Professor Sue Harrison

SARChI Research Chair in Bioprocess Engineering
Director, Centre for Bioprocess Engineering Research (CeBER)
Director, Future Water Research Institute
Department of Chemical Engineering
University of Cape Town
P/Bag Rondebosch 7701
SOUTH AFRICA
T + 27 (0)21 650 2518
F + 27 (0)21 650 5501
E Sue.Harrison@uct.ac.za
W www.chemeng.uct.ac.za; www.ceber.uct.ac.za; www.futurewater.uct.

Qualifications

BSc(Chemistry & Microbiology), UCT, 1983; BSc Hons (Microbiology), UCT, 1984; PhD Cambridge University 1990

Background

Sue has some 30 years' experience in research in bioprocess and environmental engineering, gained in the industrial and academic arenas. She joined the academic staff of the Department of Chemical Engineering at the University of Cape Town in 1991. Since then 102 Masters and PhD students have been awarded research degrees under her supervision. She regularly authors peer reviewed scientific papers (60 peer-reviewed journal papers over the period since 2011) and presents research at international and national conferences (62 at international conferences from 2011 to 2016). Her research focuses on growing the knowledge base for bioprocesses and bio-based products generated through integrated sustainable process approaches. This builds on resource efficiency principles with a strong focus on valorizing waste resources and bioremediating degraded resources. In biohydrometallurgy, her research centres on metal extraction from sulphidic minerals through tank and heap bioleaching of low grade and complex ores and electronic waste. In mine site and mine water remediation, she focuses on biological sulphate reduction for AMD treatment, SCN bioremediation, metal removal through phycoremediation, AMD prevention and re-purposing mine waste. In both mineral and organic applications, her research seeks value from waste through the circular economy, industrial ecology and maximizing of resource productivity approaches. She and her team have been lead proponents of the wastewater (and more recently, waste) biorefinery concept. She collaborates actively with researchers at the University of Mumbai, Cambridge University, Berkeley, Exeter and Imperial College London and with companies in South Africa and abroad.

Sue has taught actively into the chemical engineering, sustainable mineral resource development and biotechnology programmes at undergraduate and postgraduate levels at the Universities of Cape Town and Cambridge. She was awarded the South African DST Research Chair in Bioprocess Engineering, with effect from 2008. She received the national South African award as "Distinguished Woman Scientist" in 2008 and the national NSTF-South32 award for Research and Engineering capacity development in 2016. She is a fellow of the University of Cape Town and the South African Academy of Engineers.

Employment

2008-present	DST SARChI Research Professor in Bioprocess Engineering
2001-present	Professor, Department of Chemical Engineering, University of Cape Town, Director, Centre for Bioprocess Engineering Research, University of Cape Town
2016 – present	Director, Future Water Research Institute, University of Cape Town
2011 – Aug 2015:	Deputy Dean: Research and Postgraduate Studies, Faculty of Engineering and Built Environment, UCT
2016:	Visiting professor, Camborne School of Mines, University of Exeter, UK
2010:	Visiting professor, Imperial College London, UK
2009 – 5/2013:	Board member, Technology Innovation Agency of South Africa
2004:	Senior Zeneca Fellow, Dept Chemical Engineering, University of Cambridge, UK

	Visiting Fellow Commoner, Trinity College, Cambridge University, UK
2003 – 2013:	Board member, Cape Biotechnology Trust. Chair of Board since 2005
2002 - 2003:	Project director, new Chemical Engineering building project, University of Cape Town

Research Interests

Biohydrometallurgy, mineral bioleaching in tank and heap systems, bioleaching of electronic waste, prevention of AMD formation, biological sulphate reduction for AMD remediation, valorization of waste for the circular economy and industrial ecology, algal biotechnology, waste biorefineries, bio-based chemicals, microbial community dynamics, microbial biofilms and community structure, microbial response to stress, bio-energy

Selected Projects

- Prevention of AMD drainage formation through risk removal
- Heap bioleaching of agglomerated copper ores
- Tank bioleaching of gold-bearing ores
- Minewater remediation, including SCN- and CN- destruction and biological sulphate reduction
- Metal recovery using algal systems
- Waste valorization
- Wastewater biorefineries
- Sustainable bio-based products
- Assessing sustainability in bioprocess systems and enhancing sustainable processes through renewable energy provision

Selected Publications

- Kazadi Mbamba K., Harrison S.T.L., Franzidis J.-P. and Broadhurst J. (2012). Mitigating acid rock drainage risk while recovering low-sulfur coal from ultrafine colliery wastes using froth flotation. *Minerals Engineering* 29, 13-21. Doi:10.1016/j.mineng.2012.02.001. [Impact factor 1.352]
- Oyekola O. O., Harrison S. T. L. and van Hille R. P. (2012). Effect of culture conditions on the competitive interaction between lactate oxidisers and fermenters in a biological sulphate reduction system. *Bioresource Technology* 104, 616-621. doi:10.1016/jbiortech.2011.11.052. [Impact factor: 4.98].
- Bryan C.G., Davis-Belmar C., van Wyk N., Dew D., Rautenbach G. and Harrison S.T.L. (2012). The effect of CO_2 availability on the growth , iron oxidation and CO_2 fixation rates of pure cultures of *Leptospirillum ferriphilum* and *Acidithiobacillus ferrooxidans*. *Biotechnology and Bioengineering* 109(7), 1693-1703. Doi: 10.1002/bit.24453. [Impact factor: 3.946]Govender E, Harrison, STL, Bryan C. (2012). Modification of the ferric chloride assay for the spectrophotometric determination of ferric and total iron in acidic solutions containing high concentrations of copper. *Minerals Engineering* 35, 46-48. [Impact factor 1.352]
- Jones G.C., van Hille R.P. and Harrison S.T.L. (2012). Reactive oxygen species generated in the presence of fine pyrite particles and their implication in thermophilic minerals bioleaching. *Applied Microbiology and Biotechnology* 97(6), 2735-2742. DOI: 10.1007/s00253-012-4116-y. [Impact factor 3.689].
- Kazadi Mbamba K., Franzidis J.-P, Harrison S.T.L. and Broadhurst J. (2013). Flotation of coal and sulphur from South African ultrafine colliery wastes. SAIMM Journal, 113(5), 399-405.
- Tupikina O.V., Minnaar S.H., van Hille R.P., van Wyk N., Rautenbach G.F., Dew D. and Harrison S.T.L. (2013). Determining the effect of acid stress on the persistence and growth of thermophilic microbial species after mesophilic colonisation of low grade ore in a heap leach environment. *Minerals Engineering* **53**, 152-159. [Impact factor 1.352].
- Kantor R.S., van Zyl A.W., van Hille R.P., Thomas B.C., Harrison S.T.L. and Banfield J. (2015). Bioreactor microbial ecosystems for thiocyanate and cyanide degradation unravelled with genome-resolved metagenomics. *Environmental Microbiology*, 17(12), 4929-4941. Doi: 10.1111/1462.2920.12936. [Impact factor 5.843].
- Fagan M.A., Ngoma I.E., Chiume R.A., Minnaar S., Sederman A.J., Johns M.J. and Harrison S.T.L. (2014). MRI and gravimetric studies of hydrology in drip irrigated heaps and its effect on the propagation of bioleaching micro-organisms. *Hydrometallurgy* 150, 210-221. [Impact factor 2.169].
- Govender E., Kotsiopoulos A., Bryan C.G. and Harrison S.T.L. (2014). Modelling microbial transport in simulated low grade heap bioleaching systems: the transport model. *Hydrometallurgy* 150, 299-307. [Impact factor 2.169].

- Bryan C.G., Watkin E.L., McCredden T.J., Wong Z.R., Harrison S.T.L. and Kaksonen A.H. (2015). The use of pyrite as a source of lixiviant in the bioleaching of electronic waste. Hydrometallurgy 152, 33-43. Doi.10.1016/j.hydromet.2014.12.004. [Impact factor 2.027].
- Van Zyl A.W., Huddy R.J., Harrison S.T.L. and van Hille R.P. (2015). Evaluation of the ASTER™ process in the presence of suspended solids. *Minerals Engineering* 76, 72-80. [Impact factor 1.352].
- Ngoma I.E. and Harrison S.T.L.(2015). Investigating the effect of acid stress on selected mesophilic micro-organisms implicated in bioleaching. *Minerals Engineering* 75, 6-13. [Impact factor 1.352].
- Jones S.M.J., Brighton M. and Harrison S.T.L. (2016). Exploring the tension between energy consumption, light provision and CO_2 mass transfer through varying gas velocity in the airlift bioreactor. *Algal Research* 19, 381 -390. DOI: 10.1016/j.algal.2016.07.019 [Impact factor 4.694]
- Bombelli P., Dennis R.J., Felder F., Cooper M.B., Iyer D.M.R., Royles J., Harrison S.T.L., Smith A.G., Harrison C.J. and Howe C.J. (2016). Electrical output of bryophyte microbial fuel cell (bryoMFC) systems is sufficient to power a radio or an environmental sensor. *Royal Society Open Science* 3 (10), 160249.
- Harding K.G. and Harrison S.T.L. (2016). Generic flowsheet model for early inventory estimates of industrial microbial processes. I. Flowsheet development, microbial growth and product formation. *South African Journal of Chemical Engineering,* 22, 34-43. DOI 10.1016/j.sajce.2016.10.003.
- Harding K.G. and Harrison S.T.L. (2016). Generic flowsheet model for early inventory estimates of industrial microbial processes. II. Downstream processing. *South African Journal of Chemical Engineering* 22, 23 - 33. DOI 10.1016/j.sajce.2016.10.002.
- Van Zyl A.W., Harrison S.T.L. and Van Hille R.P. (2017). Determining the effective operating window for a thiocyanate-degrading mixed microbial community. *Journal of Environmental Chemical Engineering*, 5, 660-666. DOI 10.1016/jece.2016.12.046
- Kotsiopoulos A and Harrison S.T.L. (2017). Application of fine desulfurised coal tailings as a neutralising barrier in the prevention of acid rock drainage. *Hydrometallurgy* 168, 159-166. Doi: 10.1016/j.hydromet.2016.10.004. [Impact factor 2.29]
- Govender-Opitz E., Kotsiopoulos A and Harrison S.T.L. (2017). Insight into solute and microbial transport in heap (bio)leaching systems using residence time distribution. *Hydrometallurgy* 168, 1-6. DOI 10.1016/j.hydromet.2016.10.002. [Impact factor 2.29]
- Kantor R.S., Huddy R.J., Iyer R., Thomas B.C., Brown C.T., Anantharaman K., Tringe S., Hettich R.L., Harrison S.T.L. and Banfield J.F. (2017). Genome-resolved meta-omics ties microbial dynamics to process performance in biotechnology for thiocyanate degradation. Environmental Science and Technology 51(5), 2944-2953. [Impact factor 5.393]
- Rahman S.F., Kantor R.S., Huddy R., Thomas B.C., van Zyl A.W., Harrison S.T.L. and Banfield J.F. (2017). Genome-resolved metagenomics of a bioremediation system for degradation of thiocyanate in mine water containing suspended solid tailings. Microbiology Open 1-9. DOI: 10.1002/mbo3.446.
- Makaula D.X., Huddy R.J., Fagan-Endres M.A. and Harrison S.T.L (2017). Using isothermal microcalorimetry to measure the metabolic activity of the mineral-associated microbial community in bioleaching. Minerals Engineering 106, 33-38. [Impact factor 2.286]
- Fagan-Endres M.A., Cilliers J.J, Sederman A.J. and Harrison S.T.L. (2017) Spatial variations in leaching of a low grade, low-porosity chalcopyrite ore identified using X-ray μCT. Minerals Engineering, 105, 63-68. [Impact factor 2.286]
- Kotsiopoulos A. and Harrison S.T.L. Co-disposal of benign desulfurised tailings with sulfidic waste rock to mitigate ARD generation: influence of flow and contact surface. Minerals Engineering (in press). DOI: 10.1016/j.mineng.2017.03.003 [Impact factor 2.286]
- Jones S.J.M, Louw T.M. and Harrison S.T.L. (2017). Energy consumption due to mixing and mass transfer in a wave photobioreactor. Algal Research 24, 317-324. Doi: 10.1016/j.algal.2017.03.001. [Impact factor 5.014]
- Dobson K.J., Harrison S.T.L., Lin Q., Ni Bhreasil A., Fagan-Endres M.A., Neethling S., Lee P.D. and Cilliers J.J. Insights into ferric leaching of low grade metal sulphide –containing ore bed using X-ray computed tomography. Minerals 7(5), 85. Doi: 10.3390/min7050085. [Impact factor 1.5]

- Govender E., Kotsiopoulos A., Bryan C.G. and Harrison S.T.L. (2017) Modelling microbial transport in simulated low-grade heap bioleaching systems: the hydrodynamic dispersion model. Chemical Engineering Science (in press). DOI: 10.1016/j.ces.2017.07.008. [Impact factor 2.613]