University of Birmingham

Professor Jim Callow BSc, PhD, CBiol, FSB

Emeritus Professor of Botany

School of Biosciences (/schools/biosciences/index.aspx)

Contact details

Telephone +44 (0)121 41 45559 (tel:+44 121 41 45559)

Fax +44 (0)121 41 45925

Email j.a.callow@bham.ac.uk (mailto:j.a.callow@bham.ac.uk)

School of Biosciences
University of Birmingham
Edgbaston
Birmingham
B15 2TT
UK

About

Professor Callow is a leading international authority on the study of marine algae, with a focus on bioadhesion (how algal cells interact with and adhere to surfaces). In recent years the emphasis has been on interdisciplinary, collaborative investigations into the interactions between algal cells and micro/nanostructured materials, including those with 'biomimetic' implications, an area which has profound importance for the applied problem of marine biofouling.

Professor Callow leads two major European programmes in the area of nanomaterials for antifouling applications. For over 15 years the laboratory has played a key role as a centre of biological expertise in the programme on marine biofouling run by the US Office of Naval Research.

Qualifications

BSc, PhD

Biography

Jim Callow obtained a First Class Honours BSc and PhD in Botany from the University of Sheffield in 1966 and 1969 respectively. He was appointed to a Lectureship in the University of Leeds (1969-1982) and then to the titular Chair of Botany and Headship of the Department of Plant Sciences in the University of Birmingham in 1983. He was appointed the first Headship of the School of Biological Sciences (1988-1994). His appointment is currently held in the School of Biosciences. Professor Callow has been extensively involved in the work of the research committees of UK Research Councils (AFRC/BBSRC) and has held positions on the governing bodies of several UK plant science research centres. More recently he has been involved in several EU-funded research projects, notably as initiator and Coordinator of the interdisciplinary 6th Framework Integrated Project 'AMBIO' (Advanced Nanostructured Surfaces for the Control of Biofouling). He also initiated and coordinates the Marie-Curie Initial Training Network 'SEACOAT' (Surface Engineering for Antifouling-Advanced Coordinated Training).

Professor Callow's current research interests are in the cell biology of marine organisms (algae) in the context of recognition and adhesion processes, including those involved in the colonisation of substrates in the marine environment. This has led variously to studies on the role of interfacial physico-chemical properties in surface colonisation, studies on the molecular and mechanical properties of the bioadhesives ('glues') used by fouling organisms, studies on the cell biology of glue secretion and the role of biofilms in moderating the adhesion of algae. He has authored or co-authored over 150 papers in international, peer-reviewed journals.

Research

Research Theme within School of Biosciences: Organisms and Environment

Lab website address

http://www.biosciences-labs.bham.ac.uk/callowj/ent/ (http://www.biosciences-labs.bham.ac.uk/callowj/ent/)

Short research description

- Cell biology of adhesion mechanisms used by marine algae in cell-substratum interactions
- Nanotechnology in the context of biological adhesion (collaborative interdisciplinary approaches with physical scientists and materials engineers).
- Novel approaches to the control of bioadhesion and marine biofouling

Full research description

Algal bioadhesion in the context of marine biofouling

Research focuses on three types of marine algae that cause biofouling problems on the hulls of ships; the green seaweed *Ulva*, the brown seaweed *Ectocarpus*, and the unicellular diatom *Navicula* (or its close relative, *Seminavis*).

We use these as model organisms with which to investigate bioadhesion processes in relation to biofouling. Funding is currently provided by the Office of Naval Research (USA), the EC (Framework 7) and industry.

Work involves interdisciplinary collaborations with surface scientists, physicists, nanotechnologists and polymer scientists in the US and Europe. To study surface selection cues involved in the recruitment of our test organisms we use well-characterised self-assembled monolayers of various types and engineered surfaces presenting various micro- to nanoscale topographies. Adhesion strength of attached cells is measured hydrodynamically.

The research is generating novel insights into how these organisms detect and respond to surface cues and this information is then used in knowledge-driven approaches to the development of practical antifouling coatings.

In other studies we are interested in understanding the cellular and physiological basis of surface selection. For example we recently established that the NO-signalling

cascade is involved in perception and response of diatoms to surfaces of different wettability.

Other activities

Professor Callow is currently the Coordinator of **SEACOAT (http://www.seacoat.bham.ac.uk/)** , a Marie-Curie Initial Training Network in the area of marine antifouling.

Visiting Professor, Jožef Stefan International Postgraduate School, Ljubljana, 2008- to date

Publications

2011

Nikhil Gunari, Lenora H. Brewer, Stephanie M. Bennett, Anastasiya Sokolova, Nadine D. Kraut, John A. Finlay, Anne E. Meyer, Gilbert C. Walker, Dean E. Wendt, Maureen E. Callow, James A. Callow, Frank V. Bright and Michael R. Detty. (2011) The control of marine biofouling on xerogel surfaces with nanometer-scale topography. Biofouling, **27**, 137-149.

Callow JA, Callow ME. (2011). Trends in the development of environmentally friendly fouling-resistant marine coatings. Nature Communications **2**: 10.1038/ncomms1251.

Magin, C.M., Finlay, J.A., Clay, G., Callow, M.E., Callow, J.A., Brennan, A.B. (2011) Antifouling performance of cross-linked hydrogels: refinement of an attachment model. Biomacromolecules, **12**, 915-922.

Wang Y, Betts DE, Finlay JA, Brewer L, Callow ME, Callow JA, Wendt DE, DeSimone JM. 2011. Photocurable amphiphilic perfluoroether/poly(ethylene glycol) networks for fouling-release coatings. Macromolecules 44(4): 878-885. DOI: 10.1021/ma102271t

Sundaram, H.S., Cho, Y., Dimitriou, M.D., Weinman, C.J., Finlay, J.A., Clay, G., Callow, M.E., Callow, J.A., Kramer, E.J., Ober, C.K. (2011) Fluorine-Free Mixed Amphiphilic Polymers Based on PDMS and PEG Side Chains for Fouling Release Applications. Biofouling 27: 589-602.

Cho, Y., Sundaram, H.S. Sundaram, H.S., Weinman, C.J., Paik, M.Y. Dimitriou, M.D., Finlay, J.A., Callow, M.E., Callow, J.A., Kramer, E.J., Ober, C.K. (2011) Triblock copolymers with grafted fluorine-free, amphiphilic, non-ionic side chains for antifouling and fouling-release applications. Macromolecules, 44, 4783-4792.

Martinelli, E., Suffredini, M., Galli, G., Glisenti, A., Pettitt, M. E., Callow, M.E., Callow, J.A., Williams, D., Lyall, G. (2011) Amphiphilic block copolymer/poly(dimethylsiloxane) (PDMS) blends and nanocomposites for improved fouling-release. Biofouling, **27**, 529-541.

Beigbeder, A., Labruyere, C., Viville, P., Pettitt, M.E., Callow, M.E., Callow, J.A., Bonnaud, L., Lazzaroni, R., Dubois, P. (2111) Surface and fouling-release properties of silicone/organomodified montmorillonite coatings. Journal of Adhesion Science and Technology, **25**, 1689-1700.

Cooper, S.P., Finlay, J.A., Clay, G., Callow, M.E., Callow, J.A., Brennan, A.B. (2011) Engineered antifouling microtopographies: kinetic analysis of the attachment of zoospores of the green alga *Ulva* to silicone elastomers. Biofouling, XX, XX-XX

Sundaram, H.S., Cho, Y., Dimitriou, M.D., Finlay, J.A., Cone, G., Williams, S., Handlin, D., Gatto, J., Callow, M.E., Callow, J.A., Kramer, E.J., Ober, C.K. (2011) Fluorinated amphiphilic polymers nd their blends for fouling-release applications: the benefits of a triblock copolymer surface. Applied Materials and Interfaces, **3**, 3366-3374.

Bartels JW, Imbesi PM, Finlay JA, Fidge C, Seppala JE, Nystrom AM, Mackay ME, Callow JA, Callow ME, Wooley KL. 2011. Antibiofouling hybrid dendritic Boltorn/star PEG thiol-ene corsslinked networks. 2011. ACS Appl Mat & Interfaces 3: 2118-2129.

Wang Y, Finlay JA, Betts DE, Merkel TJ, Luft C, Callow ME, Callow JA, DeSimone JM. 2011. Amphiphilic co-networks with moisture-induced surface segregation for high performance nonfouling coatings. Langmuir 17: 10365-10369.

Dimitriou MD, Zhou Z, Yoo H-S, Killops KL, Finlay JA, Cone G, Sundaram HS, Lynd NA, Barteau KP, Campos LM, Fischer DA, Callow ME, Callow JA, Ober CK, Hawker CJ, Kramer EJ. 2011. A general approach to controlling the surface composition of poly(ethylene oxide)-based block copolymers for antifouling coatings. Langmuir DOI: 10.1021/la202509m

Ederth T, Ekblad T, Pettitt ME, Conlan SL, Du C-X, Callow ME, Callow JA, Mutton R, Clare AS, D'Souza F, Donnelly G, Bruin A, Willemsen PR, Su XJ, Wang S, Zhao Q, Hederos M, Konradsson P, Liedberg B. 2011. Resistance to galactoside-terminated alkanethiol self-assembled monolayers to marine fouling organisms. ACS Appl Mat & Interfaces. doi.org/10.1021/am200726a