

ELECTRON MICROSCOPE UNIT
ANNUAL REPORT
1999

Director

B.T. Sewell

Principal Technical Officer

D.A. Gerneke

Chief Technical Officer (Part Time)

J. Duncan

Senior Technical Officer

M.A. Jaffer

Senior Technical Officer

M. Waldron

Photographic Assistant

W. Williams

May 2000

TERMS OF REFERENCE

The Electron Microscope Unit is an Inter-faculty facility. The following terms of reference were approved by Senate (PC 11/87) and confirmed by GPC (1/2/88).

"The prime objective of the EM Unit is the provision of a dedicated service to the University's research and teaching community."

"The Unit should aim at a high level of maintenance of the instruments, with a minimum of down-time".

"The Unit should ensure the provision of an adequate basic teaching in electron microscopy for users".

The Electron Microscope Unit Advisory Board which reports to the University Research Committee was established in 1998 to have oversight of the Unit.

HIGHLIGHTS OF 1999

INSTALLATION OF AN ELECTRON BACKSCATTERED DIFFRACTION SYSTEM

At its meeting on 29 April the EMU Advisory Board approved the purchase of an EBSD system utilising funds allocated to the purchase of an Energy Dispersive X-ray Analysis system for the 200CX and funds remaining after the repair of the 200CX. Negotiations with two alternative suppliers commenced immediately and ultimately the tender from HKL technologies in Hobro, Denmark was accepted. The negotiations were protracted and complex and were largely led by Professor R.D. Knutsen in the Department of Materials Engineering. Matching funds were solicited from several companies and ultimately R70,000 was contributed by Hulett's Aluminium. Much of the money required was advanced from the EMU's maintenance reserve. This will ultimately be replenished by money raised by Material Engineering through the use of the system. The system was finally installed on the S200 in December.

CAMPAIGN FOR THE PURCHASE OF NEW TRANSMISSION ELECTRON MICROSCOPE

The campaign for a new TEM entered its second year. A meeting with Dr Renfrew Christie of UWC was held at which his support was obtained but it was made clear that no money would be forthcoming from UWC. Professor Dirk Knoessen from UWC provided substantial motivation for the instrument. Meetings with all interested parties at UCT were held at which the details of the microscope needed were refined. At this stage it became clear that there were no local projects justifying a field emission gun. Quotations based on these needs obtained from Philips and JEOL indicated that R8m would be required - this includes two major items of preparative equipment. The support from UPE was based on the acquisition of a FEG instrument and this fell away - they subsequently submitted an application to the NRF for an instrument similar to one required by us. A full proposal was drafted and submitted to the REEP committee. At this meeting it was suggested that an approach be made to the Wellcome Foundation for partial funding. Application forms were obtained from Mr John Claxton at Wellcome. From these it is clear that motivation for the instrument must be based on Medical Research requirements. Following this several meetings with Medical researchers were held but no projects which cannot be fully accomplished with existing equipment emerged. At present it seems that the case needs to be based on the need to replace the twenty year old JEOL 200CX and the research needs of the Materials Engineers and Botanists/Biochemists at UCT and the Physicists at UWC. The draft proposal was sent to Dr Anthon Botha for comment and he replied with a number of suggestions that will be incorporated in the final proposal that will be submitted to the NRF, with the approval of all involved, in 2000.

MEETINGS OF THE ELECTRON MICROSCOPE UNIT ADVISORY BOARD

A meeting of the EMU Advisory Board was held on 26 April 1999. Those attending were Professor J Martin (Chairman), Professors J. Gurney, B D Reddy, L M Steyn and J A Thomson, Associate Professors W J Els and B T Sewell, Dr C I Lang, and Mr. D A Gerneke. The meeting approved the 1998 annual report and the strategic plan for 2000-2002 subject to certain conditions which were subsequently fulfilled. The meeting also approved the purchase of the EBSD system and proposed that a consolidated structure for all UCT's electron microscopes be investigated. On the death of Professor Martin, Professor

Reddy was appointed acting chairman with the approval of the committee. Dr Sibisi subsequently nominated Professor Reddy as chairman of the Board.

MAJOR EQUIPMENT PURCHASES IN 1999

Equipment purchases in 1999 were dominated by the acquisition of the EBSD system and the upgrades to the S200 necessitated by its installation on that instrument. Initially it was planned to raise one third of the funds necessary for this from industrial users. However this was not achieved. It was nevertheless decided to proceed with the purchase for scientific reasons. An agreement with Materials Engineering was reached in which they agreed to replace funds earmarked for other puposes over a three year period. Because of this there was a substantial alteration of the timing of purchases made within the goals of the strategic plan.

A further major deviation from the 1999 purchasing plan was made necessary by Agfa's decision to cease manufacture of the film used by the EM 109 TEM. The alternative proposed by the manufacturer was the purchase of a CCD camera. This would render the group viewing system proposed in the 1999 budget redundant. Thus it was decided to save the money earmarked for that purpose towards the purchase of a CCD system in 2001. It is possible to do this because we have approximately two year's supply of film in stock.

Ultimately the items of equipment purchased from the 1999 budget included: The EBSD system, the Orion passive imaging system, an external scan control interface for the S200, the Deben stage control system for the S200, the cryo stage upgrade for the S440, the Centaurus Backscatter detector, a refrigerated centrifuge, the HP2000C ink jet printer and various computer upgrades.

USE OF THE UNIT

Services provided by the Unit during 1999 are listed in Table 1. Microscopy services with the exception of the S200 continued to be adequately utilised. Digital imaging services are being well used and plans were made to rehouse these in a larger room. Services that are not adequately used included the Kevex 7000 EDS system, the user darkroom and the image analysis facilities.

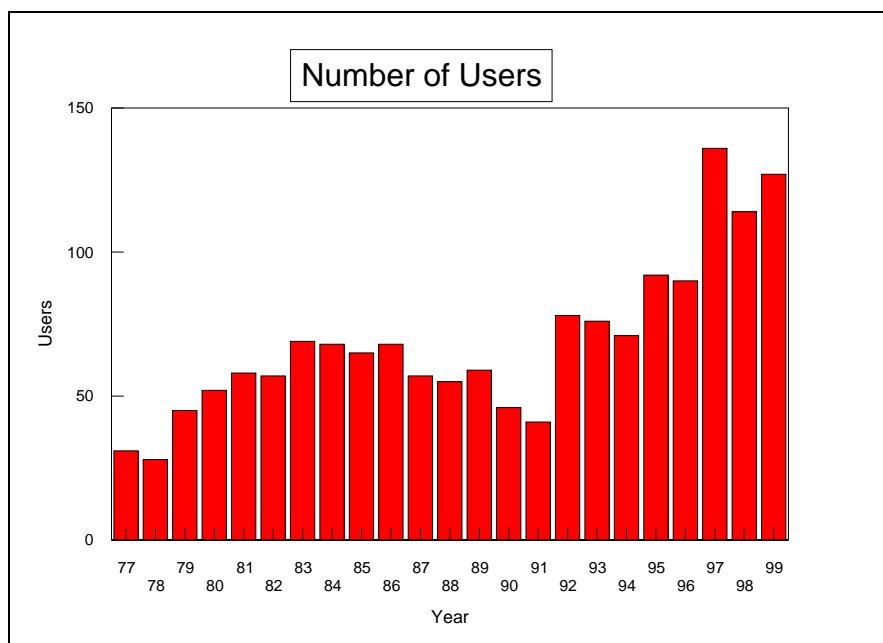


Figure1: Number of users of microscopy facilities per year since 1977.

One hundred and twenty-seven people made use of the microscopy services of the Electron Microscope Unit in 1999. In addition a further 62 users utilized services other than those related to microscopy notably the Imaging Centre and CD writing facilities.

The names and departments of the users are listed in Table 7.

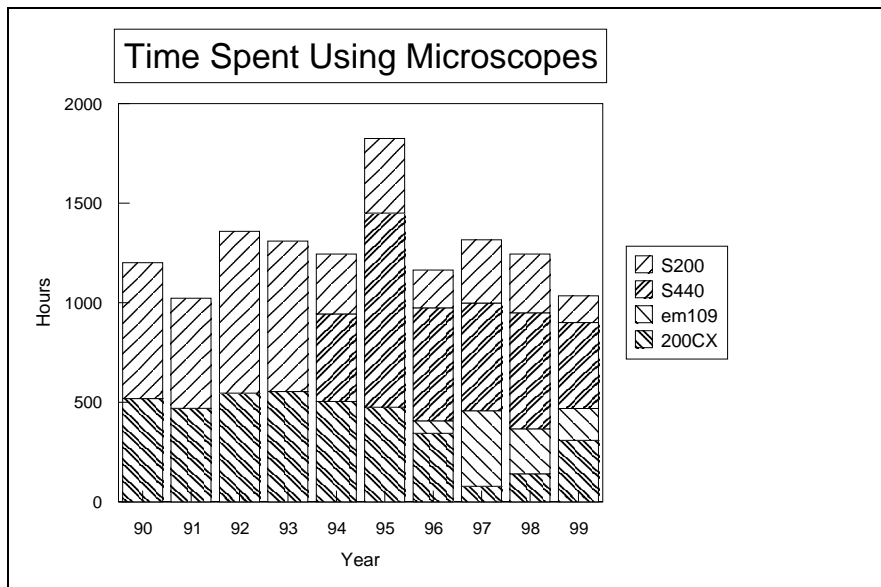


Figure 2: Time spent using the Unit's microscopes since 1990.

Total time spent using the Unit's microscopes was 1035 hours in 1999 which is the lowest level since 1991. TEM usage rose by 28% whereas SEM usage fell by 35% from the 1998 figures. In particular use of the S200 was very low. There was a significant decline in usage by the three largest users Botany (29% of previous year), Materials Engineering (84%) and the Liver Research Unit (34%) although many of the smaller users increased their use this did not compensate in terms of the aggregate hours used.

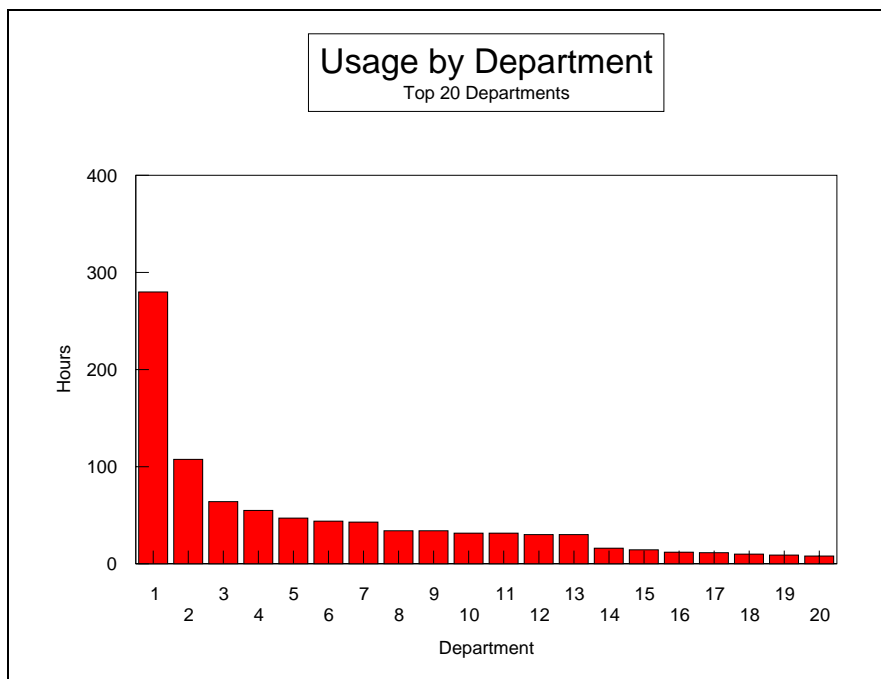


Figure 3: Microscope usage by department, institution or company

The key is as follows:

1	Materials Engineering	11	Stellenbosch University
2	Botany	12	Medical Biochemistry
3	Geological Sciences	13	Zoology
4	Microbiology	14	Mechanical Engineering
5	Biochemistry	15	NBI
6	Liver Research	16	MCM
7	Cardiovascular Res. Unit	17	Mineral Services
8	Chemical Engineering	18	Cape Technikon
9	Chemistry	19	Physics
10	UWC	20	Fine Chemicals

ELECTRON MICROSCOPES AND ASSOCIATED EQUIPMENT

LEO STEREOSCAN S440

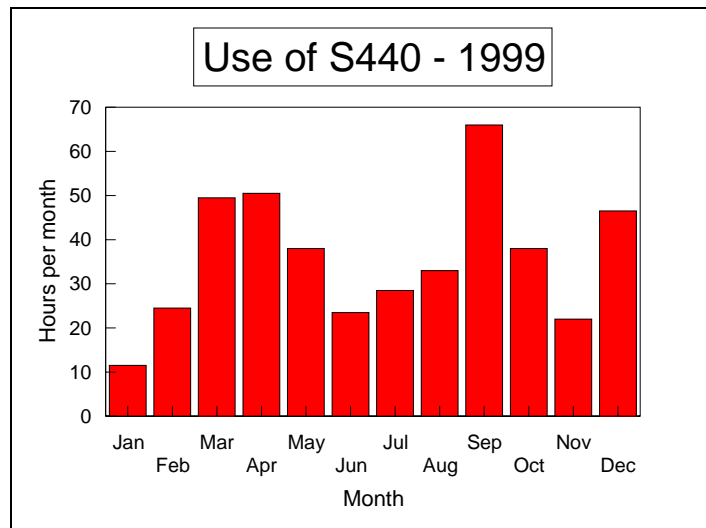


Figure 4: Use of the Leica S440 SEM

The S440 was used for a total of 431.5 hours which is 74% of the usage for 1998. Fifty three people from UCT made use of the instrument and there were sixteen outside users. Use of this instrument remains the most popular service rendered by the Unit.

The ion-getter pump failed in October damaging its power supply in the process. The power supply was repaired and the pump was replaced.

CAMBRIDGE S200 SEM AND KEVEX 7000 ANALYSIS SYSTEM

The S200 was used in total for 134.5 hours, which is less than half of that of 1998. The instrument worked reliably.

Because of the very low usage of this instrument and the need by EBSD users to have protracted access to an instrument for long, automated runs it was decided to mount the EBSD camera on this microscope. The system required substantial upgrades, notably new stage automation and an external beam control interface in order to accommodate this. It was also decided that the EBSD camera would be ideally located in the left side port of the microscope - the same port occupied by the Kevex 7000. It was decided to dismount the Kevex 7000 because (1) no use had been made of it for three years, (2) its continued use would require substantial computer and other upgrades and (3) the Kevex Sigma2 system on the S440 more than adequately covers our current EDS needs. This has effectively made the Kevex 7000 redundant and it is unlikely ever to be used again. For this reason it was advertised internationally to ascertain whether it was of use to anyone. Some interest was received from a person in Brazil but permission for it to be scrapped was not received from the Equipment Committee and no further action was taken.

Substantial upgrades to the S200 were envisaged in order to make its use for EBSD and other purposes as robust and user friendly as possible. An upgrade of particular interest was the installation of a passive digital imaging system which will ultimately replace the film camera.

The external beam control interface was installed by Mr Duncan and the Deben stage automation and EBSD system were installed by both Mr Duncan and the staff of HKL during December. The Orion imaging system was delivered but not installed because both the EBSD and it required the same slot in the computer. HKL agreed to rectify this. A further problem with the stage automation was corrected at

installation time but in the long term will require factory modification. Deben and HKL agreed to address this. The EBSD system is working satisfactorily and student from Materials Engineering commenced using it in December.

It is envisaged that the upgrading of the S200 will be an ongoing process and that many more years of use will be obtained from this instrument which was installed in 1984.

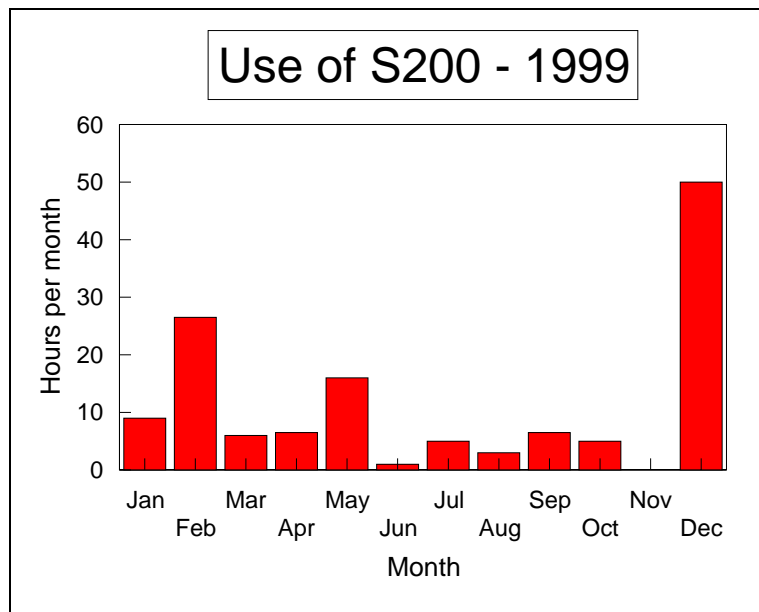


Figure 5: Use of the Cambridge S200 SEM

JEOL 200CX TEM

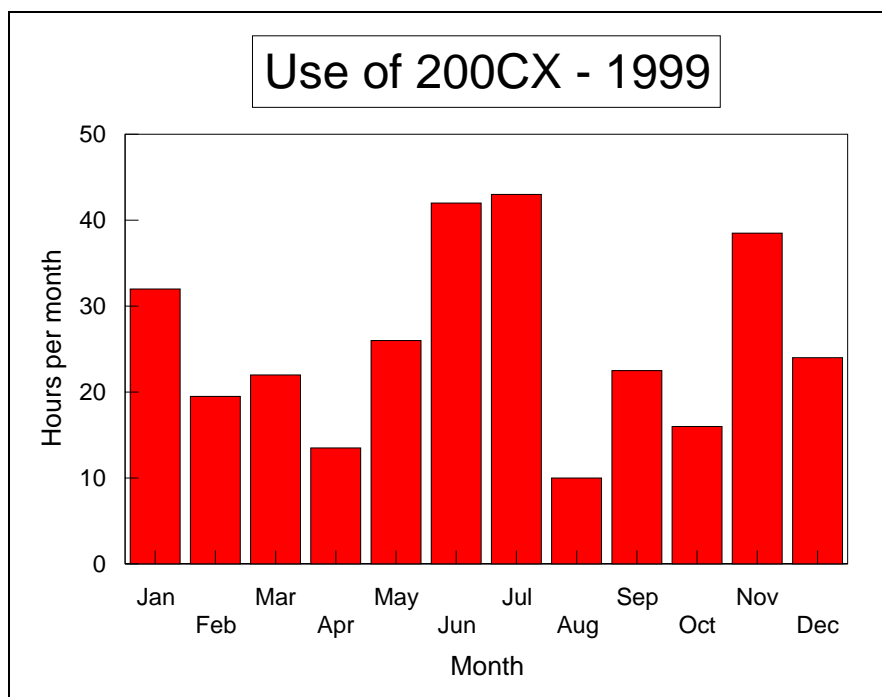


Figure 6: Use of the Jeol 200CX TEM

Use of the 200CX TEM rose to 309 hours from the very low figures of the previous two years. It was used by 23 people from UCT and 4 outside users. It should be noted that there is considerable demand from UCT users for TEM resources that are not available in the EMU and that a substantial amount of time was used on microscopes located elsewhere. The performance of the instrument remained satisfactory after the substantial repairs carried out in 1998. The CCD camera attached to the microscope

sprung a water leak due to corrosion of an aluminium plate. The manufacturer (now owned by Perkin-Elmar) acknowledged faulty design but simply ignored requests for replacement parts. The camera was brought back into service in the best way available to us but it is certain that the problem will recur.

ZEISS EM109 TEM

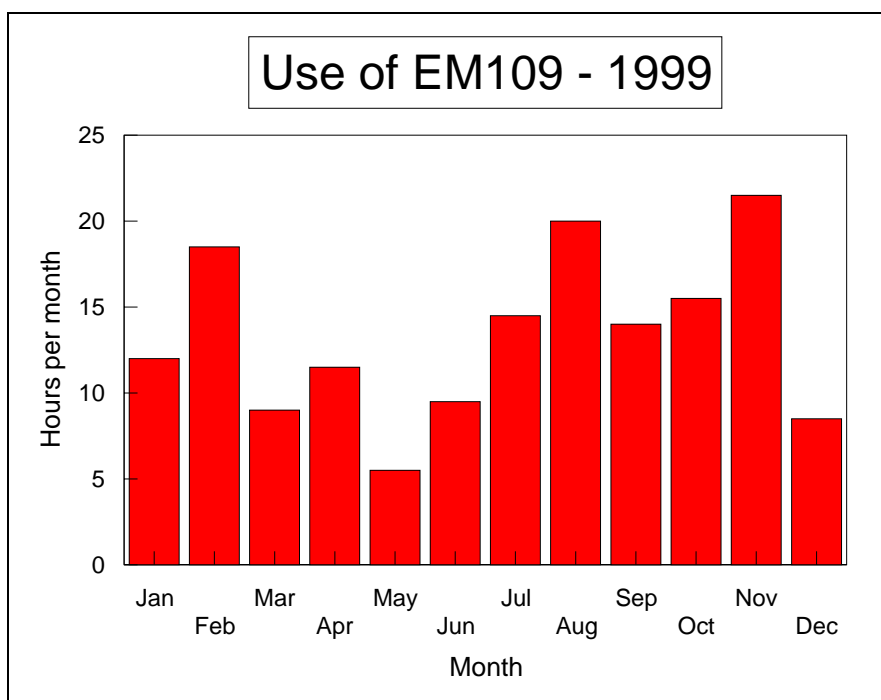


Figure 7: Use of the Zeiss EM109 TEM

Use of this instrument declined to a mere 165 hours - only 70% of last year's low figure. It was used by 18 people from UCT and 3 outside users. The instrument had a number of minor faults which were repaired. The viewing screen was replaced but disintegrated soon after insertion due to a manufacturing defect. This was acknowledged by LEO and it was replaced free of charge.

OTHER MAJOR EQUIPMENT

ULTRAMICROTOME

Use of the ultramicrotome was 198 hours which is 57% of its use during 1998. The departments of Biochemistry, Botany, Medical Biochemistry, Medicine, Microbiology and Zoology continued to use the cryomicrotomy and immunolabelling facilities and Materials Engineering became a new user of the cryoultramicrotome.

TEACHING AND EXTENSION

USER COURSES

The five day intensive course aimed at honours and post graduate students, "Introduction to Microscopy for Biologists", was held three times and attended by a total of 16 people.

8/2/1999-12/2/1999	2 students from each of Cardiothoracic Surgery, Physiology and Pharmacology.
10/3/1999-15/3/1999	5 Honours students from Biochemistry
2/8/1999-6/8/1999	5 students from the Heart Centre

INDIVIDUAL TRAINING

Four students from the departments of Chemical Engineering, Botany and Cardiothoracic Surgery were trained to operate the 200CX, eight new users from the departments of Botany, Microbiology and Chemical Engineering were trained to use the EM109, two students from Materials Engineering were trained to operate the S440 and seven new users from the departments of Biochemistry, Botany,

Microbiology and Pharmacology were trained to operate the ultramicrotome. Mr Gerneke also undertook the extensive training of Mr Ian Basson from Mineral Services who was required by that firm to set up their microscopy service.

SCHOOL VISITS

Five grade 12 learners from Bayside Christian High visited the Unit on 25 January, fourteen grade 8 learners from Camps Bay visited on 11 Feb and three A level learners from Bishops visited on 16 March.

STUDENT PRACTICALS

Third year Botany students attended a practical on thin sectioning and TEM conducted by the Unit.

RESEARCH ACTIVITY

Research was generally carried out in collaboration with other departments and laboratories. The following projects which depend on the initiatives of Unit members were active during 1999:

Studies on otoliths

M.E. Waldron

Work on using banding in otoliths from mackerel (*Trachurus trachurus*) to determine the age of the fish was submitted for publication. Similar studies on hake otoliths were done in collaboration with Theresa Akkers from the Marine and Coastal Management Institute. Funding proposals for two projects on anchovy ageing were submitted.

Single particle reconstruction

B.T. Sewell

Considerable progress was made with the structure of GroEL mutants in collaboration with Professor Helen Saibil at Birkbeck College in London. Cryo micrographs of the E461K mutant with excess GroES in the presence of 5mM ATP were taken in London and the images were processed using the computers belonging to the Visualization Centre at UCT. Modelling using Charmm was done in collaboration with Mr Robert Best and Dr Kevin Naidoo. Later in the year an offer of collaboration was received from the author of Charmm, Dr Martin Karplus from Harvard. The structure of the E461K mutant and the early modelling studies were presented at the Gordon Conference on 3D EM.

PUBLICATIONS

Publications, for 1999, that resulted from research in which the EM Unit staff have been directly involved are listed:-

Published Conference Proceedings

Akkers, T., Waldron, M., Louw, G. and Mullins, P. 1999 Hake otolith microstructures. Proceedings of the Southern African Marine Science Symposium 10

Sewell, B.T., Best, R.B, Fenton, W.A., Horwich, A.L., Roseman, A.M., Chen, S., Ranson, N. and Saibal, H.R. 1999 The structure of the E461K mutant of GroEL at 2.5nm resolution. Proceedings of the Electron Microscopy Society of Southern Africa 29:57

Siziba, K.B., Jaffer, M.A., Corrigall, A.V, Kirsch, R.E. and Meissner, P.N. 1999 Immunocytochemical localisation of protoporphyrinogen oxidase in human liver biopsies. Proceedings of the Electron Microscopy Society of Southern Africa 29: 63

Mange, S., Marcus, K., Jaffer, M.A., Sole, B. 1999 Use of electron Microscopy to investigate the structure of poly-(propylene-ethylene) impact copolymers. Proceedings of the Electron Microscopy Society of Southern Africa 29:9

Published Papers

Waldron, M.E. 1998. Annual ring validation of the South African sardine, *sardinops sagax* using daily growth increments. In Pillar, S. C., Moloney, C.L., Payne, A.I.L and Shillington, F.A. (eds) "Benguela Dynamics". South African Journal of marine Science, 19:425-430.

Popular Articles

Gerneke, D.A., 1999. Application note on the Centaurus backscatter detector. Scanlines, 15.

Publications by Users of the Unit

The following list includes those papers given to the Unit by users. It is unfortunately not a complete list of published work that has been conducted in the Unit. A great deal of the work done by users is published only as conference proceedings, such work is not reflected here.

Basson, J.A., Lang, C.I. and Knutsen, R.D. 1999. The influence of niobium and vanadium on precipitation in a high nitrogen steel. Proceedings of the Electron Microscopy Society of Southern Africa **29**:9:26

Bruyns, P. 1999. The systematic position of Quauqua (Apocynaceae-Asclepiadoideae) with a critical review of the species. Bot. Jahrb. Syst. **121**: 311-402.

Bruyns, P. 1999. A systematic analysis with notes on the taxonomy of Notechidnopsis. Kew Bulletin **54**: 327-345.

Bruyns, P. 1999. The systematic position of Rhytidocaulon. Edinb. J. Bot. **56**, 211-228 .

Bruyns, P. 1999. The systematic position of Eustegia R. Br. Bot. Jahrb. Syst. **121**, 19-44.

Bruyns, P. 1999. The relationships of Huerniopsis and Piaranthus. Syst. Bot. **24** 379-397.

Burger, V.B. and Ball, A. 1999 Snakeskin formation on tungsten carbide mining drill bits. Proceedings of the Electron Microscopy Society of Southern Africa **29**, 23

Farrant, J.M., Cooper, K., Kruger, L.A. and Sherwin, H.W. (1999). The effect of rate of drying on three different resurrection plants. Annals of Botany. **84**, 371-379.

Frimmel, H E, Hallbauer, D K, Gartz, V H (1999) Gold mobilizing fluids in the Witwatersrand Basin: composition and possible sources. Mineral. Petrol. **66**, 55-81.

Frimmel, H E, Chetty, D, Board, W S (1999) Neoproterozoic evaporites and metallogenesis in Pan-African tectonic belts in southwestern Africa. - In: Stanley, C J (ed.) Mineral deposits: Processes to Processing, 5th Biennial SGA Meeting and 10th Quadrennial IAGOD Symposium, 22-25 August 1999, London, Balkema (Rotterdam), 943-946.

Gartz, V H & Frimmel, H E (1999): Complex metasomatism of an Archean placer in the Witwatersrand Basin, South Africa: The Ventersdorp Contact Reef - a hydrothermal aquifer? Econ. Geol., **94**, 689-706.

Koonjul, P.K., Brandt, W.W., Farrant, J.M. and Lindsey, G.G. (1999). Inclusion of polyvinylpyrrolidone in the polymerase chain reaction reverses the inhibitory effects of polyphenolic contamination of RNA. Nucleic Acids Research **27**, 915-916.

Koonjul, P.K., Farrant, J.M., Brandt, W.F. and Lindsey, G.G. (1999). Isolation and characterisation of chloroplasts from *Myrothamnus flabelliolius* Welw. Journal of Plant Physiology. (In Press)

Malan, H. and Farrant, J.M. (1998). Effects of the metal pollutants cadmium and nickel on soybean seed development. Seed Science Research, **8**, 445-453.

Mundree, S.G. and Farrant, J.M. (1999). Some physiological and molecular insights into the mechanisms of desiccation tolerance in the resurrection plant *Xerophyta viscosa* Baker. IN *Plant tolerance to abiotic stresses in agriculture: role of genetic engineering*. (ed J. Cherry). In Press.

Musil, C.F., Newton, R.J., and Farrant, J.M. (1998). Ultraviolet irradiation effects on serotinous *Leucodendron lauroolum* seeds: altered seed physiology, ultrastructure and seedling performance. *Plant Ecology*, **139**, 25-34.

Sherwin, H.W and Farrant, J.M. (1998). Protection mechanism against excess light in the resurrection plants *Craterostigma wilmsii* and *Xerophyta viscosa*. *Plant Growth Regulation*, **24**, 203-210.

Sherwin, H.W, Pammenter, N.W., vander Willigen, C., February, E. and Farrant, J.M. (1998). Wood anatomy and water relations of the resurrection plant *Myrothamnus flabellifolia* *Annals of Botany*, **81**, 567-575.

Vicre, M., Sherwin, H.W., Driouich, A., Jaffer, M., Jauneau, A., and Farrant, J.M. (1999) Cell wall properties of hydrated and dry leaves of the resurrection plant *Craterostigma wilmsii*. *Journal of Plant Physiology*, **155**, 719-726.

Wittridge N.J. and Knutsen R.D. (1999) A microtexture based analysis of the surface roughening behaviour of an aluminium alloy during tensile straining. *Materials Science and Engineering*, vol **A269** pp 205-216.

Zartman, R E & Frimmel, H E (1999) Radon-generated ²⁰⁶Pb in hydrothermal sulphide minerals and bitumen from the Ventersdorp Contact Reef, South Africa. *Mineral. Petrol.*, **66**, 171-191.

M.Sc and Ph.D. Theses

Adams, Bronwyn, An investigation of the contribution of V and P type ATPase activities in *Plasmodium falciparum* and the study of the role played by digestive vacuoles in determining the chloroquin sensitivity of the parasite. PhD, Pharmacology

Cave, Lisa, Water-rock interactions in the Kapodfontein breccia pipe. MSc, Environmental Geochemistry

Dodds, Devric, Physicochemical study of inclusion of drug molecules in cyclodextrins. PhD, Chemistry

Durholtz, Deon, Biomineralization in Loliginid squid statoliths and the use of statoliths to estimate age. PhD, Zoology

Feng, Zheng, Erosion of materials, MSc, Materials Engineering

Jason, Laure, Investigations into the role of histone H2A ubiquitination in chromatin, the use of an anionic resin to mediate linker histone reconstitution onto long stripped chromatin and the effect of the rate of Micrococcal nuclease digestion on the observed repeat length. PhD, Biochemistry

Kirsch, Richard, Characterisation of the fibrinogen and fibrin proteolysis by neutrophil membrane, PhD, Medicine

Malan, Heather, Physiological responses of soybean seeds (*Glycine max* (Merr.) L.) to metal pollutants. PhD, Botany

Mange, Siyabonga, Structure-property relationships in poly-(propylene-ethylene) and co-polymers, MSc, Materials Engineering

Peterson, Yolande, The Characterisation of a novel *Xanthomonas* bacteriophage, MSc, Microbiology

Sales Kurt, The location and putative functional role of a lea-like protien (HFP12) yeast MSc, Biochemistry

FINANCE

Details of the Unit's accounts are presented in Tables 2, 3, 4, 5 and 6.

OTHER MATTERS

STRUCTURAL BIOLOGY

Attracting students to do postgraduate projects on macromolecular biological systems with a major EM component has always presented a problem because of the departmental structure of the University. The advent of post-graduate programmes involving several departments has the potential to change this. In other parts of world taught Masters courses in structural biology are available. People are available at UCT and UWC to make such a programme feasible. A meeting of interested people was convened by Professor Sewell and a decision to pursue the idea further was taken.

STUDY AND CONTACT LEAVE

Professor Sewell took study leave at the beginning of January and contact leave from 11-19 June and 1-8 July in order to further his collaboration with Professor Saibil at Birkbeck college London. He also had the opportunity to visit the laboratory of Dr Alasdair Steven at the NIH, Washington.

CONFERENCES ATTENDED BY STAFF.

Professor Sewell attended the Gordon Conference on Three Dimensional Microscopy held in Henniker, New Hampshire from 20-25 June 1999.

CRYOMICROSCOPY COURSE

Mr Jaffer attended a course on cryomicroscopy held in Eindhoven, Holland from 25 August to 5 September.

COMPUTER BASED EDUCATION

Professor Sewell completed the Windows version of the science programme "Electronic Science Tutor" for grade 11 and 12 learners in collaboration with Professor Delpierre. This involved the incorporation of significant new technology.

SERVICE TO INDUSTRIAL AND OTHER EXTERNAL USERS

The Unit offers its facilities on an ad hoc basis to external users. Clients exploiting these services during 1998 were Atlantis Diesel Engines, AGM Consulting, Patterson and Cooke, Envig, Fine Chemical Corporation, Meyer Zall Laboratories, National Accelerator Centre, Namaqua Sands, National Botanical Institute, SA Nylon Spinners, SA Metals, SA Museum, Soekor, Marine and Coastal Management Institute, Sondor Industries and Swartklip Products.

MICROSCOPY SOCIETY OF SOUTHERN AFRICA CONFERENCE 1999

The 38th Annual Meeting of the MSSA was held at the University of the Free State from 1-4 December 1999. Prof Sewell and Mr Gerneke attended.

VISITORS TO THE UNIT

Dr Ana Abu-Yaron from the Volcani Institute of the Israeli Agricultural Research Organization, Bet Dagan Israel visited on 20 January. Dr Anne d'Albis of the CNRS visited to inspect our facilities in relation to future grant applications. Dr Mike Lawrence of the Biomolecular Research Institute visited on 20th August and presented a lecture entitled A novel metal-binding protein in "Streptococcus pneumoniae: its structure and role in virulence". Mr Jean-Louis le Clef or ERL, Brussels, Belgium visited to demonstrate a passive SEM digital imaging system designed by himself. Mr Frans Lahey of Philips Electron Optics, Eindhoven, Holland visited and measured electrical and acoustic noise levels in our microscope rooms. Dr Marek Faryna and Professor Ryszard Ciach of the Institute of Metallurgy and Materials Science, Polish Academy of Sciences visited to discuss their EBSD software and their innovative ideas on the topic.

SUMMARY

The Unit was extremely active during 1999 in spite of the lower usage. Time was utilised on research and on the improvement of facilities. Significant purchases were made, largely in partnership with the Department of Materials Engineering. These purchases have opened the way to significant potential collaborations with the steel and aluminium industries.

Prepared by: Associate Professor B.T. Sewell

Director

9 May 2000

TABLE 1
Services Offered by the Unit during 1999

Service	Comment
Access to 200CX TEM	Used by 27 people
Access to S440 SEM	Used by 69 people
Access to S200 SEM	Used by 10 people
Access to the EM109 TEM	Used by 21 people
Training on 200CX	Four users were trained
Training on S440 SEM	Two new users were trained
Training on S200	One user from a private company was intensively trained
Training on the EM109 TEM	Used in courses. Eight users individually trained
Access to Ultracut S Ultramicrotome	Used by 30 people
Training on Ultracut S	Seven new users were trained
Cryo-microtomy and immunolabelling	Used by 13 people
Sectioning of blocks supplied by the user	Well used
Embedding of biological specimens	Well used
Sputter Coating of specimens supplied by user	Very popular service
Critical point drying of specimens supplied by the user	Very popular service
Access to darkroom facilities	Not used
Printing of EM films	Service used
Preparation of slides of electron micrographs for lecture purposes	Used
Access to optical microscopy facilities	Used
Access to Image Analysis (GENIAS)	Used for teaching image analysis.
Access to Image Processing and Analysis (Visilog)	Not used.
Element analysis by EDS	Well used.
"Introduction to EM for Biologists"	This course was held three times.
Access to specimen polisher	Used
Access to high vacuum coating plant and accessories	Adequately used
Store of EM consumables	Used by most users
Access to prep lab	Used
Collection of books and journals on microscopy	Well used
Vacuum Leak Detection	Used by the Unit.
Production of CD ROMS	Over 60 were produced
Digitization of transparent media on LS4500	Well used
Production of slides from digital images	Used
Digitization of video tape	Used
Production of digital videos	Used intensively by two Fine Arts students
Dye sublimation printer	Used
High quality ink-jet printer	Well used

TABLE 2
Equipment Expenditure

Income	Amount
Budgetry Allocation	505,887.00
Materials Engineering	200,000.00
Sale of Centrifuge	20,000.00
EMU Maintenance Account	16,251.26
EMU External Services Account	54,931.00
Total	797,069.26
Equipment Expenditure	
S200	
Electron Backscatter Diffraction Analysis	
- Hardware	224,828.18
- Software	213,257.73
Deben stage automation	78,956.80
External beam control	85,125.30
Orion passive imaging system	47,511.48
Dell Computer	24,800.56
S440	
Centaurus Backscatter detector	44,252.20
Cryo stage upgrade	6,642.39
Lab equipment	
Refrigerated Centrifuge	45,215.00
Computers	
HP2000C ink jet printer	6,536.00
Micellaneous upgrades	19,943.62
Total	797,069.26

TABLE 3
External Services: Fund 001258

Income	
Opening Balance	13,955.58
Sales revenue	23,701.08
Fund Transfer from Materials Engineering	100,050.04
Fund Transfer from Botany	20,000.00
Assets Transfer (Sale of centrifuge to Medical Microbiology)	20,000.00
Total	177,706.70
Expenditure	
Operating Expenses	1,347.08
Postage/Fax/phones	1,593.97
Travel	1,664.17
HP2000C Printer	6,536.00
Centrifuge	45,215.00
Computer upgrade	3,180.00
Total	59,536.22
Closing Balance 1999	118,170.48

TABLE 4
Departmental Grant: Fund 000516

Carried over from 1998	10,147.93
Annual Grant	58,264.00
Carried over to 2000	(13,777.30)
Total	54,634.63
Computer software	3,036.68
Conference expenses	3,943.37
Operating expenses	10,647.12
Periodicals	880.58
Postage	10,346.41
Photocopying	794.25
Stationery	1,285.98
General expenses	2,380.00
Cleaning	341.90
Repairs & Maintenance	2,673.59
Utilities	10,707.92
Travel	4,864.90
Other costs	80.00
Asset acquisitions	2,651.93
Total	54,634.63

TABLE 5
Consumables Store: Fund 000933

Income	
Opening Balance	32,136.08
Internal recoveries	31,562.25
Total	63,698.33
Expenditure	
Computer Consumables	2,823.60
Consumables	26,860.34
Stationery	4,133.52
Repairs & maintenance (LEO screen)	229.86
Total	34,047.32
Closing Balance 1999	29,651.01

TABLE 6
Maintenance: Fund 000995

Income	
Opening Balance	34,309.16
Internal Recoveries	31,706.00
Refund from 516 (Account was not active until March)	2,380.00
Fund Transfer	10,000.00
Total	78,395.16
Expenditure	
Computer Software	14,902.12
Operating Expenses	3,911.67
Postage	4.04
Stationery	201.76
Cleaning	84.00
Non Cap Equipment	258.30
Repairs & Maintenance	6,590.85
Utilities	452.81
Fixed Assets	16,763.62
To Investment Account	10,000.00
Total	53,169.17
 Closing Balance 1999	 25,225.99

TABLE 7
Users of the Unit
 * indicates Microscope users

ADE	Jonker, Korbin	Staff*
AGM Consulting	Ania Grobicki	Staff*
Anatomy & Cell Biology	Koubovec, D.	MSc
Archaeology	Desai, Nirdev	MSc
	Henshilwood, Chris	Staff
	Lee-Thorpe, J	Staff
	Russell, Tembe	Staff
	Sealy, Emma	Staff
	Van De Merwe, Nick	Staff
Architecture	Dumbrell, Cathy	Staff
	Roman, Samantha	BA
Biochemistry	Chauhan, Madhu	Staff
	Koonjul, Priyum	PhD*
	Lehohla, Molupe	BSc
	Lindsay, G	Staff
	Mtwisha, Linda	PhD*
	Motshwene, Precious	MSc*
	Roussow, Pauline	PhD*
	Sales, Kurt	MSc*
	Schwegmann, A	Hons
	Von Wechmar B	Staff*
	Whittaker, Anne	Staff*
Botany	Anderson, Bruce	MSc*
	Baxter, James	MSc
	Cooper, Keren	MSc*
	Chuba, David	Hons*
	Dlamini, Titus.	BSc*
	Kirkwood, David	Hons
	Klak, Cornelia	MSc*
	Luffel, Debra	BSc*
	Linder, Peter,	Staff*
	Lukheli, Shumani	MSc
	Munro, Sioban	PhD
	Newton, Rose	PhD*
	Ochura, John	PhD*
	Vander Willigen, Clare	PhD*
	Van Rensburg	MSc
	Vicre, Maite	PhD*
	West, Alan	MSc
	Westall, Kim	Hons
BEC	Lehmann, Markus	Staff*
Cape Technicon,		
Dept Mech Eng	Martin, Wickus	Mtech*
	Van der Plas, Paul	Staff
Dept Chem Eng	Palm, Nicky	Mtech*
	Soloman, Marshall	Mtech*
	Walsh, Gemma	Mtech*
Cardiothoracic Surgery	Zhang, YingXing	Staff*
Cardiovascular Research	Adler, Uschi	PhD*
	Davies, Neil	Staff*

	Han, Richard	PhD*
	Millam, Ross	Staff*
	Merzkircit, Christoph	PhD*
	Samodien, Nazlia	Staff*
	Trantina-Yates, Ameli	Staff*
	Van der Walt, Anel	PhD*
Chemistry	Craig, Tracy	PhD*
	Egan, Timothy	Staff*
	Hibbert, Barbara	Staff*
	Koch, Klaus	Staff*
	Mavuso, Winile	MSc*
	Nassimbeni, Luigi	Staff*
	Rogers, Alan	Staff*
Chemical Engineering	Brack, Brian	PhD*
	Centurier-Harris, J	MSc*
	Crickmore, Donovan	MSc*
	Diedericks, Gouwah	Hons*
	Furamera, Tendai	MSc*
	Gordan, Glodina	Hons*
	Masango, Shinga	Hons*
	Meyer, Tina	Hons*
	Miller, Sarah	MSc*
	Moon, Jo-Ann	PhD*
	Moon, Gillian	PhD*
	Saib, Abdool	MSc*
	Sealy, Sarah	Staff*
	Van Wyk, Gerrie	MSc*
Child Health Unit	Engelbrecht, Beth	Staff
Construction Economics	Cartel, Keith	Staff
Cooke and Patterson	Cooke, Robert	Staff*
	Johnson, Graham	Staff*
Centre for Marine Studies	Findlay, Ken	Staff
Electrical Engineering	Tattersfield, George	Staff
Environmental and Geographical Science	Kruger, Lynette	Staff
	Watt, Ryan	Hons
Envig	Van Noordwyk, Marike	Staff
Fine Arts	Ellis, Hannelie	BA(FA)
	Lomofsky, Lynne	MFA
Fine Chemical Corporation	Grimmbacher, Tarron	Staff*
	Jacobs, Pauline	Staff*
Geological Sciences	Ballhaus, Chris	Staff*
	Board, Warwick	MSc
	Cave, Lisa	PhD*
	Frimmel, H	Staff*
	Giuliana, Franceshini	PhD*
	Jamal, Daud	PhD*
	Makhathini, Senzo	MSc*
	McKeown, Steve	MSc*
	Miller, Sarah	MSc*
	O'Brien, Richard	MSc*
	Petrik, Leslie	Staff*
	Willis, J	Staff*
	Westerlund, Kalle	MSc*

Humanities	Bosch, Bianca	BA
	Mostert, Cristy	BA
Liver Research Centre	Kirsch, Richard	PhD*
	Siziba, Kwanele	PhD*
Materials Engineering	Abitz, Jon	MSc
	Basson Janet.	Staff*
	Burger, Victor,	MSc*
	Dermen, Debbie	BSc*
	Fourie, Koos	Staff*
	Knutsen, Rob	Staff*
	Lang, Candy	Staff*
	Loedolff, Adriaan	Staff
	Matthews, Ryan	MSc*
	Mange, Siyabona	MSc*
	Nzula, M	MSc
	Patel, Rama	Hons
	Sacks, Natasha	MSc*
	Scott., Adam	MSc*
	Shale, Teboho	MSc
	Towle, Nick	MSc*
	Topic, Mira.	PhD*
Mathematics	Bruyns, Peter.	Staff*
Mechanical Engineering	De Jager, G	Staff
	Guodye, C	BSc
	Tait, Bob.	Staff*
Medical Biochemistry	Dave, Joel	Staff*
	Geyp, Melissa	Staff*
Medical Microbiology	Turner-Smith, Kate	PhD*
	Williamson, C	MSc
Meyer Zall Laboratories	Saunders, Jana	Staff*
Microbiology	Abrahams, Garth	PhD*
	Koch, Careena	PhD*
	Matiru, Vivienne	PhD*
	Peterson, Yolande	MSc*
	Rybiki, Ed.	Staff*
	Mundree, Sagadevan	Staff*
	Thomson, Jennifer	Staff
	Topley, Elize	Hons
Multimedia	Deacon, Harriet	Staff
	Loopuyt, Maria	Staff
	Vanvadelis	Staff
	Walton, Marion	Staff
	Wilson, Fiona	Staff
NAC	Pineda, Carlos	Staff
	Przybylowicz, Jolanta	Staff
Namakwa Sands	Caywood, Janet	Staff*
NBI	Chesselet, Pascale	Staff*
	Kurzweil, Hubert	Staff*
Oceanography	Barnard, Stuart	PhD
	Boeble, Olaf	Staff
	Lechmere, Richard	Hons
	Waldron, Howard	Staff
Percy Fitzpatrick Institute	Crowe, Tim	Staff
	Cohen, Callan	Msc

Pharmacology	Torok, Isabelle	PhD*
Physics	Ntutela, Siyabulela	PhD*
	Driver, Steve	Staff
	Hempel, Maren	Staff*
	Yacoob, Sahil	Hons
Physiology	Belonje, P	Staff*
	Kellaway, Laure	Staff
Radiation Oncology	Rahbeeni, Fatima	PhD*
S.A. Metal	Lumley, Peter	Staff*
S.A. Museum	Henshilwood, Chris	Staff
SANS Fibers	Rama, Darshana	Staff*
SFRI/MCM	Akkers, Theresa	Staff*
Sondor Industries	Jordaan, Louw	Staff*
Swartklip Products	Moolman, James	Staff*
University of Stellenbosch		
Dentistry	Albertus, Tertius	Staff*
	Reid, Robin	PhD*
Inst. Polymer Science	Smith, Jaco	PhD*
	Faul, Charl	Staff*
	McLeary, James	MSc*
Geology	Vitali, Erminia	MSc*
Zoology	Mark Cooper	Staff*
UWC		
Microbiology	BenJoelolou, Mongi	PhD*
	Johns, Jhill	Hons*
	Khan, Sihaam	PhD*
	Leat, Neil	Staff*
	Govin, Vandanna	PhD*
	Wang, Weizhou	PhD*
WITS		
Atmosphere and Energy Research group		
	Annegarn, Harold	Staff*
Zoology	Day, Liz	PhD*
	Johnson, Shelley	MSc*
	Nicholson, Sue	Staff*
	Roos, Cecily	Hons

Total: 189

Total Microscope Users: 127