

**ELECTRON MICROSCOPE UNIT
ANNUAL REPORT
2000**

Director

Principal Technical Officer

Chief Technical Officer (Part Time)

Senior Technical Officer

Senior Technical Officer

Photographic Assistant

B.T. Sewell

D.A. Gerneke

J. Duncan

M.A. Jaffer

M. Waldron

W. Williams

May 2001

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 Committee which reports to the University Research Committee was established in 2001 to have oversight of the Unit.

HIGH

LIGHTS OF 2000

GRANT BY THE WELLCOME TRUST FOR A SECOND HAND TEM TO BE PURCHASED FROM BIRKBECK COLLEGE AND TRANSPORTED FROM LONDON TO CAPE TOWN

An application was made to the Wellcome Trust in terms of the existing Collaborative Support Grant awarded to Professor H. Saibil at Birkbeck College London and B.T. Sewell that the redundant JEOL 1200EXII at Birkbeck College, be transferred to Cape Town. The JEOL became redundant because Professor Saibil was awarded three new instruments. This application was successful and Wellcome agreed to pay for the entire cost of the move, provided appropriate infrastructure was available at UCT. The costs to be borne by UCT (modification of space, air conditioning, cryo containers and vacuum equipment) were motivated as part of the EMU's budget for 2001.

APPLICATION TO THE WELLCOME TRUST TO PURCHASE OF NEW TRANSMISSION ELECTRON MICROSCOPE

The third year of the campaign to raise funds for a new TEM culminated in an application to the Wellcome Trust. This was the only option after it became apparent that the NRF's equipment programme had completely collapsed. It also necessitated a shift of focus from the materials projects that were previously driving our proposal to biomedical projects. Considerable time was spent considering the projects most likely to succeed and four projects were selected from over twenty candidates. These projects included a study of Chlamydia motivated by Professor Enid Shephard, a study of the trabecular meshwork of the eye (which has consequences for glaucoma) motivated by Professor Sue Kidson, a study of HIV and papilloma virus derived virus like particles motivated by Professor Ed Rybicki and a study of the malaria parasite motivated by Professor Pete Smith and Dr Tim Egan. Dr Mary Phillips of the Wellcome Trust visited the Unit in December in order to interview the applicants as a group and explain the procedures to be followed.

THE ELECTRON MICROSCOPE UNIT TO OPEN A BRANCH IN THE INSTITUTE OF MOLECULAR MEDICINE

Negotiations with all interested parties at Medical School were held with a view to rationalizing the EM position on the Medical School Campus. After several meetings held under the chairmanship of Professor Lafras Steyn the report attached as Appendix A was produced. The plan is supported by Professor Azad. In essence this calls for the de-commissioning of the three Hitachi TEMs and their replacement by a good second hand instrument of modern design which will be housed in a well equipped unit in the proposed new building. It is proposed that the unit will be a branch of the EMU and staffed by a technical officer responsible to the Director of the EMU. Approaches were made to Professor Janse van Rensburg at Stellenbosch University Medical School concerning their willingness to part with their Philips CM12 instrument which they seldom use. They are willing to sell it but no price was agreed. The implementation of the plan would require funding for equipment and for one additional staff member.

RE-ORGANIZATION AND REFURBISHMENT OF SPACE WITHIN THE UNIT

A new room to house the light-microscopes was created by demolishing the partitions between two seldom used darkrooms. The whole light microscope operation was substantially upgraded by the purchase of a digital camera and the move of the inverted fluorescent microscope from Biochemistry to

the EMU. The space that was previously used to house the light microscopes was revamped to accommodate the JEOL 1200 EXII from London. The room previously used by Mr Williams was re-allocated to Mr Mark Berman. The communal computer area was re-carpeted and reorganized in order to house the Imaging Centre and the enquiries office was re-carpeted. The workshop was reorganized and repainted. The rectangular pin, British style plugs in the unit were replaced with regular South African ones. Most of the computer network was upgraded from coaxial cable to unshielded twisted pair cable. A new air conditioner was installed in the S440 room. A considerable accumulation of obsolete “junk” was discarded. Other planned rearrangements including the movement of the store to accommodate an enhanced cryo microscopy work area and the revamp of the central communal work area were not accomplished for various reasons and will be tackled at some future time.

MEETINGS OF THE ELECTRON MICROSCOPE UNIT ADVISORY BOARD

A meeting of the EMU Advisory Board was held on 6 June 2000. Those attending were Professor D. Reddy (Chairman), Professor L M Steyn, Associate Professors Linder, Rybicki, and B T Sewell, Dr C I Lang, Mrs E. Van der Merwe and Mr. D A Gerneke. The meeting approved the 1999 annual report and the strategic and operational plans for 2001-2003.

MAJOR EQUIPMENT PURCHASES IN 2000

A two processor Alpha UP2000 computer was purchased to support the image reconstruction and molecular modelling activities of the Unit. A Zeiss Axiocam digital camera, computer and accessories were purchased to support light microscopy. R20,000 of the purchase price was contributed from the research funds of Professor Peter Linder of the Botany Department. A diamond knife and anti-static line were purchased for cryo sectioning. A desktop computer was purchased for the use of Mr Mark Berman. An Epson flat bed scanner and 1 Mpixel camera were purchased to enhance the Imaging Centre. Components were purchased in order to build a forward scatter detector and “chamberscope” video system on the S200 but this project was not completed by year end.

USE OF THE UNIT

Services provided by the Unit during 2000 are listed in Table 1. Increased used was made of all key services of the Unit

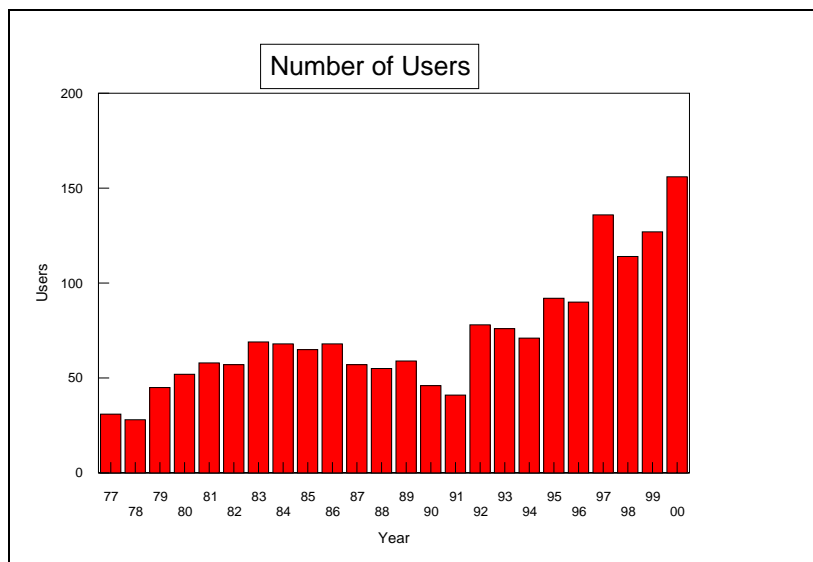


Figure1: Number of users of microscopy facilities per year since 1977.

One hundred and fifty six people made use of the microscopy services of the Electron Microscope Unit in 2000. In addition a further 31 users utilized services other than those related to microscopy notably the Imaging Centre and CD writing facilities. The Imaging Centre was heavily used by EM Users which may have forced non-users to seek facilities elsewhere.

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

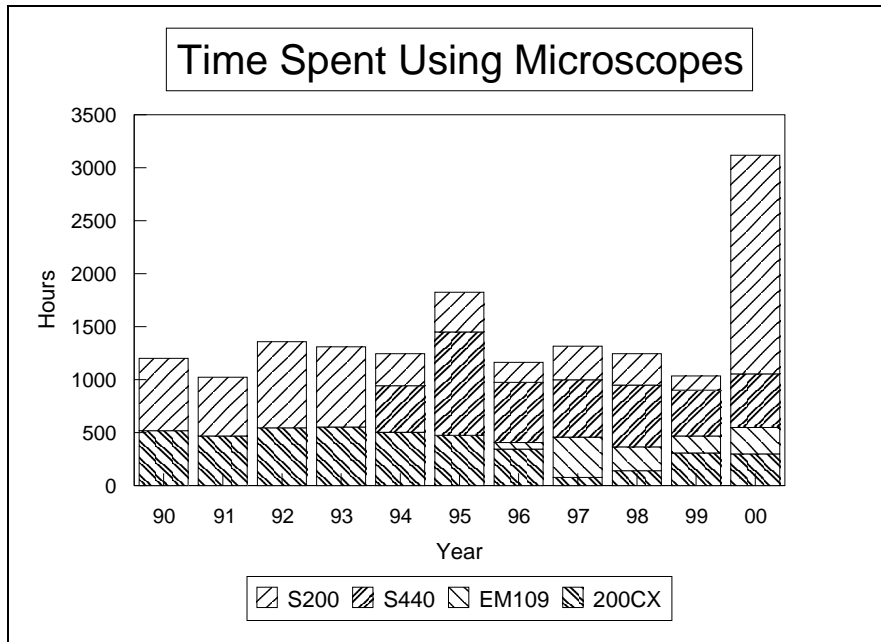


Figure 2: Time spent using the Unit’s microscopes since 1990.

Total time spent using the Unit’s microscopes was 3118 hours in 2000 which is the highest figure ever. The increased use is due to the installation of the EBSD apparatus on the S200. TEM usage rose by 17% from the 1999 figures. Since the majority of the S200 use is not comparable to that in previous years a similar statement cannot be made about overall SEM use.

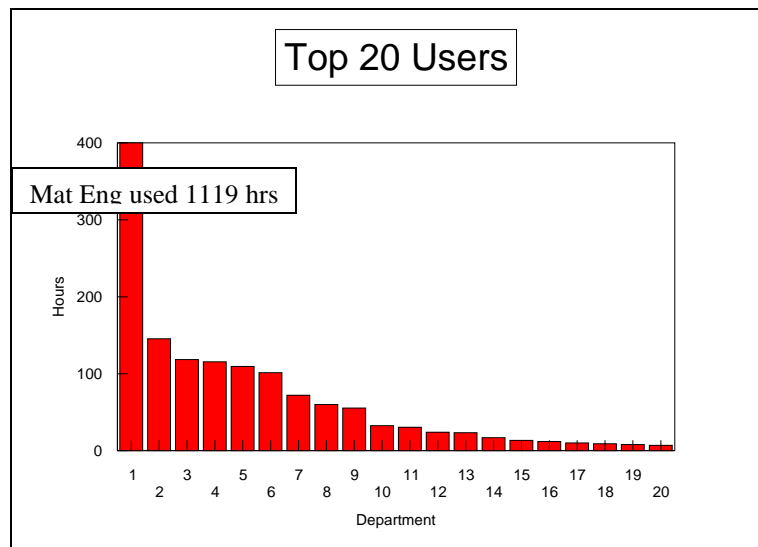


Figure 3: Microscope usage by department, institution or company

The key is as follows:

- | | | | |
|----|----------------------------|----|---------------------|
| 1 | Materials Engineering | 11 | Cape Heart Centre |
| 2 | Biochemistry | 12 | MCM |
| 3 | EMU | 13 | Botany |
| 4 | University of Stellenbosch | 14 | UWC |
| 5 | Geological Sciences | 15 | NBI |
| 6 | Microbiology | 16 | Cape Technikon |
| 7 | Medical Microbiology | 17 | Physics |
| 8 | Chemical Engineering | 18 | Swartklip Products |
| 9 | Liver Research | 19 | University of Sudan |
| 10 | Chemistry | 20 | Patterson and Cooke |

ELECTRON MICROSCOPES AND ASSOCIATED EQUIPMENT

LEO STEREOCAN S440

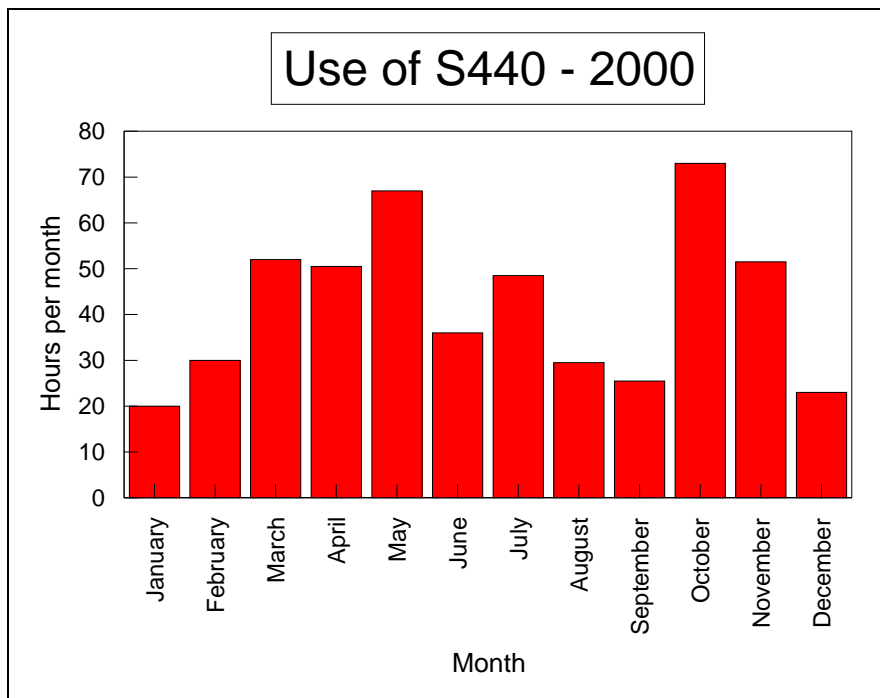


Figure 4: Use of the Leica S440 SEM

The S440 was used for a total of 506.5 hours which is 17% increase on the usage for 1999. Sixty one people from UCT made use of the instrument and there were 23 outside users. Use of this instrument remains the most popular service rendered by the Unit.

CAMBRIDGE S200 SEM

The S200 was used in total for 2063 hours, which is more than fifteen times its usage in 1999. The increased usage is due to the nature of the EBSD analyses, which involve overnight automated runs. Five people used the EBSD and four people, two of whom were not from UCT, used the instrument for secondary electron imaging. The instrument worked reliably. Permission was received from the Equipment Committee allowing the Unit to scrap the Kevex 7000 system which had not been used for three years and had to be dismantled in order to make way for the EBSD system. The Orion computerised image capture system worked well and has effectively replaced the need to record images on film.

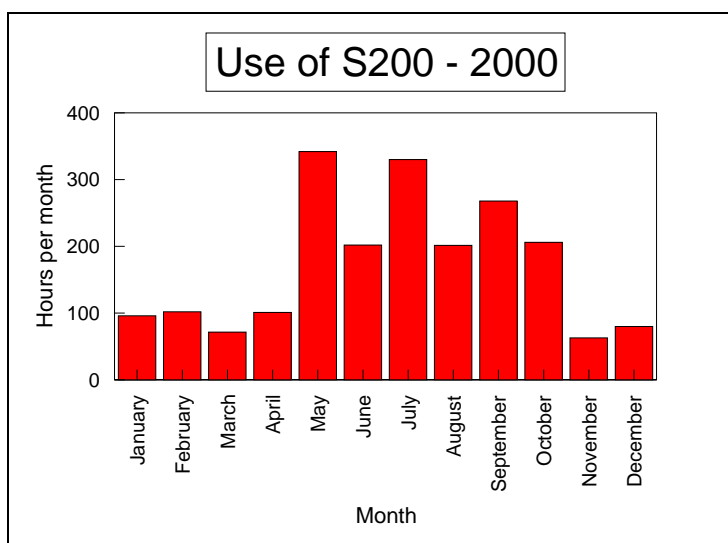


Figure 5: Use of the Cambridge S200 SEM

JEOL 200CX TEM

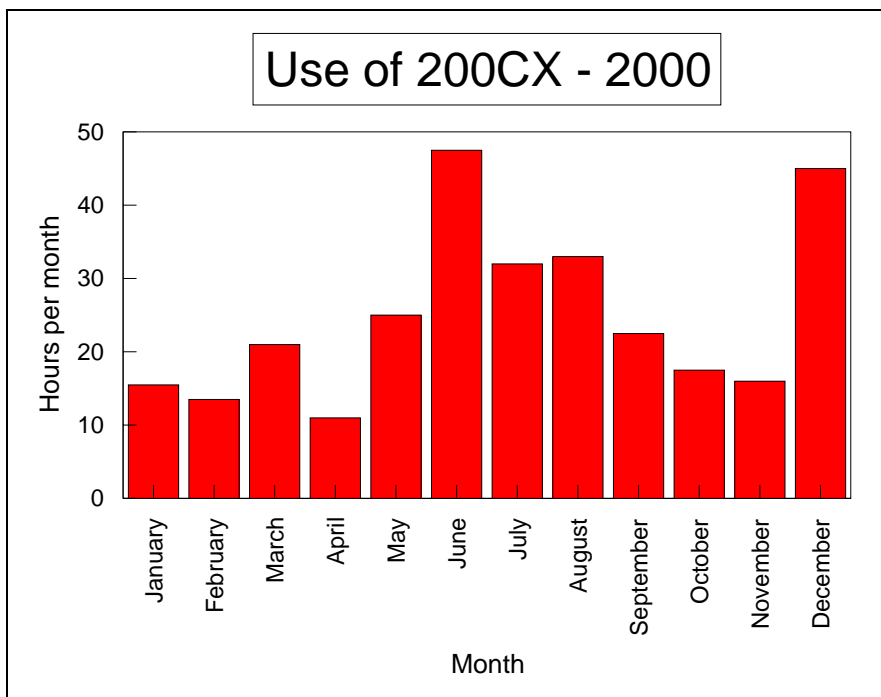


Figure 6: Use of the Jeol 200CX TEM

Use of the 200CX TEM rose to 309 hours from the very low figures of the previous two years. It was used by 28 people from UCT and 6 outside users. The instrument continues to operate as our prime TEM. Its reliability is severely compromised by its age and it is gradually failing at a number of points. In spite of this demand remains high. The fluorescent screen was replaced in 2000. An opportunity to replace the electron gun was missed when the Pretoria Technikon dismantled their 200CX and scrapped it before we were given a chance to remove parts from it. Continued expensive maintenance of this instrument will remain imperative until funds for a new TEM of at least equivalent capability are found.

ZEISS EM109 TEM

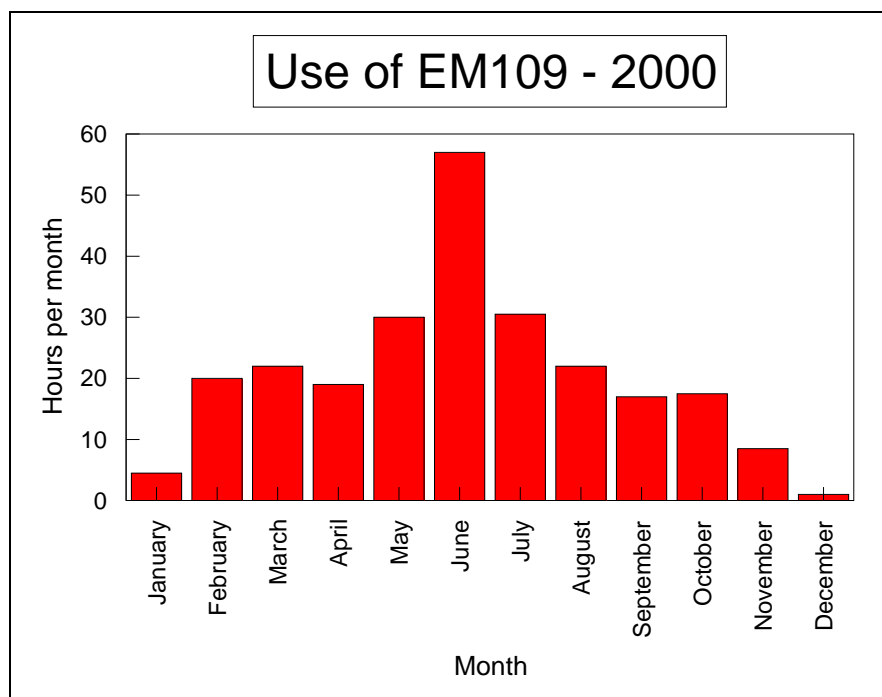


Figure 7: Use of the Zeiss EM109 TEM

Use of this instrument rose to 249 hours - a 50% increase on last year's low figure. It was used by 12 people from UCT and 3 outside users. Repairs to the instrument included the replacement of a corroded part in the water cooling circuit and the overhaul of the rotary pump. Two of the rotary pumps that are

currently in use in the Unit are nearly 30 years old and have become obsolete in the sense that spare parts are no longer available.

OTHER MAJOR EQUIPMENT

ULTRAMICROTOME

Use of the ultramicrotome was 213 hours which is a small increase on its use during 1999. The departments of Biochemistry, Medical Biochemistry, Medicine, Microbiology, Medical Microbiology and Chemical Engineering used the cryo-ultramicrotomy facilities.

LIGHT MICROSCOPY

The light microscope resources of the Unit were extended by movement of the Nikon inverted fluorescence microscope from the Biochemistry department. The primary purpose of the move was to allow users of this instrument to exploit the Zeiss Axiocam. The optical cathodoluminescence facilities were restored. A c-mount phototube was added to the Wild M400 photomicroscope to allow the Axiocam to be used with this instrument, primarily for the research needs of Professor Peter Linder, however this also had a significant impact on the study of diamonds by optical cathodoluminescence being carried out in the Geology department. The Unit's capability in light microscopy reached a level at which it can be offered as a viable service.

IMAGING CENTRE

The imaging centre was moved to its new location. The less cramped conditions enabled a higher throughput of work as well as the consolidation of all imaging and image analysis tools in one room. A flat bed scanner and 1 Mpixel digital camera were purchased to supplement the facilities. The video digitizing facilities are clearly obsolete and were only used by the Unit. The need for the Unit to offer shared facilities of this (low) quality has probably fallen away with the availability of state of the art facilities at the Montabello Design Centre.

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.

28.2.2000-2.3.2000	1 student each from Chemistry, Biochemistry and Botany
3.4.2000-7.4.2000	2 students from Pharmacology, and 1 student each from Virology and Botany
17.4.2000-20.4.2000	8 Honours students from Biochemistry

INDIVIDUAL TRAINING

Eight users from the departments of Botany, Chemical Engineering, Medical Microbiology and Microbiology were trained to operate the 200CX, six new users from the departments of Botany, Medical Microbiology, Microbiology and Pharmacology were trained to use the EM109, three students from Materials Engineering and Chemistry were trained to operate the S440 and six new users from the departments of Botany, Medicine and Microbiology were trained to operate the ultramicrotome.

SUPERVISION OF BIOCHEMISTRY HONOURS PROJECT WORK

Ms Christine Lee was supervised in her project "Purification and characterization of the NADH-dependent glutamate dehydrogenase of *Bacteroides fragilis*". She successfully processed her EM images of GDH and constructed a three dimensional model based on homology with existing structures.

STRUCTURAL BIOLOGY

Progress was made in working towards the proposed taught masters in structural biology. Syllabus proposals from David Pugh, Neil Ravescroft, Mike Lawrence, David McIntosh, Ed Sturrock, Horst Klump and Trevor Sewell were received. Kevin Naidoo, Klaus Koch and Win Hide have also agreed to participate in the course. Because of the low baseline from which we are starting in this area it will

initially be expensive to fund the resources necessary to run the course. No offers of financial support have been forthcoming. A letter of support for the course has been received from the Dean of Science at UWC. Professor Gevers has suggested that the course be launched as a component of the proposed Institute of Infectious Diseases and Molecular Medicine.

SCHOOL VISITS

Three A level learners from Wynberg High School visited on 27th January, four grade 12 learners from Harold Cressay visited on 7 February, four A level learners from Bishops visited on 9 June and eight grade 6 learners from SACS visited the Unit on 14 August.

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 2000:

Studies on otoliths

M.E. Waldron

Work on using banding in otoliths from mackerel (*Trachurus trachurus*) to determine the age of the fish was edited according to the referees suggestions and re-submitted for publication. Similar studies on hake otoliths done in collaboration with Theresa Akkers from the Marine and Coastal Management Institute were presented at the 10th South African Marine Science Symposium. Ms Margit Wihelm commenced her studies on anchovy otoliths, she will register for an MSc in Zoology at the beginning of 2001.

Studies of GroEL mutants

B.T. Sewell

Further 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 50 μ M ADP and of the E461K mutant in the presence of 250 μ M ATP were taken in London and the images were processed at UCT on our Alpha computer. Further modelling using Charmm was done in collaboration with Mr Robert Best on our Alpha computer and useful insights were obtained. I met with Professor Martin Karplus in Oxford and he gave us some helpful advice. Unfortunately the paper we planned has not yet been submitted for publication and it may take some time to co-ordinate the efforts of workers on three continents.

Structure of the nitrilase from Bacillus pumilus

M.N Berman, P. Meyer, B.T. Sewell

The nitrilase or cyanide dihydratase from *B. Pumilus* is a cyanide degrading enzyme of potential industrial significance. The purification procedure was improved. Maldi-tof analysis of the cleavage fragments of the enzyme was performed. Part of gene sequence was determined in collaboration with Dr Michael Benedik at the University of Houston. A three dimensional structure at 3nm resolution was determined by single particle analysis from negatively stained preparations. The work was presented at the MSSA technical forum in Grahamstown by Mr Berman.

Thorium impregnated lamp mantles

D.A. Gerneke

Factors influencing the longevity of mantles were investigated and presented at the MSSA technical forum by Dr C. Lang.

PUBLICATIONS

Publications, for 2000, that resulted from research in which the EM Unit staff have been directly involved are listed:-

Published Conference Proceedings

Sewell, B.T., Farr, G., Fenton, W.A., Horwich, A.L., Roseman, A.M., Chen, S., Ranson, N. and Saibil, H.R. 2000 The structural basis of a temperature sensitive mutation in chaperonin GroEL. Proceedings of the Electron Microscopy Society of Southern Africa 30:51

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.

Farrant, J.M. (2000). Comparison of mechanisms of desiccation tolerance among three angiosperm resurrection plants. *Plant Ecology* 151 29-39.

Koonjul, P.K., Farrant, J.M., Brandt, W.F. and Lindsey, G.G. (2000). Isolation and characterisation of chloroplasts from *Myrothamnus flabellifolius* Welw. *Journal of Plant Physiology* 156, 584-594

Lang C, Sordelet D. J., Besser M. F, Shechtman D, Biancaniello F.S., Gonzalez E.J. (2000) Quasi crystalline coatings: Thermal evolution of structure and properties. *J.Material Research* v15:9 1-11

Lewis A.E. and Hugo A (2000), Characterization and batch testing of a secondary lead slag. *Journal of the South African Institute of Mining and Metallurgy* 855:1-6

Mundree, S.G. and Farrant, J.M. (2000). 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). 201-222.

Ronse Decraene, L.P., Linder, H.P. & Smets, E.F.(2000), The questionable relationship of *Montinia* (Caryophyllaceae): evidence from a floral ontogenetic and anatomical study. *American Journal of Botany* 87:1408-1424.

Sales, K., Brandt, W.F., Rumbak, E. & Lindsey G.G. (2000), The LEA-like protein HSP 12 in *Saccharomyces cerevisiae* has a plasma membrane location and protects membranes against desiccation and ethanol induced stress *Biochim. Biophys. Acta.* 1463, 267-278.

M.Sc Theses

Centurier-Harris, Jonathan, Chemical Engineering: Studies in the crystallisation behaviour of Potassium Nitrate crystals.

Dlamini, Titus, Botany: Systematic studies in the genus *Melianthus* L. (Melianthaceae)

Johnson, Shelley, Zoology: Pollen digestion in flower-feeding Scarabaeidae: Protea beetles (Cetoniini) and monkey beetles (Hopliini).

Mange, Siyabonga, Materials Engineering: Structure - property relationships in poly-(propylene-ethylene) copolymers.

Morley, Terry, Botany: Phenology and growth in culture of the carrageenophytes *sarcotalia scutellata* and *grateloupia filicina*.

Nelwamondo, Azwainewi, Botany: Assimilation of silicate affects plant growth and symbiotic functioning in nodulated cowpea (*Vigna unguiculata* L Walp)

Newton, Rosemary, Botany: An investigation into seed germination requirements of some of the nut-fruited restionaceae.

Ruck, Kevin, Zoology: A new sabellid that infests the shells of molluscs and its implications for abalone mariculture

Sales, Kurt, Biochemistry: The location and putative functional role of a lea-like protein (HSP 12) in yeast.

Scott, Adam, Materials Engineering: Precipitation and fracture in a ferritic stainless steel.

Schwegmann, Anita, Biochemistry: Identification of proteins that interact with brain factor-1 and characterization of these interactions.

Westerlund, Kalle, Geology: A geochemical study of diamonds, diamond inclusion minerals and other mantle minerals from the Klipspringer Kimberlites, South Africa

PhD Theses

Basson, Janet, Materials Engineering: Precipitation reactions in a Cr-Mn-N austenitic steel with niobium and vanadium additions.

Joel, David, Medical Biochemistry: Identification and characterisation of proteases in mycobacterium tuberculosis

Govin, Vandanna, UWC Microbiology: The Molecular identification and characterization of honey bee viruses.

Koonjul, Kumari, Biochemistry: Investigating the mechanisms of desiccation tolerance in the resurrection plant, *Myrothamnus flabellifolius* (welw.).

FINANCE

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

OTHER MATTERS

Mr DANE GERNEKE RESIGNED

The Unit's well respected principal technical officer, Mr Dane Gerneke, resigned at the end of October after 20 years' service. Permission to re-advertise this post at the level of chief technical officer was granted and the advertisements were placed in early December.

STUDY AND CONTACT LEAVE

Professor Sewell took leave from 3-20 February, 19 June -1 July and 10-12 July and 11-23 December in order to further his collaboration with Professor Saibil at Birkbeck college London. The primary purpose of the December trip was to assist in the dismantling and packing of the JEOL 1200 EXII prior to its shipping to Cape Town.

CRYOMICROSCOPY COURSE

Mrs Waldron attended a cryo-SEM course presented by Dr Patrick Echlin from Cambridge University which was held at the University of Natal, Pietermaritzburg from 1-3 December 2000.

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 2000 were BEC, Cambridge University Press, Cape Residual Stress, Filke Gold Chains, Patterson and Cooke, Fine Chemical Corporation, National Accelerator Centre, National Botanical Institute, Meerlust Wine Estate, Mountain and Ski Club, Nampak, SA Nylon Spinners, SA Metals, SA Museum, Sasol Mining Initiations, Saldanha Steel, Somchem, Marine and Coastal Management Institute and Warner Lambert.

MICROSCOPY SOCIETY OF SOUTHERN AFRICA CONFERENCE 2000

The 39th Annual Meeting of the MSSA was held at the Rhodes University from 1-4 December 2000. Prof Sewell and Mr Berman attended.

VISITORS TO THE UNIT

Professor Sir Tom Blundell from the Department of Biochemistry at Cambridge visited the Unit on 28th July and met with Mairi Kilkenny, Mark Berman, Val Abratt and Christine Lee to discuss their projects and possible studentships in Cambridge. Dr Chantal de Chastellier from Hôpital Necker, Paris spent considerable time working in the Unit during the six months she spent in collaboration with Dr Lutz Thilo - she introduced the Unit to TEM autoradiography. Dr Mary Phillips of the Wellcome Trust visited the Unit on 1st December in order to brief the applicants for the EM on the procedures to be followed.

SUMMARY

2000 was a year of considerable re-organization in the EM Unit. Building works were undertaken to create additional space, light microscopy was consolidated, SEM utilization was radically altered, a major computer was purchased to support image processing and staff duties were reassigned following the unexpected resignation of Mr Dane Gerneke. The Unit has emerged stronger and better focussed.

Prepared by: Associate Professor B.T. Sewell

Director

29 May 2001

TABLE 1
Services Offered by the Unit during 1999

Service	Comment
Access to 200CX TEM	Used by 34 people
Access to S440 SEM	Used by 84 people
Access to S200 SEM	Used by 9 people
Access to the EM109 TEM	Used by 21 people
Training on 200CX	8 users were trained
Training on S440 SEM	Three new users were trained
Training on S200	Four new users were trained
Training on the EM109 TEM	Used in courses. 6 users individually trained
Access to Ultracut S Ultramicrotome	Used by 26 people
Training on Ultracut S	6 new users were trained
Cryo-microtomy and immunolabelling	Used by 9 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
User 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.
Access to Image Processing and Analysis (Visilog)	Used
Element analysis by EDS	Well used.
"Introduction to EM for Biologists"	This course was held three times.
Access to specimen polisher	Well used
Access to high vacuum coating plant and accessories	Adequately used
Store of EM consumables	Used by most users
Access to prep lab	Well used
Collection of books and journals on microscopy	Used
Vacuum Leak Detection	Not used
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
Dye sublimation printer	Used
High quality ink-jet printer	Well used

TABLE 2
Equipment Expenditure

Income	Amount
Budgetry Allocation	203,458.00
EMU Maintenance Account	5,204.00
EMU External Services Account	46,602.00
Total	255,264.00
Equipment Expenditure	
S200	
Forward Scatter Detector	5,846.00
Camera for "chamberscope"	1,561.00
Light Microscopy	
Zeiss Axiocam Digital Camera	68,299.00
Software	4,435.00
C-mount adapters	17,168.00
Lab equipment	
Diamond knife + static line	20,026.00
Computers	
Alpha UP2000	100,500.00
Two Desktop Computers + upgrades	27,698.00
Epson + Digital Camera	4,598.00
200CX	
Fluorescent Screen	5,204.00
Total	255,264.00

TABLE 3

External Services: Fund 001258

Note: This table is inconsistent with the one in the 1999 annual report - it appears as if the centrifuge has been paid for twice in fact it was paid for in 2000 and the figures here are consistent with the current SAP database.

Income	
Opening Balance	156,984.87
Sales revenue	22,259.97
Fund Transfer from Materials Engineering	54,401.00
Total	233,645.84
Expenditure	
Operating Expenses	15,642.05
Postage/Fax/phones	1,229.21
Travel	2,607.65
Transfer	-1,793.97
Asset Aquisition	86,839.00
Diamond Knife and anti-static line	20,026.00
Centrifuge	39,115.00
Computers	27,698.00
Total	104,523.94
Closing Balance 2000	129,121.86

TABLE 4
Departmental Grant: Fund 000516

Carried over from 1999 (unpaid bills)	5,864.86
Annual Grant	75,270.00
Total	81,134.86
Computer software	13,200.76
Conference expenses	1,593.51
Operating expenses	18,791.99
Periodicals	1,669.20
Postage	10,848.59
Photocopying	820.30
Stationery	1,788.77
General expenses	-9,392.50
Cleaning	315.78
Repairs & Maintenance	17,715.59
Utilities	8,420.82
Travel	5,736.11
Other costs	36.00
Asset acquisitions	9,589.94
Total	81,134.86

TABLE 5
Consumables Store: Fund 000933

Income	
Opening Balance	29,651.01
Internal recoveries	47,244.55
Total	76,895.56
Expenditure	
Computer Consumables	14,213.00
Consumables	23,675.75
Stationery	1,062.69
Repairs & maintenance	713.98
Floats	2,925.24
Total	42,590.66
Closing Balance 2000	34,304.90

TABLE 6
Maintenance: Fund 000995

Income	
Opening Balance	25,225.99
Internal Recoveries	33,093.00
Total	58,318.99
Expenditure	
Computer Software	2,354.85
Operating Expenses	3,769.77
Postage	2,568.34
Stationery	
Cleaning	
Non Cap Equipment	3,600.00
Repairs & Maintenance	23,730.95
Utilities	287.07
Fixed Assets	3,613.90
Total	39,924.88
Closing Balance 2000	18,394.11

TABLE 7

Users of the Unit
* indicates Microscope users

Adamastor Trust	Darch, Colin	Staff*
Anatomical Pathology	Schneider, J	Staff*
	Saldrin, Ryan	Staff*
Archaeology	Matthews, Thalassa	PhD
	Miller, Duncan	Staff*
	Reid, D	Staff
	Smuts, K	MSc*
	Worth, David	Staff
Architecture	Dick, Nadia	BA
	Govender, Thireshen	BA
	Ndungu, Kenneth	BA
	Sidebottom, Catherine	BA
	Stipinovich, Nadia	BA
Biochemistry	Denby, Katherine	Staff*
	Illing, N	Staff*
	Lee, C	PhD*
	Lindsay, G	Staff*
	Logan, Carol	MSc
	O’Ryan, C	MSc*
	Precious	MSc*
	Stuart, Katherine	PhD*
	Whittaker, Anne	Staff*
Botany	Anderson, B	MSc*
	Bartsche, Silke	Hons*
	Cooper, Keren	MSc*
	De Villiers, Sue	Staff*
	De Clerk	Staff
	Farrant, Jill.	Staff*
	Klak, Cornelia	MSc*
	Linder, Peter,	Staff*
	McGuire, Vicky	MSc*
	Munro, Sioban	PhD
	Newton, Rose	Staff*
	Iyer, KR	MSc*
	Skowno, A	Hons
	Vander Willigen, Clare	PhD*
	Vicre, Maite	PhD*
BEC	Lehman, Marcus	Staff*
Cambridge University Press	Field, Martin	Staff
Cape residual Stress	Emslie, Craig	Staff*
Cape Technikon, Dept Chem Eng	Pender, Tom	Staff*
	Soloman, Marshal	Staff*
	Walsh, Gemma	Mtech*
Cape Heart Centre	Davies, Neil	Staff*
	Han, Richard	MSc*
	Millam, Ross	Staff*

	Samodien, Nazlia	Staff*	
Centre for African Studies	Morrow, Sean	Staff	
Chemistry	Allie, Shameez		MSc*
	Craig, Tracey	PhD*	
	Durrbaum, Dawn	PhD*	
	Egan, Tim	Staff*	
	Mavuso, Winile	PhD*	
	Nassimbeni, Luigi	Staff*	
	Rogers, Alan	Staff*	
Chemical Engineering	Brack, Brian	PhD*	
	Butler, Bronwen	Staff*	
	Crickmore, D	MSc*	
	Guilland, D	Msc*	
	Harris, J	MSc*	
	Jaffer, Ashraf	MSc*	
	Jeenaralnam, Elizabeth	MSc*	
	Kammurtsi, Kenneth	Hons*	
	Lewandowski, Sonja	MSc*	
	Moon, G	PhD*	
	Moon, J	PhD*	
	Pillay, Kriveshini	MSc*	
	Tshwalu, M	MSc*	
Child Health Unit	Van der Ven, Nelke	MEng*	
	Engelbrecht, Beth	Staff	
	Mvanoaba, Nomso	Hons	
Civil Engineering	Machechnie, J	MSc	
	Mavunda, Terrence	Hons*	
	Morgan, Barak	MSc*	
	Ronne, Philip	MSc*	
Drama	Newmarch, Jocelyn		BA
Fine Arts	Els, Hannelie	BA	
	Garstang, Emma	Hons	
	Matthews, T	PhD	
Filke Gold Chains	Van Essen, Konrad	Staff*	
Fine Chemical Corporation	Jacobs, Pauline	Staff*	
Geological Sciences	Bailie, Russel	PhD*	
	Board, Warwick	PhD*	
	Compton, John	Staff*	
	Giuliana, Franceshini	PhD*	
	McKenna, Neil	MSc*	
	Minter, Laurie	Staff*	
	Moritz, Jana	MSc*	
	Ngu, Muy	MSc*	
	Tredoux, M	Staff*	
	Ulansky, Chad	MSc*	
	Westerlund, Kalle	PhD*	
	Whitehead, K	Hons*	
Liver Research Centre	Burch, Vanessa	PhD*	
	Kirsch, Richard	PhD*	
	Siziba, Kwanele	PhD*	
Materials Engineering	Basson Janet.	Staff*	
	Burger, Victor,	MSc*	
	Knutsen, Rob	Staff*	

	Lang, Candy	Staff*
	Loedolff, A	Staff*
	Matthews, Ryan	PhD*
	Noyane, Beau	BSc*
	Nzula, Miemie	PhD*
	Scott, Adam	MSc*
	Sheen, Martin	MSc*
	Topic, Mira.	PhD*
Mathematics	Bruyns, Peter.	Staff*
MCM	Akkers, Theresa	Staff*
	Botha, Lizeth	MSc*
	Lipinski, Marek	Staff*
Mechanical Engineering	Govender, I	MSc
Medical Biochemistry	De Chasteller, Chantelle	PhD*
Medical Microbiology	Johnston, J	
	Turner, K	
	Tiedt, Fritz	Staff*
Meerlust	Dalla, Goirgio	Staff*
Microbiology	Arbuthnot, Kate	Hons*
	Bandwe, Gama	Hons*
	Berman, Mark	PhD*
	Caroline, Melanie	Hons*
	Doeschate, Kim	PhD*
	Hogg, J	
	Jaffray, Anne	Staff*
	Koonjul, Priyum	MSc*
	Martin, Darren	PhD*
	Matiru, Vivienne	MSc*
	Meyers, Paul	Staff*
	Mpoloka, Wata	MSc*
	Mundree, Saga	Staff*
	Rybiki, Ed.	Staff*
	Schoeder, Declan	PhD*
	Ndim, Thozama	MSc*
	Pius, Kuriam	Staff*
Mountain and Ski Club	Newmarch, J	Staff
Multimedia	Davies, C	Staff
	Loopuyt, M	Staff
	Walton, Marion	Staff
	Wilson, Fiona	Staff
Nampak	Kerr, Roger,	Staff*
	Kieswetter, Griff	Staff*
NBI	Kurzweil, Hubert	Staff*
Oceanography	Bernard, Stuart	Staff
	Waldron, Howard	Staff
Patterson and Cooke	Van Sittert, Fritz	Staff*
Pharmacolgy	Walden, Jason	MSc*
Physics	Comrie, C	Staff*
	Driver, Steve	Staff*
	Hempel, Angela	Staff*
	Hempel Maren	Staff*
Plascon	Smit, Bertus	Staff*
Private	Beerstecher, J*	

Sasol Mining Initiations	Glen, Oliver	Staff*
Saldanha Steel	Beaton, T	Staff*
S.A. Museum	Henshilwood, Chris	Staff
	Reeb, Desray	PhD*
SANS Fibers	Eunice, G	Staff*
	Govender, Desisan	Staff*
	McIntyre, Billy	Staff*
Somchem	Rupert, Max	Staff*
Swartklip Products	Moolman, J	Staff*
University of Kampala	D'ujanga, Florence	PhD*
University of Sudan	Alallah, Abuzied	PhD*
University of Stellenbosch		
Chemical Engineering	Keuler, Johan	PhD*
Dentistry	Chickte, Usuf	PhD*
	Thompson, Ivan	Staff*
	Van der Ven	Staff*
Inst. Polymer Science	Faul, Charl	Staff*
	Hoogesteger, Bram	MSc*
	Michaels, Wynoma	MSc*
	Opperman, Willie	PhD*
	Schneider, J	MSc*
	Van Zyl, Andre	MSc*
Geology	Belcher, Richard	MSc*
	Henning, Esme	MSc*
	Kirsters, Alex	Staff*
	Philander, Carlos	MSc*
	Smit, Riana	PhD*
Zoology	Mark Cooper	PhD*
UWC		
Chemistry	Petrik, Leslie	Staff*
Microbiology	Govin, Vandanna	MSc*
	Huna, Thembela	MSc*
Virology	Kohl, Thomas	MSc*
	Versani, Arvind	PhD*
Warner Lambert	Adams, M	Staff*
	Miller, B	Staff*
Zoology	Griffiths, Charles	Staff*
	Hausam, Bilke	PhD*
	Jarvis, Jenny	Staff
	Johnson, Shelley	MSc*
	Wilhelm, Margit	MSc*

Total: 187

Total Microscope Users: 156

APPENDIX A

MOTIVATION FOR THE INCLUSION OF AN ELECTRON MICROSCOPE SUITE AS A CORE FACILITY OF THE MOLECULAR HEALTH SCIENCE INSTITUTE.

Background:

Representatives from the various departments housing electron microscopes at the Medical School Campus have had a number of meetings under the Chairmanship of Prof Lafras Steyn, where we have discussed the feasibility of including a core EM facility in the new Molecular Health Science Institute. As a viable EM facility already exists on upper campus, Prof Trevor Sewell, Director of the EM Unit, UCT was included in these discussions as any proposed core EM facility may best be served under a common administration. Presently on this campus there are five transmission electron microscopes (TEMs), one scanning electron microscope and one TEM in the Dept Paediatric Pathology, Red Cross Children's Hospital. The departments of Anatomical Pathology, Medical Microbiology and Anatomy and Cell Biology each house Hitachi H600 TEMs (purchased in 1982, 1983 and 1986 respectively). Cardiovascular Research Unit has a Philips 420 and Jeol TEMs as well as a Jeol Scanning electron microscope, and there is a Philips 210c is stationed at the Child Health Institute, Red Cross Children's Hospital. The present ownership of these microscopes are PAWC – (Anatomical Pathology and Paediatric Pathology), UCT (Anatomy and Cell Biology), the SAIMR (Dept Medical Microbiology) and Cardiovascular Research Unit (Private funding). The ages of these microscopes range from 14 to 18 years and it has become increasingly difficult to maintain most of them due to budget constraints and declining availability of service and of replaceable components. At present two Hitachi H600 TEMs are not fully functional and as Hitachi is no longer represented in South Africa, considerable difficulty has been experienced in obtaining spare parts. It has also long been apparent that running a large number of electron microscopes outside the EMU infrastructure has considerable disadvantages. Individual departments have neither the staff who have received the advanced technical/electronic support training that is required for “diagnostics” of faults in the microscopes nor the in house expertise to repair them.

Establishment of TEM requirements:

The needs and use of EM at Medical School falls essentially into two categories: laboratory based research projects and diagnostic EM. Access to the TEM for examination of resin-embedded material of research based projects can be planned well in advance and some delay in viewing would not be critical. In contrast, diagnostic EM is requested at short notice and would therefore have a certain level of urgency for access to the microscope within a few hours or generally by the next day. Of great concern to the pathologists is the threat of reduced financial support by PAWC, as there is presently little funding/no funding for general maintenance of their microscopes. Furthermore there has been no firm commitment from PAWC to finance either the maintenance of, or the purchase of new microscopes in the future. Of further concern to the diagnostic arena is the dissolution /integration /amalgamation of PAWC and the SAIMR into the NHLS and the uncertainty of their intentions to provide an infrastructure for (or substantially fund) a sophisticated tertiary level service such as in house diagnostic EM.

Motivation for on site TEM facilities:

A perceived problem at UCT is the geographical separation of the Medical School and “upper campus” by a distance of 2 km on opposite sides of a busy and often congested highway with an extremely dangerous on ramp. Due to additional non-EM diagnostic deadlines governed by time constraints, pathologists cannot regularly accommodate an extra 30 – 45 minutes to get to and back from the EM facility on upper campus. Likewise, due to numerous teaching/supervisory/other laboratory commitments of supervisors and technical assistants involved in laboratory-based EM projects, quick access to and from the EM facility is also required. Furthermore, electron microscopy is in most cases one component of the research or diagnostic service and preparation and sectioning of tissues are labor-intensive. Because of the recent policy of the University and PAWC to “right size” posts or not replace vacant posts with new staff members, technical

assistants and medical technologists are forced to multitask and run other procedures such as gels, staining incubations etc. in parallel. This would also be true of students doing EM-based aspects of their projects. If one wishes to sustain an interest in EM-based investigations, an on site facility with quick access to and from their home laboratories would thus be essential. The success of EM-based projects in Medical Microbiology has been attributed to the fact that there has been an electron microscope on site and “wet” specimens (which deteriorate if stored longer than 1-2 hours) could be prepared safely (within the context of bio-containment) and examined almost immediately. The EM studies done by the Cardiovascular Research Unit is subjected to regular deadlines for submission of progress reports to their funding bodies.

The above usage and perceived time constraints support the need for supported TEM facilities on the Medical School campus and this warrants consideration of space being made available within the newly established core facility of the Institute of Molecular Medicine/Health Sciences.

Management of the new Core facility.

It was agreed in principle that it was not cost effective or feasible to attempt to maintain all the electron microscopes on this campus. The provision of a Core EM facility on this campus would only be viable if future projects and EM usage was sustainable. In this regard all researchers and Pathologists using EM were asked to submit the past usage of TEM and their intended future needs. Based on these submissions, the pooled average time of TEM usage by all users on Medical School campus (including Paediatric Path, RXH) totalled 994 hours per annum (approximately 4 hours per day for a 5 day week). TEM usage by the Cardiovascular Research Unit accounted for approximately 48% of this time, the remaining time was generally accounted for by the two Pathology Divisions. A summary of future projects and Pathology EM requirements is available on request. Based on the past usage and future project proposals, the need and financial support for at least one TEM on site can be justified. It was also agreed that, as and when microscopes were shut down permanently, the remaining functional microscopes would be accessible to all TEM users. This would be an acceptable short to medium term solution until a core EM facility was established.

It was also agreed that the core EM facility at Medical School be incorporated as a satellite facility of the Electron Microscope Unit (on upper campus) which will be responsible for its administration and maintenance. It is therefore proposed that the EMU operate two branches, one at each location. Space should therefore be made available within the newly established core facility to house a component of the EMU on the Medical School site. The EMU will manage the microscopes at both locations with the aim of providing users at both locations with their primary needs (i.e. equipment for tissue preparation, sectioning and microscopy) but maintaining a unified structure that will ensure easy access by users to resources at the other site. As interest in structural work develops at the Medical School site, improvements would be made in order to serve the needs of the users located on that site. It is strongly recommended that academic and technical representation be appointed to the Medical School campus. This is to adequately maintain the day to day management as well as liaise with EM users and researchers in providing academic expertise in establishing EM-based research. Furthermore, technical expertise/know how in tissue preparation and instruction of microscope operation can be more effectively transferred to the users. The concept is that the entire EMU will be an integral part of the IMM and that the branch in the core facility will act as conduit to the initially superior facilities on upper campus.

Equipping the Core Image Facility:

Given the uncertainty of the EM support by the changes to PAWC, SAIMR and the forming of the NHLS, we have investigated a number of relatively inexpensive options that will satisfy the needs of both the diagnostic and laboratory-based research users at the Medical School campus. We have are presently investigating the intentions of NHLS and are in the process of drawing up a proposal to them that the usage of EM facility on this campus by the pathologists could provide an affordable and cost effective service. In

this regard, the relationship between the University and the NHLS regarding the ownership of microscopes and paying for the cost of patient diagnosis still needs to be quantified and clarified.

The three Hitachi microscopes that are currently at Medical School are old (two were purchased in 1982/83) and one of them is in very poor condition (the one purchased in 1986). Bearing in mind that support from Hitachi is extremely difficult to come by in South Africa, it is necessary to be very cautious about basing any long-term plans on these instruments. However, - they do work and given sufficient budget and care they can be kept working at the added cost of decreasing availability. As mentioned above, the short to medium term solution is to make available to all EM users any functioning microscopes on Medical School campus. This will provide the diagnostic service with one machine permanently at their disposal and another in the vicinity that they can use in times of breakdown. Until such time as the new building is completed, we propose that for at least the next year, access to microscopes is provided on an ad hoc basis with whatever machines are functioning and available.

We have identified that Philips CM12 TEM at virology, Stellenbosch University Medical School that was bought in 1987, is the newest instrument in the Western Cape and will become the property of NHLS. It is not currently being used by Virology and Prof van Rensburg has indicated that she will part with it but she has estimated its worth at R1m. She will however take any proposal forward. A more realistic valuation of this instrument by the suppliers is in the region of R109 000. As this instrument cannot be maintained due to lack of funding by PAWC, and has little or no use at its present location, it is our intention to negotiate to purchase it for R109 000 over the following months and if successful, to house it in the MMI building. In this event, we could get at least 5 years of substantial use from this machine before motivating for a replacement. If we are not successful in our bid for the CM12, then we propose that the Hitachi H600, presently located in the Dept Medical Microbiology, be relocated to the new site. In this case it would be necessary to apply for funding for a new microscope within 2 years. The Hitachi housed in Dept Anatomy and Cell Biology can be scrapped.

In addition to space allocation for at least one electron microscope, the core facility would also require space for the preparation of tissues, sectioning and for photography. Other instrumentation required in the core facility would include a programmable tissue processor, ultramicrotome, glass knife-maker and dark room equipment. Ultramicrotomes and glass knife makers and dark room equipment are presently located in Dept Anatomy and Cell Biology, and Anatomical Pathology and could be relocated in the new building. Funding for a programmable tissue processor would have to be applied for.