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Four categories of communications are published in the Journal.

Regular Articles contain reports of new instrumentation and new theoretical methods and their applications to microstructural analysis in a broad range of fields including biological, physical, and materials science. **Communications** are short technical or scientific articles in biological, physical, or materials science. **Reviews** have a broader technical content than Regular Articles. **Letters to the Editor** may be on any topic.

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32nd Annual Meeting

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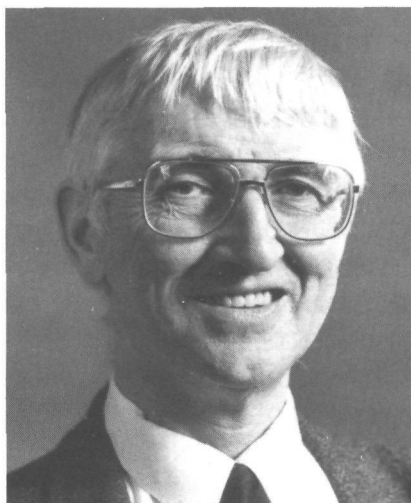
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1998 DISTINGUISHED SCIENTIST AWARDS



MICHAEL J. WHELAN
Physical Sciences

He graduated in physics from the University of Cambridge in 1954, and started research there in the Cavendish Laboratory of the Department of Physics. Working with Dr. Peter Hirsch, he followed up a line of research which had been recently initiated by A Kelly, PB Hirsch and JW Menter to try to observe directly crystal lattice defects in thin foils of metals by transmission electron microscopy. He first investigated ion beam thinning of gold, aluminium and other metals using laboratory constructed equipment, since no commercial equipment was then available. Success was achieved in the spring of 1956, when dislocations were observed in thin foils of aluminium, and their motion captured on movie film. Later that year, in collaboration with W Bollmann of the Battelle Labs in Geneva, the movement of dislocations was observed in stainless steel, a metal of low stacking fault energy, and the splitting of the dislocations into partials with an associated stacking fault was studied. The TEM technique is now widely used for characterising defects in materials. In 1958 he received his Ph.D., and after further research in Cambridge he moved in 1966 to the Department of Metallurgy of the University of Oxford, where he held the post of Reader and later of Professor. He retired from his Professorship in 1997.

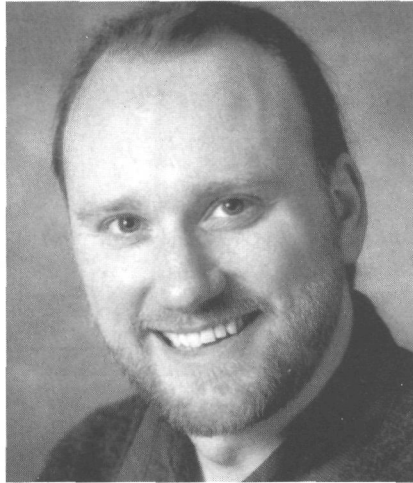
During his career he pioneered with his collaborators many techniques in the field of materials applications of electron microscopy. These include theories of image contrast, studies at elevated temperatures using a heating specimen stage, the weak-beam technique for high resolution observations of dislocations by diffraction contrast, electron energy loss spectroscopy, and in recent years the theory of reflection high energy electron diffraction with applications to molecular beam epitaxy.



AVRIL V. SOMLYO
Biological Sciences

Avril V. Somlyo has contributed to the development and application of analytical X-ray microprobe microanalysis to biological specimens, as well as rapid freezing technologies, to trap physiological events in cells and tissues. This approach has led to new insights into the transport of elements across the membranes of intracellular organelles, such as mitochondria, sarcoplasmic and endoplasmic reticulum and the nucleus *in situ*. Dr. Somlyo and her colleagues are currently studying signal transduction pathways, which regulate smooth muscle contractility, as well as the myosin molecular motors responsible for force generation. Dr. Somlyo received her Ph.D. in 1976 from the University of Pennsylvania and is currently Professor of Pathology and Molecular Physiology and Biological Physics at the University of Virginia School of Medicine. Dr. Somlyo has received the CIBA Award for Hypertension Research, the Louis and Artur Lucian Award for Research in Circulatory Diseases, and the Presidential Science Award of the Microbeam Analysis Society.

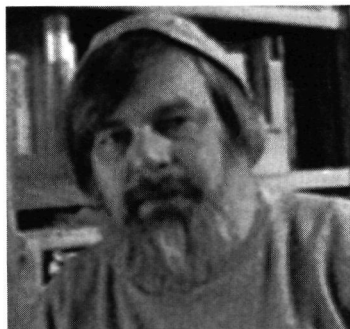
BURTON MEDAL



IAN M. ANDERSON

Ian M. Anderson received a B.S. degree from Caltech and M.Eng., M.S., and Ph.D. degrees from Cornell, all in Applied Physics. He received an (E)MSA Presidential Scholarship to attend the 50th anniversary meeting in 1992 while he was finishing his dissertation at the University of Minnesota. Since 1993, he has been at Oak Ridge National Laboratory, where he is currently a research staff member in the Metals and Ceramics Division. Dr. Anderson's research is in the development of electron-optical characterization techniques and their applications for materials analysis. His research has included the areas of secondary fluorescence corrections, ALCHEMI, energy-filtered imaging, low-voltage X-microanalysis, and the development of methods for analysis of large series of spectra and images, for which he organized a symposium at Microscopy and Microanalysis '97. He has been a member of the Program Committee since 1996.

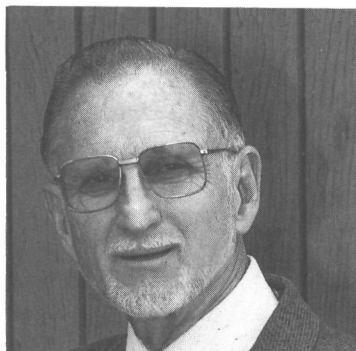
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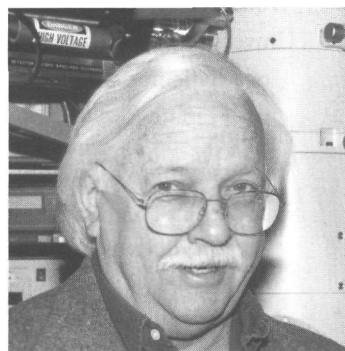
Nestor is presently a research scientist at Argonne National Laboratory and has worked in the area of microstructural characterization using electron/optical techniques for over 20 years. He received a B.S. in Physics from the Illinois Institute of Technology and a PhD in Metallurgy from the University of Illinois Urbana/Champaign. He was a Wigner Fellow at ORNL and has received awards from International Microscopy Societies for his contributions in the field of Microscopy and Microanalysis. A member of MSA since 1979, he was awarded the Societies Burton Medal in 1982. He is a member of the Education, Standards, Program, and the Telecommunications Committees. Nestor also holds Adjunct Professorial Appointments in Physics at UIC and in Materials Science at UIUC. He has developed some of the original methodologies for quantitative elemental characterization using XEDS, EELS, and EFI in the AEM and continues to work on new technologies and instrumentation for characterization. His most recent research centers on the ANL 300 kV AAEM and TelePresence Microscopy. He can sometimes be found on the Net and has known to handle a few Email and WWW requests for the Society.

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BIOLOGICAL SCIENCE
H.H. MOLLENHAUER

Dr. Mollenhauer received his degrees in electrical engineering from The University of Texas in Austin. His early work in electron microscopy was at the Cell Research Institute, The University of Texas, Austin. In 1965, he moved to the Charles F. Kettering Research Laboratory in Yellow Springs, Ohio and from there to the USDA, Veterinary Toxicology Research Laboratory, College Station, Texas. He retired in early 1992. Some of his early achievements included verifying the role of Golgi apparatus in plant secretion and cell wall formation, discovery of intercisternal elements and *cis* to *trans* polarity of plant dictyosomes, isolation of Golgi apparatus from plants and animals, and the first report of a new organelle (together with William Zebrun) called dictyosome-like structure (DLS). The DLS are unique to early spermatocytes where they coexist with Golgi apparatus. He has also published numerous papers for improving fixation, embedding, and sectioning of biological material.



PHYSICAL SCIENCE
C.J. ECHER

Chuck Echer started materials characterization in 1960 during his formal education at Oklahoma State University where he graduated with two Associate Degrees in 1963. His initial career started at ACF Industries, Albuquerque, NM performing thermal-mechanical processing treatments of metals along with optical metallography evaluations. He continued his experience at Battelle Memorial Institute, Columbus, OH in the mid-sixties performing optical metallography on space age materials. In 1968, he joined Lawrence Livermore National Laboratory where he started materials characterization using transmission electron microscopes. In 1984, he transferred to the E.O. Lawrence Berkeley Laboratory, National Center for Electron Microscopy. His senior position currently provides user scheduling, training and collaborative research managing the AEM and the In-Situ facilities. In his career he has contributed to the installation of four electron microscope facilities. To date, he has co-authored sixty publications, received twelve awards, and chaired or co-chaired in eleven scientific meetings.

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1991	Joseph R. Michael
1992	Kannan Krishnan
1993	Joseph A. N. Zasadzinski
1994	Jan M. Chabala
1995	Joanna L. Batstone
1996	Vinayak P. Dravid
1997	P. M. Ajayan

MSA DISTINGUISHED SERVICE AWARD

1992	Ronald Anderson
	G.W. "Bill" Bailey
	Frances Ball
	Blair Bowers
	Deborah Clayton
	Joseph Harb
	Kenneth Lawless
	Morton Maser
	Caroline Schooley
	John H.L. Watson
1993	E. Laurence Thurston
1994	Richard F.E. Crang
1995	Raymond K. Hart
1996	José A. Mascorro
1997	William T. Gunning, III

MSA OUTSTANDING TECHNOLOGIST AWARD

1993	Ben O. Spurlock
1994	Bernard J. Kestel
1995	Kai Chien
1996	David W. Ackland
1997	John P. Benedict
	Stanley J. Klepeis

MSA PAST PRESIDENTS

1942	G.L. Clark ¹	1970	Russell Steere
1943	R. Bowling Barnes ²	1971	Robert M. Fisher
1944	R. Bowling Barnes	1972	Daniel C. Pease
1945	James Hillier	1973	Benjamin Siegel
1946	David Harker	1974	Russell J. Barnett
1947	William G. Kinsinger	1975	Gareth Thomas
1948	Perry C. Smith	1976	Etienne de Harven
1949	F.O. Schmitt	1977	T.E. Everhart
1950	Ralph W.G. Wyckoff	1978	Myron Ledbetter
1951	Robley C. Williams	1979	John Silcox
1952	R.D. Heidenreich	1980	Michael Beer
1953	Cecil E. Hall	1981	John Hren
1954	Robert G. Picard	1982	Lee Peachey
1955	Thomas F. Anderson	1983	David Wittry
1956	William L. Grube	1984	J. David Robertson
1957	John H.L. Watson	1985	Dale Johnson
1958	Max Swerdlow	1986	Robert Glaeser
1959	John H. Reisner	1987	Linn W. Hobbs
1960	D. Gordon Sharp	1988	John-Paul Revel
1961	D. Maxwell Teague	1989	Ray Carpenter
1962	Keith R. Porter	1990	Keith R. Porter
1963	Charles Schwartz	1991	Charles Lyman
1964	Sidney S. Breese	1992	Patricia Calarco
1965	Virgil G. Peck	1993	Michael S. Isaacson
1966	Walter Frajola	1994	Robert R. Cardell
1967	Joseph J. Comer	1995	Terence E. Mitchell
1968	John H. Luft	1996	Margaret Ann Goldstein
1969	W.C. Bigelow	1997	C. Barry Carter

¹Chair of committee to arrange first meeting

²Temporary (pre-constitution)

1998 MICROBEAM ANALYSIS SOCIETY AWARDS
PRESIDENTIAL SCIENCE AWARD



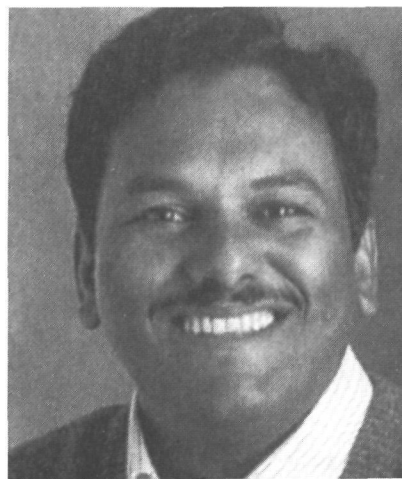
FREDERICK H. SCHAMBER

Frederick H. Schamber received his Ph.D. in physics at Iowa State University in 1970. He joined Tracor Northern in 1972 where he developed x-ray analyzer software and managed the research and development activities. He joined RJ Lee Group in 1990 and is currently Vice President of RJ Lee Instruments Limited with responsibility for product development and corporate direction. Fred's professional interests have focused on instrumentation development, with spectral analysis, computer automation, and electron optics design being particular emphases. His 1973 invention and publication of the *filtered least-squares fit from reference spectra* provided the emerging EDS industry with its first on-line method for reliable quantification of complex EDS spectra. He has been, and continues to be, extensively involved in the development of automated and integrated SEM/EDS instrumentation. Fred has served as a director of MAS and was the 1978 recipient of the society's Corning award for best contributed paper.



JON J. MCCARTHY

Jon is a native of Wisconsin and received a BS in physics and mathematics from the University of Wisconsin–Eau Claire. He received the Ph.D. in Physics from Iowa State University, following in the footsteps of such other famous MAS members as Bob Myklebust, Joe Doyle, and Fred Schamber! After a two year post-Doc appointment in the Center for Radiation Research at NIST (formerly NBS), Jon joined NORAN Instruments (formerly Tracor Northern) as a senior scientist where he is now Vice-President of Technology and Engineering. Jon has been a member of MAS since 1976 and has served the society in many roles. He has been a MAS tour speaker on three occasions, and was a session chair at the 92, 94 and 97 meetings. In 1997 he was the MAS program chair for the M&M meeting, and this year he is the MAS co-chair for M&M '98 while also organizing the MAS Topical Symposium celebrating *Thirty Years of EDS in Microanalysis*. In addition, Jon has served on the MAS council as a director (1989–91), as a corporate liaison (1992–3), and as MAS president (1995).



VINAYAK P. DRAVID

Vinayak P. Dravid received his undergraduate B.Tech degree in Metallurgical Engineering from the Indian Institute of Technology (IIT), Bombay–India in 1984, and his PhD in Materials Science & Engineering in fall of 1990 from Lehigh University. He then gathered his courage to venture into academic career the same year with the Department of Materials Science & Engineering at Northwestern University. He is now an associate professor and directs the electron probe instrumentation center (*EPIC*).

Professor Dravid's research and teaching interests revolve around nanoscale phenomena in solids—specifically interfacial phenomena in ceramics and nanostructured materials, and the prudent use of emerging as well as conventional electron microscopy techniques. He has authored over 80 refereed journal publications and holds several patents in these areas. Prof. Dravid is a recipient of various research awards including: NSF Young Investigator Award, Exxon Foundation Fellowship, IBM Faculty Development Award, the Microscopy Society of America (MSA) Burton Medal and the Robert L. Coble award from the American Ceramic Society. He has been affiliated with the MAS since his graduate days, and has served the microscopy and microanalysis community in various capacities. One of Prof. Dravid's passions (and challenges) is to increase societal awareness of science and technology, specifically that in materials science and technology. He enjoys touring and hosting local area high schools, and attempts to convey the beauty, diversity and complexity of materials via electron microscopy and microanalysis.

1998 MAS DISTINGUISHED SCHOLAR AWARDS

Z.W. Chen University of Southern California	K. Siangchaew Stevens Institute of Technology
K.D. Johnson Northwestern University	A.P. Smith North Carolina State University
R.J. Kline North Carolina State University	W. Tian University of Michigan
P.M. Raj Rutgers University	S.H. Wood University of California–Riverside

MAS PRESIDENTIAL AWARDS

	Science		Service
1977	R. Castaing	1977	P. Lublin
1978	K.F.J. Heinrich	1978	D.R. Beaman
1979	P. Duncumb	1979	M.A. Giles
1980	D.B. Wittry	1980	A.A. Chodos
1981	S.J. Reed	1981	R. Myklebust
1982	R. Shimizu	1982	J. Doyle
1983	J. Philibert	1983	D. Newbury
1984	L.S. Birks	1984	J.I. Goldstein
1985	E. Lifshin	1985	M.C. Finn
1986	R. Myklebust	1986	V. Shull
1987	O.C. Wells	1987	D.C. Joy
1988	J.D. Brown	1988	C.G. Cleaver
1989	J. Hillier	1989	W.F. Chambers
1990	T.E. Everhart	1990	C.E. Fiori
1991	J.I. Goldstein	1991	T.G. Huber
1992	G. Lorimer	1992	E. Etz
	G. Cliff	1993	H.A. Freeman
1993	D.E. Newbury	1994	J.L. Worrall
1994	D.C. Joy	1995	R.W. Linton
1995	G. Bastin	1996	P.F. Hlava
1996	A.V. Somlyo	1997	J.A. Small
	A.P. Somlyo		
1997	D.B. Williams		

MAS K.F.J. HEINRICH AWARDS

1986	P. Statham	1991	A.D. Romig, Jr.
1987	J.T. Armstrong	1992	S. Pennycook
1988	D.B. Williams	1993	P.E. Russell
1989	R. Leapman	1994	J.R. Michael
1990	R.W. Linton	1995	N. Lewis
		1997	R. Gauvin

MAS PAST PRESIDENTS

1968	L.S. Birks	1983	R. Bolon
1969	K.F.J. Heinrich	1984	D.C. Joy
1970	R.E. Ogilvie	1985	D.E. Newbury
1971	A.A. Chodos	1986	C.G. Cleaver
1972	K. Keil	1987	C. Fiori
1973	D.R. Beaman	1988	W.F. Chambers
1974	P. Lublin	1989	D.B. Wittry
1975	J.W. Colby	1990	A.D. Romig, Jr.
1976	E. Lifshin	1991	J.T. Armstrong
1977	J.I. Goldstein	1992	D.B. Williams
1978	J.D. Brown	1993	T.G. Huber
1979	D.F. Kyser	1994	J. Small
1980	O.C. Wells	1995	J. McCarthy
1981	J.R. Coleman	1996	D.E. Johnson
1982	R. Myklebust	1997	Joseph R. Michael



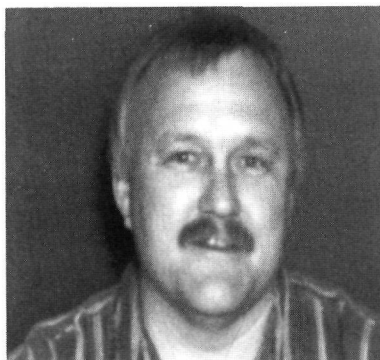
Ralph M. Albrecht
MSA President



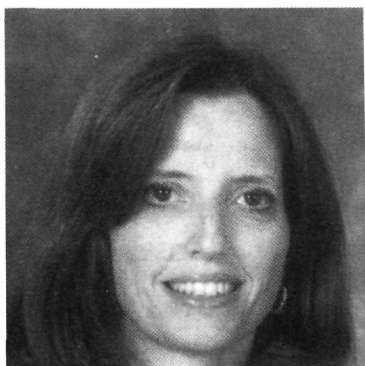
Ryna B. Marinenko
MAS President



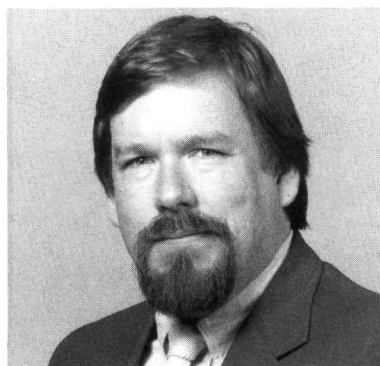
Janet Woodward
Local Arrangements Chair



Robert L. Price
Local Arrangements Treasurer



Kathleen B. Alexander
Program Chair



Jay Jerome
Program Vice Chair



Meredith Bond
Program Co Chair



Jon J. McCarthy
Program Co Chair

MICROSCOPY AND MICROANALYSIS 1998

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Jay Jerome, Vice Chair

Meredith Bond, Co Chair

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Ian Anderson	Frederick R. Maxfield
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David Joy	Jim Turner
Louis Kerr	Edgar Voelkl
Mike Kersker	Z.L. Wang
Matt Libera	Mark Willingham
Beverly Maleeff	Janet Woodward
John Mansfield	Nestor Zaluzec
Ryna Marinenko	Yimei Zhu

FOREWORD

Ralph Albrecht & Ryna Marinenko
President MSA and President MAS

Beginning with last year's volume, the proceedings of the annual meeting are being published as a supplement to our Journal, "Microscopy and Microanalysis". It should also be noted that "Microscopy and Microanalysis" is now abstracted by Current Contents in both the biological and physical science categories. The Journal is also abstracted by Biosis and by Chemical Abstracts. Hence the scientific content of Microscopy and Microanalysis can now be readily searched and is widely available. Both the meeting and the proceedings continue as a joint MSA/MAS effort under the direction of a single Program Committee, a single Local Arrangements Committee, and are published as a single Proceedings. We have also continued the Presidential Happenings "tradition" begun last year where our awards ceremonies are coupled with presentations that all meeting participants will find interesting and enjoyable.

We wish to congratulate the Program Committee chaired by Kathi Alexander and the Local Arrangements Committee chaired by Janet Woodward for their hard work and dedication in making Microscopy and Microanalysis '98 an outstanding meeting. Despite this year's earlier-than-usual meeting date and hence an earlier abstract due date, all indications are that this is one of the most successful MSA/MAS sponsored meetings both in terms of participation and attendance. Kathi and co-chairs Jay Jerome (MSA), Meredith Bond (MAS), and Jon McCarthy (MAS) have worked extremely hard during the past two years arranging sessions, speakers, pre-meeting workshops, tutorials, etc. The result is a comprehensive program of platform and poster symposia complimented by a variety of special offerings including a special pre-meeting symposium/workshop on multiphoton excitation microscopy presented by Jim Pawley, an excellent program of pre-meeting short courses organized by Brian Herman and Louis Kerr, and a special MAS symposium entitled "30 Years of Energy Dispersive Spectrometry". James Turner and John Mansfield have put together an outstanding set of tutorials, the computer workshop will be presented by Nestor Zaluzec and John Mansfield, while Sandy Silvers and Bev Maleeff from The Technologist's Forum have arranged a special discussion on image manipulation and enhancement as well as a symposium on the selection and use of instrumentation. The LAC under Janet Woodward's leadership has been equally instrumental to the success of the meeting in arranging for our world class meeting site, exciting social events, hotels, shuttles, etc. This year marks the first Microscopy and Microanalysis Meeting managed by the Rebedeau Group (headed by Mary Beth Rebedeau) which has been working closely with both the LAC and the Program Committee developing an advanced and streamlined program production process as well as coordinating on site meeting management.

Our thanks to Bill Bailey, the MSA Proceedings Editor, who, over the years, has been instrumental in producing these first class Proceedings and who sent us many friendly reminders to insure the timely submission of contributions needed for the Proceedings. We appreciate his tireless dedication. We also wish to express our appreciation to the extremely competent and professional staff at Springer Verlag for their attentive efforts in publishing our journal and, in particular, this Proceedings issue.

We also extend our hearty congratulations to the MSA and MAS award winners. Avril Somlyo and Mike Whelan have been selected as recipients for the MSA Distinguished Scientist Awards in the Biological and Physical Sciences respectively. Ian Anderson is the MSA Burton Medalist and Nestor Zaluzec is the recipient of the MSA Morton D Maser Outstanding Service Award. The MSA Outstanding Technologist Awards go to Charles Echer in the Physical Sciences category and to Hilton Mollenhauer in the Biological Sciences category. The recipient of the MAS Presidential Science Award is Fred Schamber, the MAS Presidential Service Award goes to Jon McCarthy, and the K.F.J. Heinrich Award recipient is Vinayak Dravid. Congratulations also to the 10 MSA Presidential Student Awardees, the 3 recipients of MSA Professional Technical Staff Awards, and the 8 MAS Distinguished Scholar Awardees.

Atlanta is a hub for science, communication, and travel. It is a vibrant city with great natural beauty, many modern and historical sites of interest, outstanding restaurants and shops, and an efficient, inexpensive public transportation system. Our special thanks to the City of Atlanta for the hospitality they have extended to us. We are pleased to have been able to select The Georgia World Congress Center, an outstanding internationally recognized facility, as the venue for our scientific sessions and exhibits. We thank all the organizers and participants for making Microscopy and Microanalysis 1998 a premier event. We now look forward to Portland, Oregon, the site of Microscopy and Microanalysis '99.

TITLES AND ORDER OF SESSIONS

ADVANCES IN REMOTE MICROSCOPY, INSTRUMENT AUTOMATION AND DATA STORAGE

Possibilities and examples for remote microscopy including digital image acquisition, transfer, and archiving—I. Daberkow, M. Schierjott	2
Quicktime as a storage medium for dynamic data sets in <i>in-situ</i> electromicroscopy—J. F. Mansfield	4
The Materials Microcharacterization Collaboratory—M. C. Wright	6
A testbed for automated acquisition from a TEM—C. S. Potter, B. Carragher, H. Chu, B. J. Frey, R. Josephs, C. Lin, N. Kisseberth, K. L. Miller, K. Nahrstedt	8
A model for Internet access to remote visual scientific instruments—C L. Morgan, R. A. Hillyard, G. M. Jones, D. L. Pardoe, N. R. Smith	10
Telemicroscopy: Development of a Collaboratory for Microscopic Digital Anatomy—M. H. Ellisman, M. Hadida, D. Greer, M. Wong, S. Lindsey, S. Peltier, S. J. Young	12
Network control and tools for electron microscopy—J. A. Hunt, C. Meyer	14
SEM stop-frame, color, 3D animation for motion pictures—D. Scharf, J. Wilbrink, J. A. Hunt	16
Tele-Presence Microscopy: A progress report—N. J. Zaluzec	18
A telepresence microscopy research session in the DOE2000 materials microcharacterization collaboratory—L. F. Allard, E. Voelkl, T. A. Nolan, C. K. Narula, C. Montreuil, W. C. Bigelow, J. F. Mansfield	20
National Institute of Standards and Technology—Texas Instruments industrial collaboratory testbed—M. T. Postek, M. Bennett, N. J. Zaluzec, T. Wheatley, S. Jones	22
A generic protocol for controlling an SEM over a TCP/IP link—N. W. M. Ritchie, P. V. Woods	24
Tele-tutoring—from learning to earning—West Greene School District Team, RJ Lee Group Team, L. S. Koshinski, L. T. Weinrich	26
TEM performance evaluations with slow-scan CCD cameras—M. Pan	28
A multi-instrument virtual collaborative environment via the World Wide Web at NIST—B. B. Thorne, E. B. Steel, A. J. Fahey	30
Televisualization: An aid to collaborative research in molecular structure biology—M. F. Schmid, P. Matsudaira, M. T. Dougherty, M. B. Sherman, C. Henn, W. Chiu	32
Design and implementation of a laboratory-wide image management system based on Microsoft Windows NT and optical storage technology—R. McGill	34
Centrifuge polarizing microscope—S. Inoué, R. A. Knudson, K. Suzuki, N. Okada, H. Takahashi, M. Iida, K. Yamanaka	36
Virtual EDS—A cross-platform interactive multimedia tool for self-paced instruction in energy dispersive spectroscopy and microanalysis—B. J. Griffin, C. E. Nockolds	38
A model outreach program for teaching scanning electron microscopy technology: Successes and failures—N. R. Smith, R. A. Quinta	40
LBNL and the Materials Microcharacterization Collaboratory—M. A. O’Keefe, J. R. Taylor, D. K. Owen	42
Real-time remote control of a scanning electron microscope across the vBNS/Internet 2—J. F. Mansfield, A. Adamson, K. Coffman	44

Interactive nanovisualization for science and engineering education—Scanning probe microscope on the Web—B. L. Ramakrishna, A. Razdan, J. Sun, E. Ong, A. A. Garcia	46
Integrated data acquisition and instrument control for local and remote operation of electron microscopes equipped with imaging detectors and spectrometers—W. J. de Ruijter, J. K. Weiss	48
Towards sub-Ångstrom resolution with a 200 kV TEM by means of a Cs-corrector and a computer controlled alignment procedure—M. Haider, S. Uhlemann	50
Practical autotuning for transmission electron microscopes—M. Pan	52

APPLIED IMAGE PROCESSING: WHAT IT CAN DO FOR DIGITAL IMAGING

Acquisition and processing of large dynamic range digital images—J. A. Hunt	54
Understanding digital color imaging and processing—B. D. Newell	56
Image analysis—Turning images into data—J. J. Friel, E. B. Prestridge	58
Spot measurement tool for diffraction pattern analysis—D. S. Bright, A. F. Myers, S. Turner, E. B. Steel	60
Edge sharpening for unbiased edge detection in field emission scanning electron microscope (FESEM) Images—P. M. Raj, S. M. Dunn, W. R. Cannon	62
Extracting objects with adaptive segmentation techniques: Going beyond intensity thresholding—P. Eggleston ...	64
Montages and virtual reality—A paradigm for presentation of analytical data—S. K. Kennedy, D. Barton, H. P. Lentz, J. Newlin, P. M. Sauter, F. C. Schwerer	66
Digital image acquisition and presentation for high resolution SEM—Y. Chen	68
Digital precision imaging: Every pixel counts—K.-R. Peters	70
A working model of a fully digital academic high-throughput microscopy facility—M. R. Dickson	72

IMAGING AND ANALYSIS AT THE ATOMIC LEVEL: 30 YEARS OF ATOM PROBE FIELD ION MICROSCOPY

Anecdotes from an atom-probe original—J. A. Panitz	74
The position-sensitive atom probe—A new dimension in atom probe analysis—A Cerezo, P. J. Warren, G. D. W. Smith	76
The tomographic atom probe: A new dimension in material analysis—B. Deconihout, P. Pareige, D. Blavette, A. Bostel, A. Menand	78
A transparent anode array detector for 3D atom probes—M. K. Miller	80
Development of the scanning atom probe and atomic level analysis—O. Nishikawa, T. Sekine, Y. Ohtani, K. Maeda, Y. Numada, M. Watanabe, M. Iwatsuki, S. Aoki, J. Itoh, K. Yamanaka	82
Local electrode atom probes—T. F. Kelly, P. P. Camus	84
Towards 3D lattice reconstruction with the position sensitive atom probe—P. J. Warren, A. Cerezo, G. D. W. Smith	86
Digital field ion microscopy—S. J. Sijbrandij, K. F. Russell, R. C. Thomson, M. K. Miller	88
Atom probe field ion microscopy of high resistivity materials—S. J. Sijbrandij, D. J. Larson, M. K. Miller	90

An APFIM and TEM study of Ni ₄ Mo precipitation in a commercial Ni-28% Mo-1.4% Fe-0.4% Cr wt. % alloy— R. C. Thomson, N. Brown, J. S. Bates, K. F. Russell, M. K. Miller	92
High resolution analysis of elemental partitioning in nickel-base superalloy welds using atom probe field ion microscopy—S. S. Babu, S. A. David, J. M. Vitek, M. K. Miller	94
Phase separation and precipitation in a PH 17-4 stainless steel by prolonged aging at 400°C—M. Murayama, Y. Katayama, K. Hono	96
Microstructural characterization of rapidly solidified ultrahigh strength aluminum alloys—D. H. Ping, K. Hono, A. Inoue	98
Atom probe field ion microscopy of titanium aluminides—D. J. Larson, M. K. Miller	100
Atom probe field ion microscopy of polysynthetically twinned titanium aluminide—D. J. Larson, M. K. Miller, H. Inui, M. Yamaguchi	102
Atom probe studies of the nanochemistry of steels—G. D. W. Smith, A. Cerezo, T. J. Godfrey, J. Wilde, F. M. Venker	104
The role of atom probe in the study of nickel base superalloys—D. Blavette	106
APFIM and HREM studies of nanocomposite soft and hard magnetic materials—K. Hono, D. H. Ping, M. Ohnuma	108
The atom-probe field ion microscope: Applications in surface science—G. L. Kellogg	110
Field ion microscopy of multilayer film devices—D. J. Larson, A. K. Petford-Long, A. Cerezo	112
APFIM studies of interfaces: Structure and composition—H. Nordén	114
Clustering and segregation of Ag and Mg atoms in the nucleation and growth stage of Ω and T ₁ precipitates in Al-Cu(-Li) alloys—M. Murayama, L. Reich, K. Hono	116
APFIM investigation of segregation in a nickel base alloy—M. Thuvander, K. Stiller	118

COMPOSITIONAL MAPPING WITH HIGH SPATIAL RESOLUTION

Compositional imaging rediscovered: What's new/what's not?—M. S. Isaacson	120
Interdisciplinary development of EELS compositional mapping—R. D. Leapman	122
Direct imaging of trace elements, isotopes, and molecules using mass spectrometry—R. W. Linton	124
Multispectral imaging in light microscopy—K. R. Spring	126
Quantitative energy-filtering transmission electron microscopy (EFTEM) in materials science—F. Hofer, W. Grogger, P. Warbichler	128
Polarization modulation differential interference contrast (Pol Mod DIC) microscopy: An improvement for video microscopy—N. S. Allen, D. Moxley, D. Collings, G. Holzwarth	130
Transmission electron holography of a GaN/Al _x Ga _{1-x} N heterostructure—Y. C. Wang, C. Kisielowski, E. C. Nelson, M. A. O'Keefe	132
Strategies for combining elemental distribution data derived from multiple images and samples—M. E. Cantino, J. G. Eichen	134
Quantitative composition and thickness mapping with high spatial resolution by XEDS in a 300kV FEG-AEM— M. Watanabe, D. B. Williams	136

Compositional imaging at the sub-2Å level using a 200 kV Schottky field emission transmission electron microscope—E. M. James, N. D. Browning, A. W. Nicholls, M. Kawasaki, S. Stemmer, Y. Xin, G. Duscher ..	138
Quantitative compositional mapping of phase separation in thin polymer films—D. A. Winesett, H. Ade, A. P. Smith, S. Qu, S. Ge, M. Rafailovich, S. Sokolov	140
Morphological and chemical characterization of a mechanically alloyed rubber toughened PMMA with x-ray spectromicroscopy—A. P. Smith, H. Ade, R. J. Spontak, C. C. Koch	142
X-ray microscopy analysis of the morphology of poly(ethylene terephthalate)/vecetra blends produced by mechanical alloying—A. P. Smith, C. Bai, H. Ade, R. J. Spontak, C. M. Balik, C. C. Koch, C. K. Saw	144
Compositional characterization of an O-N-O layer in a dram using FE-TEM and EDS elemental mapping—M. Kawasaki, T. Oikawa, K. Ibe, K. H. Park, M. Shiojiri, M. Kersker	146
Compositional characterization of an O-N-O layer in a dram using FE-TEM and energy filtered elemental mapping—M. Kawasaki, T. Oikawa, K. Ibe, K. H. Park, M. Shiojiri, M. Kersker	148
Compositional characterization of an O-N-O layer in a dram using FE-(S)TEM and EELS—M. Kawasaki, T. Oikawa, K. Ibe, K. H. Park, M. Shiojiri, M. Kersker	150
EFTEM and STEM EELS spectrum imaging—J. A. Hunt, R. H. Harmon	152
History and cross-disciplinary perspective of compositional imaging and mapping with NEXAFS microscopy—H. Ade	154
Industrial and clinical applications of infrared spectroscopic imaging using focal-plane arrays—L. H. Kidder, I. W. Levin, E. N. Lewis	156
Interfacial segregation and concentration profiles by energy-filtered transmission electron microscopy: Issues and guidelines—J. Bentley	158
Compositional mapping by scanning electron microscopy with energy dispersive X-ray spectrometry: Recognizing facts and artifacts—D. E. Newbury, D. S. Bright	160

30 YEARS OF ENERGY DISPERSIVE SPECTROMETRY IN MICROANALYSIS

Going nondispersive—K. F. J. Heinrich	162
EDS from then till now—A chronology of innovation—J. J. Friel	164
Si(Li) and HPG detectors: Recent measurements—R. A. Sareen, T. Nashashibi	166
The impact of EDS in materials science microanalysis—D. B. Williams	168
The impact of biological microanalysis on analytical electron microscopy—A. P. Somlyo	170
The next generation of EDS: Microcalorimeter EDS with 3 eV energy resolution—J. M. Martinis, K. D. Irwin, D. A. Wollman, G. C. Hilton, L. L. Dulcie, N. F. Bergren	172
Superconducting tunnel junction spectrometers for high resolution energy dispersive spectroscopy—C. A. Mears	174
High resolution X-ray spectroscopy at room temperature—L. Strüder, P. Lechner, P. Leutenegger, T. Schülein ..	176
Application of x-ray optics to energy dispersive spectroscopy—J. J. McCarthy, D. J. McMillan	178
The use of energy dispersive x-ray microanalysis in the geological sciences: 30 years of heavy and creative application—J. T. Armstrong	180
X-ray energy dispersive spectroscopy in the environmental scanning electron microscope—J. F. Mansfield, B. L. Pennington	182

The analysis of particles with energy dispersive x-ray spectroscopy (EDS)—J. A. Small, J. A. Armstrong, D. S. Bright, B. B. Thorne	184
Energy dispersive spectrometry in the AEM—J. R. Michael	186
Low beam energies for EDS chemical microanalysis in the SEM (LVEDS)—E. D. Boyes	188
Low voltage x-ray microanalysis of bulk bio-organic samples—P. Echlin	190
EDS of thin biological specimen in the study of time-dependent physiological processes—M. F. Wendt-Gallitelli, T. Voigt, M. Schultz, F. Rudolf, G. Isenberg	192
“Standardless” quantitative analysis by electron-excited energy dispersive x-ray spectrometry: What is its proper role?—D. E. Newbury	194
Microcalorimeter EDS measurements of chemical shifts in Fe compounds—D. A. Wollman, D. E. Newbury, G. C. Hilton, K. D. Irwin, L. L. Dulcie, N. F. Bergren, J. M. Martinis	196
Unprecedented performance improvement for thermoelectrically cooled Si(Li) detector for EDS—S. Barkan, K. F. Ihrig, M. B. Abott	198
A new EDS equipment (GEM detector with SuperATW window) and a correction for Si-contamination improve the quantitative electron probe microanalysis of biological cryosections—M. Schultz, F. Rudolf, M. F. Wendt-Gallitelli	200
Multivariate statistical analysis of particle x-ray spectra—I. M. Anderson, J. A. Small	202
Extracting chemical information from energy-dispersive x-ray spectra by multivariate statistical analysis (MSA)—M. Saunders, E. S. K. Menon, D. J. Chisholm, A. G. Fox	204
X-ray emission from porous materials: New results—R. Gauvin	206
Statistical consideration in EDS microanalysis—E. Lifshin	208
Measuring performance of EDX systems—P. Statham	210
Trace element quantitation in biological x-ray microanalysis—R. D. Leapman, C. R. Swyt-Thomas, D. v. Agoston, N. Pivovarova, S. B. Andrews	212
Quality assurance of energy dispersive spectrometry systems—E. B. Steel, R. B. Marinenko	214

PROBLEM ELEMENTS AND SPECTROMETRY PROBLEMS IN X-RAY MICROANALYSIS

Problem elements and spectrometry problems in x-ray microanalysis: The black holes of the periodic table— J. T. Armstrong	216
Extracting low energy x-ray peaks from EDS and WDS spectra—R. L. Myklebust, D. E. Newbury	218
Analyzing the light elements in an electron probe microanalyzer—G. F. Baston, H. J. M. Heijligers	220
Using quantitative iteration to correct for pathological spectral interferences—J. J. Donovan	222
Analyzing Mg and Fe in olivines, pyroxenes, and garnets: Systematic discrepancies—P. Carpenter, J. Armstrong	224
Limits of analytical accuracy for two critical semiconductor systems: (Al,Ga)(As,P) and (In,Ga)(As,P)— J. T. Armstrong	226
Beam induced composition modifications during electron beam microanalysis—D. G. Howitt, D. L. Medlin	228
k-factor standards for low-z quantification—R. Egerton, M. Malac	230
The role of Monte Carlo calculations in quantitative analysis—E. Lifshin, L. A. Peluso, R. Gauvin	232

Fluorescent spectroscopy of mineral and material samples—C. M. MacRae, I. R. Harrowfield, N. Wilson, M. Yoshiya, P. Fazey, S. Peacock, L. de Yong, H. Adachi	234
Computer simulation applied to WD analysis—S. J. B. Reed, A. Buckley	236

QUANTITATIVE MICROANALYSIS

Electron microprobe reference materials for geologic analysis—A need for developing strategy—E. Jarosewich ...	238
A Basalt glass standard for multiple microanalytical techniques—G. P. Meeker, J. E. Taggart, Jr., S. A. Wilson ...	240
Electron probe evaluation of heterogeneity in the certification of NIST standard reference materials for microanalysis—R. B. Marinenko, S. Leigh	242
Characterization of archaeological ceramics using scanning electron microscopy and electron microprobe analysis—M. N. Spilde, N. H. Olsen, N. Creager	244
A microprobe study to differentiate bulk chemical data by neutron activation analysis on Guatemalan pottery— L. Ross, J. Cogswell, H. Neff	246
Critical role of EMPA in discovery of a new lunar mineral—M. G. Snow, D. T. Vaniman	248

NEW TRENDS IN SCANNING ELECTRON MICROSCOPY AND MICROANALYSIS

The effect of mass in electron-solid interactions and the mystery of the “Heinrich kink”—J. J. Donovan, N. E. Pingitore, Jr.	250
Factors affecting the performance of backscattered electron detectors at low beam accelerating voltages in SEM—V. N. E. Robinson	252
Chemical quantitative analysis of small precipitates in the FE-SEM using the energy distribution of backscattered electrons—R. Gauvin	254
Secondary electron detectors, image quality & contrast—D. Scharf	256
Refining equipment for high resolution in-lens cryo-SEM—R. P. Apkarian, S. Lee, J. Keiper	258
Image formation with upper and lower secondary electron detectors in the low voltage field-emission SEM— J. Liu	260
Quantitative elemental analysis of the components of Pb exposed cells of <i>Plectonema boryanum</i> using regular and overplus cells: An energy dispersive x-ray spectroscopy study—J. J. Goldberg, T. E. Jensen	262
Wool and cashmere fiber identification study using scanning electron microscopy—J. D. Baker, H. P. Lentz, D. G. Kritikos, F. H. Schamber, R. J. Lee	264
Montages link microscopic to macroscopic information in concrete analysis—A. Doerr, S. Badger, P. Brown, S. Sahu	266
Design and construction of a quantitative uniaxial straining stage for the environmental SEM—J. F. Mansfield, M. D. Thouless, J. A. Stefano, J. Holbrook	268
<i>In situ</i> mechanical testing of dry and hydrated cellular materials in the environmental scanning electron microscope (ESEM)—D. J. Stokes, A. M. Donald	270
Multivariate statistical analysis of low-voltage EDS spectrum images—I. M. Anderson	272

Use of the disk-of-least-confusion in x-ray microanalysis—E. A. Kenik, S. X. Ren	274
Quantifying SEM resolution and performance—D. C. Joy, E. Völkl	276
Microstructure and microtexture in Nb-silicide based composites—B. P. Bewlay, J. A. Sutliff	278
Investigation of medium to high strain deformation micro-structures using an automated electron backscattering pattern (EBSP) system—A. Godfrey, N. C. Krieger Lassen, D. A. Hughes, D. J. Jensen	280
Evaluation of boron nitride coated Nextel 312™ Fiber/Blackglas™ composites using an environmental SEM— R. L. Schalek, J. Helmuth, L. T. Drzal	282
'Cool ESEM'—Imaging ice-containing systems at freezer temperatures—A. L. Fletcher, T. H. Keller, B. L. Thiel, A. E. Eddy, A. M. Donald	284
ESEM study of film formation in latices polymerised in presence of starch—N. Stelmashenko, A. M. Donald	286
Secondary electron contrast in molecular liquids—B. L. Thiel, D. J. Stokes, A. M. Donald	288
Electrons, ions and cathodoluminescence in the environmental SEM—B. J. Griffin	290
Charge contrast: Some ESEM observations of a new/old phenomenon—E. Doehne	292
Operating conditions for quantitative x-ray analysis in the environmental SEM—R. A. Carlton, C. E. Lyman, J. E. Roberts	294
Optimisation of the S.E. signal to background ratio in ESEM—T. H. Keller, B. L. Thiel, A. M. Donald	296
Beam size in the environmental SEM: A comparison of model and experimental data—S. A. Wight	298
Using secondary electron contrast for imaging water-oil emulsions in the environmental SEM (ESEM)— D. J. Stokes, B. L. Thiel, A. M. Donald	300

SCANNED PROBE MICROSCOPY: MUCH MORE THAN JUST BEAUTIFUL IMAGES

Topographic comparison of G-wire DNA imaged by hydration scanning tunneling and atomic force microscopy as a function of humidity—D. Janigian, E. Morales, T. Muir, B. Garcia, J. Vesenka	302
Ordering of a functional molecules on a flat surface as evidenced by scanning probe microscopies: The case of a di-alkyl amino group—C. Gorman, I. Touzov, R. Miller	304
Langmuir-Blodgett film stability via atomic force microscopy—D. Y. Takamoto	306
Atomic force microscopy studies of microstructure and properties of self assembled monolayers—J. R. Santiago, E. B. Troughton, R. A. Dennis, P. E. Russell	308
Biometrology? Finding biological, pathological, diagnostic meaning from critical length-scale measurements— M. J. Allen, V. B. Elings	310
A novel preparation method for high resolution AFM introduced with 2D-streptavidin crystals grown on a biotin-lipid monolayer—S. Scheuring, D. J. Müller, P. Ringler, J. B. Heymann, A. Engel	312
Development of polarization modulation near-field scanning optical microscope and its application to mapping defect-induced birefringence in SrTiO ₃ bicrystals—J. W. P. Hsu, E. B. McDaniel, S. C. McClain	314
Using a moderate vacuum, hot/cryo-stage equipped AFM for <i>in-situ</i> observation of α -phase growth in 60Sn40Pb hypoeutectic solder—D. N. Leonard, P. E. Russell	316
An <i>in situ</i> scanning tunnelling microscopy study of the adsorption of the aurocyanide ion onto highly orientated pyrolytic graphite—G. E. Poinen, S. M. Thurgate	318
Diamond indenter shaping using focused ion beam—J. R. Phillips, K. F. Jarausch, T. J. Stark, J. E. Houston, D. P. Griffis, P. E. Russell	320

The SPM study of surface healing due to mass transport in the liquid-like layer of ice—D. M. Trickett, V. F. Petrenko	322
Magnetically-oscillated probe AFM for imaging and stiffness measurements at the liquid-solid interface—S. M. Lindsay, W. Han, N. Tao	324
TEM analysis of deformation zones in FIB-prepared samples of microploughed gold (100) and (111) surfaces—R. D. Day, R. M. Dickerson, C. J. Maggiore, P. M. Brooks, P. E. Russell, T. Woodward, C. B. Carter	326
Comparative surface study of atomic images with variable temperature UHV-AFM and STM—M. Iwatsuki, K. Suzuki, S. Kitamura, M. Kersker	328
Scanning Kelvin force and capacitance microscopy applications—R. J. Kline, J. F. Richards, P. E. Russell	330
The surface morphology and characterisation of electronic properties of boron implanted microwave plasma CVD diamond films by atomic force and scanning tunneling microscopies—A. G. Fitzgerald, Y. Fan, P. John, C. E. Troupe, J. I. B. Wilson	332
Using AFM phase lag data to identify microconstituents with varying values of elastic modulus—D. N. Leonard, A. D. Batchelor, P. E. Russell	334
Nanomanipulation for material properties, substrate interactions and devices—R. Superfine, M. R. Falvo, G. J. Clary, S. Paulson, R. M. Taylor II, V. Chi, F. P. Brooks Jr., S. Washburn	336

ELECTRON DIFFRACTION AND SCATTERING

Electron scattering in diamond as a function of thickness—D. C. Bell	338
Absorption potential for dynamic electron diffraction: A revisit—Z. L. Wang, C. Zhang	340
Analysis of selected area diffraction patterns with WinJade—S. D. Walck, P. Ruzakowski-Athey	342
Computer analysis of electron diffraction from thin films—W. MoberlyChan, R. Kilaas, L.-H. Chan, T. Nolan, P. Dorsey, W. Cao, M. Lu, M. Gopal, T. Yamashita	344

NOVEL X-RAY METHODS: FROM MICROSCOPY TO ULTIMATE DETECTABILITY

Application of synchrotron radiation to analysis of both contamination and structure of silicon surfaces and interfaces—P. Pianetta, S. Brennan	346
Trace element detection by x-ray fluorescence—M. C. Madden, R. Wong, D. C. Wherry	348
High resolution x-ray microscopy of frozen hydrated samples—G. Schneider	350
High spatial resolution soft x-ray microscopy and microanalysis of thick and hydrated materials—W. Meyer-Ilse, J. T. Brown, C. Magowan, J. Yeung, K. E. Kurtis, P. Monteiro, B. P. Tonner, K. Nealson, S. Lelièvre, C. Larabell	352
Imaging, spectroscopy and tomography of frozen hydrated specimens with the cryo scanning transmission x-ray microscope at the NSLS—J. Maser, C. Jacobsen, Y. Wang, A. Osanna, B. Winn, J. Kirz	354
Mapping the organic and inorganic components of normal and osteoporotic bone using NEXAFS—C. J. Buckley, N. Khaleque, S. J. Bellamy, G. Dermody, M. Robins, X. Zhang	356
Mephisto: A novel synchrotron imaging photoelectron spectromicroscope—G. De Stasio	358

Quantitative non-interferometric x-ray phase imaging—K. A. Nugent, D. Paganin, J. Tiller, B. Allman	360
A state-of-the-art x-ray microprobe and its applications at the advanced photon source—W. Yun, Z. Cai, B. Lai, J. Maser, D. Legnini	362
Spatially-resolved x-ray absorption fine structure (XAFS) spectroscopy using undulator radiation focused by dynamically-bent elliptical mirrors—S. R. Sutton, P. E. Eng, M. L. Rivers, M. Newville	364
Precise x-ray microfluorescence measurements of Sr/Ca ratios in corals for paleotemperature analysis— N. E. Pingitore Jr., T. Pogue	366
Applications of laboratory-based x-ray microfluorescence analysis in archaeometry—N. E. Pingitore Jr., J. D. Leach, A. Iglesias, C. G. Sampson, D. L. Carmichael, J. A. Peterson	368
X-ray radiation damage of polymers in a scanning transmission x-ray microscope—T. Coffey, H. Ade, S. Urquhart, A. P. Smith	370
Characterizing inhomogeneous deformation substructure in large single crystals by microscopy and XRD—A synergistic analysis—P. W. Kingman	372
X-ray microscopy developments at the ESRF—B. Kaulich, S. Oestreich, R. Barrett, J. Susini	374
Bragg and Fresnel diffraction imaging using highly coherent x-rays—P. Cloetens, J. Baruchel, J. P. Guigay, W. Ludwig, L. Mancini, P. Pernot, M. Schlenker	376
Recent developments in monochromatic microprobe x-ray fluorescence (MMXRF)—Z. W. Chen, D. B. Wittry	378
Comparing elemental sensitivities obtained with an aperture and a monolithic polycapillary optic using a commercial micro-x-ray fluorescence (MXRF) instrument—C. G. Worley, L. P. Colletti, G. J. Havrilla	380

ADVANCES IN INSTRUMENTATION AND PERFORMANCE

High resolution transmission electron microscopy at zero C_s —M. A. O’Keefe	382
First application of a spherical-aberration corrected microscope material science—B. Kabius, K. Urban, M. Haider, S. Uhlemann, E. Schwan, H. Rose	384
Experimental gun brightness measurements on a 300 kV CFEG—N. J. Zaluzec, A. Nicholls	386
Measuring and tuning TEM energy filter performance—H. Brink, G. Kothleitner, M. K. Kundmann	388
Modification of a conventional TEM (CTEM) for Lorentz microscopy—M. Wall, S. Bajt, C. Cerjan	390
On the effects of spherical aberration and aperture misalignment on the formation of small electron probes— A. J. Garratt-Reed, G. Cliff, P. B. Kenway	392
Energy filtering imaging of thick biological specimens with in-column “Omega”-filter microscopes— M. H. Ellisman, G. Y. Fan, T. Honda, T. Kanayama, M. Kersker	394
A new 200kV energy filter field emission transmission electron microscope—T. Kaneyama, K. Tsuno, T. Honda, M. Kersker, K. Tsuda, M. Terauchi, M. Tanaka	396
The CM120-BioFilter: Digital imaging of frozen hydrated specimens and elemental mapping—U. Lücken, A. F. de Jong, M. Kundmann, D. Cherny, R. Leapman	398
Development of a Philips cryo-TEM provided with a liquid helium cooled tilt stage and a vacuum transfer system—R. Wagner, A. F. de Jong, A. G. Koster, R. Morrison, F. Tothill, U. Lücken	400
Development of a side entry high tilt cryotransfer stage for tomographic applications—B. L. Armbruster, R. Zolkowski, P. R. Swann	402

Magnetic deflecting microscopy: A novel visualizing method of magnetic stray fields for thick or non-transparent magnetic TEM samples—V. V. Volkov, Y. Zhu	404
Development of high resolution FE-SEM (8"FE-SEM) for 8-inches wafer inspection—K. Ohara, C. Nielsen, M. Saito	406
Quantitative visible-light and electron phase microscopy—A. Barty, K. A. Nugent, D. Paganin, A. Roberts	408
An infinity corrected all-reflecting microscope for infrared microspectrometry—J. A. Reffner, S. H. Vogel	410
Isotopic measurements of inorganic material by time-of-flight SIMS—A. J. Fahey	412

NEW DEVELOPMENTS IN MULTI-PHOTON EXCITATION MICROSCOPY

Second harmonic generation imaging (SHG) in the non-linear optical microscopy of living cells— P. J. Campagnola, L. M. Loew	414
Quantitative immunocytochemistry of proteins using 2-photon microscopy and digital image analysis—H. Wan, C. Soeller, D. R. Garrod, C. Robinson, M. B. Cannell	416
High-QE photodetector for laser confocal—J. Pawley, M. Blouke, J. Janesick	418
In-depth imaging using two-photon excitation microscopy—H. C. Gerritsen, J. M. Vroom, C. J. de Grauw	420
Visualizing neuronal structure by combining GFP-transfection with 2-photon microscopy in living brain slices— H. L. W. Horch, L. C. Katz	422
Video-rate scanning two-photon excitation fluorescence microscopy—G. Y. Fan, H. Fujisaki, R.-K. Tsay, R. Y. Tsien, M. H. Ellisman	424

UNIQUE APPROACHES IN IMAGING, COMPUTATION AND COMMUNICATION FOR CHARACTERIZATION OF THE 3D CELL & ORGANELLES I

Tomographic reconstruction of the hair cell ribbon synapse—D. Lenzi, J. W. Runyeon, J. Crum, M. H. Ellisman, W. M. Roberts	426
Crista junctions of mitochondria visualized by electron tomography—G. A. Perkins, J. Y. Song, L. Tarsa, C. McCarty, T. J. Deerinck, M. H. Ellisman, T. G. Frey	428
Electron microscopic tomography of cellular organelles: Chemical fixation vs. cryo-substitution of rat-liver mitochondria—C. A. Mannella, K. Buttle, K. Tessitore, B. K. Rath, C. Hsieh, D. D'Arcangelis, M. Marko	430
3D structure of periodic cubic-phase inner membranes in mitochondria of the amoeba <i>Chaos carolinensis</i> — Y. Deng, M. Mieczkowski, M. Marko, K. Buttle, B. K. Rath, C. A. Mannella	432
Electron tomographic studies of a large macromolecular assembly preserved in vitreous ice: The yeast spindle pole body core—E. Bullitt	434
The centrosome: Three-dimensional structure of a cell organelle at 40A resolution obtained by electron-tomography—T. Ruiz, M. Radermacher, B. Rath, C. Rieder, M. Bornens	436
The three dimensional organization of smooth muscle: Information from serial section reconstructions— R. A. Horowitz, C. M. Powers, P. Valero, R. Craig	438

Correlated 3D light and electron microscopy of large, complex structures: Analysis of transverse tubules in heart failure—M. E. Martone, A. Thor, S. J. Young, M. H. Ellisman	440
Quantitative image processing in 3D—U. Skoglund	442
A transportable multiple oblique illumination system which retrofits to conventional optical microscopes to provide high-definition real time 3-dimensional imaging—G. L. Greenberg, A. Boyde	444
Fluorescent indicators for calcium based on green fluorescent proteins (GFPs) and calmodulin—A. Miyawaki, J. Llopis, R. Heim, J. M. McCaffery, J. A. Adams, M. Ikura, H. Fujisaki, G. Y. Fan, M. H. Ellisman, R. Y. Tsien	446
Confocal imaging of both mitochondrial and cytosolic free Ca ²⁺ in cardiac myocytes co-loaded with Rhod 2 and Fluo 3: Inhibition by ruthenium red of mitochondrial but not cytosolic Ca ²⁺ transients—D. R. Trollinger, W. E. Cascio, J. J. Lemasters	448
Correlative confocal and electron microscopy of the Connexin43 gap junction protein in NRK cells: Balancing fixation conditions, cell permeabilization, antigen-antibody interaction and cell ultrastructure—G. Sosinsky, M. Martone, G. Hand, L. Musil, M. Ellisman	450
Using animation to enhance 3D visualization: A strategy for a production environment—M. T. Dougherty, W. Chiu	452

HIGH RESOLUTION PROTEIN STRUCTURES FROM ELECTRON CRYSTALLOGRAPHY

Atomic model of tubulin by electron crystallography—E. Nogales, K. H. Downing	454
Structure and action of molecular tracks and motors—R. A. Milligan	456
Actin filaments decorated with cytoskeletal proteins—D. Hanein, S. Goldsmith, W. Lehman, R. Craig, I. Correia, P. Matsudaira, D. J. DeRosier, S. C. Almo	458
Crystallographic reconstruction of the acrosomal process from <i>Limulus polyphemus</i> sperm—M. B. Sherman, J. Jakana, S. Sun, P. Matsudaira, W. Chiu, M. F. Schmid	460
Structure of the calcium pump from sarcoplasmic reticulum at 8Å resolution: Architecture of the transmembrane helices and localization of the binding site for thapsigargin—P. Zhang, C. Toyoshima, K. Yonekura, G. Inesi, M. Green, D. L. Stokes	462
Structure of a recombinant gap junction channel at 7Å resolution—V. M. Unger, D. W. Entrikin, X. Guan, N. M. Kumar, N. B. Gilula, M. Yeager	464
Electron crystallography of a prokaryotic potassium channel—H. X. Sui, H. L. Li, S. Ghanshani, S. Lee, P. J. Walian, C. L. Wu, K. G. Chandry, B. K. Jap	466

SHARED RESOURCES AND USER FACILITIES: ACCESS TO INSTRUMENTATION

The UCF/Cirent materials characterization facility—L. A. Giannuzzi, J. B. Bindell	468
Shared research equipment at Oak Ridge National Laboratory—N. D. Evans, E. A. Kenik, M. K. Miller	470
User access to Lorentz microscopy at the NCEM, LBNL, Berkeley—K. Verbist, C. Nelson, K. Krishnan	472

MICROSCOPY AND MICROANALYSIS IN THE “REAL WORLD”

Analytical light microscopy: Examples of practical problem-solving and efficiency in pharmaceutical quality control and formulation—D. A. Stoney, W. C. McCrone	474
Microscopical examination of indoor dusts—J. R. Millette, P. Few, T. J. Hopen	476
Microscopy in pharmaceutical development—R. A. Carlton	478
Analysis of in-situ converted chrysotile asbestos fibers in sprayed on fireproofing—R. L. Sabatini, T. Sugama, L. Petrakis	480
Production microscopy: A new paradigm—R. J. Lee	482
Population studies of titanium-bearing inclusions in AISI 316L using automated image analysis with scanning electron microscopy/electron dispersion spectroscopy (SEM/EDS)—S. R. Collins, M. Plishka	484
Microanalysis of thermal-sprayed titanium anodes for cathodic protection of reinforced concrete bridges—W. K. Collins, S. D. Cramer, B. S. Covino, Jr., G. R. Holcomb, S. J. Bullard, R. D. Govier, R. D. Wilson, G. E. McGill	486
Cathodoluminescence microscopy of architectural paint samples—T. J. Hopen, R. S. Brown, R. K. Wheelles, W. Stocklein	488
Applying microscopy in forensic science—H. C. Lee	490
High resolution FIB as a general materials science tool—M. W. Phaneuf, J. Li, T. Malis	492
Low energy x-ray transmission images by using a microfocuss x-ray tube and a Be-window x-ray image intensifier (XRII)—H. Konuma, K. Kuroki, K. Kurosawa, N. Saitoh	494
Examination of the surface of a MALDI-FTMS probe tip using SEM and determination of detection limits for poly(ethylene glycol)—S. H. Wood, S. J. Pastor, C. L. Wilkins	496
Binding of polychlorinated biphenyls to sediment—W. F. Tivol, A. C. Casey, X. Liu, B. Bush	498
Morphological identification of indicator viruses from a ground water aquifer recharged with reclaimed wastewater—J. R. Stewart, M. D. Sobsey, T. M. Gambling, J. L. Carson	500
Measurements of fine volcanic ash via stereoscopy in the scanning electron microscope—O. P. Mills, W. I. Rose, C. M. Riley	502
Structural changes of soot particulates as shown by HRTEM and image analysis—Á. B. Palotás, D. C. Bell, L. C. Rainey, J. B. Vander Sande	504
Corrosion product identification by micro-Raman and Mössbauer spectroscopy—F. Adar, B. Lenain, D. C. Cook, S. J. Oh	506
Raman microprobe study of the visible and near-infrared excited fluorescence spectra of glasses examined as potential Raman intensity calibration standards—E. S. Etz, S. J. Choquette, W. S. Hurst, D. H. Blackburn ...	508
Relationship between TEM microstructures of Al films and reflectance in color display tubes—S. J. Lee, E. S. Hwang, T. Dolukhanyan, C. M. Sung	510
Solidification behavior of a 319 aluminum alloy—W. T. Donlon, L. A. Godlewski, J. W. Zindel	512
Characterization of age hardening in a 319 Al alloy—R. Jahn, W. T. Donlon, J. E. Allison	514
Fractographic evaluation of thermally stressed single crystal sapphire—S. D. Wajer, P. H. Cohen	516
Application of SEM, TEM and CBED techniques for compound identification in stress corrosion cracking failure—R. Caballero, A. Quintero	518

Scanning electron microscopy/energy dispersive x-ray spectrometry (SEM/EDS): The last step in the microanalysis of particulate matter isolates—R. J. Maxwell, M. A. Smith, D. S. Aldrich	520
Industrial applications of scanning probe microscopy—S. Magonov	522
New microscopy techniques for IC defect localization—E. Cole Jr.	524
Relocating features across microanalytical instrumentation—W. H. Powers, Jr., F. H. Schamber	526
“Real-world” microscopy: Understanding environment-sensitive behavior of Ni-base welds—M. G. Burke, R. J. Wehrer, C. M. Brown	528
Characterization of solid-state vortices associated with the friction-stir welding of copper to aluminum—R. D. Flores, L. E. Murr, E. A. Trillo	530
<i>Terra Incognita</i> : Spectra from edges and elements not in the <i>EELS Atlas</i> —J. A. Fortner, E. C. Buck	532

METALS AND ALLOYS

Incommensurate structures in rhenium disilicide—A. Misra, F. Chu, T. E. Mitchell	534
Defects in Nb-Cr-Ti C15 Laves phase alloys—P. G. Kotula, C. B. Carter, K. C. Chen, D. J. Thoma, F. Chu, T. E. Mitchell	536
Nucleation of the α/γ massive phase transformation in titanium-48at% aluminum—J. E. Wittig, W. H. Hofmeister	538
Microstructure of the die-upset Nd (Pr)-Fe-B hard magnets studied by magnetic and high resolution transmission microscopy—V. V. Volkov, Y. Zhu, L. H. Lewis, D. O. Welch	540
Characterization of corrosion scales on Fe-13Cr stainless steel—S. Subramanian, S. Ling, T. A. Ramanarayanan	542
The Microstructure of oxidized consolidated nanocrystalline NiAl—T. Chen, J. M. Hampikian	544

MICROSCOPY OF CERAMICS AND MINERALS

Microstructure and microchemistry of Y-doped α -Al ₂ O ₃ —M. A. Gülgün, M. L. Mulvihill, V. Putlayev, M. Rühle	546
Stress-induced phase transformations in SiC—P. Pirouz	548
Dislocations in ceramics—C. B. Carter	550
Statics and dynamics of “charged” interfaces in electroceramics—X. Lin, C. Murray, V. P. Dravid	552
Z-contrast imaging of ordered structures in Pb(Mg _{1/3} Nb _{2/3})O ₃ and Ba(Mg _{1/3} Nb _{2/3})O ₃ —Y. Yan, Z. Xu, D. Viehland, S. J. Pennycook	554
Atomic scale structure-property relationships of defects and interfaces in ceramics—S. Stemmer, G. Duscher, E. M. James, M. Ceh, N. D. Browning	556
The complementary nature of electron microscopy and ion channeling for the assessment of radiation damage evolution in ceramics—K. E. Sickafus	558
Interpreting uranyl mineral diffraction patterns—E. C. Buck	560
White lines in the iron L _{2,3} electron-energy-loss spectra of pyrite and greigite—S. C. Cheng, R. T. Wilkin	562

TEM analysis of diamond films formed on SiO ₂ substrate by bias-enhanced nucleation—S. C. Cheng, M. D. Irwin, C. Onneby, C. G. Pantano	564
Improved adhesion of the c-BN film by the post ion implantation: TEM and FTIR—C. Sung, S. Gunasekara, E. S. Byon, S. W. Lee, S. R. Lee	566
Microstructural characterization of carbon fiber-reinforced laminated matrix composites of silicon carbide and carbon—K. A. Appiah, Z. L. Wang, W. J. Lackey	568
Carbon-induced UV sensitivity in aluminum nitride—Y. Berta, R. A. Gerhardt	570
Structure characterization of colossal magnetoresistive oxides—Y. Berta, D. B. Studebaker, M. Todd, T. H. Baum, Z. L. Wang	572
Observations of superlattice reflections associated with charge ordering in Bi _{0.2} Ca _{0.8} MnO ₃ with an energy-filter— Y. Murakami, D. Shindo, K. Hiraga, T. Oikawa, M. Kersker	574
Microstructure of PbTiO ₃ /SrTiO ₃ superlattice grown by MBE—W. Tian, J. C. Jiang, X. Q. Pan, C. D. Theis, D. G. Schlom	576
Domain structure of epitaxial SrRuO ₃ thin films on (001) LaAlO ₃ —J. C. Jiang, X. Q. Pan, Q. Gan, C. B. Eom ...	578
Microstructure and strain relaxation of epitaxial SrRuO ₃ films—J. C. Jiang, X. Q. Pan, Q. Gan, C. B. Eom	580
Determination of the site occupancy of holmium in SrTiO ₃ by alchemi—S. C. Cheng, A. Hitomi, C. A. Randall	582
Characterization of intergranular phases in tetragonal and cubic yttria-stabilized zirconia—N. D. Evans, P. H. Imamura, J. Bentley, M. L. Mecartney	584
Electron energy-loss spectroscopy (EELS) of cerium and uranium oxidation states—L. P. Keller, J. P. Bradley	586
Microstructure of Nb based Al ₂ O ₃ composites—C. Scheu, G. Dehm, W. D. Kaplan, D. E. Garcia, N. Claussen ...	588
On devitrification of monticellite (CaMgSiO ₄) films grown on (001)-oriented single-crystal MgO.—S. V. Yanina, M. T. Johnson, Z. Mao, C. B. Carter	590
Defects in pseudo-orthorhombic anorthite on basal sapphire—Z. Mao, M. T. Johnson, C. B. Carter	592
The effect of an electric field on the reaction between oxides—M. T. Johnson, C. B. Carter	594
Image periodicities introduced by three-fold astigmatism in HRTEM images of α -Al ₂ O ₃ and related materials— D. L. Medlin, J. E. Smugeresky, D. Cohen	596
Polytypic constraints for solid-state layer silicate transformation mechanisms via atomic-resolution transmission electron microscopy—J. F. Banfield, T. Kogure	598
Heterogeneous oxidation and precipitation of aqueous Mn(II) at the Goethite surface: A SPM study— J. Rakovan, M. F. Hochella, Jr.	600
Electron microscopy and microanalysis of metal phases in meteorites—D. B. Williams, J. I. Goldstein	602
Microstructures and microanalysis in ALH84001: Minerals or martians?—R. P. Harvey, J. Bradley, H. Y. McSween, Jr.	604

MICROSCOPY OF SEMICONDUCTING AND SUPERCONDUCTING MATERIALS

Photo-electron emission microscopy of semiconductor surfaces—R. J. Nemanich, S. L. English, J. D. Hartman, W. Yang, H. Ade, R. F. Davis	606
<i>In situ</i> electron microscopy studies of surface dynamical processes—R. M. Tromp	608

Near-field scanning optical microscopy studies of individual dislocations in relaxed GeSi films—J. W. P. Hsu, M. H. Gray, Q. Xu	610
Holography measurement of mean inner potential of germanium—J. Li, M. R. McCartney, R. E. Dunin-Borkowski, D. J. Smith	612
Local strain measurements in hexagonal systems—C. Kisielowski, O. Schmidt	614
Electron microscopy in the real semiconductor processing world—R. Anderson	616
The determination of copper composition profiles in semiconductor device aluminum interconnect electromigration test lines using electron probe microanalysis (EMPA)—J. M. Oparowski, T. S. Sriram, V. Ambrose	618
Electronic structure and conductivity mechanism in manganite thin films exhibiting colossal magnetoresistance—K. M. Krishnan, H. Ju, C. Nelson	620
Transmission electron microscopy studies of tin oxide thin films grown on the sapphire substrate—L. Fu, X. Pan	622
HRTEM study of interface structure of heteroepitaxially grown GaSe thin films on GaAs(100)—Z. R. Dai, S. R. Chegwiddden, F. S. Ohuchi	624
TEM observations of interfacial defects in MOCVD GaAs on single crystal Ge substrates—K. M. Jones, M. M. Al-Jassim, J. M. Olson	626
Microstructural characterization of GaN on (0001) sapphire—Z. Mao, M. T. Johnson, C. B. Carter	628
TEM investigation of Co-Si thin films on Si _{1-x} Ge _x /Si—A. F. Myers, P. T. Goeller, E. B. Steel, B. I. Boyanov, D. E. Sayers, R. J. Nemanich	630
Microstructure of porous silicon thin films—Y. Berta, R. A. Gerhardt	632
Solid-phase epitaxial regrowth of GaAs by in-situ controlled intermediate phase decomposition—J. K. Farrer, D. A. Caldwell, C. J. Palmstrøm, C. B. Carter	634
Inversion domain boundaries in AlN and GaN thin films—K. Dovidenko, S. Oktyabrsky, J. Narayan	636
AlN films grown by electric field induced flux of Al cations—M. T. Johnson, Z. Mao, C. B. Carter	638
Scanning capacitance microscopy of dopants in III-V semiconductors—D. V. Lang	640
Electron holography of semiconductor junctions—M. R. McCartney, J. Li	642
Scanning electron microscopy of dopants in semiconductors—D. Venables	644
Prospects for imaging of single dopant atoms in silicon by ADF stem—R. R. Vanfleet, J. Silcox	646
Direct transmission electron microscope observations of doping variations in InP-based semiconductor laser diodes—R. Hull	648
Microscale elemental imaging of semiconductor materials using focused ion beam SIMS—F. A. Stevie, S. W. Downey, S. Brown, T. Shofner, M. Decker, T. Dingle, L. Christman	650
Direct imaging of device characteristics in a focused ion beam system—A. N. Campbell, J. M. Soden	652
A new method for pin point failure analysis using FIB combined analytical TEM—T. Kamino, T. Yaguchi, H. Matsumoto, M. Tomita, H. Koike	654
Focused ion beam (FIB) milling damage formed during TEM sample preparation of silicon—D. W. Susnitzky, K. D. Johnson	656
Microstructural characterization of heteroepitaxial SiGeC alloys—D. J. Smith, D. Chandrasekhar, T. Laursen, J. W. Mayer, J. Huffman, McD. Robinson, E. T. Croke, A. T. Hunter	658
Direct observation of threading dislocations in GaN by high resolution Z-contrast imaging—Y. Xin, N. D. Browning, S. J. Pennycook, P. D. Nellist, S. Sivananthan, J.-P. Faurie, P. Gibart	660

Ge distribution in $\text{Si}_{80}\text{Ge}_{20}$ islands grown in the high mobility regime—R. D. Twisten, J. A. Floro, E. Chason	662
Atomic structure of twinned As precipitates in LT-GaAs—S. Ruvimov, Ch. Dicker, J. Washburn, Z. Liliental-Weber	664
Templating effects on C54-TiSi ₂ formation in ternary reactions—A. Quintero, M. Libera, C. Cabral Jr., C. Lavoie, J. M. Harper	666
Microstructure of Au/Ti ohmic contacts on n-GaN—R.-J. Liu, L. L. Smith, M. J. Kim, R. W. Carpenter, R. F. Davis	668
Kinetics of the C-axis aligned YBa ₂ Cu ₃ O ₇ thick film by a BaF ₂ process—L. Wu, Y. Zhu, V. F. Solovyov, H. Wiesmann, M. Suenaga	670
Microstructure of YBCO/Co-PBCO/YBCO edge Josephson junctions—Y. Huang, B. H. Moeckly, K. Char, K. L. Merkle	672
Crystallographical analysis of intermediate phases in Bi(2223)/Ag tape—L. Wu, Y. Zhu, M. Suenaga	674
Structure of low- and high-angle grain boundaries in YBCO/MgO films—S. Oktyabrsky, R. Kalyanaraman, K. Jagannadham, J. Narayan	676
Oxide structures: By hook or by crook—L. D. Marks, W. Sinkler, H. Zhang	678
Study of the hole distribution in oxide superconductors using a sensitive electron diffraction technique—J. Taftø, L. Wu, Y. Zhu	680
The electronic structure and bonding of copper oxides by CBED and EELs—M. Y. Kim, J. Alvarez, J. M. Zuo, J. C. H. Spence	682
Two-mirrors model: Some analytical solutions for generating the constrained coincident-site-lattice and its application to Bi ₂ Sr ₂ Ca ₁ Cu ₂ O _{8+δ} grain boundaries—V. V. Volkov, Y. Zhu	684
Application of field-emission TEM to investigating flux pinning mechanism in superconductors—A. Tonomura	686
The atomic-scale origins of grain boundary superconducting properties—S. J. Pennycook, J. Buban, C. Prouteau, M. F. Chisholm, P. D. Nellist, N. D. Browning	688
Investigation of the local superconducting properties at grain boundaries in high-T _c superconductors—C. Prouteau, G. Duscher, N. D. Browning, S. J. Pennycook, D. Verebelyi, D. K. Christen, M. F. Chisholm, D. P. Norton	690
Anisotropy of electronic structure and transport properties of oxide superconductors—V. P. Dravid	692

NANOPHASE AND AMORPHOUS MATERIALS

Structure in amorphous network solids and its evidence in electron diffraction—L. W. Hobbs	694
Observation and theoretical prediction of structure in amorphous carbon and related materials—D. R. McKenzie, D. G. McCulloch, C. M. Goringe, A. R. Merchant	696
Silicon carbide amorphization by electron irradiation—J. Bentley	698
RDF analysis of radiation-amorphized SiC using a field emission scanning electron microscope—D. C. Bell, A. J. Garratt-Reed, L. W. Hobbs	700
Fluctuation microscopy: A new class of microscopy techniques for probing medium range order in amorphous materials—J. M. Gibson, M. M. J. Treacy, P. M. Voyles	702

Experimental and theoretical characterisation of structure in thin disordered films—D. G. McCulloch, D. R. McKenzie, D. J. H. Cockayne, C. M. Goringe	704
Extended electron loss fine structure analysis of silicon-K edges using an imaging filter—J. A. Fortner, E. C. Buck, D. M. Strachan, N. J. Hess	706
Graphitic disks or polygons? Faceting of graphite disks—A. Krishnan, E. Dujardin, T. W. Ebbesen, M. M. J. Treacy	708
Microstructure in nanophase and amorphous boron-based thin films—D. L. Medlin, K. F. McCarty, D. A. Buchenauer, D. Dibble, D. B. Poker	710
An investigation into beam damage of mesoporous materials—C. F. Blanford, J. Bentley, A. Stein, C. B. Carter	712
A study of amorphous chalcogenides by electron microscopy and analysis—A. G. Fitzgerald, K. Mietzsch	714
A BCC superlattice of passivated gold nanocrystals—S. A. Harfenist, Z. L. Wang, T. G. Schaaff, R. L. Whetten	716
Porous spherical particles of ZnS nanocrystallites—M. Arnold, Z. L. Wang, S. M. Scholz, R. Vacassy, P. Stadelmann	718
Structural stability of nanocrystalline NiAl—T. Chen, J. M. Hampikian, N. N. Thadhani, Z. L. Wang	720
The experimental accuracy of lattice spacing determination on small metal particles in commercial catalysts— S.-C. Y. Tsen, P. A. Crozier, J. Liu	722
Transmission electron microscopy studies of Pd encapsulation by ceria-zirconia oxides—J. C. Jiang, X. Q. Pan, G. W. Graham, R. W. McCabe, J. Schwank	724
Microstructural analysis of disordered and ordered mesoporous silica films—C. A. Drewien, Y. Lu, C. J. Brinker, R. Ganguli, M. T. Anderson	726
Ordered assembling of size and shape selected nanocrystals—Z. L. Wang	728
Self-assembled and micro-patterned mesoscopic thin films—N. Yao, M. Trau, N. Nakagawa, I. A. Aksay	730
Growth mechanism of Ag nanocrystal supercrystals—S. A. Harfenist, Z. L. Wang, I. Vezmar, M. M. Alvarez, R. L. Whetten	732
Studies of hexagonal Pt and Au nanocluster superlattices—P. Newcomer Provencio, J. E. Martin, J. G. Odinek, J. P. Wilcoxon	734
Self-assembled cobalt oxide nanocrystals with tetrahedral shape—J. S. Yin, Z. L. Wang	736
Monolayer arrangement of Pt nanoparticles—T. C. Green, J. M. Petroski, Z. Wang, M. El-Sayed	738
Nano-characterization of industrial heterogeneous catalysts—J. Liu, J. R. Ebner	740
Effects of cation promoters in selective catalyzation of N-butane—P. L. Gai, K. Kourtakis	742
Energy-filtered imaging of zirconia pillars in montmorillonite—P. A. Crozier, M. Pan, C. Bateman, J. J. Alcaraz, J. S. Holmgren	744
Kinetically controlled growth and shape formation mechanism of platinum nanoparticles—J. M. Petroski, Z. L. Wang, T. C. Green, M. A. El-Sayed	746
<i>In situ</i> oxidation and reduction of small Pd particles on silica—P. A. Crozier, R. Sharma	748
Electron holography and digital imaging for analysis of nanostructured materials—L. F. Allard, E. Voelkl, A. K. Datye, A. H. Carim	750
Selected reflection imaging of nanostructured materials—Y. Liu, D. J. Sellmyer	752
Cu Nanoparticle formation: Copper redistribution during NaCl solution corrosion of Al-Cu-Mg alloys— R. G. Ford, R. W. Carpenter, K. Sieradzki	754

Z-contrast scanning transmission electron microscopy of nanometer-scale coated particulate materials— H. J. Gao, Y. Yan, J. Fitz-Gerald, D. Kumar, R. K. Singh, S. J. Pennycook	756
Microanalysis of alloy nanoparticles—J. H. J. Scott	758

SPATIALLY-RESOLVED CHARACTERIZATION OF INTERFACES IN MATERIALS

Complex atomic-scale structures in solids by a combination of theory and microscopy—S. T. Pantelides, S. J. Pennycook, M. F. Chisholm, A. Maiti, Y. Yan, F. Reboredo, M. Ferconi	760
Atomic structure of interfaces: Link of atomistic calculations with high resolution electron microscopy— V. Vitek	762
Monte Carlo simulation of solute-atom segregation at grain boundaries in single-phase binary face-centered cubic alloys—D. N. Seidman, J. D. Rittner, D. Udler	764
Core level shifts and grain boundary cohesion—D. A. Muller	766
Bonding and stability of metal/ceramic interfaces—U. Alber, R. Schweinfest, M. Rühle	768
Interfacial solute-atom segregation: An atomic-scale phenomenon with implications for the oxidation kinetics of Pt-Al alloys—E. C. Dickey, K. B. Alexander, B. A. Pint	770
The measurement of light element segregation using EDS and EELS—J. T. Busby, E. A. Kenik, G. S. Was	772
Grain boundary dislocations and stacking defects in the 9R phase at an incoherent twin boundary in copper— D. L. Medlin, G. H. Campbell, C. B. Carter	774
Investigating Ca segregated to a grain boundaries in MgO using multiple scattering analysis of electron energy loss spectra—J. P. Buban, J. Zaborac, H. Moltaji, G. Duscher, N. D. Browning	776
Interface characterization of metallized CVD diamond—E. S. K. Menon, M. Saunders, I. Dutta	778
Microanalysis of CaWO ₄ and ErTaO ₄ coatings in oxide fiber reinforced alumina matrix composites—S. T. Kim, V. P. Dravid, S. Sambasivan, R. W. Goettler	780
Local dielectric function of biogenic and geological polymorphs of CaCO ₃ via transmission EELS—K. S. Katti, D. Frech, M. Qian, M. Sarikaya	782
Quantitative HRTEM of twin boundaries in compound semiconductors and metals using non-linear least- squares methods—D. Cohen, G. H. Campbell, W. E. King, C. B. Carter	784
Determination of rigid-body lattice translations across antiphase and twin boundaries in compound semiconductors—D. Cohen, D. L. Medlin, C. B. Carter	786
Atomic structures of inversion domain boundaries and dislocations in sintered AlN—Y. Yan, M. F. Chisholm, S. J. Pennycook	788
Investigating atomic scale structure-property relationships at grain boundaries—N. D. Browning, H. O. Moltaji, E. M. James, S. Stemmer, J. P. Buban, J. Zaborac	790
Microstructure of Josephson junctions: Effect on supercurrent transport in YBCO grain boundary and barrier layer junctions—K. L. Merkle, Y. Huang	792
Bandstructure near misfit dislocations in Si quantum wells—P. E. Batson	794
<i>In situ</i> electron holography of grain boundary Schottky barrier dynamics in 0.5 wt% Nb doped SrTiO ₃ 36.8° symmetric tilt bicrystals—K. D. Johnson, V. P. Dravid	796
HREM characterization of magnetic tunnel junctions and discontinuous multilayers—D. J. Smith, F. Ge, C. L. Platt, S. Sankar, A. E. Berkowitz	798

DEVELOPMENTS IN MEASURING POLYMER MICROSTRUCTURES

Dose-rate dependence of radiation damage in polymers—R. F. Egerton, I. Rauf	800
Dose limited resolution—D. Van Dyck, A. J. den Dekker, J. Sijbers, E. Bettens	802
Effects of fast secondary electrons on spatially-resolved low-loss EELS of polystyrene—K. Siangchaew, M. Libera	804
Morphology study of polystyrene-polybutadiene-polycaprolactone (PS-b-PB-b-PCL), polybutadiene- polycaprolactone (PB-b-PCL), and polystyrene-polycaprolactone (PS-b-PCL) semicrystalline block copolymers—G. Kim, C. L. Jackson, F. V. Gyldenfeldt, V. Balsamo, M. Libera, R. Stadler, C. C. Han	806
Quantitative chemical speciation of multi-phase polymers using zone plate x-ray microscopy—A. P. Hitchcock, S. G. Urquhart, H. Ade, E. G. Rightor, W. Lidy	808
Profiling PVP/PS homopolymer interfaces using core-loss electron energy-loss spectroscopy—K. Siangchaew, P. Prayoonthong, M. Libera	810
Quantitation of the lateral orientational order in poly(p-phenylene terephthalamide) fibers with x-ray linear dichroism microscopy—A. P. Smith, A. Garcia, H. Ade	812
Field emission scanning electron microscopy studies of industrial polymers: A survey—E. F. Osten, M. S. Smith	814
Analysis of the spatial variation of crosslink density in superabsorbent polymers—S. G. Urquhart, H. W. Ade, G. E. Mitchell, L. Wilson, E. G. Rightor, M. Dineen, A. P. Hitchcock, U. Neuhaeusler	816
TEM studies of single and double microdomain layers of block copolymer—N. Yao, M. Park, C. Harrison, D. H. Adamson, P. M. Chaikin, R. A. Register	818
<i>In situ</i> TEM study of inert fillers in liquid environment—W.-A. Chiou, Y.-C. Lee, A. Ishikawa, H. Konishi, K. Fukushima, D. F. Shriver	820
Atomic force microscopy and related techniques: Introduction, instrumentation and application to polymeric materials—I. H. Musselman	822
Scanned-probe microscopy of elastomer blends: Morphology and mechanical properties—M. P. Mallamaci	824
The morphology of carboxylated composite latex and latex film—O. L. Shaffer, M. W. Sandor, M. S. El-Aasser	826
Quantitative thickness mapping of dewetting polymer bilayers—D. A. Winesett, H. Ade, A. P. Smith, M. Rafailovich, S. Sokolov, D. Slep	828
The Hayashi-Nishi method for measurement of mixing: Computer-generated morphologies and impact- modified polymers—M. R. Tant, D. B. Calvert, P. S. Wehner	830
Morphology of silicone/organic blends—H. Zhang, W. Chen	832

MICROSCOPIC ANALYSIS OF NATURAL FIBERS

Scanning electron microscopy of various natural textile fibers—G. Buschle-Diller	834
Automating analysis of fibrous materials—R. R. Bresee, Z. Yan	836
Investigation of the fracture of resinated single wood fibers in an environmental scanning electron microscope (ESEM)—A. Egan, S. Shaler	838
Microscopic examination of native and modified cotton fibers—W. R. Goynes	840

Microscopical procedures for investigating natural textile fibers—E. K. Boylston	842
Mid-infrared, Raman and NMR imaging of flax—D. S. Himmelsbach, S. Khalili, G. R. Gamble, D. E. Akin	844
UV absorption microspectrophotometry and histochemistry of flax and kenaf—D. E. Akin	846

SPECIMEN PREPARATION

A novel technique to determine platelet deposition on an experimental nylon membrane using LVSEM and TEM—M. A. Murphy, J. P. DiOrio	848
Uncoated LVSEM and imaging TOF-SIMS of unfixed, plunge frozen, freeze dried, fungal and plant materials—E. J. Basgall, N. Winograd	850
An <i>en bloc</i> staining protocol improves the preservation of lamellar bodies in alveolar type II epithelial cells for transgenic mice expressing modified pulmonary surfactant protein B—C.-L. Na, D. C. Beck, J. S. Breslin, S. E. Wert, T. E. Weaver	852
Microwave processing of cell monolayers <i>in situ</i> for post-embedding immunocytochemistry with retention of ultrastructure and antigenicity—V. J. Madden	854
The effect of focused ion beam (FIB) specimen geometry on x-ray fluorescence during energy dispersive x-ray spectroscopy (EDS) analysis in the transmission electron microscope (TEM)—D. M. Longo, J. M. Howe, W. C. Johnson	856
Material dependence of sputtering behavior during focused ion beam milling: A correlation between Monte Carlo based simulation and empirical observation—B. I. Prenitzer, L. A. Giannuzzi, S. R. Brown, R. B. Irwin, T. L. Shofner, F. A. Stevie	858
Comparison of focused ion beam and conventional techniques on TEM specimen preparation of metal-ceramic interfaces—A. Ramirez de Arellano López, W.-A. Chiou, K. T. Faber	860
Cross-section TEM sample preparation for copper/low-K composite stacks by ion milling—B. Foran, F. Shaapur, V. Blaschke	862
A new approach for cross-sectioning SEM specimens of semiconductors by broad-ion beam milling—K. Ogura, R. Alani	864
The small angle cleavage technique for XTEM sample preparation—S. D. Walck, J. P. McCaffrey	866
Preparation of thin sections of (Zn _x Cd _{1-x})S fine particles by an ultramicrotome—S. H. Ahn, G. S. Park, N. R. Ahn	868
TEM specimen preparation for display materials of vacuum fluorescent displays—T. Dolukhanyan, C. Sung, S. Ahn, J. Lee	870
Plasma cleaning for electron microscopy—T. C. Isabell, P. E. Fischione	872

TEM SPECIMEN PREPARATION IN THE PHYSICAL SCIENCES

The basics of microtomy for materials science microscopy—T. Malis	874
Tutorial: TEM specimen preparation in the physical sciences—tripod polishing and ion milling—R. Anderson	876

AFM AND OTHER SCANNED PROBE MICROSCOPIES

AFM and other scanned probe microscopies tutorial—P. E. Russell, A. D. Batchelor	878
--	-----

DECONVOLUTION OF BIOLOGICAL IMAGES FOR 3D LIGHT MICROSCOPY— CONFOCAL & WIDEFIELD

Deconvolution in 3-D microscopy: Applications and limitations—P. J. Shaw	880
Blind deconvolution of low and high signal-to-noise 3-D images of fluorescent subcellular structures—B. Rajwa, J. Czyz, J. Dobrucki	882
Wide-field deconvolution for time-lapse 3D microscopy of cell locomotion: The good, the bad and the artifactual—J. G. McNally	884
Convolution and deconvolution for 3D imaging of cell physiology—L. M. Loew, M. Sapia, J. Schaff	886

MINIATURIZED ARTIFICIAL MACHINES IN BIOLOGY

Patterning of surface chemistry and topography for biological applications—H. G. Craighead, R. C. Davis, M. Foquet, M. Isaacson, C. James, S. Turner, L. Kam, J. N. Turner, W. Shain, G. Banker	888
Nanobiotechnology: Biological applications of nanofabrication—J. N. Turner, W. Shain, D. H. Szarowski, L. Kam, H. C. Craighead, M. Isaacson, S. Turner, R. Davis, C. James, G. Banker	890
Optimization of microfluidics for genetic analysis—P. M. St. John, K. Connell, T. M. Woudenberg, M. Deshpande, J. R. Gilbert	892

INSTRUMENTATION: HOW TO CHOOSE IT AND USE IT

Scanned probe microscopy (AFM, et al.): How to choose and use—P. E. Russell, A. D. Batchelor	894
Choosing a scanning electron microscope—W. A. Lamberti, P. M. Brady	896
Choosing a suitable ultramicrotome, associated equipment and the proper laboratory environment for operation of the system—J. J. Bozzola	898
The confocal microscope: How to choose it and use it—J. A. Drazba	900
Designing an electron microscopy facility: Step by step procedure—J. A. Murphy	902

A TECHNOLOGISTS' FORUM SPECIAL TOPIC PRESENTATION

Fixing and embedding “difficult” biological material—H. H. Mollenhauer	904
The importance of optimizing operational procedures and calibrations in materials characterization using an analytical electron microscope—C. J. Echer	906

**APPLICATIONS AND METHODS OF VASCULAR CORROSION CASTING—
THE 3-DIMENSIONAL MICROVASCULATURE OF TISSUES**

Current applications and methods of microvascular corrosion casting: A review—A. Lametschwandtner, H. Aichhorn, B. Minnich	908
The pulmonary circulation in health and disease—S. Aharinejad, D. E. Schraufnagel	910
Vascular corrosion casting: Physiological considerations—K. R. Olson	912
Some simple quantitative applications of vascular corrosion casting—F. E. Hossler	914
Corrosion casting in the reproduction of the micro-surface topography of fibrillar collagen—P. A. Sims, R. M. Albrecht	916
Microvascularization of the uterine tube in the rabbit (<i>Oryctolagus cuniculus</i>)—R. P. Chopard, I. Watanabe, C. I. Conegero	918
Corrosion cast demonstration of tongue vasculature of normal Wistar rats—M. C. K. Makiyama, I. Watanabe, R. P. Chopard, M. M. Iyomasa, C. I. Mizusaki, R. A. Lopes	920

BIOMATERIALS

Using correlative microscopy in the study of biological-biomaterial interactions—R. M. Albrecht	922
Shear and substrate dependent changes in fibrinogen and von Willebrand factor studied by atomic force microscopy—R. E. Marchant, P. S. Sit, M. Raghavachari, C. A. Siedledcki	924
AFM and fractal analysis of biomaterial microtopography—S. Jo. T. Li, K. Park	926
A novel approach for characterisation of adhesive tooth-biomaterial interfaces by AFM—B. Van Meerbeek, Y. Yoshida, J. Snauwaert, L. Hellemans, P. Lambrechts, G. Vanherle, K. Wakasa, D. H. Pashley	928
Use of polarized light microscopy to measure internal strains of collagenous tissues—I. Vesely	930
Morphological characterization of a sustained-release drug implant by scanning electron microscopy, polarized light microscopy and image analysis—J. P. Neilly, J. S. Deng, J. L. House, J. A. Fagerland	932
Imaging of explanted mechanical heart valves—S. L. Goodman, H. Harasaki, K. E. Wika, A. M. Brendzel	934
Quantification of bone formation on calcium phosphate ceramic thin film, in vitro by tetracycline labelling— J. E. Davies, F. Krasnoshtein, L. Hryhorenko, D. Sindrey	936
Bone formation by human osteoblasts on implant materials—G. Gronowicz, M. Ahmad	938
Characterization of titanium alloy particulates to study the <i>in vitro</i> release of inflammatory mediators by human peripheral blood monocytes—B. J. Darien, P. Sims, T. Robinson, P. Manley, R. Albrecht	940
Nanoscale correlation of structure and mechanical properties of a human tooth—H. Fong, M. Sarikaya	942
Effect of “stress-absorbing” dentin adhesives on the interaction of composites with human dentin—an SEM study—C. Franci, A. V. Ritter, J. Perdigão, B. T. Rosa	944

IMAGING OF MACROMOLECULAR COMPLEXES

Cryo-electron microscopy of Aura viruses—W. Zhang, N. H. Olson, B. R. McKinney, R. J. Kuhn, T. S. Baker ...	946
---	-----

Cryo-electron microscopy and image reconstruction of PBCV-1, an algal virus with T=169, icosahedral lattice symmetry—X. Yan, N. H. Olson, J. L. Van Etten, T. S. Baker	948
CTF corrected structure of the closed-state calcium release channel—S. Ludtke, I. Serysheva, S. L. Hamilton, W. Chiu	950
Formation of proteasome-PA700 complexes directly correlates with activation of peptidase activity—G. Adams, B. Crotchet, C. Slaughter, G. DeMartino, E. Gogol	952
On the unique structural organization of the <i>Saccharomyces cerevisiae</i> pyruvate dehydrogenase complex—J. K. Stoops, Z. Hong Zhou, J. P. Schroeter, S. J. Kolodziej, R. H. Cheng, T. S. Baker, D. L. B. McCarthy, M. A. Yazdi, C.-Y. Maeng, L. J. Reed	954

CHAMBERS AND CHANNELS: FUNCTIONAL CONNECTIONS IN MULTIPROTEIN COMPLEXES STUDIED BY SINGLE CHAMBERS AND CHANNELS

Nuclear pore transport: Insight <i>in situ</i> —U. Aebi, D. Stoffler, B. Feja, K. Goldie	956
FEISEM, form and function in the nuclear pore complex—T. D. Allen, G. R. Bennion, S. A. Rutherford, E. Kiseleva, M. W. Goldberg	958
Structural studies of translocation channels: The nuclear pore complex and the translocon—Q. Yang, J.-F. Ménétret, I. V. Akey, K. Plath, T. A. Rapoport, C. W. Akey	960
The ribosome—three-dimensional structure and ligand-binding studies—J. Frank, P. Penczek, A. Malhotra, I. Gabashvili, R. Grassucci, A. Heagle, S. Srivastava, N. Burkhardt, R. Jünemann, K. H. Nierhaus, R. K. Agrawal	962
Molecular architecture of ribonucleoprotein vaults—P. L. Stewart, L. H. Rome, L. B. Kong	964
High resolution epitope mapping of the hepatitis B virus capsid by cryo-electron microscopy—J. F. Conway, N. Cheng, A. Zlotnick, S. J. Stahl, P. T. Wingfield, D. M. Belnap, A. C. Steven	966
The ryanodine receptor/calcium release channel and its interaction partners—T. Wagenknecht, M. Samsó	968
3D reconstruction of mannosidase II from single particle distributions: Noise reduction approaches for higher resolution—F. P. Ottensmeyer, A. B. Fernandes, M. Timmer, J. Kroft, K. Varga, K. W. Moremen	970
Structure of wild type yeast RNA polymerase II and location of RPB4 and RPB7—G. J. Jensen, G. Meredith, D. A. Bushnell, R. D. Kornberg	972
Cytomegalovirus capsid structure and tegument binding—A. C. Steven, W. Gibson, N. Cheng, B. L. Trus	974
Cryo-electron microscopy and image processing methods for studying the ribonucleoprotein vault—L. B. Kong, L. H. Rome, P. L. Stewart	976

PROTEOLYSIS: A VERSATILE BIOLOGICAL CONTROL MECHANISM

Protein unfolding and degradation by the CLP family of proteases—M. Kessel, F. Beuron, F. Booy, E. Kocsis, M. Maurizi, A. Steven	978
Macromolecular assemblies designed for controlled proteolysis—J. Walz, A. J. Koster, T. Tamura, W. Baumeister	980

Formation of proteasome-PA700 complexes directly correlates with activation of peptidase activity—E. Gogol, G. Adams, B. Crotchett, C. Slaughter, G. DeMartino	982
Proteolytic control of bacteriophage HK97 capsid maturation.—R. L. Duda, J. F. Conway, N. Cheng, A. C. Steven, R. W. Hendrix	984
On the structure-function relationships of the unique proteinase inhibitor human α_2 -macroglobulin— J. K. Stoops, S. J. Kolodziej, U. Qazi, N. J. Nolasco, P. G. W. Gettins, D. K. Strickland	986

RECENT ADVANCES IN LABELING TECHNIQUES

Strategies insuring the optimal use of IgG or FAB' fragments covalently bound to 1.4 nm nanogold™ in immunogold labeling procedures—C. A. Ackerley, A. Tilups, L. E. Becker	988
Fluoronanogold: An efficient labeling reagent for immunocytochemistry—J. M. Robinson	990
Dual-labeled probes for fluorescence and electron microscopy—R. D. Powell, C. M. R. Halsey, E. Gutierrez, J. F. Hainfeld, F. R. Furuya	992
Molecular cloning and expression of 6HIS—GFP reporter gene for fluorescent and electron spectroscopic imaging—M. Malecki, S. Sanchez, P. Skowron, G. Case	994
New advances in super-sensitive DNA-, RNA- and antigen detection: Combination of labeled tyramides with nanogold-silver staining (NGSS)—G. W. Hacker, C. Hauser-Kronberger, I. Zehbe, H. Su, R. Tubbs	996
Correlative instrumental neutron activation analysis, LM, and TEM to track <i>in vivo</i> distribution of colloidal gold spheres in BALB/c mice—J. F. Hillyer, R. M. Albrecht	998

DETECTION AND APPLICATION OF GREEN (AND OTHER COLORED) FLUORESCENT PROTEINS

Properties and applications of EGFP, enhanced color variants of GFP, and unstable derivatives of GFP— P. A. Kitts, X. Li, D. W. Piston, R. Chervenak, S. R. Kain	1000
Fluorescent antenna proteins from the bioluminescent bacteria—J. Lee	1002
Quantitative imaging of the green fluorescent proteins—D. W. Piston, G. H. Patterson, S. M. Knobel	1004
Green fluorescent protein as a non-invasive probe of viscosity and pH in cell cytoplasm and organelles— A. S. Verkman	1006
GFP fusions for fluorescence detection of Ca ²⁺ and Ca ²⁺ -calmodulin in living cells—A. Persechini	1008
Use of green fluorescent protein (GFP)-chimeras to study cytoskeletal assembly and dynamics— G. G. Gundersen, A. Mikhailov, J. L. Martys, L. Ho, R. K. H. Liem, L. Smelinov, E. E. Marcantonio	1010
Efficient, retroviral-mediated expression of GFP fusion proteins as inhibitors of intracellular signal transduction pathways: A case study—T. J. Murphy, X. Wang	1012
GFP-tagged protein domains as tools to study localized second messenger function in living cells—T. Meyer, E. Oancea, T. Stauffer, M. N. Teruel	1014
Microscopic investigations of the infection process of <i>Choristoneura fumiferana</i> nucleopolyhedrovirus in the spruce budworm—A. J. Brownwright, J. W. Barrett, T. R. Ladd, M. Primavera, S. S. Sohi, B. M. Arif, A. Retnakaran, S. R. Palli	1016

DYNAMICS OF CELLULAR MEMBRANE TRAFFIC

Light microscopy beyond the wavelength limit: Methods for characterizing cell surface membranes— M. Edidin, A. K. Kenworthy, L. Gheber	1018
Optical measurements of presynaptic function: What keeps vesicle traffic going?—T. A. Ryan	1020
Dynamin mediates membrane vesiculation—S. M. Sweitzer, J. E. Hinshaw	1022
Characterization of endocytic pathways by quantitative fluorescence microscopy—F. R. Maxfield, R. N. Ghosh, W. G. Mallet, T. T. Soe, P. L. Leopold, L. Cohen-Gould, S. Mayor, S. Mukherjee, X. Zha, T. E. McGraw	1024
Transport through the secretory pathway: Observations of cargo and peripheral coat proteins—J. F. Presley, N. B. Cole, J. Lippincott-Schwartz	1026
Fluorescent and electron microscopic studies suggest that confronting cisternae arise from nuclear envelope in mitotic cells—J. R. Palisano, J. L. Thacker, C. S. Piriomalli, A. M. Morrison, J. E. Tate	1028
Electron microscopy of bound polysomes on <i>in vitro</i> rough endoplasmic reticulum prepared by cryohomogenization—A. K. Christensen	1030
Immunoperoxidase labeling demonstrates an early divergence of <i>Chlamydia trachomatis</i> from the endosomal- lysosomal pathway—E. R. Fischer, M. A. Scidmore-Carlson, T. Hackstadt	1032
Nature of ADH-induced endosomes in toad urinary bladder granular epithelial cells—A. J. Mia, L. X. Oakford, A. Dibas, T. Yorio	1034

CHEMOTHERAPEUTIC AGENTS THAT AFFECT MICROTUBULES: MECHANISMS OF RESPONSE AND CHEMOTHERAPEUTIC AGENTS AND MICROTUBULES

Apoptosis and resistance to anti-microtubule agents—M. C. Willingham	1036
Neutrophil microtubules display unusual properties and are highly sensitive to taxol—J. M. Robinson, D. D. Vandr�	1038
Molecular regulation of taxane-induced apoptosis—K. Bhalla	1040
Taxol-induced apoptosis may occur via a signaling pathway independent of microtubule bundling and cell cycle arrest—W. Fan, M. C. Miller III, L. Cheng, M. C. Willingham	1042

APPLICATION OF CLASSICAL AND NOVEL MICROSCOPY TO TISSUE INJURY AND INFECTIOUS DISEASE PATHOGENESIS

Applications of correlative microscopy in diagnostic and investigative pathology—D. N. Howell, S. E. Miller	1044
Molecular pathology—implications for diagnosis and pathogenesis of infectious diseases—S. R. Zaki	1046
Immune system activation after cisplatin or “poly-plat” treatment: An <i>in vivo</i> study—D. J. Telgenhoff, S. K. Aggarwal	1048
Towards understanding the structural requirements for endogenous transcription in rotavirus—J. A. Lawton, M. K. Estes, B. V. Venkataram Prasad	1050

Negative stain electron microscopy . . . a valuable diagnostic method in a molecular probe diagnostic world— C. D. Humphrey, S. S. Monroe, R. I. Glass	1052
Ultrastructural characterization of virus-like particles produced by a recombinant baculovirus expression vector—A. J. Wasserman, H. Wang, G. Clark, J. R. Megill, S. K. Durham	1054
The application of microscopy and other imaging techniques to the study of disease in the fetus— W. R. Blackburn, J. Hudson, N. R. Cooley, Jr.	1056
Microvascular architecture of the lingual papillae in rabbits—T. S. Masuko, B. König Jr., B. R. Schmidt	1058

PATHOLOGY

Ultrastructural changes in hepatocellular rough endoplasmic reticulum in rats given a pyrimidine derivative— B. E. Maleeff, S. J. Newsholme, T. K. Hart	1060
Morphometry of liver lesions in an ultrastructural pathology study—A. Singh, W. P. Ireland, I. Chu	1062
A morphometric analysis of early effects of ethanol on hepatocyte organelles from <i>Peromyscus maniculatus</i> — J. T. Ellzey, J. P. Drake, L. Dader, P. Boentges	1064
Centrosome proliferation in the human androgen-responsive LNCaP and the androgen-independent DU145 prostate cancer cell lines—H. Schatten, M. Ripple, R. Balczon, M. Taylor, M. Crosser	1066
Sertoli cell adhesion molecules: Comparative expression of L-selectin and other CAMs in primary cells and immortalized Sertoli cell lines—A.-M. Broome, C. F. Millette	1068
Prevention of changes in endothelial cells cultured in high glucose—C. A. Taylor, Z. Imdad, J. Puchalski, S. Lemley-Gillespie, A. K. Mandal	1070
Effects of nitric oxide on monocrotaline induced right ventricular hypertrophy and lung mast cell hyperplasia in rats—K.-S. Hung, W. H. Duncan	1072
Nitric oxide synthase in diabetic retinopathy in the BBZ/Wor rat: An immunocytochemical study—E. A. Ellis, M. B. Grant, D. L. Guberski	1074
The effects of cigarette smoke on porcine airway epithelium—D. D. Morgan, A. G. Moss	1076
Molecular pathologic studies on the mechanisms of radiation-induced hematopoietic cells apoptosis and the recovery in mouse bone marrow—D. W. Wang, R. Y. Peng, C. Q. Xiong	1078
Pericyte ultrastructural pathology in autoimmune inflammatory myopathies—H. J. Finol, A. Márquez, M. Pulido-Méndez, B. Müller, I. Montes de Oca, P. Tonino	1080
Muscle biopsy: Use of cryosections, histochemistry, and electron microscopy for diagnosis—C. L. Hastings, Y. M. Jones, R. E. Mrak	1082
Ultrastructural localization of CD34 in soft tissue tumors—J. M. Minda, T. J. Lawton, M. van de Rijn	1084
Ultrastructural diagnosis of a pheochromocytoma at autopsy—S. Siew, B. Newton	1086
Ion-channel activator-induced ultrastructural changes in the dog retina—J. R. Megill, T. M. Monticello, A. J. Wasserman, W. A. Kelly, S. K. Durham	1088
Macrophage targeted photodynamic regulation of wound healing—M. Coleno, V. P. Wallace, B. J. Tromberg, T. Hasan	1090
Tissue response to bone substitute materials supporting dental implants—K. E. Krizan, D. Lew, T. Rubey, J. C. Keller	1092

CYTOCHEMISTRY (LIGHT AND ELECTRON HISTOCHEMISTRY)

Quantitation of peroxisome proliferation using silver enhanced immunogold labeling on glycol methacrylate (GMA) sections—G. D. Gagne, A. H. Illi, D. Hickman, J. A. Fagerland	1094
Subcellular localization of an oncoprotein using immunofluorescence, confocal imaging and immuno electron microscopy—K. Murti, C. Caslini, P. H. Domer, S. J. Korsmeyer, J. Boer, G. Grosveld, A. T. Look	1096
Visualization of the transport pathways of high density lipoproteins across the endothelial cells in the rat arteries—H. H. Lin, W. T. Chao, V. C. Yang	1098
Electron microscopic immunolocalization of basic fibroblast growth factor-like molecules in capillary endothelial cells—R. G. Aktas, R. J. Kayton	1100
Ultrastructural distribution of basic fibroblast growth factor-like molecules in peripheral nerves—R. J. Kayton, R. G. Aktas	1102
Acid phosphatase activity in spiral ganglion neurons of C57BL/6 mice—G. M. Cohen	1104
Age- and condition-related changes in levels of neuron specific enolase in spiral ganglion neurons of C57BL/6 mice—G. M. Cohen	1106
Demonstration of Z-RNA in the dog eye lens epithelium (germinative zone)—C. E. Gagna, J. H. Chen, H. R. Kuo, W. C. Lambert	1108
Catalase gene therapy in experimental optic neuritis: Immunocytochemistry study—X. Qi, J. Guy	1110
Ciliogenesis and axonemal dynein expression in human airway epithelium cultured in an air/liquid interface environment—J. L. Carson, W. Reed, L. Brighton, T. M. Gambling, A. M. Collier	1112
Microwave-assisted immunoelectron microscopy of skin—J. P. Petrali, K. R. Mills	1114
Investigation of DNA loop domains using fluorescent <i>in situ</i> hybridization (FISH) and epifluorescence microscopy—A. V. Klaus, S. McCarthy, J. McCarrey, W. S. Ward	1116
Immunocytochemical localization of myosin light chains in the abdominal superficial flexor muscles of the American lobster, <i>Homarus americanus</i> —L. D. Brown, M. E. Cantino	1118
Suppression of gastrin production after cisplatin treatment in rats—Y. Wang, S. K. Aggarwal	1120
Immunocytochemical analysis of murine peritoneal macrophages treated with “poly-plat”, an <i>in vitro</i> and <i>in vivo</i> study—H. J. Muenchen, S. K. Aggarwal	1122
Gamma tubulin is localized to a new organelle, the multivesicular aggregate, in mammalian oocytes—P. G. Calarco	1124
Confocal laser scanning microscopy of hamster cerebellum using FM4-64 as intracellular staining—O. Castejón, P. Sims	1126
Investigation of DNA loop domains using fluorescent <i>in situ</i> hybridization (FISH) and epi-fluorescence microscopy—A. V. Klaus, S. McCarthy, J. McCarrey, W. S. Ward	1128

BIOLOGICAL ULTRASTRUCTURE/MICROBIOLOGY

Environmental scanning electron microscopy (ESEM) study of sea urchin embryos after deciliation with chloral hydrate—H. Schatten, A. Chakrabarti	1130
The centriole-centrosome complex is affected by microgravity during cell division and in cilia of sea urchin embryos: Results from space flight experiments—H. Schatten, A. Chakrabarti, M. Taylor, M. Crosser, K. Mitchell	1132

Integrated microscopy of extracellular adhesives of the marine biofouling alga <i>Achnanthes longipes</i> (bacillariophyceae)—Y. Wang, B. A. Wustman, Y. Chen, C. Lavin, M. R. Gretz	1134
High pressure freezing and freeze substitution of primitive agglutinated foraminifera—S. T. Goldstein, E. A. Richardson	1136
EM study of isopod hemocytes—G. M. Vernon, E. J. Rappa, W. C. Murray, R. Witkus	1138
Ultrastructure of haustoria of plant pathogenic fungi—C. W. Mims, E. A. Richardson	1140
Ultrastructure of septa from the filamentous fungus <i>Aspergillus nidulans</i> —E. A. Richardson, M. Momany	1142
Ivermectin-induced hypertrophic changes in adult canine heartworm (<i>Dirofilaria immitis</i>) gut epithelium—W. L. Steffens, J. W. McCall	1144
Characterization of the cell surface of <i>Perkinsus marinus</i> , a pathogen of the Eastern oyster, <i>Crassostrea virginica</i> utilizing electron microscopy, light microscopy and epifluorescent microscopy—J. Neimark	1146
Taxonomic identification of <i>Rhabdochona</i> species found in <i>Oncorhynchus clarki</i> using scanning electron microscopy—D. Young, R. A. Heckmann, J. S. Gardner	1148
Size and density variation in microtriches from <i>Bothriocephalus</i> species found in <i>Cyprinus carpio</i> from Lake Powell, Utah—I. Bingham, L. Bingham, R. A. Heckmann, J. S. Gardner	1150
Analysis of endocytosis and food plaquette formation in the ciliated protozoan <i>Hyalophysa</i> —S. C. Landers, R. A. Treadaway	1152
Bioremediation: Utilization of aircraft paint waste as a nutrient source by <i>Pseudomonas sp. VM1</i> —J. E. Thurmond, W. N. Norton, G. T. Howard	1154
Applications of soft x-ray and other microscopy techniques to elucidate the structure of parasitic metazoa—W. J. Kozek, J. Brown, W. Meyer-Ilse, C. Larabell, M. Moronne	1156
Identification of papilloma-like virus particles in cell lines derived from green sea turtle (<i>Chelonia mydas</i>) with fibropapilloma—Y. Lu, V. R. Nerurkar, T. M. Weatherby, R. Yanagihara	1158
Fibrinogen Kurashiki (γ G268E) fibrin network structure—J. P. DiOrio, M. W. Mosesson, M. Matsuda	1160

DEVELOPMENTAL BIOLOGY

High resolution immuno-electron microscopy reveals that fetal skin contains microfibrils which are heteropolymers of fibrillin-1 and fibrillin-2—D. R. Keene, N. L. Charbonneau, B. J. Dzamba, D. P. Reinhardt, C. C. Ridgway, R. N. Ono, L. Y. Sakai	1162
Effect of prematurity on the presence of Weibel-Palade bodies in human umbilical vein endothelial cell <i>in situ</i> —N. Tabatabaei, K. H. Albertine, L. Wenhua, D. E. Lorant	1164
Temporal and spatial expression patterns of PDGF receptors in embryonic rat heart as detected through confocal scanning laser microscopy—T. Thielen, W. Carver, D. G. Simpson, T. K. Borg, L. Terracio, R. L. Price	1166
2G alters the utricular macula of chick embryos—H. Hara, C. D. Fermin	1168
Aminoglycoside damage to young rats equilibrium—H. Hara, G. Meza, B. Bohne, J. Hara, C. D. Fermin	1170
A scanning electron microscopic study of adhesive pad development in the frog <i>Phyllomedusa trinitatis</i> —T. A. Ba-Omar, J. R. Downie	1172

BOTANY/PLANT PATHOLOGY

Effect of calcium on salt tolerance of leaf epidermal cells of <i>Ruppia maritima</i> at high salinity—A. D. Barnabas, R. Jagels, W. J. Przybylowicz, J. Mesjasz-Przybylowicz	1174
Ultrastructure and elemental distribution in foliage of manganese-treated sugar maple seedlings: Comparison of freeze-substitution fixatives—C. J. McQuattie, G. A. Schier, S. Burns, J. W. Heckman, Jr.	1176
Unusual mitochondrial aggregation with virus in infected transgenic plants—L. Zhang, W. G. Langenberg	1178
Pollination in <i>Arabidopsis thaliana</i> —K. Lennon, E. Lord	1180
The contribution of <i>Symbiodinium microadriaticum</i> to the symbiosome membrane in the anthozoan host <i>Aiptasia pallida</i> —T. S. Wakefield, S. C. Kempf, M. A. Farmer	1182
Amino acid composition and immunolabelling of a 42.5 kDa protein from phloem exudate of <i>Luffa cylindrica</i> fruits—M. C. Wang, Y. R. Chen	1184

On the cover: Shaded-surface view of an Aura virus particle. This reconstruction is viewed along a two-fold axis of symmetry. Small protrusions at the outermost periphery of the glycoprotein spikes are features not previously observed in other alphaviruses. From W. Zhang, N. H. Olson, B. R. McKinney, R. J. Kuhn, T. S. Baker, Cryo-electron microscopy of Aura viruses, page 946.

