

Faculty of Applied Sciences

Department of Biotechnology & Food Technology



Annual Report 2007



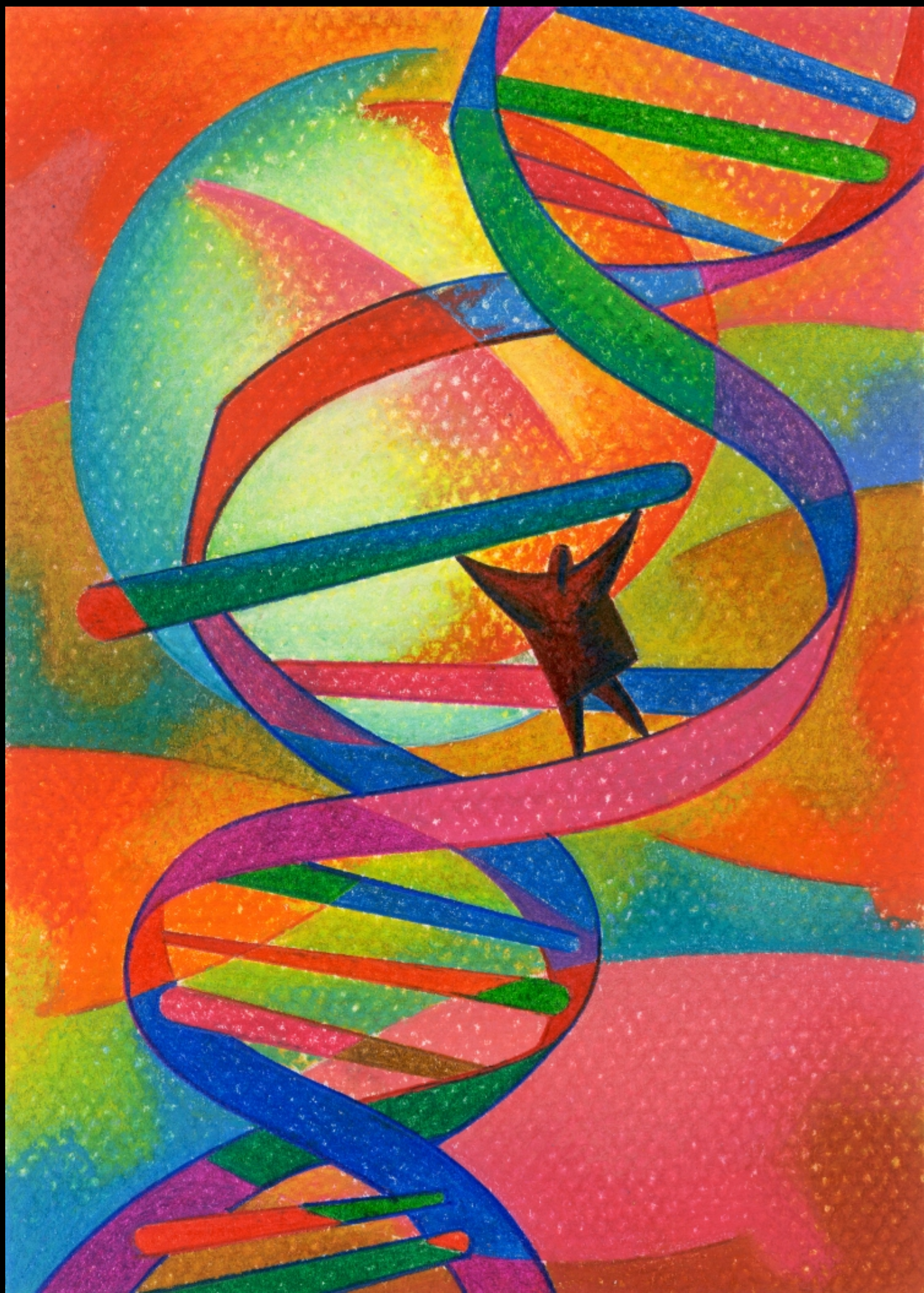
DURBAN
UNIVERSITY of
TECHNOLOGY

A Leading University of Technology in Africa

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DEPARTMENTAL MISSION STATEMENT

The mission of the Department of Biotechnology and Food Technology is to provide a comprehensive education incorporating theoretical and practical training, with emphasis on relevant biotechnological skills and their applications to improve the quality of life. The primary goal is to produce flexible, self-motivated technologists with skills and insights into relevant occupations.

To achieve its mission, the Department is committed to develop and improve the quality of instructional offerings through excellence in teaching and research.

The mission of the Department is aligned to the following principles of the institutional vision and mission:

- ✓ to achieve a balance between theory and practice;
- ✓ to engage in quality teaching and learning
- ✓ to provide the relevant career focused training in the field of biotechnology within the context of the time of the programs offered, resources and technology, and recognizing the developmental context of our society, as well as the multidisciplinary nature of our profession
- ✓ to engage in research to serve the needs of society
- ✓ to promote staff development
- ✓ to promote sustainable partnerships with the community



BIOTECHNOLOGY AT A GLANCE

Biotechnology is the application of living organisms or the individual cellular components of these organisms for commercial purposes or environmental control. It is a subject which has developed largely over the last decade, to cover a number of different areas. These involve quality control, sterilization testing, manufacturing of alcoholic beverages, bread making, cheese production, vaccines, chemicals, diagnostic kits, biosensors, chemotherapeutic drugs, nitrogen fertilizers, alcohol, antibiotics, insecticides and biomass production.

A person working in the field of biotechnology will have a working knowledge of such disciplines as biochemistry, microbiology, process engineering, genetics, molecular biology and physics. Persons achieving this qualification will be competent to apply theoretical and practical fundamental knowledge and skills in the fields of biotechnology, microbiology and biochemistry to the relevant biotechnology industries and research institutions. Graduates may apply for registration with the South African Council for Natural Scientific Professions as Certified Natural Scientists.

FOOD TECHNOLOGY AT A GLANCE

In South Africa, the second largest industry is the food and beverages industry. The industry is highly diversified and embraces sectors such as dairy, meat, fish, poultry, cereals, confectionary, canned and frozen products and a vast number of fast moving consumer goods.

Food Technologists are responsible for maintaining and improving the quality of processed food. They continually strive to make better use of food resources and to find more efficient mass-production methods while maintaining the highest level of quality control. Food Technologists may eventually specialize in one of the following areas:

- Quality Assurance/Quality Control
- Product Research and Development
- Production/Management

As there is presently a shortage of well-qualified Food Technologists, promotion opportunities to Supervisory or Management positions are good, provided students are prepared to work hard, possess leadership qualities and are willing to study further.



MESSAGE FROM THE EXECUTIVE DEAN



Prof. Darren Lorton
Executive Dean
Faculty of Applied Sciences

It is a widely held adage that the most productive segments of the workforce are the ones that are usually approached when more needs to be done. For the Department of Biotechnology and Food Technology this certainly holds true.

It has become common knowledge at the Durban University of Technology that across the Institution this Department has the highest research output, the largest number of postgraduate students, the greatest concentration of Professors, Rated Researchers and concomitant Research Niche areas and that from amongst its ranks it has attracted the lion's share of externally funded grants.

What is not common knowledge is that the Department's track record in the Teaching and Learning arena has also been exemplary. Its undergraduate success rates, throughput and graduation rates continue to rank among the highest in the Institution. As evidenced by its Internal Quality Review in 2007 the Department responded positively to concerns raised therein. The implementation of recommendations led to the Centre for the Promotion of Quality Assurance (CPQA) identifying this Department for a pilot project undertaken by the CPQA as part of a national initiative on Curriculum Design.

In addition the Department's response to the monitoring and tracking of students at risk has led to this developing into a Faculty initiative. Many of the staff of the Department continue to represent the Faculty as an Institutional level and to represent the University at National and International levels. As the staff and students of this Department continue to achieve and set new benchmarks in all areas of activity, the Faculty and University continues to look to it as the standard against which the achievement of the goal of becoming a University of Technology will be measured.

MESSAGE FROM THE HEAD OF DEPARTMENT

“First is first, second is nowhere”



Prof. Suren Singh
Head of Department

I am pleased to share with you this report of the activities of the Department of Biotechnology and Food Technology for 2007. This report is nostalgic in many ways, as it marks a decade since I assumed an academic position at the former ML Sultan Technikon and now DUT. Over the past decade, the Department has been systematically reinventing itself – through the efforts of our faculty, and most especially my predecessor head – Professor Odhav, we have been able to attract and retain a strong group of Academic and Technical staff. These colleagues have provided much energy and many ideas that have enabled our department and students to grow and renew.

We continue to be proud of our students who are making massive contributions from the laboratory to management, to mould the Biotechnology and Food Technology Industries into a new era of meeting global standards. The scholarly activities within the Department have increased substantially in the period of this report. Our growth in research is on track to become even stronger in the current, 2007-8 year.

Our status as the leading research University of Technology in our disciplines will remain unchallenged for a long time bearing in mind the pace at which we are operating, under trying circumstances.

The Department continues to break previous records in research funding. NRF and other external funding from WRC and the MRC and industry was R3.3million and our total research funding including DUT support was R4million for 2007. The efforts generated by our two NRF niche areas and focus areas in the three research thrusts in the Department viz., Enzyme Technology, Plant Biotechnology and Water and Wastewater Technology have been the forefront of our research success. National and international collaborations have been well established by our three research groups and the steady flow of scientists between various institutions have been extremely rewarding. The accomplishment of having three NRF - rated scientists bodes well for the Department in benchmarking itself against similar disciplines across South Africa.

An indicator of research excellence for the year is given by the large number of International journal publications and national and international conference presentations, which are outlined in this report. Our eleven doctoral students and twenty two Masters students and five post doctoral fellows are exclusive vital signs of a healthy teaching and research environment within the department for 2007. My heartfelt thanks to the research leaders and their teams for their great efforts and outputs, that are second to none in the KZN region and nationally among all the Universities of Technology within our disciplines.

In playing host to several visiting scientists, we were also able to further enhance our research culture and improve our outputs as well. The scholarship that this provided was invaluable and we hope to retain this endeavour for the future. Following an external benchmarking exercise for both food and biotechnology programmes in 2006, we are making great strides in restructuring and revising our curricula from undergraduate to postgraduate levels. Advisory Boards for both programmes have made considerable input in realigning our academic offerings for the “real world”. This will ensure that we create a solid foundation for our students to drive technologies and innovations that are in dire need in South Africa. The placement of our students in key industries in their work integrated learning phase bear testimony to the excellent teaching and technical expertise we offer. In addition, the employment of our graduates from the diploma to doctoral levels in key positions in industry further cements our place as being a top University offering quality programmes.

Finally, I take this opportunity to thank all my academic and technical staff for their work in 2007. The success we have accomplished are due to the myriad contributions of the staff and students within this Department. The support received from the offices our Executive Dean: Professor Darren Lortan and the Centre for Research Management and Development : Professsor Gansen Pillay are deeply appreciated. Industry must also be commended for their continual efforts in employing our students and providing feedback into our academic ambit.

The achievements outlined here and our ongoing activities further strengthen both our Biotechnology and Food Technology programmes, and see us well placed to continue achieving national and international recognition.

MESSAGE FROM THE DIRECTOR OF RESEARCH



Prof. Gansen Pillay
Research Director

Research Management and Development

Congratulations to the Department of Biotechnology and Food Technology on the inaugural publication of its 2007 Annual Report! The report provides an excellent window into the Department's teaching, research and outreach activities. It is a report that places the Department as a flourishing entity in higher education and positions it as a preferred site of study to prospective students.

What makes this Department successful?

Visionary and inspirational leadership, well qualified and experienced staff, carefully constructed and relevant teaching modules, and research programmes that are both excellent and relevant.

Importantly, it is the latter that sets the Department apart and makes it comparable to the best in the country. Over the years, the Department has journeyed on a well-mapped and strategic route to be able to reach significant milestones.

Of the twelve academic staff members (all of whom are active researchers), six possess doctoral qualifications and the remaining six, who are masters degree graduates, will graduate with their doctoral degrees by 2010. The National Research Foundation (NRF) of South Africa is a key provider of research funding to the Durban University of Technology (DUT). Researchers from the Department have consistently been able to attract significant levels of funding from the NRF for its higher degree students, postdoctoral fellows, research programmes, national and international engagements and research equipment. Of the four NRF-funded Research Niche Areas (RNAs) at DUT (which attracts guaranteed research funding for a period of five years), two are located within the Department. These are *Plant Biomass Utilisation* and *Water and Wastewater Research*. It is evident from the report that the Department has also been able to attract research funding from other external sources.

The NRF evaluation and rating system affords researchers the opportunity to subject themselves to peer-review by their national and international counterparts. Researchers are rated, *inter alia*, on their research outputs and productivity, student supervision, national and international standing and current and future research. The three members of the academic staff who hold current NRF ratings must be congratulated.

Research productivity is one of the criteria by which excellent academic departments are benchmarked. The report clearly demonstrates that in 2007 the Department successfully graduated higher degree students, published their research findings in national and international peer-reviewed journals, and have participated in both national and international conferences. Active research collaboration also occurs at both the national and international levels. NRF-bilateral funding has been awarded to the Department for collaboration with Sweden (Lund University) and with China (Jiangnan University). In addition, research collaboration takes place with the Netherlands through funding from SANPAD.

Finally, the pulse of a Department is measured by the robustness and vigour of its research activities. All of the evidence presented in the report indicates that the Department is in a healthy state and is poised to significantly catapult itself to new horizons. Congratulations once again! You make the DUT proud! Best wishes with your future activities!

DEPARTMENTAL PROFILE



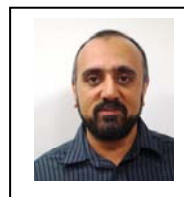
Prof. Suren Singh
Head of
Department



Prof. Bharti Odhav
Professor
Biotechnology



Prof. Kugen Permaul
Professor
Biotechnology



Prof. Faizal Bux
Professor
Biotechnology



Dr. Lalini Reddy
Associate Director
Biotechnology



Dr. Thiriloshani Padayachee
Associate Director
Food Technology



Ms. Sarla Juglal
Senior Lecturer
Biotechnology



Mr. Feroz Swalaha
Senior Lecturer
Biotechnology



Mr. Paul Mokoena
Senior Lecturer
Biotechnology



Ms. Aneliswa Makhathini
Lecturer
Biotechnology



Ms. Sharlynn Beekrum
Lecturer
Food Technology



Ms. Sarveshni Pillay
Lecturer
Food Technology



Mr. John Mellem
Junior Lecturer
Food Technology



Ms. Nokuthula Mchunu
Junior Lecturer
Biotechnology



Ms. Rena Brijlal
Senior Technician
Biotechnology



Mr. Viresh Mohanlal
Senior Technician
Biotechnology



Ms. Samantha Govender
Senior Technician
Food Technology



Mr. Ramnath (Vee) Dilraj
Technician
Food Technology



Ms. Predeshni Naicker
Technician
Biotechnology



Ms. Sharon Govender
Technician
Biotechnology



Ms. Kameshnee Naidoo
Technician
Biotechnology



Ms. Elaine Ram
Technician
Biotechnology



Mr. Prenaven Reddy
Technician
Biotechnology



Mr. Santhosh K. Pillai
Technician
Biotechnology



Ms. Rose Scott-Briggs
Technician
Food Technology



Mr. Elliot Ncayiyana
Laboratory Assistant



Mr. Lawrence Shange
Laboratory Assistant



Ms. Priscilla Phillips
Secretary
Biotechnology



Ms. Jalutchmi Govender
Secretary
Food Technology

HIGHER DEGREE STUDENTS GRADUATED IN 2007

Doctoral Students



Ms. Dawn E. Stephens

Masters Students



Ms. Busiswa Godana



Ms. Nareshini Naidoo



Ms. Sarveshnee Pillay



Ms. Lindile Kunene



Ms. Mashudu Mudzwiri



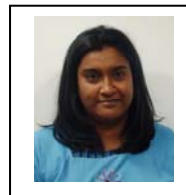
Mr. Fernando Pienaar



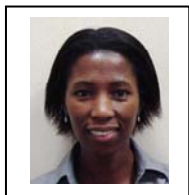
Ms. Zeenat Harrichandparsad



Ms. Bilkis B. Choonawala



Ms. Samantha Govender



Ms. Phakamile T. Mngadi



Ms. Shubnum Mustupha



Ms. Nelisha Naidoo

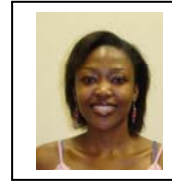
REGISTERED MASTERS STUDENTS: 2007



Ms. Nadine Moodley



Ms. Vashka Hurinanthan



Ms. Nompumelelo H. Madonsela



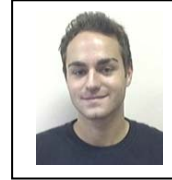
Ms. Alveera Singh



Mr. John Mellem



Ms. Kameshnee Naidoo



Mr. Kyle Wakelin



Ms. Rose Scott-Briggs



Mr. Yanadayalan Govender



Mr. Adrian P. Degenaar



Ms. Nokuthula .P. Mchunu



Ms. Sharon Govender



Ms. Thulisile T.Tenza



Ms. Nazihah Khan



Mr. Ramnath (Vee) Dilraj



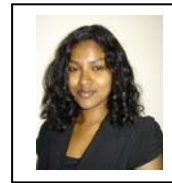
Mr. Arshad I. Kassim



Mr. Shivaan Maharaj



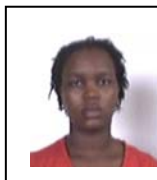
Mr. Sphamandla Xulu



Ms. Elaine Ram



Ms. Nonchlachla Mthembu



Ms. Nolwazi P. Cele



Ms. Monica Maharaj

REGISTERED DOCTORAL STUDENTS: 2007



Mr. Prenaven Reddy



Mr. Viresh Mohanlall



Mr. Santhosh Kuttan Pillai



Ms. Leroosha Govender



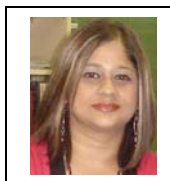
Mr. Feroz M. Swalaha



Mr. Tony Obilana



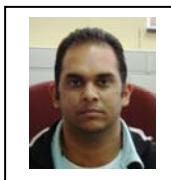
Ms. Dashika Naidoo



Ms. Nishani Ramdhani



Ms. Zinhle Marangane

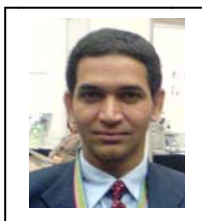


Mr. Vinodh A. Edward



Ms. Swastika Surujlall

POST DOCTORAL FELLOWS: 2007



Dr. Uma Sankar Akula

- Andra University, Faculty of Science, Vizag, India
- Supervisor : Prof. Bharti Odhav
- Research Group : Plant Biotechnology
- October 2004 - June 2007



Dr. Manimaran Ayyachamy

- India Shri AMM Murugappa Chettiar Research Centre,
- Photosynthesis and Energy Division, University of Madras, Chennai, India.
- Supervisor : Prof. Suren Singh
- Research Group : Enzyme Technology
- April 2006 - May 2008



Dr. Manjinder Singh

- Department of Molecular Biology & Biochemistry, Guru Nanak, Dev University, Amritsar, Punjab, India.
- Supervisor : Prof. Faizal Bux
- Research Group : Waste Water
- June 2006 - May 2008



Dr. Sheena Kumari

- Mangalore University, Mangalagangothri, Karnataka, India
- Supervisor : Prof. Faizal Bux
- Research Group : Waste Water
- April 2007 - Present



Dr. Lakshmi Prasanna Gangavaramu

- A G Bio Systems, India
- Supervisor : Prof. Suren Singh
- Research Group : Enzyme Technology
- May 2007 – present

TEACHING

Courses

The Department offers a wide spectrum of undergraduate courses for both Biotechnology and Food Technology. In addition sixteen service courses are offered to various disciplines outside the Department. The offering all these courses with limited laboratory space remains a huge challenge.

National Diploma : Biotechnology

Subjects	Subject Code	Lecturers	No. of Students
Semester One			
Microbiology I	MICR 101	Ms. S. Juglal	39
Chemistry I	CHMB 102	Dr. J. Adamson	46
Biodiversity & Ecology I	BIOD 101	Prof. F. Bux	44
Quantitative Methods I	QMTN 101	Mr. P Naidoo	47
Semester Two			
Microbiology II	MICR 202	Ms. S. Juglal	48
Biochemistry II	BCHM 202	Mr. P. Mokoena	44
Analytical Chemistry: Biological II	ACBL 201	Mr. J. Adamson	56
Sanitation, Safety & Hygiene I	SASH 101	Prof. F. Bux	43
Semester Three			
Microbiology : Biological III	MICR 301	Dr. K. Permaul	50
Disease and Immune Response II	DIMR 201	Dr. L. Reddy	38
Microbial Biochemistry III	MIBC 301	Mr. P. Mokoena	52
Fermentation Technology II	FERT 202	Prof. S. Singh	47
Semester Four			
Food Microbiology III	FMIC 302	Ms. S. Juglal	40
Analytical Biochemistry III	ABIC 301	Dr. L. Reddy	43
Process Technology & Management I	PRIM 101	Prof. S. Singh	44
Bioprocessing III	BIOP 301	Mr. F. Swalaha	39
Year Three : Work Integrated Learning			
Biotechnology Industry Practice I	EXBT101	Ms. S. Juglal	35
Biotechnology Industry Practice II	EXBT201	Ms. S. Juglal	35

National Diploma : Food Technology

Subject	Subject Code	Lecturer	No. of Students
Semester One			
Microbiology I	MICR 101	Ms. S. Juglal	34
Chemistry I	CHMB 102	Dr. J. Adamson	46
Physics I	PHYS 103	Mr. D. Singh	54
Quantitative Methods I	QMTN 101	Mr. P Naidoo	38
Semester Two			
Microbiology II	MICR 202	Prof. K. Permaul	48
Food Technology I	FDTE 102	Mr. J. Mellem	41
Analytical Chemistry:			
Biological II	ACBL 201	Mr. J. Adamson	66
Food Chemistry II	FCHM 202	Mr. P. Mokoena	45
Semester Three			
Food Technology II	FDTE 201	Ms. S. Beekrum	39
Food Industry Management I	FDIM 101	Mr. J. Mellem	42
Food Process Engineering I	FDPE 101	Ms. S. Pillay	41
Food Chemistry III	FCHM 302	Mr. P. Mokoena	44
Semester Four			
Food Microbiology III	FMIC 302	Ms. S. Juglal	33
Food Technology III	FDTE 301	Ms. S. Beekrum	31
Food Quality Assurance I	FDQA 101	Ms. S. Pillay	29
Food Processing Engineering II	FDPE 201	Ms. S. Pillay	34
Year Three : Work Integrated Learning			
Food Industry Practice I	EXFT 101	Ms. S. Beekrum	35
Food Industry Practice II	EXFT 201	Ms. S. Beekrum	35

Bachelor of Technology: Biotechnology

Purpose of programme:

Persons achieving this qualification will be competent to adopt a critical and innovative approach to contribute to the field of biotechnology and to pursue careers as senior technical managers and/or entrepreneurs in biotechnology industries and to contribute to the establishment of a biotechnology based business.

Entrance requirements:

National Diploma: Biotechnology (or equivalent) and a 60 % pass mark must be achieved for Food Microbiology 3 and Bioprocessing 3 (or equivalent major subjects).

Subject	Subject Code	Lecturer
Research Methodology: Natural Sciences	RMNS 20160	Prof. B. Odhav Mr. F. Swalaha Mr. I. Lazarus
Entrepreneurial Skills 1	ENSB 101	Ms. L. Brady
Industrial Biotechnology IV	INBT 401	Prof. K. Permaul
Environmental Biotechnology IV	ENBT 401	Prof. F. Bux
Plant Biotechnology IV	PLBT 401	Prof. B. Odhav
Recombinant DNA Technology IV	DNAT 401	Prof. B. Odhav
Research Project IV (1st registration)	RESP 411/421	Prof. F. Bux Prof. S. Singh Prof. B. Odhav Prof. K. Permaul Dr. L. Reddy Mr. P. Mokoena Mr. F. Swalaha

Bachelor of Technology: Food Technology

Purpose of programme:

Persons achieving this qualification will be competent to adopt a critical and innovative approach to contribute to the field of Food Technology and to pursue careers as senior technical managers and/or entrepreneurs in food and related FMCG industries..

Entrance requirements:

National Diploma: Food Technology (or equivalent) and a 60 % pass mark must be achieved for Food Technology III and Food Microbiology III.

Subject	Subject Code	Lecturer
Research Methodology: Natural Sciences	RMNS 202	Prof. B. Odhav
Entrepreneurial Skills 1	ENTP 202	Ms. L. Brady
Food Microbial Assurance IV	FDMA401	Dr. T. Padayachee
Food Technology IV	FDTE402	Dr. T. Padayachee
Food Product Development IV	FPDV401	Dr. T. Padayachee
Food Analysis IV	FANL402	Dr. L. Reddy
Food Components IV	FCMP401	Ms. S. Beekrum
Research Project IV (1st registration)	RESP 411/421	Dr. T. Padayachee Ms. S. Beekrum Ms. S. Govender

Master of Technology: Biotechnology

Purpose of programme:

Persons achieving this qualification will be able to conduct scientific research under minimal guidance in a chosen field, and to contribute to knowledge production in that field. The research problem, its justification, process and outcome are reported in a dissertation which complies with the generally accepted norms for research at that level.

Entrance requirements :

Bachelor of Technology: Biotechnology (or equivalent) and a 60 % pass mark must be achieved for the B.Tech. (or equivalent) research project.

Duration of programme :

A minimum of two years (Full-time) or three years (Part-time).

Instructional programme

This qualification is offered by means of a full research project.

Assessment:

Students are required to present two seminars (proposal and final progress report) and submit a dissertation.

Proposal

Students are required to submit and present a research proposal to the Department within 3 months of registration.

Final Progress Report

Students must present a final progress report to the Department prior to graduation.

Publications

Students are required to have ONE publication submitted to a SAPSE approved journal prior to completion of the degree.

Master of Technology: Food Technology

Purpose of programme:

Persons achieving this qualification will be able to conduct scientific research under minimal guidance in a chosen field, and to contribute to knowledge production in that field. The research problem, its justification, process and outcome are reported in a dissertation which complies with the generally accepted norms for research at that level.

Entrance requirements :

Bachelor of Technology: Food Technology (or equivalent). An overall mark of 60 % must be achieved for the B.Tech. (or equivalent) research project.

Duration of programme :

A minimum of two years (Full-time) or three years (Part-time).

Instructional programme

This qualification is offered by means of a full research project.

Assessment:

Students are required to present two seminars (proposal and final progress report) and submit a dissertation.

Proposal

Students are required to submit and present a research proposal to the Department within 3 months of registration.

Final Progress Report

Students must present a final progress report to the Department prior to graduation.

Publications

Students are required to have ONE publication submitted to a SAPSE approved journal prior to completion of the degree.

Doctor of Technology: Biotechnology

Purpose of programme :

Persons achieving this qualification will be competent scientific researchers who can work independently in developing and applying knowledge and skills to make an original contribution to the global knowledge or technology in the particular field chosen for study.

Entrance requirements :

Master of Technology: Biotechnology (or equivalent).

Duration of programme :

A minimum of three years (Full-time) or five years (Part-time).

Instructional programme :

This qualification is offered by means of a full research project.

Assessment :

Students are required to present two seminars (proposal and final progress report) and submit a dissertation.

Proposal :

Students are required to submit and present a research proposal to the Department within 3 months of registration.

Final Progress Report :

Students must present a final progress report to the Department prior to graduation.

Publications :

Students are required to have ONE publication accepted and ONE publication submitted to a SAPSE approved journal prior to completion of the degree.

Doctor of Technology: Food Technology

Purpose of programme :

Persons achieving this qualification will be competent scientific researchers who can work independently in developing and applying knowledge and skills to make an original contribution to the global knowledge or technology in the particular field chosen for study.

Entrance requirements :

Master of Technology: Food Technology (or equivalent).

Duration of programme :

A minimum of three years (Full-time) or five years (Part-time).

Instructional programme :

This qualification is offered by means of a full research project.

Assessment :

Students are required to present two seminars (proposal and final progress report) and submit a dissertation.

Proposal :

Students are required to submit and present a research proposal to the Department within 3 months of registration.

Final Progress Report :

Students must present a final progress report to the Department prior to graduation.

Publications :

Students are required to have ONE publication accepted and ONE publication submitted to a SAPSE approved journal prior to completion of the degree.

DOCTORAL DEGREES AND THESES

Ms. Dawn Elizabeth Stephens

(2003 – 2007)

Directed evolution of β -xylanase from *Thermomyces lanuginosus*.

Promoter: Prof. Kugen Permaul

Co-Promoter: Prof. Suren Singh

Mr. Vinodh A. Edward

(2003-present)

Development of a starter culture for the production of Gari, a traditional African fermented food.

Promoter : Prof. Suren Singh

Co-Promoters: Dr P.J. Van Zyl and Dr. C. Franz

Mr. Santhosh K. Pillai

(2003-present)

Studies on the bioprocess parameters for the production of hemicellulase by a *Thermomyces lanuginosus* strain.

Promoter: Prof. Suren Singh

Co-Promoter: Prof. Kugen Permaul

Mr. Prenaven Reddy

(2003-present)

Enzymatic modification of pulp and paper fibres from *Eucalyptus* and *Pinus species*.

Promoter : Prof. Suren Singh

Co-Promoters: Prof. Kugen Permaul, Dr. T. de Koker

Mr. Viresh Mohanlall

(2003 – Present)

In-vitro propagation, screening and bio-augmentation of bioactive compounds from *Ceratotheca triloba*.

Promoter: Prof. Bharti Odhav

Co- Promoter: Dr. B. Okole

Mr. Feroz Mahomed Swalaha

(2003 - present)

Optimisation of riboflavin production by fungi on edible oil effluent.

Promoter: Prof. Bharti Odhav

Ms. Leroosha Govender

(2005 – present)

Genotypic detection and identification of *Phytophthora spp.* using microarrays.

Promoter: Prof. Bharti Odhav

Co-Promoter: Dr. R. Naidoo

Mr. Tony Obilana

(2007- present)

Improvement of the nutritional profile of a millet food product through indigenous and controlled fermentation process using probiotics.

Promoter: Prof. Bharti Odhav

Co- Promoter: Prof. J. Tailor

Ms. Swastika Surujlall

(2002-present)

Monitoring and determination of the fate of estrogenous compounds in wastewater treatment.

Promoter: Prof. Faizal Bux

Ms. Nishani Ramdhani

(2005-present)

Survey of nitrifiers present in full scale activated sludge plants in South Africa using a molecular approach.

Promoter: Prof. Faizal Bux

Ms. Dashika Naidoo

(2005-present)

Survey of filamentous bacteria in full scale activated plants in South Africa.

Promoter: Prof. Faizal Bux

Ms. Shubnum Mustupha

(2007-present)

Assessment of indigenous algae for the production of biodiesel.

Promoter: Prof. Faizal Bux

Ms. Zinhle Marangane

(2007-present)

Isolation and profiling of a South African strain of *Microthrix parvicella*.

Promoter : Prof. Faizal Bux

MASTERS DEGREES AND THESES

Ms. S. Pillay

Improvement of thermostability of a fungal xylanase using error-prone polymerase chain reaction(epPCR).

Supervisor: Prof. Suren Singh

Co-Supervisor: Dr. Thiriloshani Padayachee

Ms. B. Godana

Production of enzymes for application on animals.

Supervisor: Prof. Suren Singh

Co-Supervisor: Prof. Kugen Permaul

Ms. R. Scott-Briggs

The enzymatic pre-treatment of sorghum and its effect on the nutritional value of African fermented beverages.

Supervisor: Prof. Suren Singh

Co-Supervisor: Dr. Thiriloshani Padayachee

Mr. K. Wakelin

Overexpression of a fungal xylanase in *Escherichia coli*.

Supervisor: Prof. Kugen Permaul

Co-Supervisor: Prof. Suren Singh

Ms. N.H. Madonsela

Pre-treatment of plant biomass for bioethanol production.

Supervisor: Prof. Suren Singh

Co-Supervisor: Prof. Kugen Permaul

Ms. K. Naidoo

Production of inulase from *xanthomonas campestris* pathovar phaseoli.

Supervisor: Prof. Suren Singh

Co-Supervisor: Prof. Kugen Permaul

Ms. Z. Harrichandparsad

Evaluation of bacteriological techniques, sensory evaluation, gas chromatography, and electronic nose technology for the early detection of *Aliclobacillus Acidoterrestris* in fruit juices

Supervisor: Prof. Bharti Odhav

Co-Supervisor: Mr. K. Devchand

Ms. N. Naidoo

An investigation of the antioxidant properties of culinary herbs and their potential application in a cosmetic preparation

Supervisor: Prof. Bharti Odhav

Co-Supervisor: Mr. K. Devchand

Ms. P. T. Mngadi

Molecular characterization of aflatoxigenic and non-aflatoxigenic *Aspergillus* isolates.

Supervisor: Prof. Bharti Odhav

Co-Supervisor: Dr. R. Govinden

Ms. S. Govender

Assessing milk quality using an electronic nose.

Supervisor: Prof. Bharti Odhav

Ms. M. Mudzwiri

Evaluation of traditional South African leafy plants for their safety in human consumption.

Supervisor: Dr. Lalini Reddy

Co-Supervisor: Prof. Bharti Odhav

Ms. N. Naidoo

The essential oil from *Cymbopogon validus*.

Supervisor: Prof. Bharti Odhav

Co-Supervisor: Prof. H. Baijnath

Mr. A. Kassim

Prebiotic compounds from *Asparagus spp.*, *Tulbaghia spp.*, *Sonchus oleraceus* and *Taraxacum officinale*.

Supervisor: Prof. Bharti Odhav

Ms. L. Kunene

Antifungal activity of protein extracts from maize genotypes.

Supervisor: Prof. Bharti Odhav

Mr. J. Mellem

Phytoremediation of heavy metals using *Amaranthus spp.*

Supervisor: Prof. Bharti Odhav

Co-Supervisor: Prof. H. Baijnath

Ms. M. Govender

Anti-microbial compounds from *Calendula officinalis*, *Symphytum officinale* and *Hypericum perforatum* extracts to treat skin and wound infections.

Supervisor: Prof. Bharti Odhav

Mr. Y. Govender

Factors affecting the yield and the nutritional status of *Amaranthus spp.* in KZN.

Supervisor: Prof. H. Baijnath

Co-Supervisor: Prof. Bharti Odhav

Ms. A. Singh

Bioactivity and nutritional evaluation from famine food plants from the *Amaranthaceae* family.

Supervisor: Prof. Bharti Odhav

Co-Supervisor: Dr. Lalini Reddy

Ms. N. Moodley

Determination of the antibacterial properties of traditional plants used in the treatment of tuberculosis.

Supervisor: Prof. Bharti Odhav

Mr. S. Maharaj

Microbial community analysis of a membrane bioreactor treating wastewater.

Supervisor: Prof. Faizal Bux

Ms. N. Mthembu

Morphological shifts amongst pure cultures of filamentous bacteria isolated from activated sludge.

Supervisor: Prof. Faizal Bux

Mr. S. Xulu

Profiling of filamentous bacteria from industrial wastewater treatment plants.

Supervisor: Prof. Faizal Bux

Mr. A. Degenaar

Microbial community analysis of a pilot scale activated sludge process, treating edible oil effluent.

Supervisor: Prof. Faizal Bux

Mr. F. Pienaar, Comparative analysis of genetically modified maize by implementation of a half-seed extraction technique.

Supervisor: Prof. Kugen Permaul

Ms. N.P. Mchunu

Transformation of a mutated fungal *xynA* gene into yeast and recombination in *Thermomyces lanuginosus*.

Supervisor: Prof. Kugen Permaul

Co-Supervisor: Prof. Suren Singh

Ms. V. Hurinanthan

Investigation of the potential of *Carpobrotus dimidiatus*, *Leonotis leonurus*, *Dichrostachys cinerea* and *Capparis tomentosa* against *Mycobacterium tuberculosis* *Leonotis leonurus* and *Capparis tomentosa* plant.

Supervisor: Prof. Bharti Odhav

Ms. M. Maharaj

The structure-function relationship of a *T. lanuginosus* xylanase and detection by fluorometric analysis.

Supervisor: Prof. Suren Singh

Co-Supervisor: Prof. Kugen Permaul

Ms. N. Cele

Detection, quantification and control of bacteriophages in an industrial fermentation plant.

Supervisor: Prof. Kugen Permaul

Ms. BB. Choonawala

Spirulina production in brine effluent from cooling towers.

Supervisor: Mr. Feroz Swahala

Ms. N. Khan, Bio-production of Riboflavin from spent industrial oil.

Supervisor: Mr. Feroz Swahala

Ms. S. Govender

Comparison of mutational methods on *Ashbya gossypii* to improve riboflavin production.

Supervisor: Prof. Bharti Odhav

Co-Supervisor: Mr. Feroz Swahala

Ms. T.T. Tenza

Microbial beta-carotene production on industrial effluent.

Supervisor: Mr. Feroz Swahala

Co-Supervisor: Prof. Bharti Odhav

Mr. V. Dilraj, The extension of shelf-life of chilled processed meats.

Supervisor: Dr. Thiriloshini Padayachee

OPEN WEEK

The Durban University of Technology arranges an open week yearly for prospective students introducing them to the various fields of study.

The Department enlightened students on the disciplines within the fields of Biotechnology and Food Technology. Academic staff promoted the programmes by informing students about the impact that Biotechnology and Food Technology has in Industry and day to day life.



Staff Member demonstrating use of fermenter in the brewing of Beer



Interested learners at the Departmental stands



Prospective students enlightened by manufacturing process for ice-cream

STAFF AND STUDENT STATISTICS

Table 1: Staff-Student Configuration Matrix 2007

Programme	National Diploma			B.Tech	M.Tech	D.Tech	WFTE	Prof	Ass Prof	HOD	Ass. Dir	Sen. Lect	Lect	Jr. Lect	Sen Tech	Tech	Lab Ass.	S
	1	2	3	5	6	7												
Biotechnology	111	53	24	24	20	12	816.6	2	1	1	4	5	1	1	3	4	2	1
Food Technology	108	34	35	32	1	1	166.6			1	2	1			1	2		1
Grand total	119	87	59	56	21	13		2	1	1	6	6	1	1	4	6	2	2

Table 2 : Headcount per Race and Gender from 2005 to 2007

F – Female M – Male

Year	Qualification	African		Coloured		Indian		White		Other		Total		Total
		F	M	F	M	F	M	F	M	F	M	F	M	
2005	ND: Biotechnology	63	17	6	2	78	18	4	3		1	151	41	192
	ND: Food Technology	78	22			62	19	2				142	41	183
	B Tech: Biotechnology	20	3			17	5					37	8	45
	B Tech: Food Technology	6		1		15	1					22	1	23
	M Tech: Biotechnology	6			2	12	3		1			18	6	24
	M Tech: Food Technology	1				2						3	0	3
	D Tech: Biotechnology	1	1			6	6					7	7	14
		175	43	7	4	192	52	6	4		1	380	104	484
2006	ND: Biotechnology	53	14	5	1	84	17	5	2		1	147	35	182
	ND: Food Technology	60	22	1		59	23	2			1	122	46	168
	B Tech: Biotechnology	17	8	2		17	6		1			36	15	51
	B Tech: Food Technology	13	1	1		15	1					29	2	31
	M Tech: Biotechnology	7			2	12	4		1			19	7	26
	M Tech: Food Technology					4						4	0	4
	D Tech: Biotechnology	1	1			6	6					7	7	14
		151	46	9	3	197	57	7	4		2	364	112	476
2007	ND: Biotechnology	41	18	1		84	17	2	2		1	128	38	166
	ND: Food Technology	57	19			55	23	1			1	113	43	156
	B Tech: Biotechnology	13	4	1		5		1	1			20	5	25
	B Tech: Food Technology	13				17	2					30	2	32
	M Tech: Biotechnology	5	1			8	3		2			13	6	19
	M Tech: Food Technology	1										1	0	1
	D Tech: Biotechnology	1	2			5	5					6	7	13
	D Tech: Food Technology					1						1	0	1
2007		131	44	2		175	50	4	5		2	312	101	413

Table 3 : Graduation Rates 2007

PROGRAMME	ND	B.TECH	M.TECH	D.TECH
BIOTECHNOLOGY	40	28	10	1
FOOD TECHNOLOGY	37	14	3	0

Table 4 : Biotechnology Pass Rates By Qualification Per Subject For 2007

QUALIFICATION	SUBJ CODE	SUBJECT	NO. ENROLLED	NO. PASSED	PASS RATE
NATIONAL DIPLOMA	ABIC301	ANALYTICAL BIOCHEMISTRY III	43	43	100%
	BCHM202	BIOCHEMISTRY II	44	26	59%
	BIOD101	BIODIVERSITY AND ECOLOGY I	44	34	77%
	BIOP301	BIOPROCESSING III	39	38	97%
	DIMR201	DISEASE AND IMMUNE RESPONSE II	38	32	84%
	FERT202	FERMENTATION TECHNOLOGY II	47	38	81%
	FMIC302	FOOD MICROBIOLOGY III	40	38	95%
	MIBC301	MICROBIAL BIOCHEMISTRY III	52	38	73%
	MICR101	MICROBIOLOGY I	39	31	79%
	MICR202	MICROBIOLOGY II	38	36	95%
	MICR301	MICROBIOLOGY:BIOLOGICAL III	50	34	68%
	PRTM101	PROCESS TECHNOLOGY AND MANAGEMENT I	44	43	98%
	SASH101	SANITATION SAFETY AND HYGIENE I	43	42	98%
	CHMB 102	CHEMISTRY I	44	40	91%
	QMTH101	QUANTITATIVE METHODS I	47	45	96%
	ABIC 301	ANALYTICAL BIOCHEMISTRY III	56	32	57
B TECH	DNAT401	RECOMBINANT DNA TECHNOLOGY IV	14	12	86%
	ENBT401	ENVIRONMENTAL BIOTECHNOLOGY IV	14	8	57%
	INBT401	INDUSTRIAL BIOTECHNOLOGY IV	15	12	80%
	PLBT401	PLANT BIOTECHNOLOGY IV	12	11	92%
	RESP411	RESEARCH PROJECT IV (1ST REGISTRATION)	13	11	85%
	RESP421	RESEARCH PROJECT IV (RE-REGISTRATION)	1	1	100%
	RMNS201	RESEARCH METHODOLOGY:NATURAL SCIENCES	16	15	94%

Table 5 : Food Technology Pass Rates By Qualification Per Subject For 2007

QUALIFICATION	SUBJ CODE	SUBJECT	NO. ENROLLED	NO. PASSED	PASS RATE
NATIONAL DIPLOMA	FCHM302	FOOD CHEMISTRY III	44	27	61%
	FMIC302	FOOD MICROBIOLOGY III	33	28	85%
	MICR101	MICROBIOLOGY I	34	26	76%
	MICR202	MICROBIOLOGY II	48	35	73%
	FCHM202	FOOD CHEMISTRY II	45	33	73%
	FDIM101	FOOD INDUSTRY MANAGEMENT I	42	22	52%
	FDPE101	FOOD PROCESS ENGINEERING I	41	38	93%
	CHMB102	CHEMISTRY I	46	41	89%
	PHYS103	PHYSICS I	54	38	70%
	QMT101	QUANTITATIVE METHODS I	38	37	97%
	ACBL201	ANALYTICAL CHEMISTRY : BIOLOGICAL II	66	25	38%
	FDPE201	FOOD PROCESS ENGINEERING II	34	27	79%
	FDQA101	FOOD QUALITY ASSURANCE I	29	19	66%
	FDTE102	FOOD TECHNOLOGY I	41	36	88%
	FDTE201	FOOD TECHNOLOGY II	39	22	56%
	FDTE301	FOOD TECHNOLOGY III	31	26	84%
B TECH					
	FANL402	FOOD ANALYSIS IV	18	17	94%
	RMNS201	RESEARCH METHODOLOGY:NATURAL SCIENCES	22	22	100%
	FCMP401	FOOD COMPONENTS IV	14	11	79%
	FDMA401	FOOD MICROBIAL ASSURANCE IV	12	11	92%
	FDTE402	FOOD TECHNOLOGY IV	18	17	94%
	FPDV401	FOOD PRODUCT DEVELOPMENT IV	19	16	84%
	FPRJ411	FOOD PROJECT IV (MODULE A)	16	13	81%
	FPRJ421	FOOD PROJECT IV (MODULE B)	15	13	87%

Table 6 : Service Department National Diploma Pass Rates For 2007

Programme	Subject Code	Subject	No. Enrolled	No. Passed	Pass Rate
ND: Chiropractic	BIOG102	Biology I	28	24	86%
	MMIC201	Medical Microbiology Ii	41	38	93%
ND: Chiropractic (Foundation)	BIOG102	Biology I	5	4	80%
ND: Somatology	ABSC311	Applied Biological Sciences Iii (Module 1)	24	18	75%
ND: Homoeopathy	BIOG102	Biology I	15	12	80%
	MMIC201	Medical Microbiology Ii	10	10	100%
ND: Homoeopathy (Foundation)	BIOG102	Biology I	5	4	80%
ND: Consumer Science: Food And Nutrition	FDMI101	Food Microbiology I	28	26	93%
ND: Ecotourism Management	ECBI102	Ecotourism: Biology I	39	23	59%
	ECBI202	Ecotourism: Biology Ii	39	28	72%
	ECBI302	Ecotourism: Biology Iii	21	15	71%
ND: Environmental Health	MENH101	Microbiology I	28	20	71%

ADVISORY BOARDS

These Boards have been established for both programmes that we offer and have allowed us to realign our teaching to meet industry needs. Industry representatives have actively engaged in redesigning our curricula and creating a new profile for the Work Integrated Learning Assessment guide for implementation in 2008. The networking that has emanated from this has also added tremendous value to our Department as a whole.

ADVISORY BOARD: BIOTECHNOLOGY

Message from Chairperson

Mr. R. Lalloo

Research Leader

Process and Product Technology

CSIR Biosciences

The Durban University of Technology Biotechnology Advisory Panel is a collection of students, staff and industry partners that shape the betterment of the academic and applied teaching offered by the Department of Biotechnology. The panel makes strategic and practical inputs into the curriculum of the department to align the activities of the department towards the high level education of students at the undergraduate and postgraduate level. The panel ensures that the quality of training offered at the department services the national economic and social imperatives aligned to the National Biotechnology Strategy and with local relevance to the KZN region. Students from this scarce skills field, play a major role in satisfying the human resource demands from a growing biotechnology industry sector in South Africa, including aspects of social and environmental betterment. The advisory panel meets twice a year to gather inputs and feedback from various stakeholders, including review of current best practice from other departments within DUT and the national and international landscape. A large focus of the panel is to examine the dynamics of experiential learning programs where teaching and industry participants jointly develop student academic skills and applied knowledge. This hybrid training method offers a competitive advantage to ensure unique skills supply of an applied nature. Due to the diversity of industry requirements, the advisory meetings allow all parties to understand the changing needs in human capacity and to fine tune the curricula, policy, evaluation and work-place training methods to meet current demands. The panel also resolves issues of accreditation (SAQA), student recruitment (web-site, secondary school awareness) and good practice (safety, GLP, infrastructure, etc.). Student participation at the meeting allows first hand feedback and rapid resolution of any potential shortcomings, either within the department or at industry, to ensure betterment of the training experience for learners. The Biotechnology Advisory Board is a pivotal forum to ensure ongoing success of the department, students and industry towards a knowledge based economy in South Africa.

ADVISORY BOARD MEMBERS

Chairperson	:	Mr Raj Lalloo	
HOD	:	Prof. Suren Singh	
Co-ordinators	:	Dr L Reddy & Ms S Juglal	
Head of Cooperative Education	:	Mr. Shakeel Ori	
Academic staff	:	Prof. Kugen Permaul	
		Prof. Faizal Bux	
		Mr. Feroz Swalaha	
Industry Representatives :			
1. Mr. Ashogan Sundram	(ABI)	9. Mr. Bish Sahadeo	(Millennium Waste)
2. Mr. Michael Relihan	(Plant Aid Services)	10. Mr. Ishmael Shange	(Coca Cola)
3. Ms. Chrissie de Wet	(Rand Water)	11. Mr. Dave Gunn	(Beckman Coulter)
4. Dr. Caroline Baker	(SASRI)	12. Ms. Siobhan Jackson	(EtheKwini Water)
5. Mr Abie Khan	(Alex Stuart)	13. Ms. Michelle Taylor	(Buckman)
6. Ms. Lebohlang Hanyane	(Mhlathuze Water)	14. Ms. Amelia Rampersad	(Bio Res & Dev Sol cc)
7. Mr. Paul Ramjugernath	(Co-op, DUT)	15. Ms. Bavanie Naidoo	(Coke)
8. Ms. Christina Pinto	(Wits Enterprise)	16. Ms. Ayesha Hansa	(SA Bioproducts)

ADVISORY BOARD: FOOD TECHNOLOGY

Message from Chairperson

Mr. K. Devchand
Executive Director
Analytical and Microbiological Testing Laboratory
Food and Cosmetic Technologies (FACT)

The rapid growth in the world's population had placed demands on the food industry to produce and provide a wide variety of appetizing and nutritious food products. The food industry used to be the largest most stable industry in the world until the recent rapid climatic changes that has affected food production yields and increased costs of basic commodities such as edible oils, milk and milk by products, staple cereals such as maize, wheat and rice.

The food industry recognizes these problems and are in need of highly qualified Food Scientists, Biotechnologists, Food technologist and allied technologist to address the demands not only by increased agricultural production alone but also provide adequate processing technologies to improve quality, nutrition and sustainability of these basic food products.

It is here that the Durban University of Technology and the Department of Biotechnology and Food Technology play an indispensable role in providing the basic theory, practical and research ethos in developing future Food Scientist and Biotechnologist with the impending problems of our populations, social diseases, basic food shortages. The food industry needs these graduates who play a key role in addressing the nutritional needs of the population as well as the development and welfare of the entire country.

The food industry needs these graduates to address these issues and to create the R & D or innovation in food production to reduce food shortage and generate sustainability of food production. Therefore, the South African food industry needs to take cognisance of the complementary support needed by the food industry and DUT through the process of education and continuous industrial training to develop food scientist and biotechnologist to supply the world with suitable nutritious healthy food that is a necessity for existence. This association will generate opportunities and create a vehicle whereby commercial industrial problems become academic research issues and *vice versa* can be introduced to industry for commercialization. Such would result in a win-win situation with income generation to support both the DUT and Commercial Enterprises.

Such a close collaboration will not only ensure a continuous supply of good food but will also address those consumers whose health is compromised by exposure to modern diseases. A scientific approach in food manufacturing worldwide is being more and more recognized as major prerequisites for the industries success. There is no doubt that the future prospects of qualified food scientists and biotechnologists is assured in an ever increasing hungrier world.

ADVISORY BOARD MEMBERS

Chairperson	:	Mr. Kay Devchand	
HOD	:	Prof. Suren Singh	
Co-ordinator	:	Dr. Thiriloshani Padayachee	
Academic staff member	:	Mr. John Mellem	
Head of Cooperative education	:	Mr. Shakeel Ori	
Secretary	:	Ms. Sharlynn Beekrum	
Industry Representatives	:		
1. Ms. Rosie Maguire	(SAAFOST)	6. Mr. Ryan Ponquett	(Flavour Craft)
2. Mr. Bongani Maphumulo	(Unilever)	7. Ms. Fikie Chiliza	(National Brands)
3. Ms. Seena Singh	(Natures Source)	8. Mr. Krappee Eloff	(Food Bev SETA)
4. Ms Christine Visagie	(National Starch)	9. Mr. Zuki Ndukwane	(Jonti Distributors)
5. Mr. Wayne Sabapathy	(National Brands)		

SELECTED ALUMNI



Partnus Mlekeleli Sphelele Mbanjwa

National Diploma : Food Technology

Snackworx (National Brand Limited)

Operations Supervisor

Profile:

Emulsification-Is the combination of oil and water or any immix able substances in a compatible dispersion. However lecithin is utilized to mix all the food product containing substantial amount of both oil and water or any immix able food products.

"The three years spent at the Durban University of Technology has given the work in an organized manner, independently, to have a good observation and practical skills, to meet deadlines also to learn and perform task to best of my ability."



Jhoshil Bissessur

BTech : Food Technology

All Joy Foods

Technical Manager

Profile:

Involved in the upgrade of processes and systems, ensuring legal requirements are met, raw material controls, specifications, liaison with suppliers and customers, NPD involvement, QA management, ensure the company achieves, maintains and demonstrates compliance to customers and regulatory bodies. Focus on continual improvement, to increase efficiency in the production facility.

"I cannot stress enough the benefit I derived from my days at Durban University of Technology and have never second guessed my choice to pursue my education at this great institution. Durban University of Technology thought me to always challenge myself and believe that the sky is the limit!"

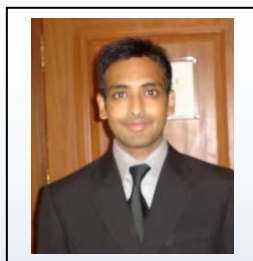


Thandeka Zulu
BTech : Food Technology
SABS
Auditor

Profile:

ISO 9001 and Food Safety Auditor. I audit food, packaging and chemical industries.

"Studying at the Durban University of Technology has helped me tremendously in upgrading my knowledge and practical skills."

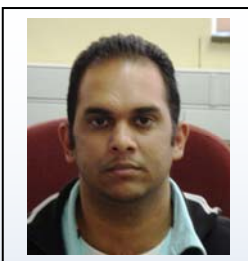


Sadhvir Bissoon
D-Tech: Biotechnology
SABS
Management : Business Improvement

Profile:

The doctoral thesis involved the use of enzymes extracted from thermophilic microorganisms to enhance the bleaching of pulp in the manufacture of paper at SAPPI. This technique resulted in the reduction of chemicals used in the bleaching process thereby promoting an environmentally friendly process.

"The skills acquired at the Durban University of Technology was invaluable and has provided the foundation to accept and address the challenges of a dynamic business world"



Vinodh Aroon Edward
MTech : Biotechnology
National Institute for Communicable Diseases
Group Manager/Senior Scientist

Profile:

I joined the NICD as Group Manager for the AIDS Research Unit: Immunology in 2007. The unit is involved in a number of collaborations both nationally and internationally and continues to make a valuable contribution to HIV research. I am also the CHAVI Central Repository Project Manager. CHAVI is an international network aimed at developing a global HIV vaccine and is headquartered at Duke University, USA. I am responsible for overseeing and coordinating clinical sample handling in African, European and US laboratories. Previous employment included working as a project leader at the SA MRC, HPRU (2005-2007) and CSIR Bio/Chemtek (2003-2005).

"A DUT education continues to provide the best platform for some of the most exciting jobs out there. DUT graduates are always in high demand in various industries."



Rumesha Veeran
MTech : Biotechnology
Schering Plough Swords, Ireland
Senior Analytical Scientist

Profile:

I am currently employed at Schering Plough Swords which is a science-based health care company involved in the research and development of women's health and central nervous system therapies. I am based in the Tableting Business Unit where I am involved in routine and non-routine testing of all contraceptive and hormone replacement therapy pills, the raw materials that are used to produce these tablets as well as the supervision of lower level analysts.

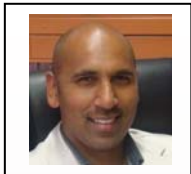
"Most of our plans have changed dramatically as we have matured and broadened our range of knowledge and experience. My years as a student within the Department of Biotechnology has proved to me that our way is not unbending and that we never have a clear view of the future. Rather than limiting me to a single path it has provided me with options and opportunities, to be a morally responsible leader, to think critically, act wisely and work skillfully."

RESEARCH



This section highlights the three main research thrusts of the Department and these straddle two NRF - funded Research Niche Areas viz., *Plant Biomass Utilisation and Water and Waste Water Technology* with guaranteed research funding for five years (2007 – 2011).

ENZYME TECHNOLOGY



Suren Singh
Professor
Head of Department



Pr. Maul
Associate Director

D. Tech Students

1. **Ms DE Stephens** - Directed evolution of a xylanase from *Thermomyces lanuginosus*.
2. **Mr. VA Edward** - Development of a starter culture for the production of Gari, a traditional African fermented food.
3. **Mr. SK Pillai** - Studies on the bioprocess parameters for the production of hemicellulase by a *Thermomyces lanuginosus* strain.
4. **Mr. P. Reddy** - Enzymatic modification of pulp and paper fibres from *Eucalyptus* and *Pinus* species.

M. Tech Students

1. **Ms. S. Pillay** - Improvement of thermostability of a fungal xylanase using error-prone polymerase chain reaction (epPCR).
2. **Ms B. Godana** - Production of enzymes for application on animals.
3. **Ms. R. Scott-Briggs** - The enzymatic pre-treatment of sorghum and its effect on the nutritional value of African fermented beverages.
4. **Mr. K. Wakelin** - Overexpression of a fungal xylanase in *Escherichia coli*.
5. **Ms. N.H. Madonsela** - Pre-treatment of plant biomass for bioethanol production.
6. **Ms. K. Naidoo** - Production of inulase from *Xanthomonas campestris* pathovar phaseoli.

Post Doctoral Fellows

1. **Dr L Prasanna**
2. **Dr M Ayyachamy**

The application of biotechnological process in the production and modification of foods, food additives, food ingredients, detergents, textiles, and the pulp and paper industries is a relatively new and emerging field in Biotechnology. A variety of enzymes have found widespread industrial applications. These include proteases (detergent preparations and textile industry), amylases and pullulanases (starch processing industry), inulinases (production of high fructose syrups) and xylanases (pulp and paper industries). Most enzymes currently produced in bulk are obtained from microbial sources. The majority of enzymes used by industry in bulk quantities catalyse depolymerisation reactions. Several industrial-scale proteins, however, are now produced by thermophilic microorganisms.

Xylanases belong to a commercially important group of carbohydrases that has a worldwide market of around 200 million dollars. One of the most important end users of the xylanase is the paper and pulp industry where thermostable cellulase free alkaline active xylanases are required in biobleaching of Kraft pulp. The use of this enzyme can replace 20-30% of chlorine used in pre-bleaching process and can reduce up to 50% in organic halogen that are known to form toxic dioxins and pose an environmental hazard.

Thus, the use of microbial inulinases [2 1, β -D fructan-fructanohydrolase (E.C.3.2.1.7)] has been proposed as the most promising approach to obtain the fructose syrups from inulin. There are, however, two major problems associated with industrial application of inulinases for production of fructose: (i) inulin has a limited solubility at room temperature, and (ii) there is ample chance of microbial contamination at room temperature. Thus, the industrial process for production of fructose and fructooligosaccharides is carried out at about 60 °C. Most of the reported inulinases lose their activity after few hours at this temperature and hence need replenishment thus adding to the cost of production. Therefore, there is a growing interest to isolate and characterize thermostable inulinases.

It is our intention to assess the industrial fitness of enzymes specifically xylanases and inulinases from *Thermomyces lanuginosus* and *Aspergillus niger*, respectively, and produce these enzymes at substantially high levels in shake flasks to fermentors under a variety of process conditions. It is also envisaged that with the increasing oil price and gradual depletion of exploitable oil in the foreseeable future the direct impact of these enzymes also have huge spinoffs in terms of improved hydrolysis of plant biomass as a step towards the production of bioethanol.

The xylanase in our laboratory already has an extremely high activity. This attribute coupled with an increased thermostability and pH stability would make it an attractive target for commercialisation. Its enhanced stability would be an obvious advantage during the papermaking process which is carried out at elevated temperatures and varying pH levels. We therefore intend to verify the evolved enzyme (provided by Prof. Kugen Permaul) usefulness in lab-scale trials with respect to production and application before embarking on process development stages.

Research in this area has a two-pronged approach viz. studying the fundamental aspects associated with the production of fungal enzymes and characterisation of these enzymes as well as modification of these natural enzymes to enhance their characteristics aspects and make them better suited to their industrial applications.

Several strains of the thermophilic fungus, *Thermomyces lanuginosus* have been studied and have shown to be good producers of hemicellulase-degrading enzymes, xylanases in particular. Xylanases and some accessory enzymes of most of these strains have been purified and characterised and showed activity at high temperatures and over a broad pH range. For example, *T. lanuginosus* produces a xylanase that was stable up to 65°C and in a pH range of 5-12. *T. lanuginosus* xylanases have shown potential in some biotechnological applications, such as bleaching of dissolving pulp, bagasse pulp and kraft pulp. Other potential applications of xylanases in biotechnology include treating animal feed to improve digestibility, processing food to clarification and converting lignocellulosic substances into feedstock and fuels. Although *T. lanuginosus* fungus produces high levels of xylanases, several studies have shown that different strains of this fungus vary in their expression of xylanases. The levels of accessory enzymes such as mannanases, mannosidases and esterases are also very low compared to those of xylanases. Different carbon sources and cultivation conditions have also been shown to have varying effects on enzyme production by different strains of *T. lanuginosus*. In addition to studying the expression of these enzymes, lab scale trials of these enzymes in pulping of paper and baking of bread have been carried out. The results have confirmed that enzyme-assisted bleaching of paper does lead to reduction of harmful chlorine compounds in a more environmentally-friendly process with a pulp that has comparable levels of brightness.

Protein engineering is an exciting new field that promises to revolutionize the future of proteins in industry. Enzymes are being engineered to suit numerous industrial applications, since natural enzymes lack the stability profile required for the rigours of biocatalytic processes. Rational design of enzymes, which requires extensive knowledge of protein structure and how it relates to function, is labour intensive. Thus scientists have adopted traditional Darwinian evolution under laboratory conditions to generate enzymes with suitable traits, in a process called 'directed evolution'. This type of protein design requires no knowledge of the structure, but rather relies on the introduction of random mutations into the gene of interest, cloning into an appropriate host and subsequent screening of isolates with the improved desired property. Modification of the xylanase from *T. lanuginosus* has conferred to them the desirable properties of increased thermostability and pH stability. Enzyme variants have been created that can withstand temperatures of up to 90°C for 90 minutes and also having longer stabilities at pH 3 and pH 9. Current research is focussed on consolidating these properties into a single enzyme and testing this enzyme in pulp trials in comparison with commercially-available enzymes.

Other projects that are being conducted are production and characterisation of bacterial and fungal inulinase enzymes, expression of modified xylanases in alternate hosts such as yeast cells, and use of amylase to pre-digest maize foods to increase their nutritional content and aid in digestion. Of significance is that the techniques acquired from this project will allow for broader applications to other enzyme systems which are steadily establishing themselves in industrial applications.





Bharti Odhav
Professor



Dr. Lalini Reddy
Associate Director

D.Tech Students

1. **Mr. V. Mohanlall** - *In-vitro* propagation, screening and bio-augmentation of bioactive compounds from *Ceratotheca triloba*.
2. **Mr. F. Swalaha** - Optimisation of riboflavin production by fungi on edible oil effluent.
3. **Ms. L. Govender** - Genotypic detection and identification of *Phytophthora spp* using microarrays.
4. **Mr. T. Obilana** - Improvement of the nutritional profile of a millet food product through indigenous and controlled fermentation process using probiotics.

MTech Students

1. **Ms. Z. Harrichandparsad** - Evaluation of bacteriological techniques, sensory evaluation, gas chromatography, and electronic nose technology for the early detection of *Alicobacillus Acidoterrestris* in fruit juices
2. **Ms. N. Naidoo** - The essential oil from *Cymbopogon validus*.
3. **Ms. P. T. Mngadi** - Molecular characterization of aflatoxigenic and non-aflatoxigenic *Aspergillus* isolates.
4. **Ms. S. Govender** - Assessing milk quality using an electronic nose.
5. **Mr. M. Mudzwiri** - Evaluation of traditional South African leafy plants for their safety in human consumption.
6. **Ms. N. Naidoo** - An investigation of the antioxidant properties of culinary herbs and their potential application in a cosmetic preparation
7. **Mr. A. Kassim** - Prebiotic compounds from *Asparagus spp. Tulbaghia spp., Sonchus oleraceus* and *Taraxacum officinale*.
8. **Ms. B. Godana** - Production of enzymes for application on animals.
9. **Ms. L. Kunene** - Antifungal activity of protein extracts from maize genotypes.
10. **Mr. J. Mellem** - Phytoremediation of heavy metals using *Amaranthus spp.*
11. **Ms. M. Govender** - Anti-microbial compounds from *Calendula officinalis*, *Symphytum officinale* and *Hypericum perforatum* extracts to treat skin and wound infections.
12. **Mr. Y. Govender** - Factors affecting the yield and the nutritional status of *Amaranthus spp.* in KZN.
13. **Ms. A. Singh** - Bioactivity from famine plants from the *Amaranthaceae* family
14. **Ms. V. Hurinanthan** - Investigation of the potential of *Carpobrotus dimidiatus*, *Leonotis leonurus*, *Dichrostachys cinereus* and *Capparis tomentosa* against *Mycobacterium tuberculosis* *Leonotis leonurus* and *Capparis tomentosa* plant.
15. **Ms. N. Moodley** - Determination of the antibacterial properties of traditional plants used in the treatment of tuberculosis.
16. **Ms. K. Muduray** - Modulating the vaginal ecosystem with prebiotic polysacchides from *A.sprengeri*, *S. oleraceus* and *T. officinale*

Post Doctoral Fellows

1. **Dr US Akula,**
2. **Dr. T. Kandasamy**

PLANT BIOTECHNOLOGY

The concept of growing crops for health rather than for food or fiber is slowly changing plant biotechnology and medicine. Plant phytochemicals provide us with thousands of novel compounds that give us medicines, fragrances, flavorings, dyes, fibers, foods, beverages, building materials, heavy metal chelators important in bioremediation, biocides, and plant growth regulators. Traditional knowledge from parts of Africa indicates that some of these are used for diverse activities such as making beer, wine, composting, controlling parasites etc.

Plant biotechnology is a platform through which we aim to identify candidate plants and plant products from the range of local wild vegetable which are currently under cultivation or growing in the wild in areas of Kwa-Zulu Natal. Emphasizes is on finding properties from local plants that will increase the commercialization potential of local plants, which in turn would lead to agronomy development. Furthermore, through micro propagation and bio-manipulation of the candidate plants the biotechnological potential will be exploited, which will lend the plant/product to be marketed on a large scale.

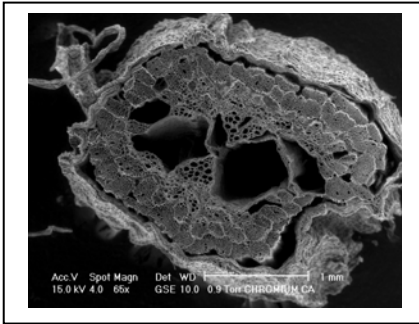
Currently, our group is investigating plants for:

- (a) nutritional value which can improve the nutritional status of our people
- (b) bioactive compounds that can be used as pharmaceuticals or nutraceuticals;
- (c) phytochemicals for therapeutic uses; and
- (d) value addition by producing novel food commodities.

Thus far, we have:

- a) established a reference laboratory for nutritional/ anti-nutritional evaluation of local plants;
- b) established standardized assays for plant compound evaluation and chemical characterization;
- c) established plant tissue micro-propagation techniques.

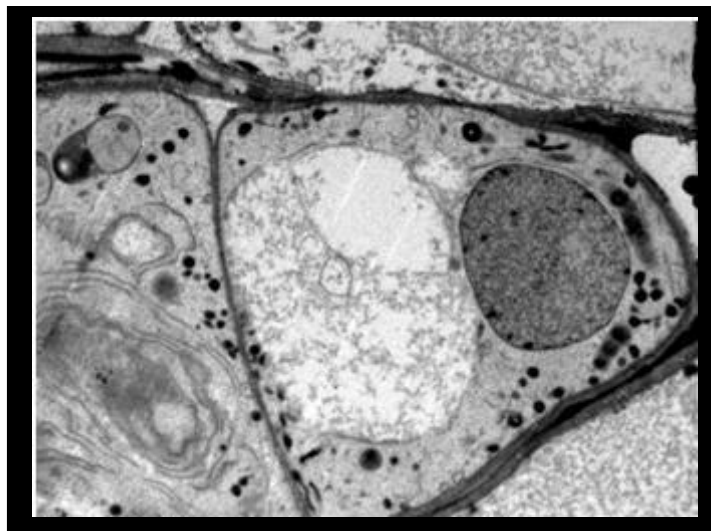
Studies undertaken by our research group over the last three years have initiated a knowledge bank regarding the nutritional composition (carbohydrate, proteins, vitamins, mineral contents) of many locally grown leafy vegetables, namely, *Solanum nigrum*, *Physalis viscosa*, *Cucumis metuliferus*, *Momordica balsamina*, *Amaranthus spinosus*, *Amaranthus hybridus*, *Amaranthus dubius*, *Asystasia gangetica*, *Justicia flava*, *Emex australis*, *Oxygonum sinuatum*, *Bidens pilosa*, *Cleome monophylla*, *Portulaca oleracea*, *Wahlenbergia undulata*, *Senna occidentalis*, *Chenopodium album*, *Ceratotheca triloba*, *Galinsoga parviflora* and *Centella asiatica*. Research has also been directed wherein some of these field plants have been used to produce novel commodities (new types of wines, beer, coffee, teas and jams). Some plants have unique phytochemicals with unique biological properties – such as anti-microbial, anti-septic and anti-cancer properties.

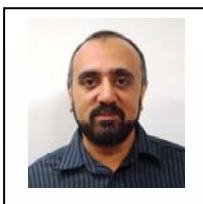


From the repertoire of knowledge we have plants that be can be used commercially such as:

- *Calendula officinalis*, *Symphytum officinale* and *Hypericum perforatum* extracts that can treat infections caused by multi resistant pathogens
- *Warburgia salutaris* has anti-cancer activity
- *Cymbopogon validus* which reduces the acne causing propionibacteria
- *Taraxacum officinale*, *Sonchus oleraceus* and *Asparagus sprengeri* produces prebiotic compounds.
- *Leonotis leonurus* which has immune stimulating compounds
- *Amaranthus dubius* can be used for phytoremediation of arsenic
- *Acaranthus aspera*, a famine plant that has mosquito repellent properties

The best prospect for market development of indigenously produced foods lies in the value added products and the export markets. In both cases, this research is a crucial and necessary step for the development of a knowledge base to support these new market developments. This research can make a significant contribution to the development of transforming wild vegetables into highly successful commercial farming. This will have a huge impact in that it will create entrepreneurial opportunities and also empower the local agronomy and marketing community.





Faizal Bux
Professor

Projects

1. Biodiesel production using algal biomass
2. Bioremediation of hexavalent contaminated groundwater
3. Microbial community analysis of a full-scale membrane bioreactor
4. Microbial carotenoid production from cooling tower brine effluent
5. Monitoring of specific endocrine disrupting chemicals in the environment due to industrial discharges
6. Characterization of filamentous bacteria from activated sludge treating industrial wastewater
7. Analysis of problematic filamentous bacteria in activated sludge wastewater treatment plants
8. Analysis of the nitrifying bacterial population in activated sludge wastewater treatment plants

D.Tech Students

1. **Ms. S. Surujlall** - Monitoring and determination of the fate estrogenous compounds in wastewater treatment.
2. **Ms. N. Ramdhani** - Survey of nitrifiers present in full scale activated sludge plants in South Africa using a molecular approach
3. **Ms. D. Naidoo** - Survey of filamentous bacteria in full scale activated plants in South Africa.
4. **Ms. S. Mustupha** - Assessment of indigenous algae for the production of biodiesel.
5. **Ms. Z. Marangane** - Isolation and profiling of a South African strain of *Microthrix parvicella*.

M.Tech Students

1. **Mr. S. Maharaj** - Microbial community analysis of a membrane bioreactor treating wastewater.
2. **Ms. N. Mthembu** - Morphological shifts amongst pure cultures of filamentous bacteria isolated from activated sludge.
3. **Mr. S. Xulu** - Profiling of filamentous bacteria from industrial wastewater treatment plants.
4. **Mr. A. Degenaar** - Microbial community analysis of a pilot scale activated sludge process, treating edible oil effluent.

Post Doctoral Fellows

1. **Dr. M. Singh**
2. **Dr. S. Kumari**

WASTE WATER RESEARCH

Since its inception in 1994, the activity area “Water and Wastewater Technology” has developed into a Centre of excellence, with the research thrust focusing on the development of suitable technology for the remediation of domestic and industrial waste and, the provision of potable quality water to the community. With much emphasis currently being placed on environmental sustainability, there is a need for the development and application of novel biotechnological processes to satisfy the above demands. Having developed the infrastructure and capacity to function as an area of excellence, emphasis will be placed on sustaining the current level of growth and attaining the deliverables. Since water research demands a multi-disciplinary approach, the current available expertise, includes both chemical engineering and biotechnology will be used in synergy. The projects are selected and executed in close consultation with industrial partners. The projects are aimed at helping the industries maintain acceptable levels of effluent discharges, thus reducing negative environmental impact and commercialization of products generated from waste streams. One of the major advantages and strengths is the development of essential skills through student training, to satisfy the much needed human resource needs of the water sector (including industry) in South Africa.

Biodiesel production using algal biomass

Biodiesel is cutting edge technology being researched worldwide to supplement the world's ever-growing energy requirements. In the wake of global damage being caused by global warming and the rising cost of crude oil, it has become imperative to research sources of “green” energy, without compromising food security or adding to an already strained environment. Biodiesel from algae has shown much potential in this regard. In South Africa, our research group is one of the pioneering groups in this field. Our research encompasses a full bodied approach to upstream processing from screening of algae for strain selection to optimisation of growth conditions and maximisation of lipid yields at lab scale as well as utilising a small pilot scale raceway pond (approx. 3000L capacity). Concurrently, our efforts have been expanded to include work on photobioreactors and downstream processing from harvesting and lipid extraction to the conversion of oil to biodiesel and characterisation thereof, with optimisation taking place at each step.

Bioremediation of hexavalent contaminated groundwater

Groundwater in the Durban South basin is contaminated with hexavalent chromium with the plume of approximately 3 km. The current remedial approach is focusing on 'pump and treat' technology. However, the project also involves isolating indigenous bacteria from the contaminated soil with the intention of bioremediation of the contaminated soil. Focus will also be on bioaugmentation/biosupplementation to stimulate the indigenous microbial population to facilitate reduction to the tri-valent form.

Microbial community analysis of a full-scale membrane bioreactor (MBR)

Currently there is an increased focus on water reuse projects and for more feasible advanced wastewater treatment technologies. The MBR process is an emerging advanced wastewater treatment technology that has been successfully applied at an ever increasing number of locations around the world primarily due to the system meeting an increasing demand for a low maintenance treatment system capable of treating a wide range of effluents and subsequently allowing for on-site water reclamation with the effluent quality passing stringent discharge standards. South Africa in particular has a need to develop new strategies for water management and reuse. For optimization and greater efficiency of the plant, fundamental and comprehensive knowledge of the microbial communities present is imperative. The project aims at elucidating the bacterial community and their associated roles within the MBR which will allow for increased optimization of the plant. Fluorescent *in situ* hybridization is a unique molecular method that may be used for the identification of microorganisms within the SMBR. The problem faced with identification of the microorganisms in SMBR, is the inadequacy of microbiological equipment and expertise. FISH allows for the quick, simple and accurate detection of bacterial species without the need to culture. The application of the FISH technique is useful to determine the abundance of respective populations in microbial community samples.

Microbial carotenoid production from cooling tower brine effluent

Two carotenoids, Beta-carotene, which are highly pigmented (red, orange, yellow), fat-soluble compounds naturally present in many fruits, grains, oil and vegetables, and Astaxanthin (red), which belongs to a larger class of phytochemicals known as terpenes, will be produced from algae, *Dunaliella salina* and *Haematococcus pluvalis* respectively using cooling tower brine effluent as a substrate. It is the only eukaryotic alga which can accumulate maximum amounts of beta-carotene in its inter-thylakoid space of chloroplast when subjected to optimum conditions. It is commonly used in cosmetic and dietary supplement, for its antioxidant activity. Beta-carotene will be extracted from *Dunaliella salina*, which will be maintained on suitable medium. Astaxanthin is a very potent antioxidant with applications in Cosmetic, Nutraceutical, Food and Feed Industries. It is responsible for the colouration of crustaceans and salmonoids. Astaxanthin enhances the immune system, prevents oxidative stress and can cross the blood-brain and retina barriers. While astaxanthin is a natural nutritional component, it can be found as a food supplement. The supplement is intended for human, animal, and aquaculture consumption. This study will attempt to produce astaxanthin by growing *H. pluvalis* in cooling tower brine effluent and supplementing with various components in order to maximise astaxanthin production. Production will be scaled up using flat plate and tube bioreactors to determine the best reactor configuration for astaxanthin production. Statistical design of experiments will be used to choose and optimise the amounts of supplements required.

Monitoring of specific endocrine disrupting chemicals in the environment due to industrial discharges

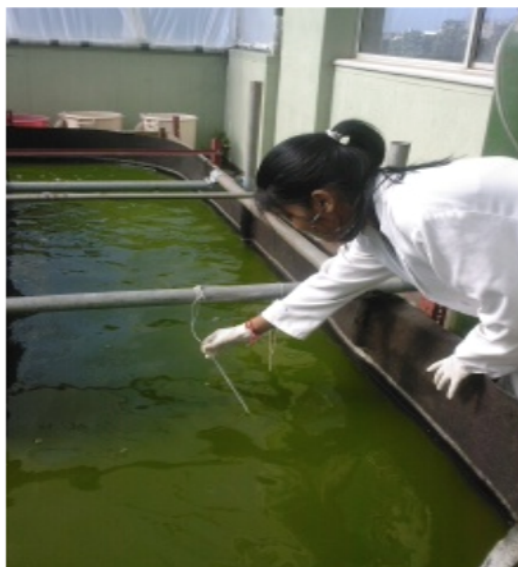
The study focused on isolating microorganisms from industrial wastewater capable of aerobic degradation of PCBs. The degradation potential of the selected isolates is being investigated using different analytical techniques viz. ultra violet or visible spectrophotometer (UV/Vis), thin layer chromatography (TLC) and gas chromatography electron capture detector (GC-ECD). The degradation potential of the isolates are analysed by comparative GC analysis of selected PCB congeners. The potential degradation of these organisms will be investigated in a soil environment.

Characterization Of Filamentous Bacteria From Activated Sludge Treating Industrial Wastewater

This research aims at profiling predominant filamentous bacteria from an activated sludge process treating industrial wastewater in Durban (Kwa-Zulu Natal). Most research has been focused on filaments occurring in domestic wastewater and not much work has been done on filaments occurring in industrial wastewater. Isolation has been greatly dependent on conventional isolation methods whereas micromanipulation provides an added advantage by directly isolating specific filaments from the sludge.

Analysis of problematic filamentous bacteria in activated sludge wastewater treatment plants

Bulking and foaming have drawn considerable interest, as they are the major problems affecting activated sludge process efficiency. Both are direct consequences of poor solid separation caused by filamentous bacteria. The identification and characterisation of filamentous bacteria and their association with specific operating conditions and influent characteristics were the first steps taken towards establishing methods of control. The amelioration of filamentous bacterial related activated sludge problems would significantly facilitate enhanced plant operation and possibly permit the treatment of higher influent loadings. The project aims at investigating the filamentous bacterial population dynamics in conjunction with the plant operating conditions and the respective influent characteristics. This type of work has been documented in South Africa. Novel molecular techniques are being used to identify the filamentous bacteria. The techniques that will be applied are Fluorescent *in Situ* Hybridisation (FISH), DNA sequencing, Polymerase Chain Reaction (PCR) and gel electrophoresis. Real-time PCR will also be used to quantify the bacteria to draw a possible correlation between filamentous bacterial numbers and process performance.



RESEARCH AUDIT

Prof. B. A. Prior
Professor Extraordinary
Department of Microbiology
University of Stellenbosch



Prof. B. A. Prior and Prof. S. Singh

During the month of September, 2007, the Department of Biotechnology and Food Technology hosted a prominent S.A. scientist, viz, Prof. B. A. Prior.

Prof. Prior, a Professor Extraordinary at the Department of Microbiology at the University of Stellenbosch, has more than 160 publications and 3 patents to his credit. He is rated by the NRF as a scientist who enjoys considerable international recognition and has been invited as a visiting scientist to institutions such as MIT, University of California and University of Frankfurt, amongst many others.

Prof. Prior held intensive meetings with staff and postgraduate students with the view of increasing departmental output by outlining a specific research strategy. He provided a detailed analysis on the output of peer reviewed papers in terms of impact factor, citations received and journals in which these papers were published. He commended the department for good congress participation: 25 congress presentations made by 5 staff members and 72 presentations made by 7 staff members and noted that the department has received excellent funding from the NRF, WRC and DUT (more than R6 million) but recommended that we should continue to access such funding while also considering other sources, e.g., private industry.

Although four international scientists are recorded to have spent time in the Department of Biotechnology, he recommended that more scientists should be invited to present short courses on their specialty related to the research interests of the department. Prof. Prior was impressed with the number of completed postgraduate students: 9 D.Tech, 43 M.Tech, 173 B.Tech students have graduated. Currently 5 D.Tech, 29 M.Tech and 5 postdoctoral associates are registered in the department but there is a need for more laboratory space to train this group effectively. In terms of post-doctoral fellows, two have completed their stay, and 5 are currently active in the department. He suggested that since they bring new expertise into the department and help with the training of graduate students, they need to be recognized as temporary staff members by the DUT. He made several valuable recommendations to improve the research culture and output in the Department. He also provided valuable input on how to improve the undergraduate and B.Tech curricula in Biotechnology, especially with regards to practical training and specialized courses.

Table 7 :**International Journal Publications by staff members with DUT addresses (2002-2007)**

Surname	Initials	No. of Articles	Article equivalents	% of total articles	% of total article equivalents
Singh	S	18	5,51	31	12
Bux	F	13	4,49	22	10
Odhav	B	16	6,43	27	14
Permaul	K	4	1,06	7	2
Padayachee	T	2	0,58	4	1
Reddy	L	2	0,66	4	1
Mohanlall	V	1	0,50	2	1
Juglal	S	1	0,33	2	1
Pillay	D	12	2,64	20	6

Table 8 :**Post Doctoral Fellow Outputs 2003-2007**

Name	Commencement date	Supervisor	Publications		International Conference	National Conference
Acc	Sub					
A. Kunamneni	April 2003	S. Singh	5		0	2
S. Akula	October 2004	B. Odhav	4	4	1	2
N. Kango	May 2005	S. Singh	0	0	0	0
M. Ayyachamy	April 2006	S. Singh	1	2	0	0
M. Singh	June 2006	F. Bux	0	1	0	0
L. P. Gangavaramu	May 2007	S. Singh	0	0	0	0
S. Kumari	April 2007	F. Bux	0	0	0	0

Table 9 :

Target of publications submitted by staff from the Department of Biotechnology & Food Technology (2002-2007)

Publication Year	SA Journal in ISI	Non-SA Journal in ISI	SA journal not in ISI	Non-SA Journal not in ISI	Book Chapter	Total number of articles
	Count	Count	Count	Count	Count	Count
2002	3	6	0	0	2	11
2003	3	6	0	0	0	9
2004	1	2	0	0	2	5
2005	1	5	0	1	1	8
2006	2	6	0	0	0	8
2007	0	6	0	0	0	6

Table 10 :

Author distribution of publications (2002-2007)

Publication date	Articles with single author	Articles with two authors	Articles with three authors	Articles with four authors	Articles with five or more authors	Total number of articles
	Count	Count	Count	Count	Count	
2002	0	3	6	1	1	11
2003	0	0	6	2	1	9
2004	1	2	0	1	1	5
2005	0	1	3	3	1	8
2006	0	2	5	1	0	8
2007	0	1	3	0	2	6
Total	1	9	23	8	6	47

RESEARCH FUNDING

Prof. Suren Singh

SOURCE OF FUNDING	CATEGORY	AMOUNT
DUT : IRDP (Institutional Research Development Program)	Post Doctoral Fellowships	
	Bursaries / Running Expenses / Equipment	R 163 600
NRF : IRDP (Institutional Research Development Program)	Post Doctoral Fellowships	
	Bursaries / Running Expenses / Equipment	R 330 000
NRF : Economic and International Competitiveness	Bursaries / Running Expenses / Equipment	R 182 400
NRF : International Science and Technology	SIDA Swedish Bilateral Grant with Lund University	R 493 000
	NEP (National Equipment Program) HPLC.	
NRF : Research Infrastructure	Fermentation Vessel	R 765 000
TOTAL		R1 934 000

Prof. Bharti Odhav

SOURCE OF FUNDING	CATEGORY	AMOUNT
NRF : IRDP (Institutional Research Development Program)	Running Expenses / Research Equipment	
	Masters/Doctoral Study	R 212 494.79
FA Monoculture : Economic Growth and International Competitiveness	Running Expenses	
	Masters/Doctoral Study	
	Student Assistantships	R 189 900
FA Agro : Indigenous Knowledge Systems	Running Expenses	
	Masters/Doctoral Study / Student Assistantships	R 430 963.96
	Sabbatical Grant	
TOTAL		R 833 358,75

Prof. Faizal Bux

SOURCE OF FUNDING	CATEGORY	AMOUNT
DUT : IRDP (Institutional Research Development Program)	Equipment	R100 000
	Operating Expenses	
	Supplementation of Student Bursaries	R115 000
NRF : IRDP (Institutional Research Development Program)	Capital Expenditure	
	Supplementation of Student Bursaries	
	Operating Expenses / Head Conferences	R 457 000
ESKOM	Operating Expenses / Student Support	
	Research Assistance	R 60 000
TOTAL		R 732 000

Prof. Kugen Permaul

SOURCE OF FUNDING	CATEGORY	AMOUNT
DUT : IRDP (Institutional Research Development Program)	Equipment	R100 000
	Overseas Conference Funding	R 16 500
	Research Running Expenses	R 61 500
NRF : IRDP (Institutional Research Development Program)	Student Bursaries / Running Expenditure	
	Research Equipment	R 110 800
TOTAL		R 288 800

Dr. Lalini Reddy

SOURCE OF FUNDING	CATEGORY	AMOUNT
DUT : THUTHUKA (Institutional Research Development Program)	Running Expenses	R 25 000
NRF : THUTHUKA (Institutional Research Development Program)	Student Bursaries	R 20 000
	Running Expenses	R 15 000
TOTAL		R 60 000

Mr. Feroz Swalaha

SOURCE OF FUNDING	CATEGORY	AMOUNT
DUT : IRDP (Institutional Research Development Program)	Supplementation of Student Bursaries	
	Running Expenses	R 62 200
NRF : IRDP (Institutional Research Development Program)	Supplementation of Student Bursaries	
	Running Expenses	R 50 000
TOTAL		R112 200

RESEARCH OUTPUTS

ACADEMIC STAFF	Number of Academic Staff			Staff Registered for HQ			Research Funding							Post Grad Award		Post Grad Reg		Post Docs	Visiting Scientists
	M	D	O	M	D	O	DUT/Seed	External	Ac c	Sub	Other	Nat'l	Int.	M	D	M	D	M	
1, Prof. S. Singh		√					R 163 000	R1 770 400	2	4	-	11	4	2	1	4	3	2	2
2. Prof. B.Odhav		√						R 833 358	2	4	-	3	1	7	-	8	4	1	2
3. Prof. F. Bux		√					R 215 000	R 517 000	3	-	-	-	1	2	-	5	5	2	-
4. Prof. K. Permaul		√					R 178 000	R 110 800	2	3	1	10	2	2	1	6	2	-	-
5. Dr. L Reddy		√					R 25 000	R 35 000	-	1	-	3	1	1	-	2	-	-	1
6. Prof. Gansen Pillay							-	-	-	2	-	-	-	-	-	-	-	*	-
7. Dr. T. Padayachee		√					-	-	-	2	-	1	1	-	-	2	-	-	-
8. Mr. P. Mokoena	√				√		-	-	-	-	-	-	-	-	-	-	-	-	-
9. Mr. F. Swalaha					√		R 50 000	R 62 200	-	-	-	-	-	-	-	4	-	-	-
10. Ms. A. Makathini	√				√		-	-	-	-	-	-	-	-	-	-	-	-	-
11. Ms. S. Juglal	√						-	-	-	-	-	-	-	-	-	-	-	-	-
12. Ms. S. Pillay	√				√		-	-	-	-	-	-	-	-	-	-	-	-	-
13. Ms. S. Beekram	√						-	-	-	-	-	-	-	-	-	-	-	-	-
14. Mr. J. Mellem			√	√			-	-	-	-	-	-	-	-	-	-	-	-	-
15. Ms. N. Mchunu			√	√			-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL FOR DEPARTMENT							R 631 000	R 3 328 758	9	16	1	28	10	14	2	31	14	5	5

VISITING SCIENTISTS

1. Prof. K.D. Bhoola

- **Asthma and Allergy Research Institute, Australia**
- **Visit Date** : 07-08 February 2007
- **Activities** : Assisted in the finalization of a manuscript and discussed involving a joint proposal to MRC.

2. Prof. D.S. Argyropoulos

- **Organic Chemistry of Wood Components Laboratory. North Carolina State University, Raleigh, US.**
- **Visit Date** : 26 – 30 June 2007
- **Activities** :
 - Delivered a lecture to Faculty: "Toward the forest biorefinery with new chemistry and new tools"
 - Discussed collaborative projects on lignocellulose bioprocessing with Enzyme Technology Group.
 - Initiated Faculty collaborations viz., Department of Chemistry -Prof KG Moodley.

3. Prof. B. A. Prior

- **Department of Microbiology, University of Stellenbosch, Stellenbosch**
- **Visit Date** : 1 - 31 August 2007
- **Activities** :
 - Presented lectures to honours and other postgraduate students in the field of lignocellulose enzymology.
 - Served as an advisor in the projects of a number of scientists and students including Professor S. Singh, Prof. K. Permaul, Prof B Odhav and Prof F Bux.
 - Evaluated Masters and Doctoral proposal and presentations.
 - Provided critical input on the current research foci and the two research niche areas within the Department.
 - Evaluated the undergraduate and postgraduate curricula.
 - Interviewed postdoctoral fellows for critical input in terms of research within the Department
 - Reviewed manuscripts (10) in the final phase for submission to international journals.

4. Prof. E.J. da Silva

- **Former UNESCO Chair, Paris, France**
- **Visit Date** : 7 – 20 September 2007
- **Activities** :
 - Delivered lectures to Faculty:
 - i) DUT lecture, 13 September 2007 -
– “Biotechnology : Issues, Perspectives and Seeds of a new economic order
 - ii) Faculty Research Day, 20 September 2007
– “Science and Technology in Developing Countries”
- Reviewed 10 manuscripts for submission to international journals.

5. Dr. K. Mayo

- **Center of Infectious Diseases and Vaccinology, Arizona State University, USA**
- **Visit Date** : 10 September 2007
- **Activities** : Assisted in setting up plant monoculture systems and helped current M.Tech students in plant tissue culture micropropagation systems.

6. Dr. P. Biely

- **Slovak Academy of Sciences. Bratislava, Slovakia**
- **Visit Date** : November 2006
- **Activities** : Provided insight to the following areas of research
 - Recent progress in assays of xylanolytic enzymes
 - Diversity of endo-beta-1, 4-xylanases
 - Alpha-galactosidase of thermotolerant *Aspergillus fumigatus* - an enzyme catalysing galactosyl transfer to internal units of oligosaccharides
 - Hemicellulolytic esterases - different and possible applications
 - Metal-dependent acetylxylan esterases
 - Oligosaccharides as prebiotics; cyclic oligosaccharides - intermediates of starch degradation in some bacteria



Dr. P. Biely (centre) with DUT staff and students

IN MEMORIUM: PROFESSOR EDGAR DA SILVA

Former Director of Life Sciences: UNESCO



Professor Edgar da Silva, a graduate of the University of Bombay in Microbiology and Chemistry was awarded, in 1962, the Bachelor of Science degree (first class with Honours). In 1966, he obtained the Master of Science Degree, and in 1969 his Doctoral degree for research studies on the cyanobacteria. As a NORAD fellow, his research study, on the marine algae at the Norwegian Seaweed Research Institute, Trondheim, Norway, in 1970, was followed by a teaching assignment at the University of Helsinki, Finland. Two years later, he joined the Institute of Physiology, University of Uppsala, Sweden as a UNESCO fellow. Prof da Silva is a former Vice-President of the World Federation for Culture Collections (WFCC), author of several publications and member of many well known microbiological societies. Moreover, he has been a keynote plenary speaker at several international events in Argentina, China, Kuwait, Nigeria, South Africa, Sweden, Thailand, USA, etc. Topics included biopolicy in regional cooperation, microbiological education, and on globalization and sustainable development.

At UNESCO since 1974 in various capacities within the Division of Scientific Research and Higher Education and the Division of the Basic Science, Prof da Silva has been instrumental in the planning and implementation of several UNESCO regional and international programmes in Applied Microbiology as well as in the global networks dealing with management and use of microbial resources and training opportunities in the fields of marine and plant biotechnology. Moreover, he mobilized several extrabudgetary programmes in close cooperation with UNEP and UNDP and Donor Member States for activities in national development in biotechnology and regional cooperation in microbiology.

He was also the Director, Division of Life Sciences that was subsequently transformed into a section of the Life Sciences within a new Division of the Basic and Engineering Sciences prior to his retirement from UNESCO. Prof da Silva has had teaching assignments as Visiting Professor at the Osaka University (Japan) and its outreach station, the UFS, and at the outreach station of ICBiotech at Mahidol University, Thailand. A fellow of the World Academy of Art and Science and following a keynote lecture to the Biotechnology Division of the Royal Swedish Academy of Engineering Sciences and the Biofocus Foundation, Prof da Silva was awarded the Biopolicy Award in 2003. Sadly, shortly after a visit to South Africa, Prof da Silva passed away on 28 October 2007 in Mumbai, India, after suffering a heart attack.

PUBLICATIONS

DoE ACCREDITED JOURNAL PUBLICATIONS

1. **Stephens, D.E., Rumbold, K., Permaul, K., Prior, B.A. and Singh, S. 2007.** Directed evolution of the thermostable xylanase from *Thermomyces lanuginosus*. *Journal of Biotechnology* 127:348-354.
2. **Ayyachamy, M., Khelawan, K., Pillay, D., Permaul, K. and Singh, S. 2007.** Production of inulinase by *Xanthomonas campestris* pv *phaseoli* using onion (*Allium cepa*) and garlic (*Allium sativum*) peels in solid state cultivation". *Letters in Applied Microbiology*. 45:439 -444.
3. **Ismail, A., Wentzel, M. and Bux, F. 2007.** Using respirometric techniques and fluorescent in situ hybridization to evaluate the heterotrophic active biomass in activated sludge. *Biotechnology and Bioengineering*. 98:561-568.
4. **Ramdhani, N. and Bux, F. 2007.** Functional characterization of heterotrophic denitrifying bacteria in activated sludge. *South African Journal of Science*. 103:113-116.
5. **Degenaar, A.P., Ismail, A. and Bux F. 2007.** Comparative evaluation of the microbial community in biological processes treating industrial and domestic wastewaters. *Journal of Applied Microbiology*. (online doi : 1365-2672.2007.03563.x).
6. **Odhav, B., Akula, U.S., Baijnath, H., and Beekrum, S. 2007.** Preliminary assessment of nutritional value of traditional leafy vegetables in KwaZulu-Natal, South Africa. *Journal of Food Composition and Analysis*. 20: 430-435.
7. **Mngadi, P.T., Govinden, R. and Odhav, B. 2007.** Co-occurring mycotoxins in Animal Feeds *African Journal of Biotechnology*.
8. **Akula, U.S. and Odhav, B. 2007.** *In Vitro* 5-Lipoxygenase inhibition of Polyphenolic anti-oxidants from undomesticated plants of South Africa. *African Journal of Biotechnology*.
9. **Pillay, B. and Pillay, D. 2007.** Development and application of prokaryotic biosensor systems for the evaluation of toxicity of environmental samples. Water Research Commission ISBN: 978-1-77005-538-4. 120pp.
10. **Olaniran, O., Pillay, D. and Pillay, B. 2007.** Microbial community profiling in cis- and trans-dichloroethene enrichment systems using denaturing gradient gel electrophoresis. *Journal of Microbiology and Biotechnology* 17: 560-570.

CONFERENCES

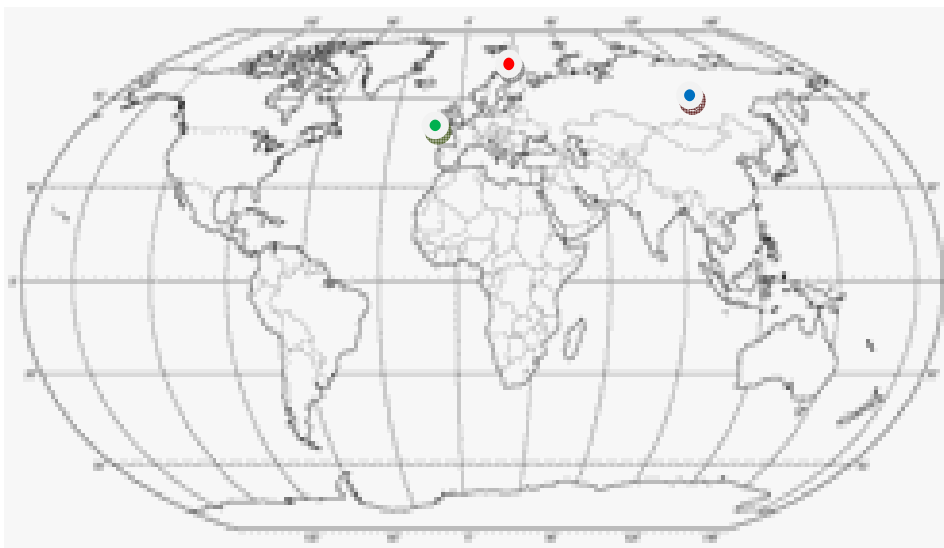
International

1. **Stephens, D.E., Singh, S. and Permaul, K.** Creation of thermophilic and alkalophilic xylanases by directed evolution. June 2007 - 10th International Congress on Biotechnology in the Pulp and Paper Industry, Madison, WI, USA.
2. **Bux, F., Maharaj, S., du Toit, G. and Wentzel, M.C.** (2007) Molecular approaches to study the dynamics of nitrifying bacteria in a conventional activated sludge system and membrane bioreactor. 4th International Water Association Leading-Edge Conference and Exhibition on Water & Wastewater Technology held in Singapore, 3-6 June 2007. Detailed paper on CD.
3. **Mudzwiri, M., Reddy, L. and Odhav, B.** Safety profile of traditional leafy plants from Kwa-Zulu Natal, South Africa. 13th European Congress of Biotechnology, September 2007, Barcelona, Spain.
4. **Padayachee, T., Permaul, K., and Singh, S.** Enzymatic processing of maize meal using α amylase from *Thermomyces lanuginosus*. Calgary, Alberta, Canada 22 to 26 September, 2007. Proc. Agricultural Biotechnology International Conference: AIBC 2007 "Harnessing Science for the Consumer: The fit of Agricultural Biotechnology".
5. **Stephens, D.E., Singh, S. and Permaul, K.** 2007. Creation of a thermophilic and alkalophilic xylanases by directed evolution. 10th International Congress on Biotechnology in the Pulp and Paper Industry. Madison, Wisconsin, June 10-15, p.118
6. **Reddy, P. and Singh, S.** 2007. Biodegradation of pulp mill effluent in fed batch and continuous reactors by thermotolerant microorganisms. 10th International Congress on Biotechnology in the Pulp and Paper Industry. Madison, Wisconsin, June 10-15, p.123
7. **Reddy, P. and Singh, S.** Biodegradation of pulp mill effluent in fed-batch and continuous reactors by thermotolerant micro-organisms. 2007. 10th International Conference on Biotechnology in the Pulp and Paper Industry, Madison, Wisconsin, 8 - 11 June 2007.

National

1. **Padayachee, T.,** attended 19TH SAAFoST Biennial Congress and Exhibition. Consuming Science – Focus on the Facts. 2 – 5 September 2007
2. B Tech students presented the research projects at the Annual South African Society for Microbiology (KZN branch) symposia held in Durban on the 30 October 2007. Best prize for oral presentation was won by Ms V. Chetty from the Dept of Biotechnology, DUT competing against honours students from UKZN and University of Zululand.
3. Work Integrated Learning presentations hosted by the Department on Nov, 30 2007 at DUT. Final year students presented their projects to staff and industrial guest.
4. DUT Annual Research Day presentations was held on 20 September. Postgraduate students and staff participated. Ms. A. Singh (Masters student) won the best poster award.

INTERNATIONAL COLLABORATIONS



http://english.freemap.jp/world_e/4.htm



Jiangnan University

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School of Biotechnology
1800 Lihu Avenue, Wuxi 214122,
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Lund University

Department of Biotechnology
Centre for Chemistry and Chemical Engineering
P.O.Box 117 S-221 00 Lund Sweden



South African Netherlands Research Programme on Alternative in Development (SANPAD)

Netherlands Institute for Southern Africa (NIZA),
Prins Hendrikkade 33, Amsterdam,
The Netherlands



Prof. D. Pillay, Prof. S. Singh, Prof K. Permaul, Ms. N. Mchunu (DUT); Prof. E. Nordberg-Karlson and students (Lund University) - Swedish bilateral

FOOD-BIO INNOVATIONS

Technology Station

Biotechnology and Food Technology Consultation Services for External Customers

The Department offers services and the use of their specialized process plant equipment to:

- Industries (SMMES, Corporate, Entrepreneurs)
- Other academic or research institutions



Proposed Scope of Activities

FOOD-BIO INNOVATIONS will provide assistance and consultancy to the following industrial sectors:

Agriculture and Food

Agricultural benefits from biotechnology include: improved crop varieties, new and improved agri-food products, more effective livestock vaccines, new uses for conventional agricultural commodities, better diagnostics for food safety, new techniques for improvement in the value-added processing industry, improved biological pest control agents, and improved resource management practices.

Animal Agriculture

The meat processing industry also represents the largest portion of S.A's agri-food industry. The development and production of new strains of lactic acid bacteria to extend the storage life of meat. These bacteria are similar to those used in the manufacture of cultured dairy products such as cheese and yogurt.

Plant Agriculture

Biotechnology is pinpointed as one of the few hopes we have to increase food production. Cereal crops have anchored the province's agricultural industry since its pioneering days. S.A is a major producer of wheat and barley and is the leading producer of maize in the world. These crops generate substantial revenues but are subject to world commodity pricing. Biotechnology can be used to improve production of existing crops or develop alternative crops for production of novel products.

Soil and Water Remediation

An important environmental application of biotechnology is bioremediation. This involves the harnessing of naturally occurring microorganisms that feed on chemical compounds, breaking them down into non-toxic substances. These microbes, known to have existed for millions of years, are capable of removing sludge and heavy metals from liquid streams. They are now being used to degrade pollutants and previous non-biodegradable contaminants found in industrial and municipal waste. The ability of these microbes to degrade such materials is being enhanced through the use of biotechnology. Opinion polls indicate that the

general public is concerned about global environmental protection. Accordingly, governments around the world have placed environmental concerns high among their priorities.

Cleaning and Sanitation

Environmental concerns have led to the development of many biodegradable cleaning products for institutional and commercial use. Examples include products for drain and grease trap cleaning, rug and upholstery shampoo, and septic and recreational vehicle tank cleaning.

Waste Disposal

Waste disposal is a growing problem, especially in heavily populated countries and the agricultural industry. Inadequate disposal contaminates ground water and creates intolerable odors. Products using microorganisms have been developed and produced by Alberta companies, many being marketed to other countries.

Pulp and Paper

Environmental issues relating to pulp and paper by-products have received considerable media attention. This area of forestry has therefore received a greater share of attention and great strides have been taken to develop products and processes to reduce harmful by-products. Biotechnology has resulted in the implementation of enzymes to reduce dioxin and organic chlorine emissions from pulp and paper bleach plants. They can also be used to partially bleach wood pulp, thereby reducing the need for chlorine in paper production.

Fossil Fuels

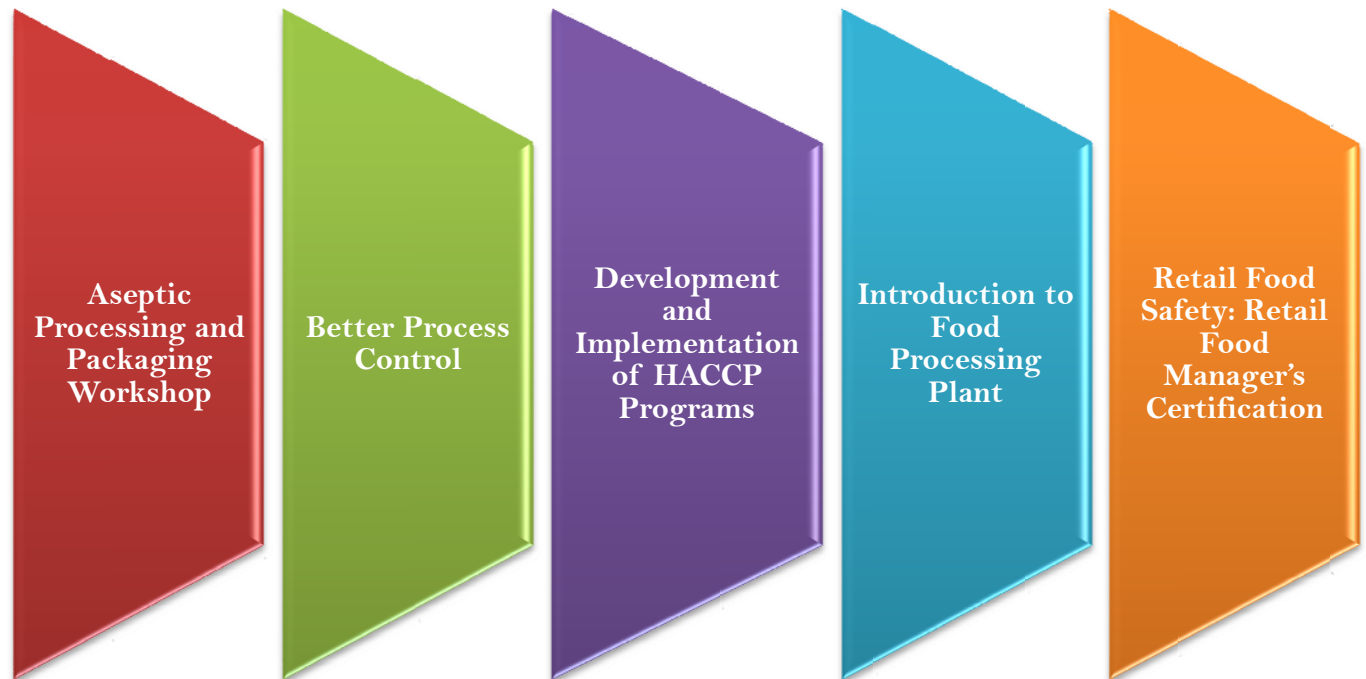
Desulfurization of fossil fuels (coal, oil, oil shales, flue gas) offers a vast potential market for biotechnology. Many biotechnological applications exist specific to the oil sector. A few examples include the microbial degradation of refinery sludges and slop oil; microbially enhanced oil recovery and site remediation to degrade petroleum products. With application to both upstream and downstream operations, the optimization potential will certainly be realized as benefits to many companies in our province.

Forensic Biology

Integrate the disciplines of biology, law and forensic science. FOODBIO-INNOVATIONS will provide a broad survey of biosciences, including human, animal and plant physiology, microbiology, biochemistry and basic laboratory techniques.

Food Technology Workshops and Services

Workshops:



Analytical Services

For a nominal fee, basic food analysis, sensory testing, storage studies, and nutritional labeling assistance are available through the Food Technology Department.

Services offered by Food-Bio Innvoations:

- Contract or commercial research
- Specialist advice
- Testing and analysis (HPLC, Gas Chromatography, Uv And Fluorescent Spectroscopy, NIR Analysis, Microbiological Analysis)
- Feasibility studies
- Contract/project administration
- Identification and preparation of research funding applications
- Student projects and internships

Competitive Analysis

There are currently no direct local competitors to FOODBIO-INNOVATIONS in the Kwa Zulu Natal area. The nearest two competitors are:


- Cape Peninsula University of Technology-Agrifood Technologies
- University of Limpopo-Agrofood Technologies
- Bio-Science Technologies (Pty) Ltd
- CSIR
- Mangosuthu University of Technology-Chemical Engineering Technologies
- Food and Cosmetic Technologies (FACT)

FOOD-BIO INNOVATIONS will be the largest technology station in Durban. This makes it an attractive choice for both researchers and relevant industries. Indirect competition comes from larger technology stations in other provinces with established reputations and from amateurs who already own high-quality equipment. Certainly there are other consulting opportunities in the Durban area. However, because our target customers have an avid interest in biotechnology and food technology, these other opportunities are not competition for the technology station.

Situational Analysis

There are several key factors that will ensure our success. In order of relative importance, these factors are:

Once the technology station is funded (construction, purchase of initial equipment) we will have an extremely low cost structure. This factor will allow us to operate on a low-fee basis while maintaining very high quality throughout our programs. There is very little competition, either locally, or nationally. The technology station will offer leading edge solutions to industry, researchers, and educators alike. This gives us an opportunity to become a regional leader in the field of biotechnology and food technology and will attract support from foundations, government agencies and other organizations that support this kind of work.



“If you can’t maximize the power of the individual, you haven’t done anything. If you expand the ability of individual members of the organization, you expand the ability of the organization.”

-Bob Buckman, CEO and Chairman of Buckman Laboratories,1999



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