

Dr Rachel Sammons PhD

Senior Lecturer and Programme Lead BMedSc (Biomedical Materials Science)

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About

Rachel Sammons is the Programme Lead for the BMedSc(Biomedical Materials Science) programme. She is also First Year Tutor and Examinations Officer for this Programme.

Rachel Sammons research interests focus on surface interactions between mammalian cells and bacteria and biomaterials – especially titanium and hydroxyapatite, for bone repair and the prevention of infection.

Qualifications

- Senior Lecturer in Biomaterials, 2005.
- Lecturer in Biomaterials, School of Dentistry, 1997.
- PhD in Microbial Genetics, University of Birmingham, 1980.
- BSc in Biological Sciences, University of Birmingham, 1976.

Biography

Dr Sammons graduated from the University of Birmingham in 1976 with a BSc (Hons) in Biological Sciences. She gained her PhD in 1980 on the biochemistry and genetics of spore germination of *Bacillus subtilis* 168. She was then awarded a Royal Society European Exchange Fellowship to work at the Centre de Génétique Moléculaire, CNRS, Gif-sûr-Yvette, France on chromosomal rearrangements in *Bacillus subtilis* trpE26. She returned to Birmingham in 1982 to resume work on the molecular biology of bacterial spore germination but in 1988 she moved to the Department of Anatomy, to take up a Research Fellowship as a cell biologist. In 1991 she was awarded a Senior Research Fellowship by the charity "Action Research" to work on the molecular biology of osteoblast-hydroxyapatite interactions and the influence of calcium phosphate phase variability in plasma sprayed coatings on bone cell behaviour. She moved to the School of Dentistry and was made a lecturer in biomaterials in 1997, senior lecturer in 2005 and has been Course Leader of the BMedSc(Biomedical Materials Science) degree programme since 2001.

Infections associated with implanted medical devices cause considerable problems because they can rarely be successfully treated with antibiotics and in most cases the implant has to be removed. Dr Sammons research focuses on ways to improve cellular attachment and differentiation on titanium surfaces and inhibit bacterial attachment and proliferation. This may include ion implantation or application of coatings (especially hydroxyapatite) which optimise the tissue response and reduce bacterial interactions. Sammons has published several papers on biofilms and biomineralisation, having worked for several years on the manufacture of hydroxyapatite by a species of *Serratia* bacteria. She maintains collaborative links with researchers and companies in Japan, initiated by a BBSRC Japan Partnering award, and in Europe via membership of a Eureka! Consortium, as well as collaborative links with Italian and Swedish researchers, working on cell-dental implant interactions and degradation of bone-substitute materials, using the scanning electron microscope as an investigative tool. She was recently awarded a grant from the Furlong Charitable Foundation to carry out a collaborative programme of research on the development of reinforced artificial ligaments.

Teaching

- **[Biomedical Materials Science BMedSc \(/undergraduate/courses/med/biomedical-materials-sci.aspx\)](#)**
- **[Dental Surgery BDS \(/undergraduate/courses/med/dental-surgery.aspx\)](#)**
- MSc in Advanced General Dental Practice.

Postgraduate supervision

Dr Sammons is interested in supervising doctoral research students in the area of:-

Modification of titanium and hydroxyapatite surfaces for optimisation of tissue interactions and prevention of bacterial attachment and proliferation.

Research

Research Interests:

- **Bacterial biomineralisation by a species of *Serratia*.** The ability of a species of *Serratia* bacteria to form biofilms within confined spaces and to manufacture hydroxyapatite is being exploited in an EPSRC funded project to study the ability of ultrasonic dental instruments to remove biofilms and calculus from the root canal and other confined spaces in collaboration with Prof. Damien Walmsley and scientists at Bath University. Project commenced in 2013.
- **Development of tissue engineered ligaments:** This is a collaborative project with Professor Liam Grover, Chemical Engineering, University of Birmingham funded by Orthopaedic Research UK. The aim of the project is to develop a reinforced tendon for repair of injuries to tendons and ligaments. Project commenced March

- **Development of antimicrobial titanium surfaces and periimplantitis:** The aim of this research is to investigate bacterial attachment to commercial titanium (dental implant) surfaces in order to develop modified surfaces that will deter bacterial attachment. This project is funded by an EPSRC Advantage West Midlands Case Studentship and commenced November 2010. A linked pilot project involves collaboration with Dr H. Dong (metallurgy and Materials), developing active Screen Plasma Alloying for manufacture of wear-resistant antimicrobial surfaces.
- **Antimicrobial bone cements:** The aim of this research is to investigate the feasibility of incorporation of antibiotics and other antimicrobial substances into various types of calcium phosphate bone cement. This is a collaborative project with Dr Mike Hoffmann and commenced October 2010.
- **Tissue reactions to bone-anchored hearing aids:** Investigation of biofilm formation and inflammatory response to bone anchored hearing aids (BAHA); Like dental implants, BAHAs form a bridge connecting the external environment and sterile bone. Approximately 20% of patients suffer an adverse skin reaction to the implants. This collaborative research project is investigating the inflammatory response to BAHAs, focussing on the presence of inflammatory markers in tissue exudate and biofilm formation on the internal implant screws. This is a collaborative project involving several staff. in the School of Dentistry, Queen Elizabeth Hospital NHS Trust and Birmingham Children's Hospital.
- **Bacterial biomineralisation by a species of *Serratia*** This project was initially funded by a BBSRC until 2005 and the work has continued to 2010 via PhD and Masters studentships in Dental School and School of Engineering (Metallurgy and Materials). The bacteria manufacture hydroxyapatite via a mechanism involving an acid-phosphatase enzyme located in the bacterial cell wall that cleaves organic phosphates, liberating inorganic phosphates that combine with calcium ions to form mineral. Analogous to bone mineral formation, the method can be used to form 3D scaffolds whose surface topography resembles that of the original biofilm and is a non-line-of sight method of coating metal and polymer substrates with hydroxyapatite.

Other activities

- College Programme Approval and Review Committee (CPARC) member

Publications

1. Shirota, T., Shintani, S., Yoshizawa, Y., Kuboki, Y., Sammons, R. and Yagami, K. Optimal Diameter of Honeycomb Tunnel Structure induces Bone Regeneration and Metabolism by Promoting Angiogenesis for an Implant Circumference Bone Defect. **Journal of Hard Tissue Biology** 22 (2013) 409-417.
2. Sammons, R., Wang, A., Mikheenko, I., Handley-Sidhu, S., and Macaskie, L., Bacterially Derived Nanomaterials and Enzyme-Driven Lipid-Associated Metallic Particle Catalyst Formation. In: A. Iglič, and C.V. Kulkarni, (Eds.), **Advances in Planar Lipid Bilayers and Liposomes**, Academic Press, Burlington, 2013, pp. 237-261.
3. Wang, A., Mei, J., Tse, Y.Y., Jones, I.P., and Sammons, R.L. Hydroxyapatite synthesis on solid surfaces using a biological approach, 17th International School on Condensed Matter Physics, **Journal of Physics Conference Series** 398 (2012) 012005.
4. Fu, X., Sammons, R.L., Bertoti, I., Jenkins, M.J. and Dong, H. Active screen plasma surface modification of polycaprolactone to improve cell attachment. **Journal of Biomedical Materials Research Part B-Applied Biomaterials** 100B (2012) 314-320.
5. Dong, Y., Li, X., Tian, L., Bell, T., Sammons, R.L., Dong, H. (2011) Towards long-lasting antibacterial stainless steel surfaces by combining double low plasma silvering with active screen plasma nitriding, **Acta Biomaterialia**, 7:447-457.
6. Monksfield, P., Chapple, I.L.C., Matthews, J.B., Grant, M.M., Addison, O., Reid, A.P., Proops, D.W. and Sammons, R.L. Biofilm formation on bone-anchored hearing aids. **Journal of Laryngology and Otology** 125 (2011) 1125-1130.
7. Buhagiar, J., Bell, T., Sammons, R. and Dong, H. Evaluation of the biocompatibility of S-phase layers on medical grade austenitic stainless steels. **Journal of Materials Science-Materials in Medicine** 22 (2011) 1269-1278.
8. Sammons, R.L. (2011) Modifying biomaterial surfaces to optimise interactions with bone In Williams R (ed) Surface modification of biomaterials; Methods, analysis and applications. Woodhead Publishing, Oxford. pp 365-391.

