University of Birmingham

Professor Lynne Macaskie

Professor of Applied Microbiology

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About

Lynne Macaskie has been working for more than 25 years on applications of microorganisms in various areas of Biotechnology for the Environment. Her interests range from bioremediation of xenobiotics and heavy metals through to nuclear waste treatment and biomineral encapsulation and barrier agents for this.

Over the last 15 years she has moved into hydrogen biotechnology fuel cells for clean power generation and biomanufacture of metallic catalysts for green chemistry applications. Biorecovery of strategic and precious metals from wastes dovetails into the biorefining of such recovered materials into new catalysts.

Qualifications

BSc Microbiology, University of London (1974)

PhD Biochemistry, University of London (1977)

Biography

1977-1979: Broodbank Fellow at University of Cambridge (Food spoilage microbiology)

1979-1986: Postdoctoral fellow at University of Oxford, Physical Chemistry Laboratory (Microbe-metal interactions and metal recovery)

1986-1991: Departmental Demonstrator in Department of Biochemistry, University of Oxford and BTP Fellow, Pembroke College Oxford from 1988-1991 (Bioprocess development)

1991-date: University of Birmingham Lecturer in Biotechnology 1991, Personal Chair 2003.

Teaching

From 1991- 2001 Lynne Macaskie led various modules in Applied Microbiology and Biotechnology and she left undergraduate teaching in 2002 to take up various industrial fellowships.

Postgraduate supervision

PhD projects are available in all the areas outlined above. See also: **www.findaphd.com/search/customlink.asp?inst=birm-Biol&supersurname=Macaskie (http://www.findaphd.com/search/customlink.asp?inst=birm-Biol&supersurname=Macaskie)**

Research

Research Theme within School of Biosciences: **Institute of Microbiology and Infection (/research/activity/microbiology-infection/index.aspx)**

Microbial bioremediation of nuclear and industrial wastes

Lynne Macaskie has been working for more than 25 years on applications of microorganisms in various areas of Biotechnology for the Environment. Her interests range from bioremediation of xenobiotics and heavy metals through to nuclear waste treatment and biomineral encapsulation and barrier agents for this. Recently she has focused on the biorecovery of precious metals from wastes and biofabrication of nanocatalysts for energy and green chemistry applications.

She is also working on hydrogen biotechnology with a goal to deliver clean electricity from agri-food wastes and precious metal wastes together, using the same bacteria for both functions to 'close the loop' and forestall waste production. Recently she has moved into capture of waste carbon dioxide from hydrogen production processes, by conversion of the waste CO_2 into high value products.

The goal is an integrated biorefinery where wastes from each stage of the process are used as valuable raw materials for other stages.

The four pillars of Lynne's research are:

- **Biological hydrogen production (/research/activity/bio-hydrogen/index.aspx)**
- Nuclear waste reprocessing
- Precious metal recovery
- Bionanocatalysts manufacture

Publications

See Lynne's Google Scholar profile (http://scholar.google.co.uk/citations?user=PpOjd44AAAAJ)

Bionanocatalysts and Green Chemistry

Wood J, Bodenes L, Bennett JA, Deplanche K, **Macaskie LE** (2010) Hydrogenation of 2-butyne-1,4-diol using novel nio-palladium catalysts *Ind & Eng Chem Res* in press (Feb 2010)

Bennett JA, Creamer NJ, Deplanche K, **Macaskie LE**, et al (2009) Palladium supported on bacterial biomass as a novel heterogeneous catalyst: a comparison of Pd/Al2O3 and bio-Pd in the hydrogenation of 2-pentyne *Chem Eng Sci* in press doi:10.1016/j.ces.2009.06.069

Mikheenko IP, Bennett JA, Shannon IJ, Wood J, **Macaskie LE** (2009) Biomineralised palladium is an effective hydrogenation catalyst. *Adv Mats Res* **71-73**, 725-728.

Macaskie LE, Deplanche K (2008) Catalytic activity of biomanufactured Au nanocatyalysts in selective oxidation of glycerol *J. Biotech* **S136**, S375.

Creamer NJ, Deplanche K, Snape TJ, **Macaskie LE** (2008). A biogenic catalyst for hydrogenation, reduction and selective dehalogenation in non-aqueous solvents *Hydrometallurgy* 94, 138-143

Creamer NJ, Mikheenko IP, Yong P, Deplanche K, Sanyahumbi D, Wood J, Pollmann K, Merroun M, Selenska-Pobell S, **Macaskie LE** (2007) Novel Pd hydrogenation bionanocatalyst for hybrid homogeneous/heterogeneous catalysis. *Catalysis Today* **128**, 80-90

Creamer NJ, Mikheenko IP, Deplanche K, Yong P, Wood J, Pollmann K, Selenska-Pobell S, **Macaskie LE**. 2007. A novel hydrogenation and hydrogenolysis catalyst using palladized biomass of Gram negative and Gram positive bacteria. *Adv Mats Res* **21-21** 603-606.

Bionanocatalysts and environment/remediation

Deplanche K, Snape TJ, Hazrati S, Harrad, S, **Macaskie LE** (2009) Versatility of a new bioinorganic catalyst: palladized cells of *Desulfovibrio desulfuricans* and application to dehalogenation of flame retardant materials. *Environ Technol* **30**, 681-692.

Humphries AC, Penfold DW, **Macaskie LE** (2007) Cr(VI) reduction by bio- and bioinorganic catalysis via use of bio-H_2: a sustainable approach for remediation of wastes *Journal of Chemical Technology and Biotechnology* **82**, 182-189.

Harrad S, Robson M, Hazrati S, Baxter-Plant VS, Deplanche K, Redwood MD, **Macaskie LE** (2007) Dehalogention of polychlorinated biphenyls and polybrominated diphenyl ethers using a hybrid bioinorganic catalyst. *Journal of Environmental Monitoring* **9**, 314-318.

Humphries AC, Mikheenko IP, **Macaskie LE** (2006) Cr(VI) reduction by immobilized palladized sulfate-reducing bacteria *Biotech Bioeng* **94**, 81-90

Mabbett AN, Yong P, Farr JPG, Macaskie LE (2004) Reduction of Cr(VI) by palladized biomass of *Desulfovibrio desulfuricans* ATCC 29577 *Biotechnology and Bioengineering* **87**, 104-109.

Humphries AC, Nott KP, Hall LD, **Macaskie LE** (2004) Continuous removal of Cr(VI) from aqueous solution catalysed by palladised biomass of *Desulfovibrio vulgaris Biotechnol Letts* **26**, 1529-1532.

Mabbett NA, **Macaskie LE et al** (2004) Reduction of Pd by palladized biomass of *Desulfovibrio desulfuricans Biotechnol Bioeng* **87**, 104-109.

Baxter-Plant VS, Mikheenko IP, **Macaskie LE** (2003) Sulphate-reducing bacteria, palladium and the reductive dehalogenation of chlorinated aromatic compounds *Biodegradation* **14**, 83-90

Mabbett AN **Macaskie, L.E et al** (2001). Effective reduction & removal of chlorophenol by hybrid bioinorganic catalytic processes. In *Biohydrometallurgy: Fundamentals, Technology and Sustainable Development* Eds V.S.T. Ciminelli & O Garcia, Elsevier, pp 335-342..

Fuel cells

Yong P, Mikheenko IP, Deplanche K, Sargent F, **Macaskie LE** (2009) Biorecovery of precious metals from wastes and conversion into fuel cells for electricity production *Adv Mats Res* **71-73**, 729-732.

De Carvalho RP, Yong P, Mikheenko IP, Paterson-Beedle M, **Macaskie LE** (2009) Electron paramagnetic resonance of active bio-Pd-based electrodes for fuel cells *Adv Mats Res* **71-73**, 737-740.

Yong P, Mikheenko IP, **Macaskie LE** (2008) Manufacturing of fuel cells by bio-crystallization *J Biotechnol* **136S** S374-S375

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Yong P, Mikheenko IP, **Macaskie LE** (2007) Novel fuel cell catalyst for clean energy production based on a bionanocatalyst. *Adv Mats Res* **20-21**, 655-658.

Precious metal removal/recovery and new nanocatalyst formulations from wastes

Deplanche K, Woods RD, Mikheenko I, Sockett RE, **Macaskie LE** (2008) Manufacture of stable palladium and gold nanoparticles on native and genetically engineered flagella scaffolds *Biotechnol Bioeng*, **101**, 873-880

Deplanche K, **Macaskie LE** (2008) Biorecovery of gold by *Escherichia coli* and *Desulfovibrio desulfuricans Biotech Bioeng* **99**, 1055-1064

Deplanche K Attard GA **Macaskie LE** (2007) Biorecovery of gold from jewellery waste by *Escherichia coli* and biomanufacture of catalytically active Au-material *Adv Mater Res* **20-21** 647-650.

Redwood MD, Deplanche K, Baxter-Plant VS, **Macaskie LE** (2008) Biomass-supported catalysts on *Desulfovibrio desulfuricans* and *Rhodobacter sphaeroides Biotechnol Bioeng* **99**, 1045-1054.

Macaskie LE, Creamer NJ, Essa AMM, Brown NL (2007) A new approach for the recovery of precious metals from solution and from leachates derived from electronic scrap *Biotechnology and Bioengineering* **96,** 631-639.

Murray AJ, Macaskie LE et al (2007). Biorecovery of platinum group metals from secondary sources *Adv Mats Res* **21-21**, 651-654.

Deplanche K, Attard GA, Macaskie LE (2007).Biorecovery of gold from jewellery wastes by *Escherichia coli* and biomanufacture of active Au-nanomaterial. Adv Mats Res **21-21**, 647-650

Mabbett AN, Sanyahumbi D., Yong P., **Macaskie LE** (2006) Biorecovered precious metals from industrial wastes: single step conversion of a mixed metal liquid wastes to a bioinorganic catalyst with environmental application. *Environmental Science and Technology* **40**, 1015-1021.

Essa A, Brown ML, **Macaskie LE** (2006) A new approach to the removal of heavy metals from liquid wastes via off gases produced by *Klebsiella pneumoniae*. *Biotechnology and Bioengineering* **95**, 574-583.

Creamer NJ, Baxter-Plant VS, Henderson J., Potter M., **Macaskie LE** (2006) Palladium and gold removal and recovery from precious metal solutions and electronic scrap leachates by *Desulfovibrio desulfuricans*. *Biotechnology Letters* **28**, 1475-1484.

Humphries AC, Nott KP, Hall LD, Macaskie LE (2005) Reduction of Cr(VI) by immobilized cells of *Desulfovibrio vulgaris* NCIMB 8303 and *Microbacterium* sp. NCIMB 13776 *Biotechnology & Bioengineering* **90**, 589-596.

Humphries AC, **Macaskie LE** (2005) Reduction of Cr(VI) by palladized biomass of *Desulfovibrio vulgaris* NCIMB 8303*Journal Chemical Technology and Biotechnology* **80**, 1378-1382.

Chassary P., Vincent, T., Sanchez Marcano J, **Macaskie LE**, Guibal E (2005) Palladium and platinum recovery from bi-component mixtures using chitosan derivatives. *Hydrometallurgy* **76**, 131-147.

Mikheenko IP, Mikheenko PM, Dementin S, Rousset M., **Macaskie LE** (2005) Nanoengineering of ferromagnetic palladium in hydrogenase negative mutants of *Desulfovibrio fructosovorans*. In *Proceedings, 16th International Biohydrometallurgy Symposium Cape Town South Africa* Eds. STL Harrison, DE Rawlings, J.Petersen. Published by 16th International Biohydrometallurgy Symposium, Cape Town ISBN 1-920051-17-1. pp 383-387.

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De Vargas I., Sanyahumbi D., Ashworth MA, Hardy CM, **Macaskie LE** (2005) Use of X-ray photelectron spectroscopy to elucidate the mechanism of palladium and platinum biosorption by *Desulfovibrio desulfuricans* biomass. *Ibid*. pp 605-616.

Essa AMM, **Macaskie LE**, Brown NL (2005) A new method for mercury removal *Biotechnology Letters* **27**, 1649-1655.

De Vargas I, **Macaskie LE**, Guibal E (2004) Biosorption of Pd and Pt by sulphate-reducing bacteria *J Chem Technol Biotechnol* **79**, 49-56.

Mikheenko IP, Baxter-Plant VS., Rousset M, Dementin S, Macaskie, LE (2004)Reduction of palladium (II) with *Desulfovibrio fructosovorans*, its [Fe]-only hydrogenase negative mutant and the activity of the obtained hybrid bioinorganic catalyst. In *Biohydrometallurgy: A Sustainable Technology in Evolution* Eds M. Tsezos, A. Hatzikioseyian, E. Remoundaki, National Technical University of Athens ISBN 960-88415-0-X pp 1147-1154.

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Yong P, Rowson NA, Farr JPG, Harris IR, **Macaskie LE** (2002) Bioreduction and biocrystallization of palladium by *Desulfovibrio desulfuricans* NCIMB 8307 *Biotechnol, Bioeng* **80**. 369-379.

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Yong P, **Macaskie LE** et al(2002) Bioaccumulation of palladium by *Desulfovibrio desulfuricans J Chem Technol Biotechnol* **77**, 593-601.

Yong P, Farr JPG, Harris IR, **Macaskie LE** (2002) Palladium recovery by immobilized cells of *Desulfovibrio desulfuricans* using hydrogen in a novel electrobioreactor *Biotechnol Letts* **24**, 205-212.

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Yong P, Rowson NA, Farr JPG, Harris IR, **Macaskie LE** (2002) Bioreduction and bio-crystallization of palladium by *Desulfovibrio desulfuricans* NCIMB 8307. *Biotechnology and Bioengineering* **80**, 369-379.

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Yong P, **Macaskie LE** et al (2001) Recovery of Pd & Pt from liquid waste & spent auto catalysts using *Desulfovibrio desulfuricans* in a flow-through electrobioreactor.In *Biohydrometallurgy: Fundamentals, Technology, Sustainable Development* Eds V.S.T. Ciminelli & O Garcia, Elsevier, pp 327-334.

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Redwood MD, Paterson-Beedle M., **Macaskie LE** (2008) Integrating dark and light biohydrogen production strategies: towards the hydrogen economy *Rev Environ Sci Bio/Technol*, 8, 149-185.

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Macaskie LE, Redwood MD, Orozco R, Bridges N (2008) 'Bio' solutions to recover 'bio' energy from 'bio' wastes *J. Biotechnol* **S136**, S429.

Redwood MD, **Macaskie LE** (2006) A two-stage, two organism process for biohydrogen from glucose. *Int J Hydrogen Energy* **31**, 1514-1521.

Penfold DW, Sargent F, **Macaskie LE** (2006) Effect of knocking out the twin arginine transport (tat) system of *E. coli* strains MC4100 and HD701 on hydrogen production. *FEMS Microbiology Letters* **262**, 135-137.

Pedfold DW, **Macaskie LE** (2004) Production of H_2 from sucrose by *Escherichia coli strains* carrying the pUR plasmid which encodes invertase activity *Biotechnol Letts* **26**, 1879-1882

Penfold DW, Forster CF, Macaskie LE (2003) Increased hydrogen production by *Escherichia coli* strain HD701 in comparison with the wild-type parent strain MC4100 *Enz Microbial Technol* **33**, 185-189.

Humphries, A.C., Penfold, D.W., Forster, C.F. Macaskie, L.E. (2004).Chromate reduction by immobilized cells of *Desulfovibrio vulgaris* using biologically produced hydrogen. In *Biohydrometallurgy: A Sustainable Technology in Evolution* Eds M. Tsezos, A. Hatzikioseyian, E. Remoundaki, National Technical University of Athens ISBN 960-88415-0-X pp 525-532.

Nuclear wastes and uranium

Paterson-Beedle M, **Macaskie LE**, Readman JE, Hriljac JA (2009) Biorecovery of uranium from minewaters into pure mineral product at the expense of plant wastes *Adv Mats Res*, **71-73**, 621-624.

Macaskie LE, Mennan CM Paterson-Beedle M, Readman JE, Hriljac JA (2008) Removal of radionuclides into biogenic metal phosphate matrices: a novel remediation strategy *Geochim Cosmochim Acta* **72**, A580-A580

Paterson-Beedle M, **Macaskie LE**, Lee CH, Hriljac JA, Jee KY, Kim WH (2006) Utilisation of a hydrogen uranyl phosphate-based ion exchanger supported on biofilm for the removal of cobalt, strontium and caesium from aqueous solutions. *Hydrometalurgy I* **83**, 141-145.

Lloyd, J.R., Yong, P., **Macaskie, L.E**. (2000)Biological reduction and removal of Np(V) by two microorganisms. *Environmental Science and Technology* **34***,* 1297-1301.

Paterson-Beedle M, **Macaskie LE**, Lee H, Hriljac JA, Jee KY, Kim WH (2006) A novel hydrogen uranyl phosphate-based inorganic ion exchanger for the removal of ^{60}Co ^{85}Sr and ^{137}Cs from aqueous solutions *Recent Advances in Actinide* Paterson-Beedle, M., Macaskie, L.E. (2004)Removal of cobalt, strontium and caesium from aqueous solutions using native biofilm of *Serratia* sp. and biofilm pre-coated with hydrogen uranyl phosphate. In *Biohydrometallurgy: A Sustainable Technology in Evolution* Eds M. Tsezos, A. Hatzikioseyian, E. Remoundaki, National Technical University of Athens ISBN 960-88415-0-X . pp 1155-1162.

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Bioremediation, microbiology and microbe-metal interactions

Mikheenko I,RoussetM, Dementin S, ***Macaskie LE*** *(2008) Bioaccumulation of palladium by* Desulfovibrio fructosovorans *and hydrogenase deficient strains.* Appl Environ Microbiol *19, 6144-6146*

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Non-invasive bioreactor imaging and modelling

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