

**THE INSTITUTE FOR MICROBIAL
BIOTECHNOLOGY AND
METAGENOMICS**

2009

**DEPARTMENT OF BIOTECHNOLOGY
UNIVERSITY OF THE WESTERN CAPE**

Director: Professor Don A Cowan

Deputy Director: Dr Marla Tuffin

Senior Administrator: Dr Heide Goodman

LEAF Administrator: Dr Rolene Bauer

Institute for Microbial Biotechnology and
Metagenomics
Department of Biotechnology
University of the Western Cape
Bellville 7535
Cape Town,
South Africa

Contact details:

Tel: +27 219592083

Fax: +27 219591587

Cell: +27828799117

dcowan@uwc.ac.za

ituffin@uwc.ac.za

hgoodman@uwc.ac.za

<http://www.imbm.co.za/>

Background

The **Advanced Research Centre for Applied Microbiology [ARCAM]** was established by Professor Cowan in 2001. In 2007, the University of the Western Cape approved the elevation of **ARCAM** to Institute status, as the “**Institute for Microbial Biotechnology and Metagenomics**” (**IMBM**). To date, IMBM has been housed in a 400m² laboratory suite in the Old Chemistry Building at the University of the Western Cape (UWC), Cape Town, South Africa.

About the Director

Professor Don Cowan trained as an enzymologist and graduated from the University of Waikato, New Zealand in 1981. After a period of post-doctoral research, he took up a tenured Lectureship in the Department of Biochemistry and Molecular Biology at University College London in 1985. In 2001 he moved, as Associate Professor, to take the Chair of Microbiology at UWC. During his research career he has published over 160 research papers, reviews and book chapters. He sits on the Editorial Boards of 13 international journals. Don Cowan was promoted to Senior Professor in 2004, elected as a Fellow of the Royal Society of South Africa in 2005 and a Member of the Academic of Sciences of South Africa in 2007. He was awarded the UWC Vice-Rectors Award for research excellence in 2008 and the SASM Silver Medal for “*exceptional, meritorious and original research in microbiology*” in 2009.



Field work in Antarctica, January 2009

The IMBM Team

As of December 2009, the IMBM team, led by Professor Cowan and Dr Marla Tuffin, comprised some 50 researchers, including 17 post doctoral research staff, 9 PhDs, 12 MScs and 3 technical/administrative assistants headed by Dr Heide Goodman.

Members of the IMBM team



IMBM
Institute for Microbial
Biotechnology and
Metagenomics


Donald Cowan
Director


Marla Tuffin
Deputy Director


Heide Goodman
Senior Administrator

October 2009

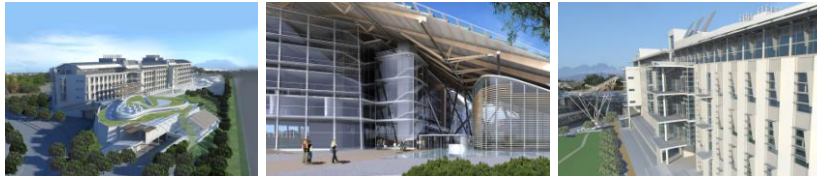
 Rolene Bauer LEAF Administrator	 Marla Buijen Andriano Post Doctorate	 Desiré Barraud Post Doctorate	 Anna Casanueva Post Doctorate	 Samantha Easton Post Doctorate	 Salim Fall Post Doctorate	 Rob Huddy Post Doctorate	 Gordon Jamieson Post Doctorate	 Bronwyn Kirby Post Doctorate	 Laisev Lilelkyte Post Doctorate
 Andriy Maslyanko Post Doctorate	 Tracy Meiring Post Doctorate	 Inonge Mutalo Post Doctorate	 Moola Mutondo Post Doctorate	 Jean Baptiste Ramsdell Post Doctorate	 Francesca Stomeo Post Doctorate	 Mark Taylor Post Doctorate	 Adolphe Ze Ze Post Doctorate	 Lomnie van Zyl Str. Researcher	 Basil Braaf Technician
 Dominique Anderson Ph.D	 Nazreen Ebrahim Ph.D	 Nehakazi Galada Ph.D	 Claude Kwasajo Ph.D	 Lubosa Kambulu Ph.D	 Natasha Mavengere Ph.D	 William Mavengere Ph.D	 Colin Ohlhoff Ph.D	 Lucinda Adonis MSc	 Wellington Charwa MSc
 Randall Crisp MSc	 Farzana Dhansay MSc	 Afshin Ghaziagar MSc	 Xiao Ping Hu MSc	 Hanna Kwon MSc	 Thudani Makhalanyane MSc	 Tshifhiwa Mamphegoro MSc	 Lesley-Ann Mathews MSc	 Clive Mketu MSc	 Megan Oldale MSc
 Irfan Abdulla Hons	 Keemenuo Rafisi Hons	 Dean Boyesen Hons	 Yu Gao Hons	 Timna January Hons	 Andiswa Mgudlwa Hons	 Tanya Nyman Hons	 Oraltwe Tshukudu Exchange	 Fungai Manhanga Assistant	 Anna Le Roux Assistant

The IMBM Laboratory

The current IMBM laboratory is sited in 400m² of refurbished space on the ground floor of the Old Chemistry Building at UWC. An open-plan laboratory, designed to house up to 26 researchers, is supplemented by support rooms, a computer suite, post doctoral offices and a student work-room

With the completion of Phase 1 of the new UWC Life Sciences building, the IMBM laboratory will move in early 2010 to a new state-of-the-art research space. IMBM has been allocated a floor space of approximately 1200m², capable of housing over 55 researchers and support staff.

CAD images of the Life Science Building



Research Projects

Molecular Ecology of Antarctic Dry Valley Soils

In a major collaboration with Professor Craig Cary of the University of Waikato, NZ, IMBM researchers are investigating microbial diversity and function in the cold desert soils of the McMurdo Dry Valleys of Eastern Antarctica. This program is supported by the NRF and Antarctica NZ, who provide the logistics for an annual field expedition to Antarctica.

**Desert soils in the Miers Valley,
Eastern Antarctica**



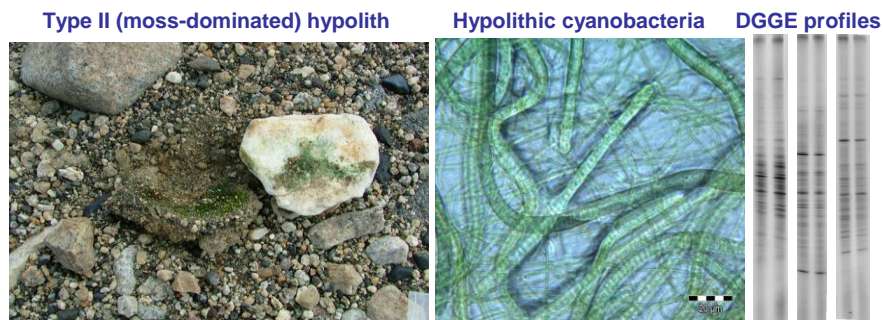
**A quartz hypolith – hiding an active
community of cold-adapted organisms**



The mineral soils of the Antarctic Dry Valley represent one of the most extreme environments on Earth. The extreme conditions to which endemic microorganisms are exposed include very low temperatures, low water availability, oligotrophy, high salinities and periodic high radiation levels.

IMBM researchers are focusing on the phylogenetic diversity and activity of microorganisms in hypolithic habitats, which provide an elegant model system for studying the factors which dictate microbial community structure and function.

As the leader of one of the world's leading Antarctic microbiology research teams, DAC co-authored an important Nature review in late 2009.



Novel microorganisms from extreme habitats

In a series of collaborations with international research researchers, IMBM researchers have studied the microbial diversity, using both culture-dependent and culture-independent methods, of thermophilic, halophilic and haloalkaliphilic habitats in China and neighbouring regions, Ethiopia and Kenya. Numerous novel bacteria and archaea have been identified and isolated. In particular, IMBM researchers have demonstrated that nanoarchaea, a novel group of hyperthermophilic archaeal parasites, are found in high temperature habitats around the world, including S.W. China (Yunnan Province), Chile, and New Zealand. They have also shown, for the first time, that nanoarchaea are not restricted to hyperthermophilic habitats, and may be found in hypersaline pools, including the Darling salt pans in the Western Cape.

Soda Ash, Ethiopia



Thermal pool, Wai-O-Tapu, NZ



Microbial molecular ecology of pristine and polluted South African environments

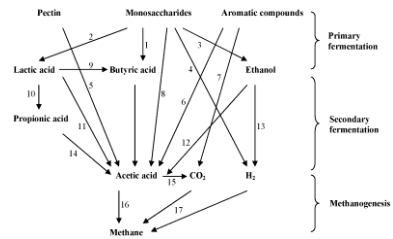
IMBM researchers are involved in a variety of studies aimed at understanding the microbial diversity and key functional organisms in specific Western Cape habitats. These include wetland systems contaminated with olive processing wastewater and winery waste, and pristine fynbos soils (both in collaboration with Professor Stephanie Burton, Biocatalysis and Technical Biology Unit, CPUT), soils amended with precipitates derived from neutralization of Fly Ash with Acid Mine Drainage (in collaboration with Dr Leslie Petrik, Department of Chemistry UWC, Dr Odile Bruneel, University of Montpellier, FR and Kelley Reynolds, Eskom, SA), sulphate reduction processes in Darling hypersaline ponds (in collaboration with Prof Alex Roychoudhury, Department of Geology, SUN) and riparian soils (with Dr Shayne Jacobs, Department of Conservation Ecology and Entomology, SUN).

Phylogenetic surveys of some of these habitats have identified novel groups of actinobacteria. These findings have led us to initiate a program of isolation of novel actinomycetes (in collaboration with Professor Stephanie Burton, Department of Chemical Engineering, UCT and Professor Alan Bull, University of Kent, UK).

Wine-wastewater contaminated wetland system in the W. Cape.

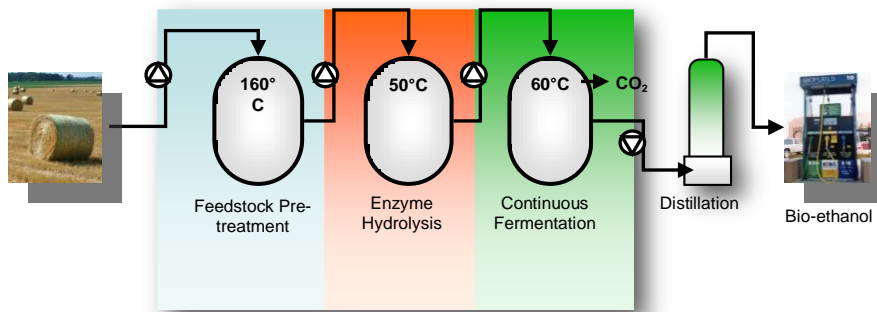


Trophic interactions implicated in the degradation of wine wastewater chemicals



Bioenergy, Biofuels and Bioresources

IMBM researchers are involved in several studies aimed at the recovery of valuable chemical and energy products from low value feedstocks. In early 2009, IMBM was awarded a large project grant from the PlantBio Trust to develop lignocellulosic enzyme digestion technology. In a collaborative program including laboratories at the University of Stellenbosch (Dr Heinrich Volschenck), Cape Peninsular University of Technology (Prof. Stephanie Burton) and the CSIR (Prof. Dean Brady) and administered through IMBM, metagenomic DNA and cDNA technologies are applied to the discovery of novel active enzymes for digestion of the cellulose, hemicellulose and lignin fractions of lignocellulosic biomass.



As part of a wider biofuels research program, IMBM maintains a major collaboration with **TMO Renewables Ltd**, a leading UK biofuels company working in the bioethanol sector. Our role is to assist TMO Ltd to develop new fermentation technology for the thermophilic conversion of pentose feedstocks to biofuel. IMBM research activities include proteomic and transcriptomic studies of production strain metabolism and genetic control.

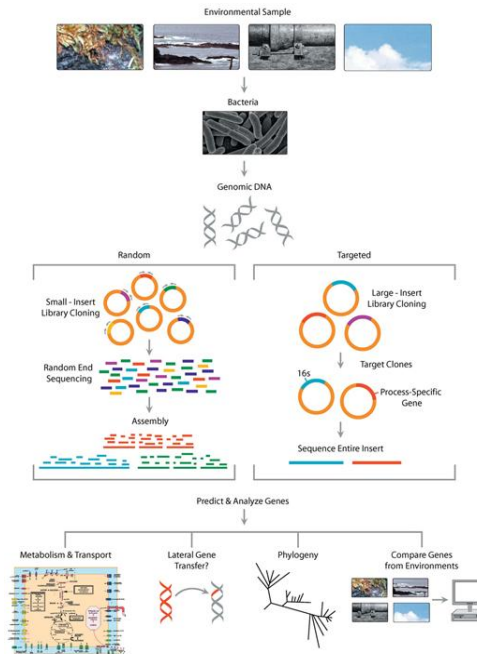
IMBM is also actively researching the molecular basis of microbial solvent tolerance and the characterisation of new metabolic pathways for production of alternative biofuels such as 1-butanol and butan-1,2-diol.

Metagenomic Gene Discovery

The term *metagenomics* applies to any studies which are based on extraction of total community DNA from an environmental source (i.e., that are not dependent on the isolation and/or culturing of any individual organism).

In collaboration with Professor Stephanie Burton and others, the IMBM laboratory has been involved in the development of new metagenomic technologies for recovery of novel genes from the environment. Cloning approaches include the use of subtractive hybridisation with magnetic gene capture and the preparation of large insert libraries using commercial fosmid vector kits.

Fosmid library screening (in conjunction with transposon mutagenesis and direct clone sequencing) has been highly successful and IMBM researchers have identified a range of novel enzyme genes, including an esterase gene with only 22% amino acid homology to any other known gene.



Genomics and Genome Analysis

With the recent acquisition by the UWC Department of Biotechnology of a state-of-the-art high throughput Illumina DNA sequencer, IMBM is ideally positioned to employ this new and exciting technology for studies of genome structure, gene discovery and environmental genomics. IMBM researchers have already embarked on the sequencing of the genomes of a novel psychroalkaliphilic *Nesterenkonia* isolate, the thermacidophile *Alicyclobacillus acidocaldarius* and several cold-adapted bacteriophage.

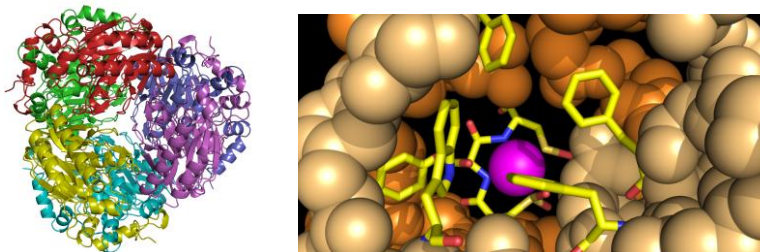
Structure, Engineering and Applications of Nitrile-type Enzymes

IMBM researchers have cloned, sequenced and expressed the gene for a thermostable nitrile hydratase from the thermophilic organism *Geobacillus pallidus*. To investigate the molecular basis of substrate specificity, a combination of site-specific mutagenesis and x-ray crystallography was used to generate and characterize mutants with substantial activity on aromatic substrates. These

studies have been undertaken in collaboration with Professor Trevor Sewell (UCT) and Professor Mike Danson (University of Bath, UK) under the auspices of the NRF-Royal Society program.

The potential use of these enzymes as industrial catalysts, particularly for the nitrile hydratase catalyzed conversion of 3-cyanopyridine to nicotinamide, and the chiral resolution of amides using the D-specific amidase is under investigation, in collaboration with Professor Stephanie Burton, CPUT.

High resolution (1.8Å) structures of the *G. pallidus* amidase and NHase active site channel (showing the hydrophobic side chains and the active site Co^{III} atom).



Nanotechnology

In a new project linking the chemical and physical technologies available at the University of Leeds (through a collaboration with Dr Sarah Staniland) and the biological skills of the IMBM laboratory, a new class of magnetic nanoparticles and nanobiocarriers will be developed. These will be based on the capacity of certain microorganisms (magnetobacteria) to accumulate transition metals and synthesise magnetic nano-size particles.

IMBM Technology

Molecular Ecology and Metagenomics

IMBM researchers employ modern molecular phylogenetic techniques to investigate microbial and gene diversity, and community structure and function in various environments. Core technologies include environmental nucleic acid isolation, RT-PCR, 16S rRNA gene analysis and Denaturing Gradient Gel Electrophoresis (DGGE).

Gene Discovery

IMBM researchers are involved in the development of leading edge technologies for metagenomic gene discovery. These involve the preparation and screening of large-insert fosmid, cosmid and BAC expression libraries, PCR-dependent targeting of specific genes, and subtractive- hybridization-magnetic gene capture methods for direct isolation of new genes from environmental DNA sources.

The IMBM Culture Collection

IMBM has accumulated an extensive collection of microbial isolates (including over 300 thermophilic bacteria, 100 psychrotrophic bacteria and 100 actinomycetes), metagenomic DNA libraries and environmental DNA preparations. These materials constitute a highly valuable resource for the identification of novel genes, metabolic pathways and secondary metabolites.

Novel actinomycetes from the IMBM Culture Collection



Gene Expression and Protein Purification

IMBM researchers have extensive skills in the cloning, expression and recovery of heterologous genes. *E. coli* is most commonly used as the production host strain, but alternative hosts (including *Streptomyces* sp., *Bacillus* sp., *Saccharomyces cerevisiae*) are available as required. The laboratory also has access to a novel filamentous fungal expression system, suitable for large-scale extracellular production of heterologous proteins.

Enzymology and Structural Biology

The products of the gene discovery program are typically functional proteins, particularly enzymes. The IMBM laboratory has both the technology and skill to undertake detailed physical and functional characterization of novel enzymes. Protein structures are determined using the Department of Biotechnology Protein Crystallography Unit, in collaboration with members of staff from UWC and the neighbouring University of Cape Town.

Structural Biology

The Department of Biotechnology at UWC houses one of only two protein crystallography units in sub-Saharan Africa's. Operated by Prof. Trevor Sewell, this facility provides unique opportunities to investigate the structural properties of novel proteins. Linked with site-specific and random mutagenesis technologies, this is a powerful resource for studies of structure-function and for protein design.

Proteomics and Genomics

The Department of Biotechnology has recently acquired the complete technology for DiGi analysis of proteomes using 2D Gel Electrophoresis. This facility is available, in collaboration with Prof. Bongani Ndimba of the Proteomics Research Unit, for the comparative assessment of microbial growth, gene expression, engineered strains and much more.

Research and Post Graduate Degree Positions

Grant awards from the NRF are typically notified in November/December of each year. Post Doctoral, PhD and Masters bursaries and positions specified in these awards are available from January the following year, typically for a 2 or 3 year tenure. Graduating students interested in research positions in the IMBM laboratory should contact Professor Cowan or Dr Tuffin at imbm.uwc@gmail.com to enquire about the availability of research projects.

All formal applications for higher degrees (Masters and PhD) are made on application forms accessible on the UWC web-site (www.uwc.ac.za) and must clearly identify IMBM as the laboratory of choice. Applications for Post-Doctoral positions (letter of application plus full CV) should be made directly to Professor Cowan or Dr Tuffin.

IMBM Researchers (December 2009)

Post-Doctoral

Adolphe Zeze (PhD, Bordeaux, FR)
Ana Casanueva (PhD, UCT)
Andrij Maslyanko (PhD, U. Szeged, Hungary)
Bronwyn Kirby (PhD, UCT)
Desiré Barnard (PhD, SUN)
Francesca Stomeo (PhD, U. Sevilla)
Gordon Jamieson (PhD, UMIST, UK)
Inonge Mulako (PhD, UCT)
Jean-Baptiste Raymond (PhD, U. Rouen)
Laisve Lideikyte (PhD, LUA, Lithuania)
Maria Bailen (PhD, U. Autonoma, ES)
Mark Taylor (PhD, Imperial College London, UK)
Moola Mutondo (PhD, Cologne)
Rob Huddy (PhD, UCT)
Saliou Fall (PhD, U. Lyon)
Samantha Easton (PhD, UCL, UK)
Tracy Meiring (PhD, U. Pretoria)

PhD

Ncebakazi Galada
Joseph Lako
Kelley Reynolds (PT)
Kambula Lukusa
Nazneen Ebrahim
Dominique Anderson
William Mavengere
Natasha Mavengere
Colin Ohloff
Mesfin Gameda (with U. Addis Ababa, ET)
Claude Kouadjo (with U. Cote d'Ivoire, Cdi)

Masters

Babele Emedi
Farzaana Dhansay
Thulani Makhalanyane
Clive Mketsu
Hanna Kwon
Megan Oldale
Tshifiwa Mamphogoro
Lucinda Adonis
Lesley-Ann Matthews
Randall Crisp
Afshin Ghasiasgar
Xiao-Ping Hu

Recent IMBM Graduates

Kamini Moodley (MSc, 2004)
Joseph Lako (MSc, 2005)
Ncebikazi Galada (MSc, 2005)
Nthabiseng Mashapu (MSc, 2005)
Antoinette van Schalkwyk (PhD, 2005)
Tsepo Tsekoa (PhD, 2005)
Konanami Rashemuse (PhD, 2005)
Quinton Meyer (PhD, 2006)
Jacques Smith (PhD, 2006)
Jo Rapley (MSc, 2007)
Eveline Kaambo (2007)
Jennifer van Wyk (PhD, 2008)
Mornay du Plessis (PhD, 2008)
Marshall Keyster (MSc, 2008)
Parik Kowlessur (MSc, 2008)
Dominique Anderson (MSc, 2009)
William Mavengere (MSc, 2009)
Natasha Mavengere (MSc, 2009)
Nuraan Khan (PhD, 2009)
Andrew Nel (PhD, 2009)

Associate Members of IMBM

Professor Stephanie Burton

Biocatalysis and Technical Biology Unit, Cape Peninsular University of
Technology, SA

Professor Michael Danson

Department of Biochemistry, University of Bath, UK

Professor Roy Daniel

Department of Biological Sciences, University of Waikato, NZ

Professor Craig Cary

Department of Biological Sciences, University of Waikato, NZ

Professor Antonio Ventosa

Department of Microbiology, University of Sevilla, ES

Professor Alan Bull

Department of Biological Sciences, University of Kent, UK

Professor Tony Atkinson

TMO Renewables Ltd., Guildford, UK

Professor Sara Sjoling
Department of Biological Sciences, Sodertorns Hogskola, SW

Dr Jenny Blamey
Biosciencia, Santiago, CHE

Professor Trevor Sewell
Electron Microscopy Unit, University of Cape Town, SA

Dr Bongani Ndimba
Department of Biotechnology, University of the Western Cape, SA

Dr Leslie Petrik
Department of Chemistry, University of the Western Cape, SA

Ms Kelley Reynolds
Eskom Plc., SA

Professor Lise Ovreas
University of Bergen, NO

Professor Nils-Kare Birkeland
University of Bergen, NO

Professor Peter Schoenheit
Institut für Allgemeine Mikrobiologie, University of Kiel, DE

Dr Amare Gassesse
University of Addis Ababa, ET

Professor Frank Robb
University of Maryland Biotechnology Institute, USA

Dr Alex Roychoudhury
Department of Geology, Stellenbosch University, SA

Dr Odile Bruneel
Laboratoire Hydrosociences Montpellier, University of Montpellier, FR

Professor Hugh Morgan
Department of Biological Sciences, University of Waikato, NZ

Professor Stephen Pointing
Department of Biology, University of Hong Kong, HK

Professor Roberta Farrell
Department of Biological Sciences, University of Waikato, NZ

Professor Shayne Jacobs
Department of Conservation Biological and Entomology, Stellenbosch University, SA

Dr Heinrich Volschenck
Department of Microbiology, Stellenbosch University, SA

Professor Dean Brady
CSIR Modderfontein, SA

Professor Hamadi Iddi Boga

Department of Microbiology and Microbial Ecology, Jomo Kenyatta
University of Agriculture and Technology, KE

Dr Sarah Staniland

School of Physics and Astronomy, University of Leeds, UK

Professor Alan Christoffels

SA National Bioinformatics Institute, University of the Western Cape, SA

IMBM Publications

Table 1. Publication outputs for the Institute [2002 – 2009].

Year of Publication	Number of Publications*
2002	5
2003	6
2004	5
2005	6
2006	10
2007	18
2008	11
2009	11

* Chapters, reviews and research publications

Research Papers, Reviews and Book Chapters: 2007 - 2009

1. Cowan, DA, Casanueva, A, Stafford, W. (2007) *Ecology and biodiversity of cold-adapted organisms*. Ch. 9 in **Physiology and Biochemistry of Extremophiles**. Gerday, C., Glansdorff, N., eds. ASM Press, Washington DC, pp. 119-133.
2. Cowan, DA and Stafford, W. (2007) Metagenomic methods for determining active microorganisms and genes in bioremediation and biotransformation processes. Ch. 58 in **ASM Manual of Environmental Microbiology**, 3rd Edition. Editors: CJ Hurst, RL Crawford, JL Garland, DA Lipson, AL Mills, LD Stetzenbach. Eds., 1310 pp. ISBN: 978-1-55581-379-6
3. Daniel, R.M., Danson, M.J., Hough, D.W., Lee, C.K., Peterson, M.E. and Cowan, D.A. (2008) Enzyme stability and activity at high temperatures. Ch. 17 in **Anatomy & Physiology of Extremophilic Proteins**, Nova Science, Eds. Thomas, T, Sidiqui, S. pp. 1-34. ISBN 978-1-60456-019-0

4. Sjöling, S, Cowan, DA. (2008) Metagenomics – microbial community genomes revealed. Ch. 20 in *Psychrophiles: from Biodiversity to Biotechnology*. Margesin, R.; Schinner, F.; Marx, J.-C.; Gerday, C. (Eds.) 462 pp. ISBN: 978-3-540-74334-7
5. Meyer, QC, Burton, SB, Cowan, DA (2007) Subtractive hybridization magnetic bead capture: A new technique for the recovery of full length ORFs from the metagenome. **Biotechnol. J.** 2:36-40
6. 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. **Appl. Microbiol. Biotechnol.** 75:801-811.
7. Márquez, C, Carrasco, IJ, Xue, Y, Ma, Y, Cowan, DA, Jones, BE, Grant WD, Ventosa, A. (2007) *Aquisalimonas asiatica* gen. nov., sp. nov., a moderately halophilic bacterium isolated from an alkaline, saline lake in Inner Mongolia, China. **Int. J. System. Evol. Microbiol.** 57:1137-1142.
8. Castillo, AM, Gutierrez, MC, Kamekura, K, Ma, Y, Cowan, DA, Jones, BE, Grant WD, Ventosa, A. (2007) *Halovivax ruber* sp. nov., a novel extremely halophilic archaeon isolated from Inner Mongolia, China. **Int. J. System. Evol. Microbiol.** 57:1024-1027.
9. Olaniran, AO, Stafford, WHL, Cowan, DA, Pillay, D, Pillay, B. (2007) Microbial community profiling in cis- and trans-dichloroethene enrichment systems using denaturing gradient gel electrophoresis. **J. Microb. Biotechnol.** 17:560-570.
10. Rashamuse, KJ, Burton, SG, Stafford, W, Cowan, DA. (2007) Molecular characterization of a novel family VIII esterase from *Burkholderia multivorans* UWC10. **J. Mol. Microbiol. Biotechnol.** 13:181-188
11. Gutiérrez, MC, Castillo, AM, Kamekura, M, Xue, Y, Ma, Y, Cowan, DA, Jones, BE, Grant, WD, Ventosa, A. (2007) *Halopiger xanaduensis* gen. nov., sp. nov., an extremely halophilic archaeon isolated from a saline lake in Inner Mongolia, China. **Int. J. System. Evol. Microbiol.** 57:1402-1407.
12. Silva-Stenico, E, Vengadajellum, CJ, Janjua, HJ, Harrison, STL, Burton, SG, Cowan, DA. (2007) Degradation of low rank coal by *Trichoderma atroviride* ES11. **J. Indust. Microbiol. Biotechnol.** 34:625-631.
13. Pagaling, E., Haigh, R., Grant, WD, Cowan, DA, Jones, B., Ma, Y., Ventosa A., Shaun Heaphy. (2007) Sequence analysis of an archaeal virus isolated from a hypersaline lake in Inner Mongolia, China. **BMC Genomics**, 8:410-416

14. Carrasco, IJ, Márquez, MC, Xue, Y, Ma, Y, Cowan, DA, Jones, BE, Grant, WD, Ventosa, A. (2007) *Bacillus chagannorensis* sp. nov., a moderate halophile from a soda lake in Inner Mongolia, China. **Int. J. System. Evol. Microbiol.** 57:2084-2088.
15. Carrasco, IJ, Márquez, MC, Xue, Y, Ma, Y, Cowan, DA, Jones, BE, Grant, WD, Ventosa, A. (2007) *Salsuginibacillus kocurii* gen. nov., sp. nov., a moderately halophilic bacterium from soda lake sediment. **Int. J. System. Evol. Microbiol.** 57: 2381-2386.
16. Rashamuse, KJ, Burton, SG, Cowan, DA. (2007) A novel recombinant ethyl ferulate esterase from *Burkholderia multivorans*. **J Appl. Microbiol.** 103:1610-1620.
17. Carrasco, IJ, Márquez, MC, Xue, Y, Ma, Y, Cowan, DA, Jones, BE, Grant, WD, Ventosa, A. (2007) *Halorubrum ejinorensis* sp. nov., isolated from Lake Ejinor, Inner Mongolia, China. **Int. J. System. Evol. Microbiol.** 57:2538-2542.
18. Kimani, SW, Agarkar, VB, Cowan, DA, Sayed, MF-R, Sewell, BT. (2007) The crystal structure of an aliphatic amidase from *Geobacillus pallidus* RAPc8: evidence for a fourth nitrilase catalytic residue. **Acta Cryst. D.** 63:1048-1058.
19. Cowan, DA, Casanueva, A. (2007) Stability of ATP in Antarctic desert soils. **Polar Biology**, **30:1599-1603.**
20. Porter, D., Roychoudhury, AN, Cowan, DA. (2007) Dissimilatory sulphate reduction in hypersaline coastal pans: Part 1. Activity across a salinity gradient. **Geochim Cosmochim. Acta.** 71:5102-5116
21. Wood SA, Rueckert A, Cowan DA, Cary SC. (2008) Aquatic cyanobacteria, important contributors to edaphic cyanobacterial diversity in the Dry Valleys of Eastern Antarctica? **ISME J.** 2:308-320
22. Oboirien, BO, Burton, SG, Cowan, DA, Harrison, STL. (2008) The effect of the particulate phase on coal biosolubilisation mediated by *Trichoderma atroviride* in a slurry bioreactor. **Fuel Processing Technology.** 89:123-130.
23. Galada, N, Casanueva, AI, Baker, GC, Grant, WD, Heaphy, S, Jones, BW, Ma Y, Ventosa, A, Blamey A, Cowan, DA. (2008) Nanoarchaeal 16S rRNA gene sequences are widely dispersed in hyperthermophilic and mesophilic halophilic environments. **Extremophiles.** 12:651-656.
24. Gutiérrez, MC, Castillo, AM, Pagaling, E, Heaphy, S, Kamekura, M, Xue, Y, Ma, Y, Cowan, DA, Jones, BE, Grant, WD, Ventosa, A. (2008) *Halorubrum kocurii* sp. nov., an archaeon isolated from a saline lake. **Int. J. Syst. Evol. Microbiol.** 58:2031-2035.

25. Carrasco, IJ, M. C. Márquez, Y. Xue, Y. Ma, D. A. Cowan, B. E. Jones, W. D. Grant and A. Ventosa. (2008) *Sediminibacillus halophilus* gen. nov., sp. nov., a moderately halophilic Gram-positive bacterium from a hypersaline lake. **Int. J. System. Evol. Microbiol.** 58:1961-1967.
26. Márquez, C, Carrasco, IJ, Xue, Y, Ma, Y, Cowan, DA, Jones, BE, Grant, WD and Ventosa, A. (2008) *Aquisalibacillus elongatus* gen. nov., sp. nov., a moderately halophilic bacterium of the family Bacillaceae isolated from a saline lake. **Int. J. System. Evol. Microbiol.** 58:1922-1926.
27. Hu, L, Pan, H, Xue, Y, Ventosa, A, Cowan, DA, Jones, BE, Grant, WD, Ma, Y. (2008) *Halorubrum luteum* sp. nov., isolated from Lake Chagannur, Inner Mongolia, China. **Int. J. System. Evol. Microbiol.** 58:1705-1708.
28. Taylor, M, Tuffin, M, Burton, SG, Eley, K, Cowan, DA. (2008) Microbial responses to solvent and alcohol stress. **Biotechnol. J.** 3:1388-1397
29. Cowan, DA. (2008) Biotechnology in South Africa. **Biotechnol. J.** 3:1322-1323
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