ELECTRON MICROSCOPE UNIT

ANNUAL REPORT

2007

Permanent Staff

Director **B.T. Sewell**
Principal Technical Officer (Part Time) **J. Duncan**
Chief Technical Officer **M. Jaffer**
Chief Scientific Officer **B.Weber**
Chief Technical Officer **M. Waldron**
Technical Assistant **S. Karriem**

Temporary Staff

Lecturer in Structural Biology **A Varsani**
Computer manager **R Austin**
Web Programmer **A Gillespie**

HIGHLIGHTS OF 2007

THE ACQUISITION OF A 200 kV FIELD EMISSION TRANSMISSION ELECTRON MICROSCOPE

The replacement of the JEOL 200CX instrument purchased in 1980 has been a subject of discussion since 1992. Several applications for the purchase of a new instrument were made during the time preceding 2006. All were unsuccessful but they enabled us to develop the case for the new instrument. An opportunity arose in 2006 to acquire the four year old FEI F20 owned by the Laboratory of Molecular

Biology at the Medical Research Council, Cambridge UK for GBP100,000. FEI F20's are popular workhorse instruments that have successfully been used in both Biological and Materials sciences. FEI agreed to translocate the instrument under guarantee for EUR109k. Our application to the NEP - based entirely on the Structural Biology needs - succeeded in raising R1.6M. Additional money (R200k) was raised from the DST and from the residual money remaining in the Carnegie Corporation grant with their approval. The installation of the instrument did not begin at UCT until October 2007 as considerable delays were experienced by the MRC in obtaining a replacement instrument. The installation was completed in mid-December. As it stands the instrument is a baseline cryo FEGTEM equipped with a focussing camera and two (very old) cryo stages. In due course it will be necessary to purchase a CCD camera, new cryo stages, stages for materials applications and a software upgrade.

REFURBISHMENT OF ROOM 228

Room 228 was refurbished before the Tecnai F20 TEM was installed. The old Jeol 200CX was removed and scrapped, wooden partitions were removed, the room was repainted, a new floor laid and new air conditioning installed. Acoustic tiles were fixed on the walls to dampen the sound and vibrations of the vacuum pumps and a new power supply was installed. Acoustic curtains were hung to channel the airflow in accordance with the manufacturer's specifications.

CONCLUSION OF THE CARNEGIE GRANT

The grant for the extremely successful, Joint UCT/UWC masters programme in structural biology came to an end in October 2007. The programme which produced sixteen graduates with a further two expected to graduate in 2008 established structural biology in South Africa and has dramatically raised the bar for biological electron microscopy. A full report on the programme is attached.

USER MEETINGS

The series of user meetings initiated in 2006 continued throughout 2007: A user is invited to present their work which is then discussed by the other users present and the EM staff. The focus is on discussion which will enable the Unit staff the understand the needs of the user and the user to understand how best to use the capabilities of the Unit to solve their problems. Sixteen meetings were held in 2007 and a register of attendance is maintained.

MEETINGS OF THE ELECTRON MICROSCOPE UNIT ADVISORY BOARD

A meeting of the EMU Committee was held on 13 August 2007. The meeting was attended by Prof. de La Rey, Prof. Tait, A/Prof. Sewell, Prof. Kidson, A/Prof. Claeys, A/Prof. Knutsen with Mrs. McBride and Mrs. Windvogel in attendance. The committee discussed and approved the 2006 annual report and discussed some strategic issues. Time did not allow for a discussion of the operational plan or the budget.

MAJOR EQUIPMENT PURCHASES IN 2007

Tecnai F20 FEG TEM

Edwards Film Degassers (~~x2~~x2)

2x Protection tip and vacuum sleeves for Gatan cryoholders

Fax machine

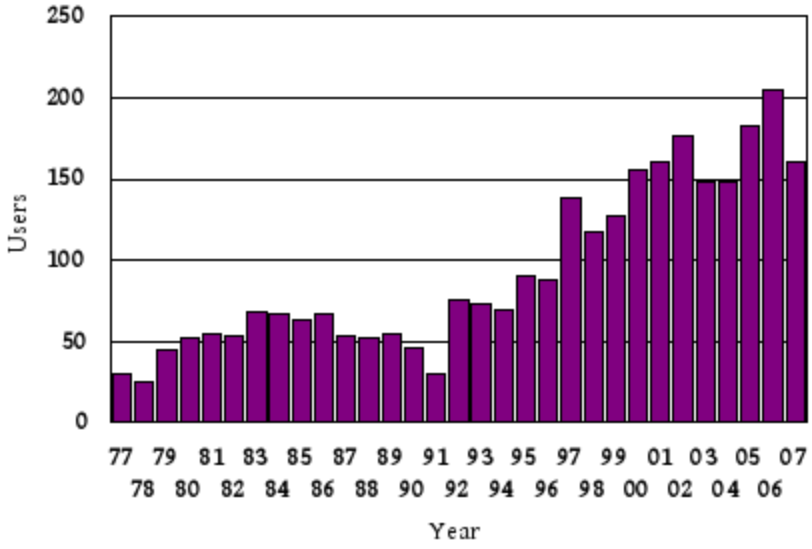
Target for Sputter coater

UPS's for all computers

USE OF THE UNIT

Services provided by the Unit during 2007 are listed in Table 1. Frequent usage was made of all key

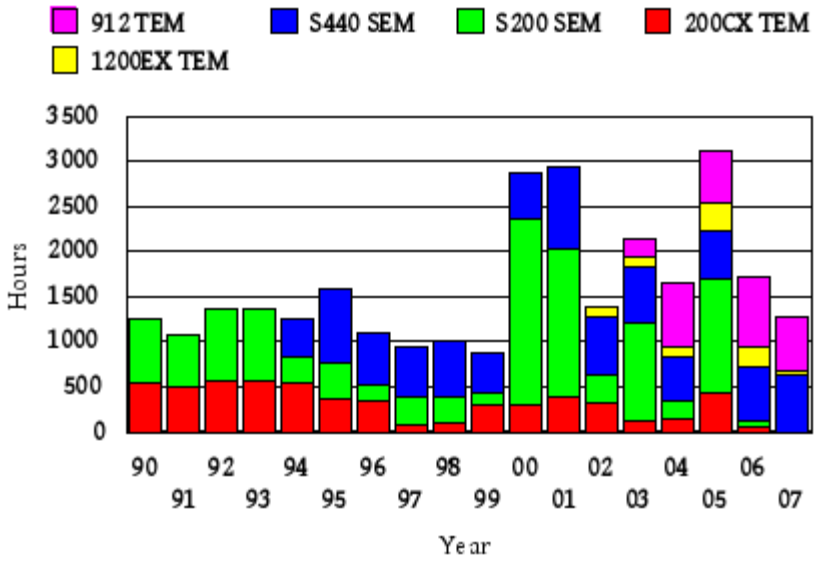
Fig.1 Number of users per year 1977-2007



services of the Unit.

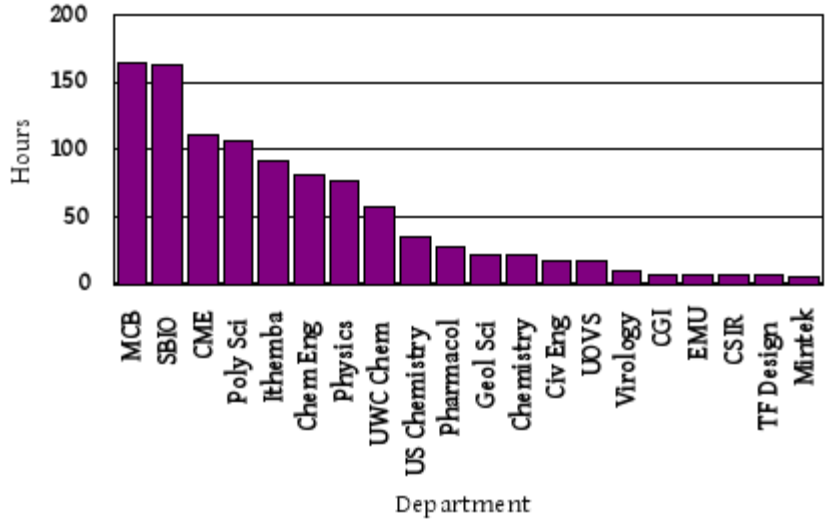
160 people made use of the microscopy services of the Electron Microscope Unit in ~~2006~~2007, this is a decrease from 2006 when 205 people visited the Unit. Fifteen further users utilized services other than those related to microscopy, notably printing and liquid nitrogen collection. The names and departments of the users are listed in Table 2.

Fig.2 Microscope Usage, 1990-2007



Total time spent using the Unit's microscopes was 1289 hours in 2007 which was lower than microscope hours in 2006 (1713 hours). This decrease is largely due to the fact that the S200 was hardly used for EBSD by Materials Engineering in 2007. Another factor is that the 200CX TEM was retired early in the year and the replacement TEM was not installed until October

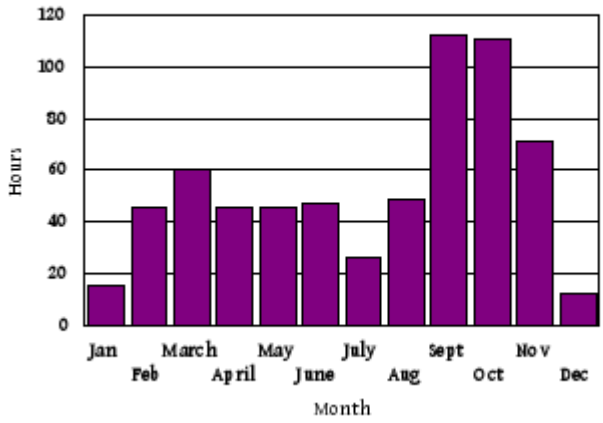
Fig 3. Microscope usage by department, institute or company



ELECTRON MICROSCOPES AND ASSOCIATED EQUIPMENT

LEO STEREOSCAN S440 SEM

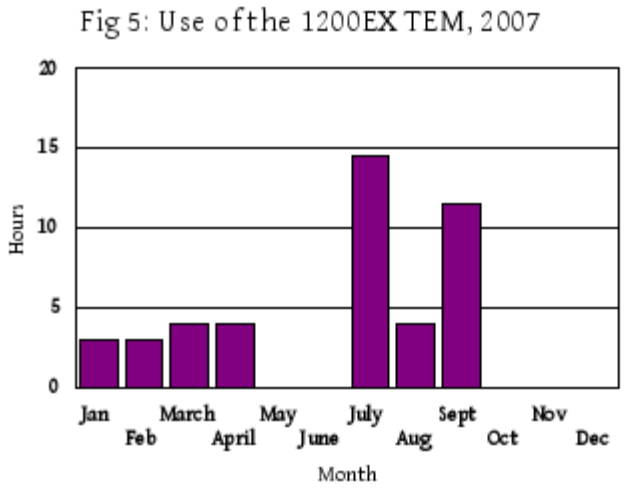
Fig 4: Use of the S440 SEM, 2007



The S440 was used for a total of 643.5 hours which is a-slight increase on the usage in 2007 (591 hours) and is still the most popular instrument in the department. Fifty three people from UCT made use of the instrument and there were 39 outside users. The number of hours the instrument was used was more than last year, but there was a reduction in the number of users. The instrument was down for approximately 3 days during 2007, as a result of power cuts.

CAMBRIDGE S200 SEM

The S200 was only used 13 hours, most of this in one month, the instrument was only used by one student from Materials Engineering for EBSD, who had reached the end of her project and was writing up for most of the year. The instrument is fully functional, it has an operational EBSD system and an advanced digital photography system.

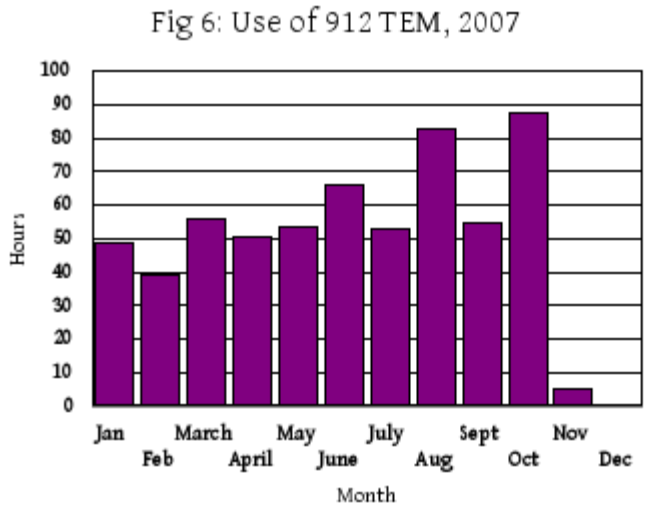


JEOL 1200EX **TEM**

Fig 5: Use of the 1200EX TEM, 2007

The Jeol 1200EX was fully operational all year although it was used for a total of 44 hours, much less than the usage in 2006 which was 234 hours. This instrument was used exclusively by the Structural Biology students who utilised the cryo facilities on the equipment.

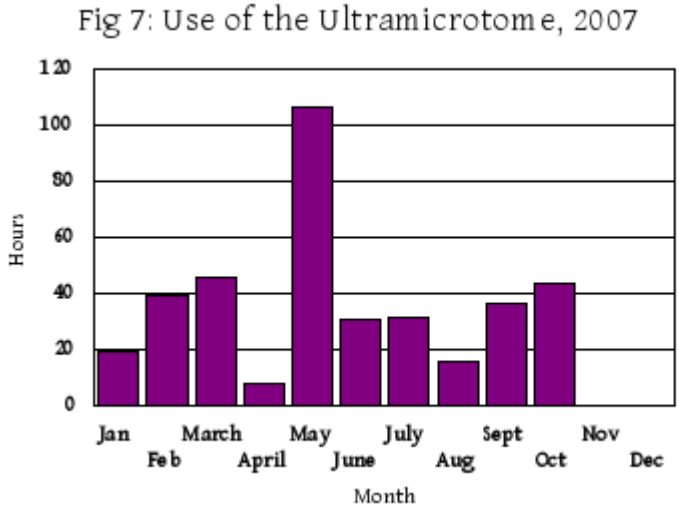
LEO 912 TEM



The Leo 912 proves to be the most popular and well-used TEM in the department and was used for a total of 597 hours by 42 people from UCT and 32 outside users. Most of the outside users were from Polymer Science, University of Stellenbosch. In 2006, the microscope was used for 762 hours by 68 people. The instrument usage dropped off in November and December because Mr. Jaffer went to Mecca at the end of November. Unfortunately the instument suffered considerable damage which we believe was

due to the frequent cycling of power during December and January. So far we have repaired the CCD camera and vacuum pump. The in built computer display screen is currently being replaced at a cost of R21k. Even when that is repaired problems that have not yet been properly diagnosed remain.

ULTRAMICROTOME



Use of the ultramicrotome was 332 hours, a slight decrease from last year (378 hours). Cryomicrotome facilities were used by MCB, Dept of Polymer Science (US), Materials Science and Manufacturing - CSIR, Natural and Agricultural Sciences (UFS) and Dept of Physics (UFS

LIGHT MICROSCOPY

All the light microscopes and Zeiss Axiocam continued to be used throughout the year, mainly by MCB students

IMAGING CENTRE

The imaging centre has sophisticated software capability aimed at image enhancement and three dimensional reconstruction. Photographic negative digitization using the Nikon LS4500 and Leafscan scanners is the basis of data analysis. However, these units have to be replaced because the scanning processes are not fully reproducible and are time consuming. The newer scanners offer a much better dynamic range and a smaller pixel size and they scan with precision thus eliminating geometric distortions that can accompany. Furthermore spares (e.g. filters) are difficult to come by and the newer operating systems XP and Vista provide no hardware or software support.

TEACHING AND EXTENSION

INDIVIDUAL TRAINING

Leo 912 TEM

Penny Hsu, MCB
Tebogo Mabotha, Chemistry
Eugene Lakay, Chemistry (US)
Olivia Carulie, Med Virology
Sirika Pillay, MCB
Marla Tuffin, Biotechnology (UWC)
Reama George, Ithemba Labs
Michael Schmeisser, Horticulture (US)
Jenny Miller, Structural Biology
Inonge Mulaka, MCB
Ziyanda Sigcau, Physics
Alice Maredza, MCB
Leandri van der Vyver, Structutral Biology

Allison Lynch, MCB
Jeol 1200EX TEM
Jenny Miller, Structural Biology
Leo S440 SEM
Sarah George, Materials Engineering.
Jerry Oguh, Materials Engineering.
Megan Becker, Chemical Engineering.
Osei Ofuso, Materials Engineering.
Olowole Solane, Physics.
Nicola Toma, Chemical Engineering.
Vicky Cain, Materials Engineering.
Ultramicrotome
Olowole Solane – Physics
Michael Schmeisser – Horticulture (US)
Sirika Pillay – MCB
Penny Hsu – MCB
Mohau Shikwane – Chem Eng
Inonge Mulaka - MCB

SCHOOL VISITS

We had a total of 109 learners from various schools.

Ten Bishops A Level students visited in February, 30 Gr11 Herschel and 34 Gr 11 Bergvliet High students visited in March. Five A Level students from Hout Bay International School visited in May and 30 Gr 11 Students from the American International School in Tokai visited in November.

MICROSCOPY FOR BIOLOGISTS

The Microscopy for Biologists course was held in April and attended by 25 MCB honours students.

STRUCTURAL BIOLOGY MSC STUDENTS

Students from the Structural Biology Masters programme spent 2 weeks in the Unit. They were taught cryo TEM on the Jeol 1200EX and how to operate the Leo912 TEM

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 ~~2006~~2007:

Chromatin
T. Frouws, B.T. Sewell, H.-G. Patterton
Glutamine synthetase
J. van Rooyen, B.T. Sewell, V.R. Abratt
3D reconstructions from metal coated objects
J.D. Woodward, B.T. Sewell
Angiotensin converting enzyme
J. Watermeyer, I. Chitapi, B.T. Sewell, E. Sturrock
Nitrile hydratases
T. Tsekoa, B.T. Sewell, O.T. Bishop, M. F.-R. Sayed, D.A. Cowan
The amidase from *Geobacillus pallidus*
S.W. Kimani, B.T. Sewell, M.F.-R. Sayed, D.A. Cowan
Structure of the nitrilase from *Bacillus pumilus, Pseudomonas stutzeri* and *Gloeocercospora sorghi*
B.T. Sewell, B. Weber, N. Thuku
The cyanide degrading enzymes are of potential industrial significance. We have solved three structures at varying resolutions by single particle techniques and made substantial progress on the structure of the pH 5.4 fibrous form of the cyanide dihydratase from *B. pumilus*. Progress was made towards the creation of an atomic model on the basis of homology with two known structures.

PUBLICATIONS

Publications, for 2007, that resulted from research in which the EM Unit staff have been directly involved are listed:-

Bredell H, Martin DP, Van Harmelen J, Varsanii A, Sheppard HW, Donovan R, Gray CM, Hivnet028 Study Team, Williamson C. 2007 HIV Type 1 Subtype C gag And nef Diversity in Southern Africa. AIDS Research and Human Retroviruses 23(3) 477-481

Corradi, H., Chitapi, I., Sewell, B.T, Georgiadis, D., Dive, V., Sturrock, E, Acharya, K. R. (2007). The Structure of Testis ACE in Complex with the C Domain-Specific Inhibitor RXPA380, Biochemistry, 46, 5473-5478

Kimani, SW, Agarkar,VB Cowan, DA, Sayed, MF-R and Sewell, BT (2007) Structure of an aliphatic amidase from *Geobacillus pallidus* RAPc8 Acta Cryst. D63, 1048–1058

Lefeuvre, P., Martin, D.P., Hoareau, M., Naze, F., Delatte, H., Thierry, M., Varsani, A., Becker, N., Reynaud, B. & Lett, J-M., 2007. Begomovirus 'melting pot' in the south-west Indian Ocean islands: molecular diversity and evolution through recombination,. J Gen Virol 88, 3458-3468

Makhongela HS, Glowacka, A., Agarkar VB, Sewell, BT, Weber, B, Cameron RA., Cowan DA, and Burton SG (2007) A novel thermostable nitrilase superfamily amidase from *Geobacillus pallidus* showing acyl transfer activity. Applied Microbiology and Biotechnology, 75, 801-11

Owor, B. E., Shepherd, D. N., Taylor, N. J., Edema, R., Monjane, A. L., Thomson, J. A.,Martin, D. P. & Varsani, A., 2007. Successful application of FTA Classic Card technology and use of bacteriophage phi29 DNA polymerase for large-scale field sampling and cloning of complete maize streak virus genomes. J.Virol.Methods 140, 100-105.

Owor, B., Martin, D.P., Shepherd, D,N., Edema, R., Monjane, A,L., Rybicki, E.P., Thomson, J.A. & Varsani, A., 2007. Genetic analysis of maize streak virus isolates from Uganda reveals widespread distribution of a recombinant variant. J.Gen.Virol 88, 3154-3165.

Thuku, R. N., Weber, B. W., Varsani, A. & Sewell, B. T., 2007. Post-translational cleavage of recombinantly expressed nitrilase from Rhodococcus rhodochrous J1 yields a stable, active helical form. FEBS J. 274, 2099-2108.

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. (2007) Mechanisms of desiccation tolerance in Angiosperm resurrection plants. In: Plant Desiccation Tolerance. Eds: Jenks, M.A. and Wood, A.J., CAB International Press, Walingford, UK

Hartmann, P.C., and Sanderson, R.D (2007). Preparation of magnetite-polystyrene core-shell hybrid nanoparticles, initiated by a covalently bonded azo compound. Macromolecular Symposiu, 255 (2007) 24 – 35.

Knutsen, R.D. (2007) Correlating microstructural features and surface roughening in ferritic stainless steel. Mat.Sci. Forum 550 65-74

Moore, J Farrant, J.M. Brandt, W and Lindsey, G.G. (2007) Desiccation induced ultrastructural and biochemical changes in the leaves of the resurrection plant Myrothamnus flabellifolia. Australian Journal of Botany.

Mtwisha, L., Farrant, J.M., Brandt, W and Lindsey, G.G. (2007). Loss of a 53 kDa LEA-like protein in the seeds of the camel thorn tree, *Acacia erioloba*, correlates with the loss of desiccation tolerance in germinating seedling. Functional Biology 34(2) 139-148

Oracz, K., Bouteau, H., Farrant, J.M, Cooper, K., Belghazi, M., Job C, Job D., and Bailly, C. (2007) ROS production and protein oxidation as a novel mechanism of seed dormancy alleviation during dry after-ripening. Plant journal

Parker, S and Knutsen, R.D. (2007). Analysis of microstructure evolution during Steckel mill rolling of AISI304 stainless steel. Materials Science and Engineering

Samakande A, Hartmann P C, Cloete V. and Sanderson R D.(2007). Use of acrylic based surfmers for the preparation of exfoliated polystyrene-clay nanocomposites; Polymer, 48, 1490-99

Samakande, A, Sanderson, R.D. and Hartmann, P.C (2007). Synthesis and characterization of novel quaternary ammonium RAFT agents. Synthetic Communications 37: 3861-3872.

Schwegmann, A, Guler, R, Cutler, A. Arendse, B., Kottam, A. Ryan, G. Hyde, W Leitges, M. Seioghe, C and Brombacher, F (2007) PKCdelta is critical for confinement of *Listera* within macrophage phagosomes, PNAS

Silva-stenico, E Vengadajellum, C.J. Janjua, H.J., Harrison, STL. Burton, S.G. And Cowan, D.A. (2007). Degradation of low rank coal by *trichoderma atroviride* ES11. J Indust Biotechnol

van Reenen, A.J. And Sultan, O. (2007) The effect of catalyst isomerization on polypropylene properties. Z. Naturforsch 62b 362-366.

PhD Theses

Bajic, Jelena. Molecular and Cell Biology. Exploring the longevity of dry *Craterostigma wilmsii* (homoiochlorophyllous) and *Xerophyta humilis* (poikolichlorophyllous) under simulated field conditions.

Deppa, Ntsapokazi. Chemistry. Rarity of kidney stones in South Africa's black population : studies of urinary macromolecules, crystal matrix extract containing osteopontin, and bone turnover markers in urine and serum from black and white subjects as a key to understanding this paradox.

Heath, Livio Edward. Molecular and Cell Biology. Molecular studies on Beak and feather disease virus.

Kirby, Bronwyn. Molecular and Cell Biology. The characterization of actinomycetes isolated from diverse South African sources, with emphasis on the genus Kribbella.

Mabotha, Tebogo E. Chemistry. Haemozoin formation, effects of chloroquine on iron distribution in Plasmodium falciparum and the correlation of thermordynamic and structural factors with 4-aminoquinoline activity

Mhlongo, Welcome Thabani. Chemistry. Polymorphism and cyclodextrin inclusion complexes of antihypertensive agents.

Ncanana, Sandile Welcome. Chemical Engineering. Biocatalytic studies of phenol oxidases producing antioxidants.

Newell, Anthony. Chemical Engineering. An evaluation of sulfidisation in the flotation recovery of heavily oxidised sulfide minerals - with particular reference to oxidised Merensky ores.

Nxumalo, S. Mechanica Engineering. The PT8V ordering transformation in PT 11 AT.%V

Viljoen, Elvera. Chemical Engineering. The influence of molybdenum and vanadium on the activity and selectivity of a cobalt Fischer-Tropsch catalyst.

Welker, Catherin. Chemical Engineering. Ruthernium based Fischer-Tropsch synthesis on crystallits and

clusters of different sizes - from “Nano” to “Angstrom”.

MSC THESES

Adetula, Bolade Adewale. Physics. Production and characterisation of metal layers containing nano-sized inert gas inclusions.

Bayley, Gareth. Inst Polymer Science, University of Stellenbosch. Synthesis and characterisation of organic-inorganic hybrid block copolymers of polydimethylsiloxane and polystyrene

Camagu, Sigqibo Templeton. Center for Materials Engineering. Surface modification of titanium-based alloys.

Frouws, Timothy Duncan. Structural Biology. Iterative helical real-space reconstruction of histone octamer tubular crystals and implications for the 30 nm chromatin fiber.

Greesh, Nagi, Inst Polymer Science, University of Stellenbosch. Preparation of polymer-clay nanocomposites using emulsion polymerization : influence of clay modifiers on the final nanocomposites morphology

Halsey, Richard James. Molecular and Cell Biology. Construction and characterization of chimaeric human immunodefiency virus type 1 subtype C Gag virus-like particles.

Marekwa, Mpho David. Center for Materials Engineering Evaluation of metal dusting of nickel-chromium-iron based alloys in a laboratory environment.

Motshweni, Jim. Process Engineering, University of Stellenbosch. Synthesis of mixed metal oxides for use as selective oxidation catalysts

Woodward, Jeremy David. Structural Biology. The feasibility of high resolution, three-dimensional reconstruction of metal-coated surfaces in structural biology.

USER PROJECTS

Project	PI	Students	Technique	Status
Archaeology				
Investigation of bones from FWJ;20, a Pliocene hominin archaological site in Northern Kenya	Braun, D:		SEM	Ongoing
Biosystematics				
Pollination in Pelargonium species found in the Western Cape	Van der Niet, T		SEM	Ongoing
Center for Materials Engineering				
Influence of Grain Size and Niobium Content on Hot Strength of Ferritic Stainless Steels	Dr R Knutsen	Cain, V	SEM	Ongoing
Aluminium alloy development for semi-solid casting	Prof R Knutsen	George, S	EBSD, SEM	Ongoing
Investigation of the characteristics of kenaf fibre reinforced polypropylene composites	Dr K. Marcus	Kim, S	SEM	Ongoing
The influence of ordering on mechanical properties of platinum alloys	Prof C Lang	Mshumi, C	TEM	Ongoing
Hybrid Thermoplastic Composite	Dr K Marcus	Ofuso, O	SEM	Ongoing
Modifying the microstructure of an investment cast Ti-6Al-4V alloy (an aerospace alloy) using hydrogen as a temporary alloying	Prof R Knutsen	Ohug, J	SEM	Ongoing

element				
Chemistry				
Solid State Phase Transition	Prof S Bourne	Bathori, N	SEM, TEM	Ongoing
Host - guest inclusion chemistry	Prof S Bourne	De Villiers	SEM	Ongoing
Cross-linking of polypropylene membranes with PVA for membrane-assisted solvent extraction Chemistry.	Prof S Burton	Garcin, C	SEM	Ongoing
Haemozoin formation, effects of chloroquine on iron distribution in Plasmodium falciparum and the correlation of thermordynamic and structural factors with 4-aminoquinoline activity	Prof T. Egan	Mabotha,T De Villiers, K, Oyekola, S, Prasadu, R	SEM,TEM	1x PhD Ongoing
Investigation of the effect of dietary oxalate dosages in urinary risk factor for calcium oxalate kidney stone in black and white subjects	Prof A Rodgers	Teleke, V	SEM	Ongoing
Chemical Engineering				
Mapping platinum group materials in Bushveld ore samples	Becker, M		SEM	Ongoing
Gold Catalysis	Prof E Van Steen	Beeming, B	TEM	Ongoing
Nanometre and Angstrom sized cobalt ensembles and their performance in the Fischer-Tropsch synthesis	Prof M Claeys	Fischer, N	TEM	Ongoing
Migration of potassium	Prof E Van Steen	Gwagwa, Y	SEM	Ongoing
The removal of iron from acid mine drainage by the high density sludge process	Prof A Lewis	Hove, M	SEM	Ongoing
Removal of mixed metals from dilute hydromatallurgical stream	Dr E Van Steen	Mokone, T	TEM	Ongoing
Binam and trenaum metal catalysts for fuel cell applications	Naidoo, J		SEM	Ongoing
The use of molybdinum, manganese and tungsten carbides as catalysts for Fischer-Tropsch synthesis	Prof E Van Steen	Patterson, V	TEM	Ongoing
Eutectic freeze crystallisation	Prof A Lewis	Reddy, T	TEM	Ongoing
Effect of cobalt catalyst structural type on C selectivity on Fischer-Trosch synthesis	Dr E Van Steen	Qui, Y	SEM, TEM	Ongoing
Shape Selectivity in Zeolites and Molecular Sieves	Dr E Van Steen	Toma, N	SEM	Ongoing
Stability of Ruthenium in the Fischer-Tropsch synthesis	Dr E Van Steen, Dr M Clayes	Welker, K	SEM, TEM	1 x PhD
Civil Engineering				
Visser Hoek clay investigations	Dr F Scheele	Makgekcenene, B	SEM, TEM	Ongoing
Investigation of sheer strength on geosynthetic clay liners used in landfill systems	Dr F Scheele	Rounciuell, W	SEM	Ongoing
Geological Sciences				
Investigation of authigenic minerals during the early diagenesis of organic-rich sediments	Dr J Compton	Herbert, C	SEM	Ongoing
Petroleum system of the southern Brogdasdorp - an integrated approach	Dr J Compton	Madyibi, L	SEM	Ongoing
Sedimantology in the Buffels	Dr J Compton	Price, W	SEM	Ongoing

River				
The geometallurgy of Namakwa sands	Dr J Compton	Philander, C	SEM	Ongoing
Geochemistry and morphological characteristics of the Eltehdate diamonds, Kimberly crater, NW Australia	Prof Le Roex	Smit, K:	SEM	Ongoing
Human Biology				
Analysis of melanocyte migration postnatal & adult skin	Prof S Kidson	Govender, D	SEM	Ongoing
Oceanography				
Investigation of a prominent colour front in False Bay	Waldron, H		SEM	1 x publication
Medical Virology				
The antibody responses to Human Papillomavirus (HPV) infection in South African men and women	Prof A-L Williamson	Zizipho, M	TEM	Ongoing
Molecular and Cell Biology				
Construction and charaterization of Chimeric GAG VLPs	Prof E Rybicki	Halsey, R	TEM	Ongoing
The characterization of actinomycetes isolated from diverse South African sources, with emphasis on the genus Kribbella.	Dr P Meyers	Kirby, B	SEM	1 x PhD
Molecular charaterisation of the novel genes from *Xerophyta viscosa*	prof J Farrant	Meduc, F	TEM	Ongoing
Charaterisation of RecQ DNA Helicies from *Bacteriodes fragilis*	Prof V Abratt	Paul, L	TEM	Ongoing
The optimization of Chimeric HIV VLP production & immunogenicity of these VLPs in mice	Prof E Rybicki	Pillay, S	TEM	Ongoing
Pharmacology				
Charaterising endocytosis in the malaria parasite *Plasmodium falciparum*	Dr H Hoppe	Smythe, W	TEM	Ongoing
Physics				
Plasma-sprayed ceramic coatings	Prof Britton, Prof Harting	Bolade, A, Goro, G	SEM, LM	Ongoing
Application of Ni-Si semiconductor material	Prof Britton, Dr Harting	Odoele, A	SEM, TEM, LM	1 x MSc
Structural features of hydrogenated amorphous silicone	Dr Britton, Dr Harting	Sigcau, Z	TEM	Ongoing
Structural Biology				
Structure of Maize Streak Virus	Dr B.T.Sewell	Dent, K.:	TEM	Ongoing
Human papillomavirus structure	Dr B.T.Sewell	Eicher, J	TEM	Ongoing
Iterative helical real-space reconstruction of histamine ocatmer tubular crystals and implications for the 30nm chromatin fibre	Dr B.T.Sewell	Frouws, T	TEM	Ongoing
Three-dimensional reconstruction of Heterocapsa circularisquama RNA Virus by Cryo-Electron microscopy.	Dr B.T.Sewell	Miller, J	TEM	Ongoing
Structure of the nitrilase *Rhodococcus rhodochrous* J1: Homology modeling and three-dimensional reconstruction	Dr B.T.Sewell	Thuku, N	TEM	Ongoing

The structure of the type III Glutamine Synthetase from *Bacterioides fragilis* determined by combining electron microscopic and X-ray data	Dr V Abratt	Van Rooyen, J	TEM	Ongoing
The feasibility of high resolution, three-dimensional reconstruction of metal-coated surfaces in structural biology	Dr B.T.Sewell	Woodward, J	TEM	Ongoing
Virology				
Analysis of Penguinpox virus	Dr Marais	Carulei, O	TEM	Ongoing
Zoology				
Investigation of the sexual organs of the velvet worm	Dr.M.Picker		SEM	Ongoing
Cape Peninsula University of Technology				
The use of high power ultrasound to disinfect beverages	McMaster, L	Siphokazi, B. Malcaka, S	SEM	Ongoing
CSIR				
Synthesis of silicon nanoparticles	Scriba, M		SEM, TEM	Ongoing
iThemba				
Modification and charaterization of materials using nanotechnology and thin film physics	Dr M Maaza	Balla, N, Fasasi, B	SEM	Ongoing
FeSi and FeSi doped with Co for superconductiong properties	Dr M Maaza	Kana, A,Saleh, S, Sithole, J	SEM	Ongoing
The synthesis of Diamond-like carbon nano-structure by pulsed laser ablation	Dr M Topic	Lussi, C	SEM	Ongoing
University of Stellenbosch				
Electrospinning of hollow fiber membranes	Dr R Sanderson	Abdumizzagh, K	TEM, SEM	Ongoing
Preparation of nanofluids for heat transfer application	Dr R Sanderson	Botha, S:	SEM, TEM	Ongoing
Synthesis of WN-dialhyl N-alloy drivatives and the study of their coordination to the PGM ions	Prof Koch	Bruce. J	TEM	Ongoing
Mealiness of forelle pears with special reference to cell wall composition & degradation	Dr M Huysamer	Crouch, E	TEM	Ongoing
Synthesis of complex polymer architectures in mini emulsions	Dr P Hartman	Bailly, N	TEM	Ongoing
synthesis and charaterisation of organic-inorganic hybrid block co-polymers	Dr R Sanderson	Bayley, G	TEM	Ongoing
Pitting on Ostrich skins	Engelbrecht, A		SEM	Ongoing
Permeability studies of coatings	Dr V Cloete	Etmimi, H	SEM, TEM	Ongoing
Preparation of polymer-clay nanocomposites using emulsion polymerization : influence of clay modifiers on the final nanocomposites morphology	Dr R Sanderson	Greesh, N	TEM	Ongoing
Co-electrospinning composite submicron fibers	Dr R Sanderson	Kriel, H	SEM, TEM	Ongoing
Synthesis and characterisation of magnetic nanoparticles	Prof Koch	Lakay, E	SEM	Ongoing
Grafting of cellulosic materials for paper applications	Dr R Sanderson	Matawa, H	TEM	Ongoing
Novel RAFT medicated polymer-	Dr R Sanderson	Samakande,A	TEM	Ongoing

clay nanocomposites				
Colour development in leucodendrons	Prof G Jacobs	Schmeisser, M	TEM, LM	Ongoing
Investigation of specialty coatings.	Dr V Cloete	Skillington, P	SEM	Ongoing
Investigating PVOH nanofibers as materials for humidity and other sensor applications	Dr R Sanderson	Smit, E	SEM	Ongoing
Polypropylene/nanosilicon composite	Dr R Sanderson	Sultan, O	TEM	Ongoing 1 x publication
Self heating coatings	Dr R Sanderson	Van Dungen, E	SEM, TEM	Ongoing
Ca-clay nanocomposites	Dr R Sanderson	Zongeni, E	TEM	Ongoing
University of the Western Cape				
Nanoarchaea	Dr. D Cowan	Casanueva, A	SEM, TEM	Ongoing
Consolidated nanomaterials	Prof Linkov	Davids, W	TEM	Ongoing
Proton conductivity membrane for fuel cells	Prof Linkov	Luo, H	TEM	Ongoing
Preparation of H2 selective and defect free membranes by aerosol filtration	Dr B Baldergroen	Meyer, F	SEM	Ongoing
Hydrogen storage	Prof Linkov	Suttisawat, Y	TEM	Ongoing
Viural diversity in Antarctic dry valleys	Dr M. Tuffin Prof D Cowan		TEM	Ongoing
Palladium/ceramic composite membranes for the separation of hydrogen from underground coal gasification product gas	Prof Linkov	Williams,M		Ongoing

FINANCE

Details of the Unit's accounts are presented in Table 3.

OTHER MATTERS

LEAVE BY THE DIRECTOR

The Director took contact leave in June and July in order to visit the MPI Biophysics in Frankfurt, EMBL in Heidelberg, spend an extended period with Professor Michael Benedik at Texas A&M University and attend the Gordon Conference on Three Dimesional Electron Microscopy. During this time three papers were written of which two have since been published and the third is still under review.

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 2007 were: CAE (Stellenbosch Automotive Engineering), CGI, CSIR, Mintek, Mittal Steel, Namakwa Sands, NBI, One eighty Degrees, Origen, SASOL, Patterson and Cooke, Plascon, Roedinger Agencies, Silver Solutions and T.F.Design. These clients almost exclusively use the S440 SEM and the 912 TEM and together accounted for 99 hours instrument time.

VISITORS TO THE UNIT

Professor Edward Egelman, University of Virginia
Dr Michael Lawrence, Walter and Eliza Hall Institute, Melbourne Australia

SUMMARY

The total instrument usage and the number of users decreased in 2007. There are however a large number of collaborative projects that are ongoing. The structural biology programme was terminated - ending a

period of unprecedented development in high end microscopy which has substantially raised the research profile of South Africa.

Prepared by: Associate Professor B.T. Sewell and Mrs. Miranda Waldron

TABLE 1

Services Offered by the Unit during 2007

Service	Comment
Access to 200CX TEM	Retired
Access to 1200EX TEM	Used by 4 people
Access to S440 SEM	Used by 91 people
Access to S200 SEM	Used by 1 person
Access to 912 TEM	Used by 75 people
Training on 200CX	No new users were trained
Training on the 1200EX TEM	1 new user was trained
Training on S440 SEM	7 new users were trained
Training on the 912 TEM	14 new users were trained
Access to Ultracut S Ultramicrotome	Used by 39 people
Training on Ultracut S	6 new users were trained
Cryo-microtomy and immunolabelling	Well used
Sectioning of blocks supplied by the user	Well used
Embedding of biological specimens in methacrylate and epoxy	Well used
Freeze substitution	Used
Sputter Coating of specimens supplied by user	Very popular service
Critical point drying of specimens supplied by the user	Very popular service
Printing of EM films	Service used
Access to optical microscopy facilities	Used
Access to Image Processing and Analysis (Analysys)	Used
Element analysis by EDS	Well used.
"Introduction to EM for Biologists"	This course was held once.
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	Well used
Collection of books and journals on microscopy	Used
Vacuum Leak Detection	Used
Production of CD ROMS	Well used
Digitization of transparent media on LS4500	Used
Digitization of transparent media on Leafscan	Used
High quality ink-jet printer	Very popular
Flat bed scanner	Well Used

TABLE 2.

~~2006~~ 2007 User list

* Indicates non- microscope users

UCT USERS

Archaeology		
	D Braun.	Staff
Biosystematics		
	Van der Niet, T	Visiting Lecturer
Botany		
	Britton, M	Staff*
	McLean.A	Staff*
	——————————Potts, A	

MSc*

Verboom, A.	Staff*

Center for Materials Engineering

Abbas, N	Hons
Cain, V	PhD
Chetty, S	Hons
Freemantle, C	Hons
George, S.	Msc
Kim, S	MSc
Knutsen, R.	Staff
Letaba, G	Hons
Madzikanda, F	Hons
Mashabela, P	Hons
Mashao, C	Hons
Mshumi, C	MSc
Nkosi, Z	Hons
Nukwa, K	Hons
Ofuso, O	Msc
Ohug, J	MSc
Park-Ross, P.	Staff
Peterson, S	Hons
Visram, S	Hons
Williams, R	Hons
Wright, T	Hons

Chemistry

Bathori, N	Post Doc
De Villiers, K	MSc
Mabotha,T.	PhD
Oyekola, S	MSc
Prasadu, R	MSc
Teleke, V	MSc

Chemical Engineering

Becker, M	Staff
Beeming, B	MSc
Cairns**,** P.	Staff
Fischer, N	PhD
Garcin, C	PhD
Gwagwa, Y.	MSc
Hove, M	PhD
Julies, F.	MSc
Magarosi, P	MSc
Mokone, T.	PhD
Naidoo, J	PhD
Patterson, V	MSc
Reddy, T	PhD
Shikwane, M	MSc
Qui, Y.	MSc
Toma, N.	MSc
Welker, K.	PhD

Civil Engineering

Rounciuell, W	MSc
Makgekcenene, B.	MSc

Fine Art

Langerman, F	Staff

Geological Sciences

Compton, J	Staff
Herbert, K	PhD

	Madyibi, L	MSc
	Price, W	Hons
	Smit, K	MSc
Human Biology		
	Govender, D	PhD
IIDMM		
	Gail, A	Msc
	Tiedt, F	Staff
Molecular and Cell Biology		
	Cooper , K.	Staff
	De Villeirs, G	MSc
	Farrant, J.	Staff
	Halsey, R.	PhD
	Hsu, P	MSc
	Jaffray, A	Staff
	Ka'mngora, A.	MSc
	Kirby, B.	PhD
	Lynch, A.	PhD
	Maredza,A	MSc
	Meduc, F	MSc
	Meyers, P	Staff
	Mulaka, I	MSc
	Nyaradzo,	Msc
	Paul, L	Post Doc
	Pillay, S	MSc
	Rafudeen, S.	Staff
	Rholand, J.	PhD
	Roden, L.	MSc*
	Rybicki, E.	Staff
	Sattar, S	MSc
	Sirika, P	MSc
	Valley-Omar,Z	PhD
Medical Virology		
	Maulana, Z	MSc
Oceanography		
	Waldron, H.	Staff
Pharmacology		
	Hoppe, H.	Staff
	Smythe, W	MSc
Physics		
	Bolade, A.	MSc
	Britton, D.	Staff
	Goro, G.	PhD
	Harting, M	Staff
	Odoele, A.	PhD
	Sigcau, Z.	PhD
	Solane O	MSc
Structural Biology		
	Dent, K.	MSc
	Eicher, J.	MSc
	Frouws, T.	Msc
	Miller, J.	MSc
	Sewell, B.	Staff
	Thuku, N.	MSc
	Van Rooyen, J.	PhD
	van der Vyver, L	Hons
	Varsani, A.	Staff

	Weber, B.	Staff
	Woodward, J.	Msc
Virology		
	Carulei, O	Hons
	Zizipho, M	MSc
Zoology		
	Guambe	Post Doc
	Picker, M.	Staff

OTHER HIGHER EDUCATIONAL INSTITUTIONS

Cape Peninsula University of Technology

Chemical Engineering		
	Aziz, M	Staff
	Malcaka, S	Mtech
Food Technology		
	Siphokazi, B.	Mtech
	McMaster, L.	Staff

CSIR

	Scriba, M	PhD
	Matabola, P	Staff

iThemba

	Balla, N	PhD
	Barnabas, A	Staff
	Fasasi, B.	Post Doc
	Kana	Staff
	Lussi,C	Staff
	Mazaa, M.	Staff
	Saleh, S	Msc
	Sithole, J	PhD
	Topic, M.	Staff

University of the Free State

Agricultural Science		
	Luyt, R	Staff
Physics		
	Swart, H	Staff

University of Stellenbosch

Horticulture		
	Crouch, E	Staff
	Schmeisser, M	PhD
Institute of Polymer Science		
	Abdumizzagh, K	Post Doc
	Abdulallah, A	MSc
	Bailly, R.	MSc
	Baker, A	MSc
	Bayley, N	MSc
	Berg, I	MSc
	Etmimi, H	MSc
	Greesh, N.	MSc
	Kriel, H	PhD
	Mange, S	Msc
	Matawa, H	MSc
	Nagi, K.	MSc
	Samakande, A	MSc
	Skillington, P.	Staff

	Smit, E.	PhD
	Staisch, I	Staff
	Sultan, O	MSc
	Swart, T.	MSc
	Van Dungen, E	PhD
	Van Swchalkwyk, A.	MSc
	Zongeni, E	MSc
Process Engineering		
	Botha, S	MSc
	Bruce. J.	PhD
	Lakay, E.	MSc
Viticulture and Oenology		
	Du Plessis, B.	Msc
	Koekemoer, L	Hons
	Raath, P.	Staff

University of the Western Cape

Biotechnology		
	Casanueva, A.	Post-Doc
	Tuffin, M.	Staff
Chemistry		
	Davids, W	MSc
	Luo, H	MSc
	Meyer, F.	MSc
	Petrik, L.	Staff
	Suttisawat, Y	MSc
	Williams,M.	PhD

COMMERCIAL USERS

180º Engineering Solutions		
	Basson, J	Staff
CAE		
	Wotherspoon, D	Staff
CGI		
	Beja, B.	Staff
	Barron, M.	Staff
Department of Agriculture, Elsenberg		
	Engelbrecht, A	Hons
Ecosoil		
	Van der Merwe, H	Staff
Mintek		
	Barkhuizen, D.	Staff
Namkwa Sands		
	Kiewits, D	Staff
	Philander, C	PhD
NBI		
	Manning, K	Staff
	Roux, K	Staff
	Sniyman, D.	Staff
Origen		
	Fahy, G	Staff
Plascon		
	Treuenicht, J	PhD
	Reyskins, D	PhD
Private		
	Litveld, W (Orchid book)	
	Klatzow, D. (Forensics)	

Patterson and Cooke

	Magubane, T.	Staff
	Van Sittert, F.	Staff

SASOL

	Velaers, A	PhD

Silver Solutions

	Greyling, C.	Staff

TF Design

	Rees, C	Staff

TABLE 3

E.M.U. Finances, 2007

Detailed Budget

		Operating 000516	External Services 001258	Equipment 170025	Consumables 000933	Maintenance 000995
Opening Balance		33,983	351,152	196,933	25,616	146,954
Income		108,530	117,654	2,761,910	52,877	134,346
Expenditure		-111,631	-42,858	-1,847,109	-54,780	-26,786
Closing balance		**30,882**	**425,948**	**1,111,734**	**23,713**	**254,514**
Income						
Grant Transfers				337,250		
Operating Grant		108,530				
Budget allocation				2,424,660		
Internal recoveries					52,877	133,527
External recoveries			117,654			819
Sales revenue						
Total		**108,530**	**117,654**	**2,761,910**	**52,877**	**134,346**
Expenditure						
Admin/Operating	Tel, Postage, Fax	35,359	2,485		44	
	PC Consumables	6,575			6,919	
	PC components	250				
	Fund Transfer	3,000				
	Stationery	3,163				
	Travel	3,790				
	Conferences	1,365				
	Cleaning	114				
	Utilities	17,097			22,345	968
	Periodicals	1,697				
	General Operating	17,282	3,295	272,012	25,072	
	Repair and Mantenance	3,167	37,078			20,480
	Equipment			1,532,109		4,933
Assets		18,772		42,988	400	405
Total		**111,631**	**42,858**	**1,847,109**	**54,780**	**26,786**