



Parker Centre

Student-Industry Research Program

Summer 2007-2008

Symposium

Program and Student Biographies



Parker Centre Mission Statement

The Parker Centre aims to add value to the world's hydrometallurgical industries by delivery of the best science and technology

The Parker Centre works to:

- Improve hydrometallurgical processes for the extraction of metals and metallic compounds such as alumina, gold, nickel, copper and zinc from minerals using aqueous solutions
- Reduce the environmental impact of these processes.

The Student-Industry Research Program provides a win-win-win situation for students, industry and the Parker Centre.

Wins for students through

- Introduction to hydrometallurgy research possibilities
- Introduction to potential employers
- Beginning of formation of working network of fellow students and researchers

Wins for industry through

- Introduction to some of the brightest students coming into the workforce in the next couple of years
- Establishment of working relationship with possible future employees
- Ability to pursue smaller projects or pilot projects related directly to their business that may otherwise not be viable

Wins for Parker Centre

- Ability to link industry partners with potential new research staff
- Ability to provide students from a wider science background with an insight into the area of hydrometallurgy and minerals processing
- The ability to provide additional personnel for running smaller scale studies in conjunction with current Parker Centre staff and postgraduate students.

Student-Industry Research Program Provides Research Experience for Local and International University Undergraduate Students

The Parker Student-Industry Research (S-IR) Program has been running in its current form for three years. The original program, the Summer Jobs Program, first run during the summer of 2003-2004, was internally funded by the Parker Centre and set up to give undergraduate students some insights into the minerals processing industry and its research.

The S-IR Program is a program for undergraduate students and is fully sponsored by industry. Projects ideally are scoped by industry sponsors and designed to investigate aspects of hydrometallurgy processing that are relevant to current industry needs. The program provides students with an opportunity to develop networks with researchers and potential employers and provides industry with an introduction to top student researchers who are potential future employees. The ultimate aim of the initiative is to entice students to do further research in hydrometallurgy as part of their studies and/or enter the hydrometallurgy industry when they have finished their degree.

The international reach of the program now extends across both hemispheres and into four continents. With support from BHP Billiton, one of the Centre's Industry Participants, the S-IR Program was extended in 2007 to enable Northern Hemisphere students to participate during their summer break. Four students from Russia were selected to work with Parker Centre researchers for a three-month period. It is hoped that the winter program will become as successful as the summer program. Through this initiative it is hoped to foster both Industry and research affiliations with promising students world-wide.

Successful applicants are employed as research assistants for eight to ten weeks either over the Australian summer university vacation or during the Northern Hemisphere summer break. They work on meaningful research projects with Centre researchers, usually at CSIRO Minerals Waterford Laboratories, Curtin University of Technology, Murdoch University or the University of Queensland.

Requirements of the program are the completion of a 10-12 week research project under the supervision of a Parker Centre researcher. All students present their results at a Student Symposium and provide a technical report to the Parker Centre and the sponsoring company.

If your company is interested in participating in this program by sponsoring students, please contact the Parker Centre at hydrocrc@parkercentre.com.au.

**The Parker Centre wishes to thank the sponsors of the
Student-Industry Research Program**

Summer 2007-2008:

Industry Sponsors

**Alcan
Anglo Platinum
Barrick
BHP Billiton**

**Rio Tinto
Nyrstar
Minara Resources
Vale**

Research Participant Sponsors

**CSIRO Minerals, Waterford Laboratories (Perth)
CSIRO Minerals, Clayton Laboratories (Melbourne)
Curtin University of Technology
Murdoch University**

***Thanks also to the many supervisors and co-supervisors
involved in guiding these young researchers in their projects
during the 2007-2008 summer.***

**Peter Balding
Nicoleta Balliu
David Barker
Paul Breuer
Goutam Das
Alex Heath
Gordon Ingram
Matthew Jeffrey
Franca Jones
Erich Königsberger
Iztok Livk**

**Mark Maley
David Maree
Robbie McDonald
David Muir
Lesley Mutch
David Ralph
Bill Richmond
Denis Shiers
Kosta Simic
Elizabeth Watkin
Helen Watling**

Thank you also to our judging panel:

**John Berry, General Manager Program Management Branch, DoIR
Nilce Alves dos Santos, Research and Development Engineer, Vale
Paul Breuer, CSIRO Minerals, Waterford**



Symposium Program

Auditorium, ARRC
26 Dick Perry Drive, Kensington
Wednesday 6 February 2008



Time

12:15 – 12:45
12:45 – 1:00

Presentation

Registration
Welcome: Kate Wright, Nanochemistry Research Institute, Curtin University

Session 1

Chair Jane Rosser

1:00 – 1:20

Tsun Yau Mak (Paco) Adiabatic ore leaching for heap temperature profiling
Sponsor: **RIO TINTO**; Supervisors: Gordon Ingram, Nicoleta Balliu, David Maree



1:20 – 1:40

Daniel Hoath: Optimisation of identification techniques for biomining micro-organisms
Sponsor: **RIO TINTO**; Supervisors: Elizabeth Watkin, Lesley Mutch



1:40 – 2:00

Sin Wei Lim: Process options for heap leach liquors
Sponsor: **MINARA RESOURCES**; Supervisors: Robbie McDonald, Peter Balding



2:00 – 2:20

Tracey Richards: The effects of a copper SX reagent system on the activity of selected bacteria
Sponsor: **ANGLO PLATINUM**; Supervisors: Helen Watling, Denis Shiers



2:20 – 2:50

Afternoon Tea

Session 2

Chair Jane Rosser

2:50 – 3:10

Jeremy Hartley: Investigations into the behaviour of ethyl xanthate in contact with nickel sulfide flotation concentrate
Sponsor: **BHP BILLITON**; Supervisors: David Ralph, Mark Maley



3:10 – 3:30

Hetal Devchand: Magnesium sulfate solubility in nickel laterite sulfuric acid leach solutions
Sponsor: **BHP BILLITON**; Supervisor: Erich Königsberger



3:50 – 4:10

Priscilla Macieira: Rheological studies on nickel laterites
Sponsor: **VALE**; Supervisors: Goutam Das, David Muir



4:10 – 4:30

Jacinta Mora: Characterisation of paragoethite process residues with surface charge measurements
Sponsor: **NYRSTAR**; Supervisors: Bill Richmond, Franca Jones



4:30 – 4:40

mini leg-stretch

4:40 – 5:00

Rebecca Meakin: The effect of pre-oxidation, lead and oxygen on the reactivity of iron sulfides in cyanide solutions
Sponsor: **BARRICK**; Supervisors: Matthew Jeffrey, Paul Breuer



5:00 – 5:20

Mitesh Chauhan: Effect of ultrasound on precipitation process
Sponsor: **ALCAN**; Supervisor: Iztok Livk



5:20 – 5:40

Steven Wang: Labview programming for automating continuous tall column
Sponsor: **ALCAN**; Supervisors: Alex Heath, Kosta Simic, David Barker

5:40 – 7:00

Prize presentation and refreshments



Student Biographies



MITESH CHAUHAN

University of Cape Town, South Africa



My name is Mitesh Chauhan and I am a Zimbabwean currently studying at the University of Cape Town in South Africa. At 21, I am an undergraduate in Chemical Engineering who has successfully completed third year and will graduate in December 2008. Through out my life, I have maintained a certain level of determination and have overcome several obstacles that lie before me and feel very confident that I will accomplish my



goal of obtaining a degree in Chemical Engineering. I completed my primary and secondary education in Harare, Zimbabwe and grew up in this country which is currently going through a difficult period. It is a very challenging environment, a challenge I am willing to overcome and feel greatly motivated to excel in life. My other passion lies in playing sport, in particular cricket, which I feel helps me maintain a fine balance in life.



I had always known that I wanted to take the path of Chemical Engineering, because it involves problem-solving and the fact that I possess one of the most important qualities required to be successful, hard work. In my second year I went to Anglo Platinum for one week and was exposed to Mineral Processing, in particular Metallurgy and since then decided that this was the path of Chemical Engineering I would venture into.



The S-IR Program will present me with an opportunity to apply myself and hopefully add value to your company. By interacting with the full-time staff this would yet again be a priceless opportunity that will give me the adequate knowledge and learning experience that would, in addition, provide me with a greater incentive to work hard and become a Chemical Engineer. It will provide me with one of the essentials, and that is to get a tangible practice in the world of Chemical Engineering. Working at CSIRO Minerals would give me the invaluable working experience that I am hoping to obtain. With this student program, I am hoping to form larger networks, thus giving me an opportunity to spread my wings and have a good name for myself.



After I complete my degree, I would like to work in the Minerals Industry in Australia as it has always been one of my ambitions to work here. This will give me the necessary work experience after which I would like to do my Masters in Chemical Engineering, if financially able.



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I take pleasure in what I am studying and feel that it is imperative to do so, in order to achieve my aspirations in life.

HETAL DEVCHAND

Curtin University of Technology, WA



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Hi, I am Hetal Devchand. I grew up in Zimbabwe and came to Perth to undertake a double degree course in Chemical Engineering and Chemistry, of which I am in my fourth year. I have always had an avid interest in chemical processes and thus chose an engineering double degree to further this interest and train to work in a developing field, such as chemical engineering.



I have been grateful for the opportunity to work in the Parker Centre's Student-Industry Research Program; it has provided me with a chance to work with experienced researchers, as well as developing contacts with academic staff who have exposure to practical problems faced in industry. The project I have been working on has been ideal for me as it combines knowledge from both my chemistry and chemical engineering studies. I have also gained a great deal of valuable practical experience from being involved in this program.

The mining industry is an interesting and fast growing industry, especially here in Western Australia. Hence, I feel privileged to have gained work experience in the research sector of this industry through this program. Before I graduate, I am keen to also gain work experience in the industrial sector of mineral extraction and processing. Working in both these sectors would provide me with a comprehensive understanding of the various aspects of chemical engineering in the mining industry.

The chemical engineering field is extremely diverse, encompassing industries such as oil and gas, industrial pharmaceuticals and mining. Hence, in the next few years, I would like to gain experience working within as many of these industries as I can, in order to find the industry for which I am most suited. Within five years I aim to work towards becoming a chartered engineer working in a field that I find both interesting and challenging. After I am established as a chartered engineer I would like to explore the research fields in chemical engineering.

JEREMY HARTLEY

Murdoch University, WA

I am a mature age student and have just completed a degree with double majors in chemistry and biotechnology, and it is my intention to complete honours in the coming year.

I became interested in metallurgy during the course of my degree as it provides a career path that is both interesting and rewarding. The S-IRP has thus been a welcome introduction to a real industry problem, and has increased my resolve to pursue a career in this area.



I will shortly be looking for a research position in the minerals industry, ideally in a field which combines the two disciplines which compose my degree. Thus in 12

months time I hope to be in possession of first class honours and part of the graduate programme of a company that is both innovative and family friendly. In five years time I would anticipate in extension of the same goals, but would be hoping to add to them moves towards adding management skills to my resume.



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DANIEL HOATH

Curtin University of Technology, WA

I was born in Perth, Western Australia. I have never been overseas or left Australia my whole life, due to this I have a huge desire to travel. I have had a strong interest in science since high school, mainly chemistry and physics. I completed my first year of university through a Bachelor of Pharmacy, but decided this was not the career I wanted. I changed to a Bachelor of Science majoring in Molecular Biotechnology. After 3 years of university I have successfully completed the degree as of 2007 and I am continuing on to an Honours year in 2008. I will be doing research into the area of acidophilic micro-organisms related to biomining.



I hope to gain my first solid grounding in 'real' laboratory practice from the Parker Centre Student-Industry Research Program and gain essential research skills that I will use in the years to come through my honours and PhD. I also hope to gain an understanding of the industry and the major areas within it. A lot of what I am doing in the summer program is new to me as my degree was medically focused, but the new area has brought exciting opportunities.

In 12 months time I plan to have completed my Honours year in 2008 and then after a short break and possibly some travelling I hope to continue on and do my PhD or start full time research somewhere within the field of environmental science. The choice I make completely depends on how I feel after my experiences through my honours year.

In 5 years time I will have completed my PhD and will be becoming established in my career in science, or I may be thinking about starting my PhD if I decided to go out and work for a few years after completing my honours year. A career involving travel will be great.

SIN WEI LIM

Curtin University of Technology, WA

I was born in Malaysia and lived in Brunei before migrating to Australia with my family in 1995. I attended Seton Catholic College and always had an interest in science and mathematics. Consequently, my teachers encouraged me to pursue an engineering degree. I chose chemical engineering because it provides broad opportunities with various industries around the world. I have recently completed my third year in Chemical Engineering at Curtin University. However, it was in my



second year at university where I developed a keen interest in the mineral processing aspect of engineering.



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The Student-Industry Research Program has provided me with an invaluable opportunity to explore the mineral industry as well as gain working experience in the field of research. The project I am currently working on involves determining the “at temperature” metal solubilities using synthetic leach liquor samples. Through this program, I hope to gain some industry experience and as well as a new way of thinking and approaching a problem. This is a chance to prove to myself that I am capable of not only learning the theory behind the science but also to be able to put my knowledge into practice.

My short term goal is to complete my final year of studies and to gain more work experience in the petroleum or mineral industry through a graduate program. In five years, I plan to be working as a full time engineer. More importantly, I would like to work in an environment that will continue to challenge me intellectually and one where my efforts have significant impact. I also hope to be able to explore the world by working overseas in the future.

PRISCILLA CAMARGOS MACIEIRA

Universidade Federal de Minas Gerais (UFMG)
Belo Horizonte, MG, Brazil

I was born in Brazil in 1985. Since then, many surprising things have happened in my life. After years of high school studies, my passion for chemistry and mathematics made me choose the Chemical Engineering course. Initially I wanted to work in the cosmetic industry, however, when I began university, I discovered that there are many opportunities in this course. I took advantage of every opportunity and waited for the one which I would be pleased to work in. Within the research projects offered by the university, I worked with cellulose and food, but it was in mining that I found the satisfaction that I was looking for. The opportunity to learn about working in mining was offered to me by the Vale Company after three and a half years of study, and I am still working in the company as a trainee student with nickel ore.



Being a part of the Parker Centre’s Student-Industry Research Program was surprising and a great opportunity to improve my knowledge of hydrometallurgy and make contact with industries, research centres and people whose interests are the same as mine. This experience will not only make me grow professionally but also personally, once I have the privilege of being in a professional environment beyond the borders of my country.

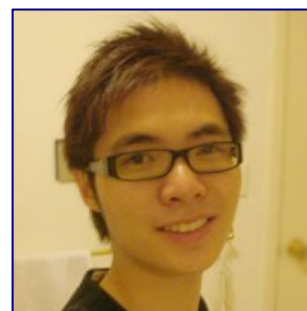
In the next years, after I graduate, I intend on working in hydrometallurgy research within an industry. I also intend to continue my studies, specializing in that area.

TSUN YAU MAK (PACO)

Curtin University of Technology, WA



I was born in Hong Kong in 1986 and came to Australia in 2000. I studied at All Saints' College, and have become interested in chemistry since year 11. With my solid grades in mathematics, I naturally chose to study chemical engineering and applied chemistry (double degree) in Curtin University. Although the course appeared to be totally different from what I expected, I found it really challenging and interesting. I have completed four years of my five-year course, and I thought it's time for real practical experience to learn how to apply the knowledge learnt.



It is a pleasure to be able to work in the Parker Centre Student-Industry Research Program. I never expected that I could find my vacation work relevant to both of my majors. To be honest, my knowledge of the minerals field was really limited at the start. This is my fourth week working at CSIRO Minerals and I have learnt a great deal already. I am working on a project about adiabatic ore leaching for heap temperature profiling. At the end of the program, I am hoping to understand more about bioleaching of copper minerals.

In 2008, I will be completing my double degree course. I am planning to apply for permanent residence, and then I would be able to continue working in Australia. I am planning to find graduate work in the metallurgical field to make the great use of my valuable experience, though I don't mind working in the oil and gas field to increase my exposure to different areas. In five years time, I would like to become a professional engineer to solve problems without monitoring by supervisors.

REBECCA MEAKIN

The University of Western Australia, WA

I was born in Perth and grew up here, attending high school at St. Hilda's Anglican School for Girls. During this time, I grew to love chemistry and physics; therefore I chose to study a Bachelor of Science at The University of Western Australia, majoring in Chemistry and Physics. Although I enjoyed studying, I was not sure that I wanted to pursue a career based in research, which was where I seemed to be heading. During my second year at university, UWA introduced a Chemical Engineering degree, which appealed to me as I thought it could provide me with the practical applications that I wanted. I completed my Bachelor of Science in July 2007, having started my Bachelor of Engineering, majoring in Chemical Engineering, at the start of 2007.



I undertook work experience over the summer of 2006-07 at BHP Billiton in the Hydrometallurgy group, working on a project involving nickel sulphide leaching. I found this to be a great experience, gaining some idea of what goes on in the engineering industry. My supervisor, Dr Mark Maley, suggested I apply to the



Parker Centre Student-Industry Research Program and I did, gaining a place within the Gold group, which has been a fantastic experience. I have enjoyed learning what is involved in gold processing and seeing another aspect of the minerals processing industry.



I have two years left of my Chemical Engineering degree, during which time I hope to participate in the student exchange program at UWA. After I graduate, I plan to gain a place in a graduate program for an engineering company in the minerals processing industry. In five years time I see myself as having completed my graduate program, done some travelling and gained a job within the engineering profession with continuing opportunities to travel.



JACINTA MORA

Curtin University of Technology, WA



I have just completed my third year of a Bachelor of Chemical Engineering at Curtin. There are several things I hope to achieve by the end of the program. These include increasing my patience and persistence, learning some chemistry I would not be exposed to in my university course and learning how to generate and interpret reliable experimental results. The program has also interested me in how research works and its relationship with industry; I think that good research could have positive effects for both industry and the environment. Perhaps after a few years industry experience I would like to move into the field



TRACY RICHARDS

University of Cape Town, South Africa



My name is Tracey Richards. I am from Durban, a beautiful city located on the east coast of South Africa.

During my high school career at Durban Girls' High School, I excelled at both mathematics and chemistry. As part of my school work experience program, I was given the opportunity to work with an engineer for a week. It was this experience that motivated me to pursue a career in engineering.



In 2005 I received a bursary from the Anglo American Research Laboratories. I then journeyed to the west coast of South Africa and enrolled at the University of Cape Town to study Chemical Engineering. I developed a passion for the concepts and discovered that a great deal of self-discipline and determination was required in order to be successful. I have now completed my third year and I will graduate at the end of 2008.



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Being a part of the Student-Industry Research Program for 2007 - 2008 is an amazing opportunity. It offers us, as undergraduates, the opportunity to be exposed

to the practical aspects and applications of what we are studying. We are also given the chance to interact and forge business relationships with engineers in industry.

Once I have completed my degree, I intend to enter the working world as a young research engineer and gain as much experience as possible. As a chemical engineer in South Africa, I would also like to use my education and skills to actively assist in the development of my country.



STEVEN WANG

University of Melbourne, Victoria

I was born in Hong Kong and came to Australia in 2003. I commenced studies in Chemical Engineering in 2004, and during that year completed vacation work with the Clean Power from Lignite CRC at Monash. In 2006 I did vacation work with the Priority Research Centre for Energy in Newcastle, where I was responsible from investigations of industrial coal and sewage dewatering, as well as CFC gas elimination (patent project). In 2008, I will enter the final year of my Chemical Engineering degree, following my most recent vacation work through the Parker Centre, working with Dr Alex Heath, Kosta Simic, Dr Cordelia Selomulya (Monash) and David Barker at the Clayton site of CSIRO Minerals, developing Labview automation of a gamma-attenuation rig on a tall thickener column to allow continuous concentration profiling of the bed solids.

For the next 12 months, I am hopeful that I can attain a Process Engineer position in industry to develop my practical engineering skills based on my theoretical knowledge that I acquired from university and past internship experience. In addition to this, I hope I can be qualified as a professional process engineer within the next five years.