. PASTE DEPT. CF ANATOMY EMORY UNIVERSITY ATLANTA, GEORGIA 30322

DAVID L. DAVIDSON SUUTHWEST RESEARCH INST. P.O. DRAWER 28510 SAN ANTONIO, TEXAS 78223

PAULA K. DAVIS 965 N. RUSTIC CIRCLE DALLAS, TEXAS 75218

GLENN L. DECKER
DEPT. CF CELL BICLOGY
UNITY. CF TEXAS SOUTHWESTERN MEC.
DALLAS, TEXAS
75235

ROBERT S. DECKER
DEPT. CELL PICLOGY
SOUTHWESTERN MEDICAL SCHOOL
UNIVERSITY OF TEXAS
DALLAS, TEXAS 75235

RUSSEL L. DETER
DEPT. CF ANATOMY
BAYLOR CCLLEGE OF MEDICINE
HOUSTON, TEXAS
77025

RICHARD A.F. DIXON
P.G. BCX 1541
COLLEGE STATION, TEXAS 77840

LEON DMOCHOWSKI M.D. ANDERSON HOSPITAL TEXAS MEDICAL CENTER HOUSTON, TEXAS 77025

WILLIAM J. CCHSON DEPT. OF BIOLOGY TEXAS ARM UNIVERSITY COLLEGE STATION, TEXAS 77843

RONALC F. DODSON DEPT. CF NEURGLOGY PAYLOR COLLEGE OF MEDICINE HOUSTON, TEXAS 77025

ELIZABETH DONNELL DEPT. GE ANATOMY TULANE UNIV. MED. SCHOOL NEW ORLEANS, LOUISIANA 70112

EARPARA L. DOWNS 800 BABCCCK #1C6 SAN ANTONIO, TEXAS 78201

ELEANOR DUKE DEPT. CF BIOLOGICAL SCIENCE UNIV. CF TEXAS AT EL PASO EL PASC, TEXAS 7993C

DONALD DUNCAN
DEPT. CF ANATOMY
UNIV. CF TEXAS MEDICAL BRANCH
GALVESTON, TEXAS
77550

HOU-CHI DUNG
DEPT. CF ANATOMY
UNIV. CF TEXAS MEDICAL SCHOOL
SAN ANTONIO, TEXAS
78229

JOYCE ECKELPERG 6300 CUMFRIES #226 HOUSTON, TEXAS 77035

JOANNE T. ELLZEY
DEPT. OF BIOLOGICAL SCIENCE
UNIV. OF TEXAS AT EL PASO
EL PASO, TEXAS
79912

LAWRENCE L. ESPEY TRINITY UNIVERSITY 715 STADIUM DR. SAN ANTONIO, TEXAS 78212

ALFREDO FERIA-VELASCO INSTITUTO DEL SEGURO SOCIAL DEPT. DE INVESTIGACION CIENTIFIC APARTADO POSTAL 73-032 MEXICO, D.F.

JANET AUNE FERRILLO
DEPT. CF PIOLOGY
TEXAS WOMAN'S UNIVERSITY
DENTON, TEXAS
76204

DEAN S. FOLSE
DEPT. OF PATHOLOGY
UNIV. OF TEXAS MEDICAL BRANCH
GALVESTON, TEXAS

ANGELINE FOWLER
DEPT. OF CLIN. CHEM. & LAB. MED.
M. D. ANDERSON HOSPITAL
TEXAS MEDICAL CENTER
HOUSTON, TEXAS 77025

CLAUDIA FOWLER
DEPT. OF PATHOLOGY
UNIVERSITY OF TEXAS
SOUTHWESTERN MEDICAL SCHOOL
DALLAS, TEXAS 75235

CARL FREEMAN KENT CAMBRIDGE SCIENTIFIC, INC. 9323 PORTAL HOUSTON, TEXAS 77071

ROBERT G. FREEMAN DEPT. OF PATHCLOGY SOUTHEASTERN MEDICAL SCHOOL DALLAS, TEXAS 75235

CYNTHIA GABRIEL
DEPT. OF PATHOLOGY
M.D. ANDERSON HOSPITAL
HOUSTON, TEXAS
77025

ROBERT E. GALLION PHILIPS ELECTRONIC INST. 721 PARK FOREST DR. GARLAND, TEXAS 75040

FERNANDE A. GARD 704 CLEMENT ST. ROIJON APT. 5 RADFORD, VIRGINIA 24141

MARION L. GAY DEPT. OF HUMAN BIOCHEMICAL GENET UNIV. OF TEXAS MEDICAL BRANCH GALVESTON, TEXAS 77550 JOHN H. GHICONI DEPT. OF PATHOLOGY UNIV. OF TEXAS MEDICAL SCHOOL SAN ANTONIO, TEXAS 78229

MICKEY D. GLASS DEPT. CF PATHULCGY SOUTHWESTERN MEDICAL SCHOOL DALLAS, TFXAS 75235

CHESTER A. SLEISER
DEPT. OF VETERINARY PATHGLOCY
TEXAS AGM UNIVERSITY
COLLEGE STATION, TEXAS
77843

MARGARET ANN GOLDSTEIN DEPT. OF MYOCARDIAL PICLOGY BAYLOR COLLEGE OF MEDICINE HOUSTON, TEXAS 77025

AMADOR GONZALEZ-ANGULC
INSTITUTO DEL SEGURO SOCIAL
DEPT. DE INVESTIGACION CIENTIFIC
APARTADO POSTAL 73-032
MEXICO 73, D.F.

AGUSTIN GONZALEZ-LICEA INSTITUTO DEL SEGURC SCCIAL DEPT. DE INVESTIGACION CINETIFIC APARTACO POSTAL 73-032 MEXICO 73,D.F.

NORMAN GRANHOLM DEPT. OF PATHOLOGY UNIV. OF TEXAS MEDICAL BRANCH GALVESTON, TEXAS 77550

DONALD S. GREENBERG BAYLOR CCLLEGE OF MEDICINE TEXAS MEDICAL CENTER HOUSTON, TEXAS 77025

RON GRUENER
DEPT. CF NEURCBICLOGY
UNIV. OF TEXAS MEDICAL SCHOOL AT
HOUSTON, TEXAS
77025

NECIP GUVEN
DEPT. OF GEOSCIENCES
TEXAS TECH UNIVERSITY
LUBBOCK, TEXAS
79409

CHARLES R. HACKENBROCK DEPT. OF CELL BIOLOGY SOUTHWESTERN MEDICAL SCHOOL DALLAS, TEXAS 75235

WILLIAM E. HAENSLY DEPT. OF VETERINARY ANATOMY TEXAS A&M UNIVERSITY COLLEGE STATION, TEXAS 77843

ROBERT L. HALES
DEPT. OF VIROLOGY
M.D. ANDERSON HOSPITAL
HOUSTON, TEXAS
77025

NOEL M. HALL, JR. DEPT. CF BICLOGY SOUTHERN METHODIST UNIVERSITY DALLAS, TEXAS 75222

ROBERTA LEE HALLORAN 5353 DORA #1 HOUSTON, TEXAS 77005 MARGIE K. MARNESS DEPT. CF PATHOLOGY BAYLOR COLLEGE CF MEDICINE HOUSTON, TEXAS 77025

JOHN E. HARRIS NATL. OCEANOGRAPHIC DATA CHNTER NOAA ROCKVILLE, MARYLAND 20852

HOWARD HAYDEN REICHERT 711 SOUTH ST. PAUL STREET DALLAS, TEXAS 75201

JIM HAYES
DEPT. OF ANATOMY
UNIV. OF TEXAS MEDICAL BRANCH
GALVESTON, TEXAS
77550

GORDON W. HEATH
DEPT. CF HISTCLCGY
UNIVERSITY CF TEXAS DENTAL PRANC
HOUSTON, TEXAS
77025

F.C. HECK TEXAS A&M UNIVERSITY COLLEGE STATION, TEXAS 77843

MITCHELL HENRY
DEPT. OF OCEANOGRAPHY
TEXAS A&M UNIVERSITY
COLLEGE STATION, TEXAS

J. RICHARD HILLMAN TEXAS TECH SCHOOL OF MEDICINE DEPT. OF ANATOMY LUBBOCK, TEXAS 79409

TERRY HCAGE
DEPT. CF RIDLOGY
SAM HOUSTON STATE UNIV.
HUNTSVILLE, TEXAS
77340

CHARLES L. HOLIFIELD PPG INDUSTRIES CHEM. CIV. P.O. BCX 4026 CORPUS CHRISTI, TEXAS 78408

KATHRYN V. FOLMES DEPT. MICROBICLOGY SOUTHWESTERN MEDICAL SCHOOL UNIVERSITY OF TEXAS DALLAS, TEXAS 75235

DAVID HOM
DEPT. OF CELL RIOLOGY
UNIV. OF TEXAS MEDICAL BRANCH
GALVESTON, TEXAS
77550

GWYNFRYN HOPKINS DEPT. CF BIGLCGY RICE UNIVERSITY HOUSTON, TEXAS 77001

ROPERT HOSTETLER
ANIMAL SCIENCE
TEXAS A&M UNIVERSITY
COLLEGE STATION, TEXAS

MARSHALL L. HOUSTON UNIVERSITY OF TEXAS DENTAL SCHOOL AT SAN ANTONIO SAN ANTONIO, TEXAS 78229 SHYI-YI HUANG DEPT. OF MICHCHIOLOSY SOUTHWESTERN MEDICAL SCHOOL DALLAS, TEXAS 75-235

MAKOTO IGARASHI DEPT. OF OTCLARYNGOLOGY BAYLOR COLLEGE OF MEDICINE HOUSTON, TEXAS 77025

PHILIIP J. IVES
DEPT. OF VETERINARY MEDICINE
TEXAS A&M UNIVERSITY
COLLEGE STATION, TEXAS
77843

JOHN W. JACKSON DEPT. OF CELL BIOLOGY SOUTHWESTERN MEDICAL SCHOOL DALLAS, TEXAS 75235

ROBERT P. JERNIGAN KENT CAMBRIDGE SCIENTIFIC CC. WACO, GEORGIA 30182

SISTER CLEMENT JOHNSON DEPARTMENT OF NEURAL SCIENCES UNIVERSITY OF TEXAS GRADUATE SCH TEXAS MEDICAL CENTER HOUSTON, TEXAS

ANDREW M. JCNES
925 N. DENISCN WE
MANHATTAN, KANSAS
66502

PEGI S. JONES
DEPT. OF ANATOMY
UNIV. OF TEXAS MEDICAL PRANCH
GALVESTON, TEXAS
77550

HAROLC W. JORDAN BROWN, RCOT & NORTHROP P.O. BCX 34416 HOUSTON, TEXAS 77034

LIANE E. JORDAN
DEPT. OF MICROPIOLOGY
BAYLOR COLLEGE OF MEDICINE
HOUSTON, TEXAS
77025

MARGARET S. JUDGE UNIVERSITY OF TEXAS MED. SCHOOL SAN ANTONIO, TEXAS 78229

S.S. KALTER
SOUTHWEST FOUNDATION FOR RES. &
P.O. BCX 28147
SAN ANTONIC, TEXAS
78228

KARL KARNAKY MOUNT DESERT ISLAND LAB. SALISBURY COVE, MAINE 04672

ALLEN KASTEN 909 W. VIRGINIA ST. MCKINNEY, TEXAS 75069

GARNETT KELSOE DEPT. OF BIOLOGY SOUTHERN METHODIST UNIV. DALLAS, TEXAS 75222 ANGELA W. KENNERY EM LAB UNIV. OF TEXAS MEDICAL MRANCH GALVESTON, TEXAS 77550

JOYCE KEPHART CELL RESEARCH INSTITUTE UNIV. OF TEXAS AUSTIN, TEXAS 78712

F.C. KETLER SOUTHWESTERN CAMERA CC. 3801 DRUMMOND ST. HOUSTON, TEXAS 77025

ROGERS S. KIMMONS PHILIPS ELEC. INST. HOUSTON, TEXAS 77036

STEPHEN L. KIMZEY CELLULAR ANALYTICAL LAR. MANNED SPACECRAFT CENTER HOUSTON, TEXAS 77058

TOM KING
DEPT. OF PATHOLOGY
SCOTT AND WHITE HOSPITAL
TEMPLE, TEXAS
76501

GERALD KIRBY DEPT. OF MECHANICAL ENG. TEXAS TECH UNIVERSITY LUBBOCK, TEXAS 79409

C. WARD KISCHER
DEPT. CF ANATCMY
UNIV. OF TEXAS MEDICAL PRANCH
GALVESTON, TEXAS
77550

MARCELLA KLIMA DEPT. CF PATHCLOGY ST. LUKE'S EPISCOPAL HOSPITAL HOUSTON, TEXAS 77025

DAVID KNEZEK 4219 DIXON BIG SPRING, TEXAS 79720

LORNE S. LABEL 710 W 21ST ST AUSTIN, TEXAS 78705

DENNIS J. LANDIS
DEPT. OF OPTHALMOLOGY
BAYLOR COLLEGE OF MEDICINE
HOUSTON, TEXAS
77025

DIMITRIJ J. LANG DEPT. OF MOLECULAR BICLOGY UNIV. CF TEXAS DALLAS, TEXAS 75230

PAULETTE LANGLINAIS DEPT. CF PATHCLOGY USA ISR BAMC FT. SAM HOUSTON, TEXAS 78234

LA PUSHIN, RAMAH 4938 GLENMEADOW HOUSTON, TEXAS 77035 MATTHEW LAVAIL
PEDIATRIC RESCARCH PLDG.
CHILDREN'S HOSPITAL MET. CENTER
300 LONGWOOD AVE.
BOSTON, MASSACHUSETTS C2115

ALFRED S. LEA OFFICE OF ASSOCIATE DEAN BAYLOR COLLEGE OF MEDICINE HOUSTON, TEXAS 77025

SCOTT LEA DEPT. OF BIOLOGY BAYLOR UNIVERSITY WACC, TEXAS 76703

THOMAS P. LEFFINGWELL CELL RESEARCH INSTITUTE UNIV. CF TEXAS AUSTIN, TEXAS 78712

ALBERT LEIPOVITZ SCOTT & WHITE CLINIC TEMPLE, TEXAS 76501

F.A. LEMOINE
P.O. BOX 20381
HOUSTON, TEXAS 77025

CHARLES W. LEWIS DEPT. CF PATHGLOGY BAYLOR COLLEGE OF MEDICINE HOUSTON, TEXAS 77025

BENJAMIN LICHTIGER DEPT. CF SURGICAL RES. RI-426 M.D. ANDERSON HOSPITAL HUUSTON, TEXAS 77025

JAMES N. LINCSEY
DEPT. CF HUMAN PICLOGY, CHEMISTR
DIVISION CF CELL RIOLCGY
UNIV. CF TEXAS MEDICAL PRANCH
GALVESTON, TEXAS 77550

MYLES L. MACE, JR.
DEPT. CF CELLULAR BIOLCGY
M.O. ANDERSCN HOSPITAL
HOUSTON, TEXAS
77025

BRUCE MACKAY
ANATOMIC PATHOLOGY
M.D. ANDERSON HOSPITAL
HOUSTON, TEXAS
77025

WM. F. MACKENZIE USAF SAM DEPT. CF VETERINARY PATHOLOGY BROOKS AFR, TEXAS 78235

MARGARET ANN MALLIA
DEPT. OF PEDIATRIC CARDIOLOGY
UNIV. CF TEXAS MEDICAL BRANCH
GALVESTON, TEXAS

PETER A. MARSH J.M. HUBER CO. P.O. BCX 831 BORGER, TEXAS 79007

GARY MARSHALL
SECTION OF CELL BIOLOGY
M.D. ANDERSON HOSPITAL
HOUSTON, TEXAS
77025

J.A.S. MARSHALL CELL RESEARCH INSTITUTE UNIVERSITY OF TEXAS AUSTIN, TEXAS 78712

RICHARD B. MARSHALL DEPT. CF PATHOLOGY UNIV. CF TEXAS MEDICAL ARANCH GALVESTON, TEXAS 77550

JAMES H. MARTIN DEPT. CF PATHOLOGY BAYLOR MEDICAL SCHOOL DALLAS, TEXAS 75246

JOHN E. MARTIN
COLLEGE OF VET. MEDICINE
DEPT. OF VET. ANATOMY
TEXAS AGM UNIVERSITY
COLLEGE STATION, TEXAS 77843

LEF D. MARTIN DOW CHEMICAL CC. BLDG. #8-1218 FREEPORT, TEXAS 77541

JOE A. MASCERRE DEPT. GF ANATOMY TULANE MEDICAL SCHOOL NEW ORLEANS, LOUISIANA 70112

J.L. MATTHEWS DEPT. OF MICROSCOPIC ANATOMY BAYLOR COLLEGE OF DENISTRY DALLAS, TEXAS 75226

MURRAY A. MATTHEWS
DEPT. OF ANATOMY
L.S.U. MEDICAL CENTER
1190 FLORIDA AVE.
NEW ORLEANS, LCUISIANA 70119

JOHN E. MAYFIELD DEPT. OF BIOLOGY ALABAMA STATE UNIVERSITY MONTGOMERY, ALAPAMA 36101

HEATHER D. MAYCR DEPT. CF VIRCLOGY & EPIDEMICLOGY BAYLOR COLLEGE OF MEDICINE HOUSTON, TEXAS 77025

NEWELL H. MCARTHUR DEPT. OF VETERINARY MED. TEXAS A&M UNIVERSITY COLLEGE STATION, TEXAS 77843

JAMES L. MCATEE DEPT. GF CHEMISTRY BAYLOR UNIVERSITY WACO, TEXAS 76703

BRUCE MCCARTY
DEPT. OF PATHCLOGY
SOUTHWESTERN MEDICAL SCHOOL
DALLAS, TEXAS
75230

BILL MCCOMBS SCOTT-WHITE HOSPITAL TEMPLE, TEXAS 76501

MANLEY MCGILL
DEPT. OF CELL BIOLOGY
M.D. ANDERSCN HOSPITAL
HOUSTON, TEXAS
77025

ROBERT F. MCGREGOR DEPT. CF PATHOLOGY ST. LUKE'S HOSPITAL HOUSTON, TEXAS 77025

JAMES D. MCINTOSH DEPT. OF MICROSCOPIC ANATOMY BAYLOR COLLEGE OF DENTISTRY DALLAS, TEXAS 75226

DAVID MCKAY NASA/MAIL CCCE TN7 HOUSTON, TEXAS 77058

THOMAS R. MCKEE ELECTRON MICROSCOPE CENTER TEXAS A&M UNIVERSITY COLLEGE STATION, TEXAS 77843

A.B. MCKINNEY, JR.
ORA-FAILURE ANALYSIS LAB.
TEXAS INSTRUMENTS, INC.
DALLAS, TEXAS

C. WALLACE MCNUTT
DEPT. OF ANATOMY
UNIV. OF TEXAS MEDICAL SCHOOL
78229

SHIRLEE MAY MEDIA ENTOMOLOGY DIVISION USDA - P.C. PCX GE COLLEGE STATION, TEXAS 77840

A. J. MIA DEPT. OF LIFE SCIENCES BISHOP COLLEGE DALLAS, TEXAS 75241

KATY JO MILLER DEPT. OF CELL BIOLOGY SOUTHWESTERN MEDICAL SCHOOL DALLAS, TEXAS 75235

MAHLON F. MILLER 3510 CLOVERDALE HOUSTON, TEXAS 77025

RAMIREZ MITCHELL THE CELL RESEARCH INSTITUTE UNIVERSITY OF TEXAS AUSTIN, TEXAS 78712

ELSA V. MOCEGA 2121 MANCR LANE PARK RIDGE, ILLINOIS 60068

HILTON H. MOLLENHAUER U.S.O.A. VETRINARY TOXICOLOGY & ENTOMOLOG COLLEGE STATION, TEXAS 77840

P.C. MOLLER DIV. OF BIOLOGICAL & MED. SCIENC BROWN UNIVERSITY PROVIDENCE, RHODE ISLAND 02912

RICARDO MORALES
DEPT. OF ANATOMY
UNIV. OF TEXAS MEDICAL BRANCH
GALVESTON, TEXAS
77550

COY R. MCRRIS 2911 CCLE WACO, TEXAS 76707

DALE M. M. MUSTLER DEPT. OF RICLOGY TEXAS ARM UNIVERSITY COLLEGE STATION. TEXAS 77843

ERNEST MUELLER DEPT. CF PATHCLOGY UNIV. CF TEXAS MEDICAL BRANCH GALVESTON, TEXAS 77550

MIKE MULLEN
PERKIN-ELMER CORPORATION
SUITE # 202
11110 LOST ALAMITOS
LOS ALAMITOS, CALIFORNIA 90720

LEE MUNZ OPTEC INC. 100 MIDLAND ROAD OAK RIDGE, TENNESSEE 37630

DAVID L. MURPHY DEPT. CF CELL PIOPHYSICS BAYLOR CCLLEGE CF MEDICINE HOUSTON, TEXAS 77025

BROCKS MYERS
DEPT. CF VIROLOGY
M.D. ANDERSON HOSPITAL
HOUSTON, TEXAS
77025

JOAN NASH
DEPARTMENT OF MICROSCOPIC ANATOM
BAYLOR COLLEGE OF DENTISTRY
DALLAS, TEXAS
75226

VIRGINIA R. NELSON 4017 GLENROSE GARLAND, TEXAS 75040

BRENDA KAY NEVELS DEPT. CF PATHOLOGY TEXAS CHILDRENS HOSPITAL HOUSTON, TEXAS 77025

FRANKLIN S. NEWMAN VET. RESEARCH LAB. AGRICULTURAL EXPERIMENT STATICN BOZEMAN, MONTANA 56715

WILLIAM N. NORTON DEPT. OF ENTOMOLOGY TEXAS ASM UNIVERSITY COLLEGE STATION, TEXAS 77840

DR. CONSTANCE OLIVER
DEPT. CF PATHOLOGY
MEMORIAL HOSPITAL FOR CANCER
NEW YORK, NEW YORK
10021

CONSTANCE CLIVER SOLAN-KETTERING INSTITUTE FOR CA 410 EAST 68TH ST. NEW YORK, NEW YORK 10021

ROPERT M. OLIVER 6406 WILBUR DR. AUSTIN, TEXAS 77025 SHARON S. OLIVEP VETERANS ADMINISTRATION CONTER RESEARCH LAB. TEMPLE, TEXAS 76501

STEPHANIE C. CLNEY DEPARTMENT OF MICROBIOLOGY BAYLOR COLLEGE OF MEDICINE HOUSTON, TEXAS 77025

POEN S. CNG
DEPT. CF ANATCHIC PATHCLOGY
M.O. ANDERSON HOSPITAL
HOUSTON, TEXAS
77025

ROBERT PARDUE
DEPARTMENT OF CELL BICLOGY
UNIVERSITY OF TEXAS MEDICAL BRAN
GALVESTON, TEXAS
77550

DORA PATTERSON
DEPT. CF ANATOMY
UNIV. CF TEXAS MEDICAL PRANCH
GALVESTON, TEXAS
77550

GARY G. PAULSON MATERIALS EVALUATION LAB. 8000 GSRI AVE. BATON ROUGE, LOUISIANA 70808

WILLIAM PAVLAT UNIV. OF TEXAS MEDICAL SCHOOL SAN ANTONIO, TEXAS 78229

ELIZABETH PAYNE DEPT. OF PHYSIOLOGY VANDERPILT UNIVERSITY NASHVILLE, TENNESSEE 37203

RONALD G. PEACCCK 3524 TRICE ST, WACO, TEXAS 76707

BRUCE PETERS DIVISION OF NEUROLOGY UNIV. OF TEXAS MEDICAL BRANCH GALVESTON, TEXAS 77550

RICHARD G. PETERSON UNIV. OF TEXAS MEDICAL SCHOOL AT 102 JESSE JONES LIBRARY HOUSTON, TEXAS 77025

W.F. PETTY CARL ZEISS, INC. 1814 WINDSONG TRAIL RICHARDSON, TEXAS 75080

MERL D. PHILLIPS 141 NORTH PLAZA SAN ANTONIO, TEXAS 78227

C.W. PHILPGTT DEPT. OF BIOLGGY RICE UNIVERSITY HOUSTON, TEXAS 77001

THOMAS B. POOL
DEPARTMENT OF BIOLOGY
GILMER HALL
UNIVERSITY OF VIRGINIA
CHARLOTTESVILLE, VIRGINIA 22901

MICHAEL T. POSTEK BOX 1891 COLLEGE STATION, TEXAS 77840

GEORGE J. RACE DEPT. CF PATHGLOGY BAYLOR MEDICAL CENTER DALLAS, TEXAS 75246

STEVE RAIGUEL TIUSM ANATOMY LUBBOCK, TEXAS 79409

ELSA E. RAMCS DEPARTMENT OF EXPERIMENTAL MEDIC BAYLOR COLLEGE OF MEDICINE HOUSTON, TEXAS 77025

EDWARD G. RENNELS
DEPT. OF ANATOMY
UNIV. OF TEXAS MEDICAL SCHOOL
SAN ANTONIO, TEXAS
78212

HARLEY W. RENC DEPT. OF PICLOGY BAYLOR UNIVERSITY WACD, TEXAS 76703

JAMES P. REYNCLOS
DEPT. OF PATHOLOGY
UNIV. OF TEXAS MEDICAL SCHOOL AT
HOUSTON, TEXAS
77011

ROLAND C. REYNOLDS SOUTHWESTERN MEDICAL SCHOOL 5323 HARRY PINES PLVD. DALLAS, TEXAS 75235

ROBERT W. RIESS GENETICS FOUNDATION PATTERSON LAB. B. 472 UNIVERSITY OF TEXAS AUSTIN, TEXAS 78712

A.S. RILEY 5227 CALADIUM DR. DALLAS, TEXAS 75229

E.R. RIVERA
DEPT. OF BOTANY
UNIV. CF TEXAS
AUSTIN, TEXAS
78712

JAMES H. ROAN COLLEGE OF CENTISTRY BAYLOR UNIVERSITY DALLAS, TEXAS 75226

DANIEL K. ROBERTS 3333 E. CENTEREAL, SUITE #301 WICHITA, KANSAS 67208

SANDRA RCBINSCN DEPT. CF PHYSICS M.D. ANDERSON HOSPITAL HOUSTON, TEXAS 77025

TOM D. ROGERS
CELLULAR ANALYTICAL LAR.
DC 72 NASA / MSC
HOUSTON, TEXAS
77058

GEORGE G. ROSE UNIV. CF TEXAS DENTAL BRANCH P.O. BCX 20068 HOUSTON, TEXAS 77025

LAWRENCE M. RCSS
DEPT. OF ANATOMY
UNIV. OF TEXAS MEDICAL BRANCH
GALVESTON, TEXAS
77550

EDNA E. ROSSITER
DEPT. OF PATHOLOGY
BAYLOR CCLLEGE OF MEDICINE
HOUSTON, TEXAS
77025

MERVYN L. RUDEE WIESS COLLEGE RICE UNIVERSITY HOUSTON, TEXAS 77001

F.H. RUDENBERG DEPT. OF PHYSIOLOGY UNIV. OF TEXAS MEDICAL BRANCH GALVESTON, TEXAS 77550

IRWIN W. RUSHING DEPT. OF BIOLOGY NAVARRO JUNIOR COLLEGE CORSICANA, TEXAS 77025

KRISTYNA RYBICKA DEPT. OF CARDIOVASCULAR SURG. RE TEXAS HEART INSTITUTE HOUSTON, TEXAS 77025

H. WAYNE SAMPSON DEPT. OF GROSS ANATOMY BAYLOR COLLEGE OF DENTISTRY DALLAS, TEXAS 75226

KATHERINE SCHAEFFER SCHOOL OF DENTISTRY DEPT. OF ORAL PATHOLOGY MEHARRY MEDICAL COLLEGE NASHVILLE, TENNESSEE 37208

EDDIE SCHILDMEIJER PHILLIPS ELECTRONIC INSTRUMENT 7302 MARWIN DRIVE SUITE #106 HOUSTON, TEXAS 77036

VERNON E. SCHOLES
DEPT. OF MICROBIOLOGY
UNIVERSITY OF SOUTH ALABAMA
MOBILE, ALABAMA

MARY SCHUNDER
DEPT. OF ANATOMY
TEXAS COLLEGE OF OSTEOPATHIC MED
FORT WORTH, TEXAS
76107

RANDY SCOTT
ELECTRON MICROSCOPE CENTER
DEPT. OF BIOLOGY
TEXAS A&M UNIVERSITY
COLLEGE STATION, TEXAS 77843

LEONARD L. SEELIG
DEPT. DF ANATOMY
UNIV. OF TEXAS MEDICAL SCHOOL
SAN ANTONIO, TEXAS
78229

ROBERT SEIBERT LADD RESEARCH INDUSTRIES BURLINGTON, VERMONT 05402 GABRIEL SEMAN DEPT. CF VIRCLOGY M.D. ANDERSCN HOSPITAL HOUSTON, TEXAS 77025

JOSEPH A. SERIFINI 1418 FINLEY RC. IRVING, TEXAS 75062

JOHN J. SESSION DEPT. CF BIOLOGY TEXAS SOUTHERN UNIV. HOUSTON, TEXAS 77004

LONNIE T. SHEPHERD
DEPT. OF SURGICAL PATHOLOGY
SCOTT & WHITE CLINIC
TEMPLE, TEXAS
76501

MASATAKA SHINO
DEPT. OF ANATOMY
UNIV. OF TEXAS MEDICAL SCHOOL
SAN ANTONIO, TEXAS

ROBERT F. SHORTHOSE RCA SERVICE COMPANY 5520 GRAND LAKE HOUSTON, TEXAS

RUTH SIMS T.W.U. STATION DEPT. BIOLOGY BOX 23971 DENTON, TEXAS 76204

DON B. SINGER
DEPT. OF PATHOLOGY
TEXAS CHILDRENS HOSPITAL
HOUSTON, TEXAS
77025

PERCY SINGLETON
DEPARTMENT OF BIOLOGY
T.S.U.
HOUSTON, TEXAS
77004

RAYMOND F. SIS COLLEGE OF VETERINARY MEDICINE DEPT. OF VETERINARY ANATOMY TEXAS A&M UNIVERSITY COLLEGE STATION, TEXAS 77843

CON SMITH
DEPT. OF MICROBIOLOGY
SOUTHWESTERN FOUNDATION
FOR RES. AND ED.
SAN ANTONIO, TEXAS

11

ı (

MARILYN N. SMITH
DEPT. OF PATHOLOGY
ST. LUKE'S EPISCOPAL HOSPITAL
HOUSTON, TEXAS
77025

COL. J.R. SNOGA, USAF, MC CMR 8, BOX 369333 WILFORD HALL USAF MED CTR. LACKLAND AFB, TEXAS 78236

R.S. SOHAL
DEPT. OF BIOLOGY
SOUTHERN METHODIST UNIVERSITY
DALLAS, TEXAS
75222

BERNARD L. SOLOFF
GENERAL MEDICAL RESEARCH
VETERANS ADMINISTRATION HOSPITAL
LITTLE ROCK, ARKANSAS
72206

ARTHUR E. SCWERS
P.O. BOX 9151
COLLEGE STATION, TEXAS 77840

TIMOTHY STACEY
DEPT. OF PATHOLOGY
ST. JOSEPHS HOSPITAL
HOUSTON, TEXAS
77002

THEODORE E. STALEY
DEPT. OF PHYSIOLOGICAL SCIENCE
OKLAHOMA STATE UNIVERSITY
STILLWATER, OKLAHOMA
74074

ANN M. STEIN 3604 CEDAR PLAZA #102 DALLAS, TEXAS 79235

WAYNE A. STENBACK DEPT. OF EXPERIMENTAL BIOLOGY BAYLOR COLLEGE OF MEDICINE HOUSTON, TEXAS 77025

DR. PATRICK R. STERRETT ASSISTANT PROFESSOR OF ANATOMY TEXAS TECH UNIV. SCHOOL OF MEDIC LUBBOCK, TEXAS 79409

HAROLD C. STERNLICHT 9307 TIMBERSIDE HOUSTON, TEXAS

JAMES C. STINSON DEPT. OF SURGICAL PATHOLOGY SCOTT AND WHITE HOSPITAL TEMPLE, TEXAS 76501

ROBERT STOCKBURGER DEPT. OF BIOLOGY BAYLOR UNIVERSITY WACO, TEXAS 76703

J. DONALD STOWE CARL ZEISS, INC. 3131 WEST ALABAMA HOUSTON, TEXAS 77006

DON SULLINS
AGRONOMY FIELD LAB
TEXAS AGM UNIVERSITY
COLLEGE STATION, TEXAS
77843

F. E. SUMMERS, JR.
UT DENTAL SCIENCE INSTITUTE
1018 BLODGETT
HOUSTON, TEXAS
77000

CLARMAN A. SUMRALL
DEPT. OF R&D
CONTINENTAL CARBON CO.
P.O. BOX 22085
HOUSTON, TEXAS 77027

MINORU SUZUKI DEPT. OF PATHOLOGY BAYLOR COLLEGE OF MEDICINE HOUSTON, TEXAS 77025

ROBERT P. SWAIN
1201 E. MULBERRY
APT. 408
SAN ANTONIO, TEXAS
78209

GLEN R. SWEARINGEN DEPT. OF VIRCLOSY M.D. ANDERSON HOSPITAL HOUSTON, TEXAS

ROBERT B. SZAMIER
DEPT. OF NEUROBIOLOGY
UNIV. OF TEXAS MEDICAL SCHOOL
HOUSTON, TEXAS
77025

WM. H. TALLEY
WM. H. TALLEY
HOUSTON, TEXAS 77027

A. CECIL TAYLOR
UNIV. CF TEXAS DENTAL BRANCH
P.O. BCX 20069
HOUSTON, TEXAS
77025

CARL F. TESSMER, M.D.
CHIEF, LABORATORY SERVICE
VETERANS ADMINISTRATION CENTER
TEMPLE, TEXAS
76501

HARVEY THOMAS
DEPT. CF PATHOLOGY
UNIV. OF TEXAS MEDICAL SCHOOL
SAN ANTONIO, TEXAS
78229

NOLAN H. THOMPSON DEPARTMENT OF BIOLOGY T.S.U. HOUSTON, TEXAS 77045

LARRY THORPE UTMB, GALVESTON INTERNAL MEDICINE GALVESTON, TEXAS 77550

E. LAWRENCE THURSTON DEPT. OF BIOLOGY TEXAS A&M UNIVERSITY COLLEGE STATION, TEXAS 77843

BEVERLY TILLMAN
P.O. BCX 807
TEAGUE, TEXAS 75860

DAN TIMMERMANN P.O. BCX 787 STATE UNIVERSITY, ARKANSAS 7246

MRS. W. T. TOPLEMAN UT SOUTHWESTERN MED. SCHOOL CELL BIOLOGY DALLAS, TEXAS 75235

ROBERT W. TOLER
DEPT. CF PLANT SCIENCE
TEXAS A&M UNIVERSITY
COLLEGE STATION, TEXAS
77843

TONALD N. TOMAS
DEPT. OF BIOLOGY
TEXAS AGM UNIVERSITY
COLLEGE STATION, TEXAS
77843

NORBERTO TREVINO-GARCIA INSTITUTO MEXICANO DEL SEGURO SO DEPTO. DE INVESTIGACION CIENTIFI APDO. POSTAL 73-032 MEXICO 73, D.F. (MEXICO CITY) MELVIN TROUSDALS
DEPT. OF MICROSIGLOGY
UNIV. OF TEXAS MEDICAL SCHOOL
SAN ANTONIO, TEXAS
78229

FRANCIS R. TURNER DEPT. OF BOTANY INDIANA UNIVERSITY BLOOMINGTON, INDIANA 47401

ROBERT A. TURNER
DEPT. GF SURGICAL PATHCLOGY
SCOTT AND WHITE HOSPITAL
TEMPLE, TEXAS
76501

JOHN E. UBELAKER
DEPT. OF BIOLOGY
SOUTHERN METHODIST UNIVERSITY
DALLAS, TEXAS
75222

W. BARRY VAN WINKLE
DEPT. CF PHARMACOLOGY
ROYAL FREE HOSP. SCHCCL OF MEDIC
UNIV. OF LONDON
LONDON WCIN 18D ENGLAND

JOHN H. VENABLE DEPT. CF VETERINARY ANATOMY OKLAHOMA STATE UNIVERSITY STILLWATER, OKLAHOMA 74074

S. VENKETESWAREN DEPT. CF BIOLOGY UNIVERSITY OF HOUSTON HOUSTON, TEXAS 77004

VIRGIL V. VICROY, JR. 3005 LONGWOOD LANE DICKINSON, TEXAS 77539

JOSEPH M. VILES
DEPT. OF ZOOLOGY & ENTOMOLOGY
IOWA STATE UNIVERSITY
AMES, IOWA
50010

MARGARITA VILLOCK MARINE BIOMEDICAL INSTITUTE UNIV. CF TEXAS MEDICAL RRANCH GALVESTON, TEXAS 77550

W.M. VCGT 2711 IRVING BLVD, RCA SERVICE CC DALLAS, TEXAS

GEORG ANN WAITS DEPT. OF RIOLOGY RICE UNIVERSITY HOUSTON, TEXAS 77045

MELVIN W. WATSON DEPT BIOLOGY UNIV. OF SOUTH FLORIDA TAMPA, FLORIDA 33620

ALAN B. WECKERLING DEPT. CF PATHCLOGY BROOK ARMY MEDICAL CENTER FT. SAM HOUSTON, TEXAS 78234

W. GORDON WHALEY
CELL RESEARCH INSTITUTE
UNIVERSITY OF TEXAS
AUSTIN, TEXAS
78712

STUART W. WHITE 13944 PEYTON, DR., APT #222 DALLAS, TEXAS 75240

SLEN M. WILLIAMS DEPT. OF ANATOMY UNIVERSITY OF TEXAS MED. SCHOOL SAN ANTONIO, TEXAS 78229

IVAL WILLIAMS
PERKIN-ELMER CORP.
4322 KELLING
HOUSTON, TEXAS
77045

LEO J. WILLIAMS, JR. DEPT. OF PATHOLOGY ST. JOSEPH HOSPITAL HOUSTON, TEXAS 77002

VICK F. WILLIAMS DEPT. OF ANATOMY U.T. HEALTH SCIENCE CENTER SAN ANTONIO, TEXAS 78240

WILLIE J. WILSON DEPT. OF PLANT SCIENCE TEXAS A&M UNIVERSITY COLLEGE STATION, TEXAS 77843

WILLIAM B. WINDBORN
DEPT. OF ANATOMY
UNIV. OF TEXAS MEDICAL SCHOOL
SAN ANTONIO, TEXAS
78229

DAVID WINKLER
P.O. BCX 1541
COLLEGE STATION, TEXAS 78840

ZYGFRIED WOLANSKI ENGR. MET. LAR. CONNAIR AERCSPACE - GC FORT WORTH, TEXAS

JOE G. WOOD DIVISION OF NEUROSCIENCE UNIVERSITY OF TEXAS MEDICAL SCHO HOUSTON, TEXAS 77025

KATHY WOODLE UT MEDICAL SCHOOL NEUROBIOLOGY HOUSTON, TEXAS 77025

ROBERT D. YATES
DEPT. OF ANATOMY
TULANE UNIV. SCHOOL OF MEDICINE
NEW ORLEANS, LOUISIANA
70112

RUSSEL K. YCUNG DEPT. OF MEDICINE M.D. ANDERSCN HOUSTON, TEXAS 77025

JAMES L. YOUNGBLOOD NASA/MSC ESB - MATERIALS TECHNOLOGY HOUSTON, TEXAS 77058

EUGENE R. ZIMMERMANN DEPT. OF ORAL PATHOLOGY BAYLOR COLLEGE OF DENTISTRY DALLAS, TEXAS 75226

Hi, 'Neighbor'...

Although distantly separated geographically, we are never the less closely united by our interest in electron microscopy. After all these years we still find this scientific field of tremendous interest, as we are sure you do. We are constantly developing new ideas, new techniques and new products to assist the electron microscopist.

Amarillo

El Paso

TEXAS

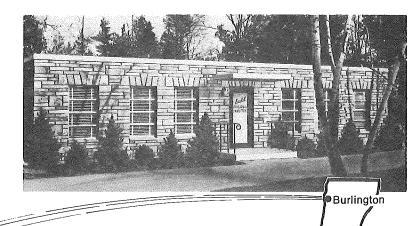
Dallas Ft. Worth

Austin

Houstone

San Antonio

Galvestor



VERMONT/

Among the many new products we now offer are:

- 1. The Ribas-Kurtz Staining Chamber capable of handling 20 grids simultaneously.
- 2. Our **Dri-Block Oven** for the uniform polymerization of embedments.
- 3. Our new Vacuum Evaporator.
- 4. Self-cleaning (self-heating) apertures for all electron microscopes.
- 5. **Flamers** for holding large size aperture discs during cleaning. The large SEM aperture discs are readily accommodated.
- 6. Our Critical Point Dryer. This unit for use with either Freon or carbon dioxide is built with the same high quality as all Ladd products.

Technical literature, price and delivery information on all the above products is available on request.

Please write to:



P.O. BOX 901 BURLINGTON, VERMONT 05401 Or telephone us at 802-658-4961.

THE STEREOSCAN SPECTRUM...

A scanning microscope to fit every budgetevery requirement





STEREOSCAN 180

The ultimate in scanning electron microscopes from the standpoint of performance and flexibility. The new 180 basically features a continuously variable and compensated 1 to 60Kv beam potential, exceptional video processing flexibility, outstanding sample chamber accessibility and sample staging. Without a doubt, the Stereoscan 180 is truly the world's most versatile scanning electron microscope.

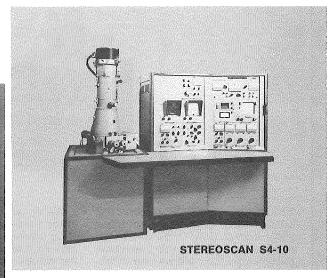
Fact: More than 600 Stereoscans are now in use throughout the world. Kent Cambridge, a leader in scanning electron microscopes, offers complete sales and service anywhere.

STEREOSCAN 600

An economical SEM for the modest budget. It's compact, simple to operate, and offers excellent image quality. A broad range of up-grade accessories are available including cathoduluminesce, specimen current, x-ray analyzer transmission and high resolution recording. Ask for our 4-color brochure.

STEREOSCAN S4-10

A medium priced, high resolution instrument with a high degree of versatility and up-grade capabilities which include: multiple detectors, LaB₀ gun, broad range of video processing, and sample stage capabilities such as heating, cooling, tensile as well as beam blanking and microfabrication. Ask for a copy of our latest S4-10 brochure.



K-222



KENT CAMBRIDGE SCIENTIFIC CO.

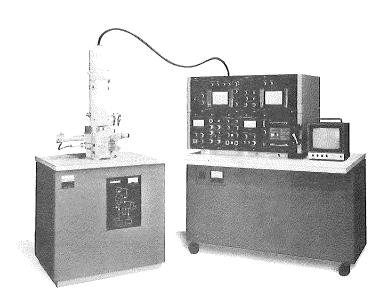
A Division of Kent Cambridge Corporation 8020 Austin Ave., Morton Grove, III. 60053 Telephone: (312) 966-1010

☐ St ☐ St ☐ PI	ereoscan 600 ereoscan 180	brochure featuring: Stereoscan S4-10 sales representative appointment
Name_		
Title		
Compa	any	
Addres	ss	
City		
State_		Zip
Phone.		

Also in • Mariton, N. J. (609) 983-3616 • Atlanta, Ga. (404) 237-7106 • Houston, Tex. (713) 772-0558 • Mountain View, Calif. (415) 965-3880 • Toronto, Canada (416) 889-8330.

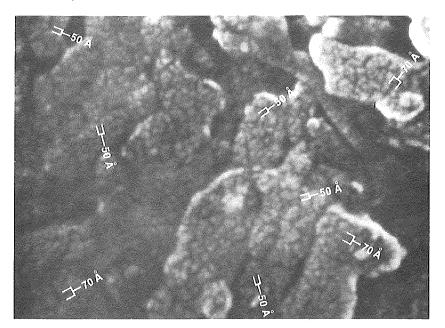
Now, a scanning electron microscope that gives you 109Å-guaranteed!

Hitachi "Hiscan" HHS-2R



The Hiscan HHS-2R is the first conventional SEM to guarantee a resolution of 70 Å. This extends the applications for scanning electron microscopy, and allows you to obtain more precise data.

We've also engineered many other time-saving, high-performance advantages into the HHS-2R, making it today's best SEM buy for the money.



For example, you get simultaneous display of two magnifications for the same specimen; magnification variable from 20 X to 300.000 X; no routine cleaning; a removable, drawer-type specimen stage; and modular, plug-in electronics so that you can tailor the instrument to your present requirements and budgets, then expand it as needed

You really have to see the Hiscan in operation to fully appreciate what it can do. For details and/or a demonstration, call or write: Perkin-Elmer Corporation, 411 Clyde Avenue, Mountain View, CA 94043. Tel: (415) 961-0461.

Gold coated magnetic tape. Resolution standard taken at 150,000X magnification.

PERKIN-ELMER

JEOL

Scanning Microscope



JSM-35

This is a medium-sized scanning microscope designed for ease of operation and maintenance. It can be widely used not only in the research fields such as biological, non-biological, and medical science, but also in the industry, e.g. for quality control purposes. It can also readily provide much information owing to its high resolution and various attachments.

Resolving power:

100 Å guaranteed.

Accelerating voltage:

 $0 \sim 35 \text{ kV}$.

Magnification:

 $10X \sim 180,000X$.

JEM-100C

The recently developed JEM-100C, guaranteeing the world's highest, resolving power of 1.4 Å, has been carefully designed with an accent on enhancement of performance, ease of operation, reliability and compact size. A variety of attachments offer exceptional flexibility in application. In addition, the JEM-100C has the following features:

Aberration-free low magnification images.

JEOL -patented cool beam gun incorporated.

15 Å scanning transmission images and 50 Å secondary electron images when using JEOL's unique ASID scanning device.

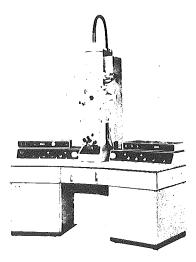
Micro-micro diffraction patterns of small areas down to 200 Å.

1 Å attainable with increasingly popular 100 kV field emission gun, and 5 Å (STEM) attainable when the gun is used with an ASID scanning device.

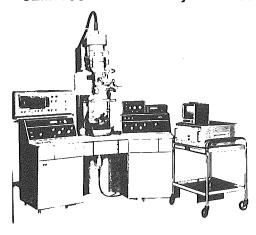
All solid state circuitry.

Expandability into analytical electron microscope.

Electron Microscope



JEM-100B Based Analytical Electron Microscope



The JEM-100B electron microscope can be fitted with the energy dispersive X-ray spectrometer combined with the ASID High Resolution Scanning Device and side entry goniometer ... without sacrificing the JEM-100B's performance as a transmission electron microscope.

Ideally suited for crystallographic studies due to:

- Simultaneous observation of scanning image on the display tube and a selected area (<200Å) diffraction pattern on the fluorescent screen.
- Dark field image capability.
- 100 kV accelerating voltage.
- High resolution goniometer stage (top or side entry type).

Provides 30 Å scanning transmission electron images and 50 Å resolution secondary electron images, using a conventional thermal emission gun.

Allows elemental analysis of the micro-area 200 Å in dia., in combination with the Energy Dispersive X-ray Spectrometer, enabling you to obtain valuable date on specimens.

For further information please contact: Paul D. Enos, JEOL U.S.A., INC., 214 S. Sheppard Drive, Euless (Dallas), Texas 76039, Telephone #(817)267-6011

TRANSMISSION **ELECTRON** MICROSCOPY



REPLICATION ELECTRON

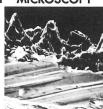


LIGHT **MICROSCOPY** I METALLOGRAPHY

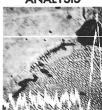
FOR



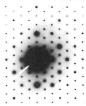
SCANNING **ELECTRON MICROSCOPY**



ELECTRON MICROPROBE **ANALYSIS**



X-RAY AND **ELECTRON DIFFRACTION**



ELEMENT AND COMPOUND IDENTIFICATION — PARTICLE SIZE DISTRIBUTION ANALYSIS OF CONTAMINANTS, FRACTURES, CRYSTALLINITY, CORROSION



ERNEST F. FULLAM, INC.

SCIENTIFIC CONSULTANTS - ACCESSORIES SUPPLIER P. O. BOX 444, SCHENECTADY, N. Y. 12301 TELEPHONE 518 785-5533

LABORATORY TESTED SUPPLIES AND ACCESSORIES FOR MICROSCOPY

EVAPORATOR ACCESSORY RING CAT. #1275



SEM **JOYSTICK** STAGE CONTROL CAT. #1191



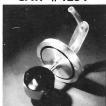
MATERIALS FOR

EVAPORATION REPLICATION SPECIMEN PREPARATION PARTICLE DISPERSIONS

CALIBRATION AND RESOLUTION STANDARDS CHEMICAL REAGENTS AND SOLVENTS **EVAPORATORS AND EVAPORATION ACCESSORIES** SPECIMEN GRIDS AND SCREENING **SUBTRATES**

TWEEZERS DUSTERS TOOLS SCISSORS **CONTAINERS — PLASTIC AND GLASS**

FREEZE DRYING **STAGE** CAT. #1254



RESOLUTION CALIBRATION STANDARD CAT. #1749



WRITE FOR CATALOG

TILTING HOLDER CAT. #1754



ROTARY TILTING **SUBSTAGE** CAT. #1737



SEMI CONDUCTOR SUBSTAGE CAT. #1810



TENSILE SUBSTAGE CAT. #1813

APERTURES



HOT-COLD STAGE CAT. #1756



CHUCK-JAW HOLDER CAT. #1811

