Dr Juliet Coates PhD

Lecturer in Plant Molecular Genetics
Royal Society Leverhulme Trust Senior Research Fellow 2013-14

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

Contact details

Telephone +44 (0)121 41 45478 (tel:+44 121 41 45478)

Fax +44 (0)121 41 45925

Email j.c.coates@bham.ac.uk (mailto:j.c.coates@bham.ac.uk)

Twitter @JulietCCoates (http://twitter.com/@JulietCCoates)

School of Biosciences
University of Birmingham
Edgbaston
Birmingham
B15 2TT

About

My research interest is in understanding development and evolution, particularly in plants. I run a small research group who work primarily with moss and Arabidopsis; we also grow liverworts, spikemoss, grasses, green seaweeds and microalgae. We use molecular genetics, cell biology, developmental biology and 'omics approaches to understand gene and protein function in these systems.

I am currently a **Royal Society-Leverhulme Trust Senior Research Fellow (https://royalsociety.org/grants/case-studies/juliet-coates/)** .

Qualifications

1995-1999

University of London (University College London), UK
PhD: "Armadillo homologues in Dictyostelium discoideum"
Funding: MRC/GlaxoSmithKline 4-year Graduate Programme

1992-1995

University of Cambridge, UK
M.A. (Hons) Natural Sciences, Class I (Part II Zoology)

Biography

Juliet spent her formative years growing up in Brighton. She carried out her undergraduate degree in Cambridge and then moved to London for her PhD, living and working north of the river with regular forays south to appreciate the Tate Gallery, the Royal Festival Hall and the Ministry of Sound.

She carried out her first postdoctoral position at the MRC Laboratory of Molecular Biology in Cambridge, in Mario de Bono's lab. She worked on the molecular and cellular mechanisms underlying behaviour in C. elegans and spent considerable time picking worms on what was at one time Sydney Brenner's bench.

She then crossed over the great evolutionary divide to "the green side" having been awarded an independent postdoctoral fellowship (Gatsby Charitable Foundation Interdisciplinary Research Fellowship) and worked for 3 years in the Department of Plant Sciences at the University of Cambridge, investigating Armadillo-related proteins in Arabidopsis.

In 2004 she accepted a position as a lecturer in Plant Molecular Genetics in Birmingham. She has a young son and currently works part-time.

Teaching

In 2013-14 Juliet will not be teaching, as she has obtained a year's **Royal Society-Leverhulme Trust Senior Research Fellowship (https://royalsociety.org/grants/case-studies/juliet-coates/)**

Juliet is passionate about teaching, particularly about enthusing students to enjoy both plant science and developmental biology, and encouraging them to consider plant science as a career choice for the future.

Undergraduate teaching

- 3rd year Plant Cell Biology and Development (Module leader): Model plants and molecular genetics, plant hormone signalling, plant cytoskeleton, plant evolution and development, techniques for studying plant molecular and cell biology
- 2nd year Plant Science - model plants and plant development and hormones
- 2nd Year Cell and Developmental Biology: Model organisms - *C. elegans*
- 1st Year Plant Science and Environmental Biology: Plant hormones and development, Plant Cell Biology
- 2nd Year Core Skills: How to analyse a scientific paper
- Supervision of lab research projects and literature reviews

- Tutor groups: Biological Science, Human Biology, Natural Sciences
- Final Year exams officer
- College and School Learning and Teaching Committees and working groups
- Plant Biology degree label leader

Postgraduate teaching

- Previous teaching on MSc Analytical Genomics/Biotechnology: Functional genomics and reverse genetics

Postgraduate supervision

Current PhD student: Eleanor Vesty (NERC-funded)

Current MRes students (2013-14): Sarah Needs, Amy Whitbread

Past PhD student: Laura Moody (BBSRC-funded)

Past PhD/MSc student: Dan Gibbs (BBSRC-funded)

Past MSc students: Anushree Choudhary, Marcus Griffiths, Anup Mistry

Past MRes student: Jessica Fannon

For a list of possible PhD projects offered by Dr Coates **www.findaphd.com/search/customlink.asp?inst=birm-Biol&supersurname=Coates (http://www.findaphd.com/search/customlink.asp?inst=birm-Biol&supersurname=Coates)**

Research

Research Theme within School of Biosciences: **Molecular and Cell Biology (/research/activity/cellbiology/index.aspx)**

Lab website addresses:

- **sites.google.com/site/julietcoates/ (http://sites.google.com/site/julietcoates/)**
- **Facebook:** Coates lab @ Birmingham

Plant development, cell biology and evolution

We are interested in plant evolution and development: in all kinds of plants!

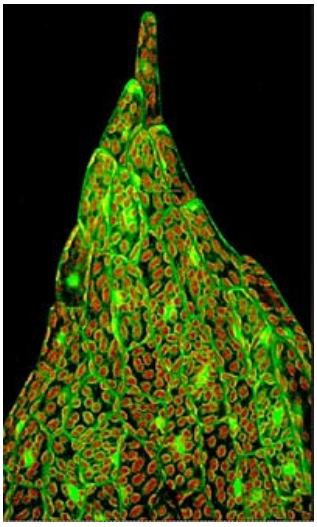
Complex organisms such as animals and plants are composed of many cells. The evolution of many-celled (multicellular) organisms from single-celled ancestors is one of the most important steps in the history of life on earth. Very little is known about how this critical event occurred.

In multicellular organisms, cells acquire particular identities by responding to signals that tell them which genes to turn on, and therefore which proteins to make. Each cell type contains a different combination of proteins. This process of acquiring specific cell identities to make a viable organism (such as a plant with leaves, flowers and roots) is called “multicellular development”.

The ancestral single-celled organism that gave rise to animals and plants existed around 1.6 billion years ago. When plants colonised the land, an explosion of plant multicellular evolution occurred from simple water-dwelling green algae. The transition of plants from water to land (around 500 million years ago) was a giant leap in plant evolution and allowed plants to colonise just about every square inch of the globe. It also led to a dramatic increase in the size and complexity of plants.

It is thought all multicellular organisms, including plants, evolved from a relatively small number of single-celled ancestors. Thus, certain fundamental molecular processes controlling multicellular development are likely to be shared by all species. We would like to find out what these processes are!

Why is this important?



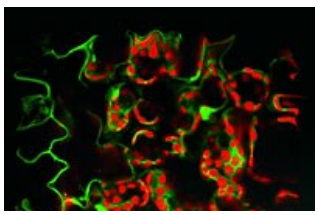
Algae and plants are a fundamental part of life on earth. They are integral to our atmosphere, our ecosystems and our society (for food, fuel and much else besides). Most of the complex land-dwelling plants we use in every day life evolved in the last 200 million years. This leaves a “hole” of at least a billion years during which we have very little idea of what was going on in terms of plant evolution. So, understanding how plants got to be the way they are is one of the most under-investigated areas of modern biology.

Over the last decade or two there has been an increased scientific interest in plant biology, probably for a couple of reasons. Firstly, we eat plants. Pretty much everybody depends on one or more members of the grass family (rice, wheat, etc) to provide their staple source of carbohydrate. Growing enough crops in the right places to sustain current world population growth is becoming increasingly challenging; we need to find ways to make plants grow in places that they would not normally be able to. The second reason is that many of the scientific tools that allowed us to understand a great deal about how bacteria, yeasts and animals work at the molecular level, including genetic engineering, can now be used to understand plant biology too.

If we can trace the evolutionary history of the plants we see around us we stand a better chance of being able to use them in a productive way. For example, by understanding how ancient plants made the journey to land, we can identify their drought-resistance strategies and manipulate modern crops to be more drought-resistant when required. In addition, algae are highly adaptable and can live in a huge variety of inhospitable environments. If we could encourage plants to use these algal mechanisms we could grow plants in a diverse range of habitats all over the globe. Algae also provide a potential untapped resource of fuel that could be grown in the water rather than taking up valuable space on land.

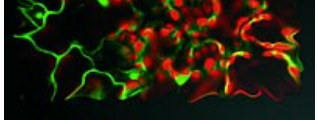
What do we actually do?

1) Conserved genes and proteins for multicellular development



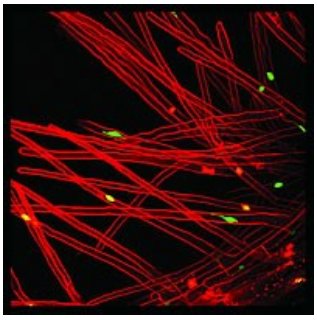
One of our key research interests is in evolutionarily ancient proteins that are required for multicellular development in animals, amoebae and plants (e.g. Armadillo-repeat proteins, GSK3s, Tetraspanins). We are currently investigating protein function in an “up-and-coming” and evolutionarily ancient model plant, the moss Physcomitrella patens, which evolved around half a billion years ago. Comparing these functions in Physcomitrella, Sellaginella, rice and Arabidopsis will give us insights whether our proteins of interest proteins are part of evolutionarily conserved developmental signaling pathways.

Collaborators: **Rita Tewari (http://www.nottingham.ac.uk/genetics/people/tewari/index.php)**, **Liz Bailes (http://www.nottingham.ac.uk/genetics/people/bailes/index.php)**, **Karen Bunting**



(http://www.nottingham.ac.uk/genetics/people/bunting/index.php) , Peter Winn (http://biosciences-people.bham.ac.uk/About/staff_profiles_contact.asp?ID=287) and Mike Tomlinson (http://www.platelet.bham.ac.uk/staff/MichaelTomlinson.shtml) .

2) Regulation of plant root architecture



We are interested in signals and proteins that control how roots branch to form a network. This is a developmental process of huge agricultural importance, and is critical for plant growth and responses to changing environments. We investigate root branching mechanisms in Arabidopsis, and plan to use our Arabidopsis data to inform research to manipulate root development in cereals and grasses

Collaborators: Malcolm Bennett (http://www.nottingham.ac.uk/bennett-lab/) , Susana Ubeda-Tomas (http://www.nottingham.ac.uk/bennett-lab/susana.htm) and Ilda Casimiro.

3) Studying complex algae

The oceans are still full of both single-celled and many-celled algae. Their conversion of sunlight into sugars drives nearly all other ecosystems, thus we are totally dependent upon them. They represent a relatively "untapped" reserve of biofuels. However, too many algae can have a negative environmental impact, causing destructive algal "blooms". Almost nothing is known about the genetic complement of algae, particularly complex and multicellular algae, which have some similar characteristics to land plants. We plan to use new high-throughput technologies to sequence and analyse a diversity of algal transcriptomes.

We are/have been generously funded by:

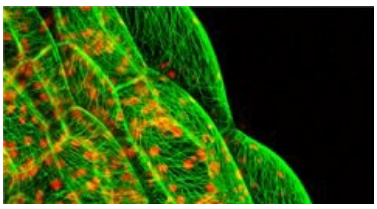
- The Leverhulme Trust
- NERC
- BBSRC
- The Gatsby Charitable Foundation
- The Royal Society
- The Nuffield Foundation
- The University of Birmingham
- British Society for Cell Biology

Lab members past and present:

- Eleanor Vesty (PhD student)
- Sue Bradshaw (research technician)
- Sarah Needs (MRes student)
- Dan McLeod (MSci student)
- Younousse Saidi (Former postdoc; now at Bayer Crop Science (http://www.bayercropscience.com))
- Laura Moody (Former PhD student, now in Jane Langdale's lab (http://dps.plants.ox.ac.uk/langdalelab/) at the University of Oxford)
- Anushree Choudhary (former MSc student, then visiting researcher, now PhD student on the MIBTP scheme in Warwick/Birmingham, supervisor Dr Lindsey Leach (http://www.birmingham.ac.uk/staff/profiles/biosciences/leach-lindsey.aspx))
- Marcus Griffiths (former MSc student, now PhD student at the University of Nottingham)
- Maxwell Ware (former MSci student, now doing a PhD at Queen Mary, University of London)
- Bethany Burns (former project student, now working for the NHS)
- Lauren McAtamney (former project student, now doing a PGCE)
- Jessica Fannon (former MRes student, now PhD student at the University of Warwick)
- Kiran Kaur Bansal (former MSci student)
- Bill Grey (former MSci project student, with Mike Tomlinson's lab, now PhD student at Hammersmith hospital/KCL)
- Tim Hearn (former project student, now doing PhD in Alex Webb's lab (http://www.plantsci.cam.ac.uk/research/alexwebb.html) from October 2011)
- Susan Harding (former MSci student, now at Froude Hoffmann)
- Dan Gibbs (former PhD student, then in Mike Holdsworth's lab (http://www.mycib.ac.uk/zope/holdsworth_lab) at the University of Nottingham, now a Birmingham Fellow in the School of Biosciences)
- Candida Nibau (former postdoc, now in Glyn Jenkins's lab at IBERS in Aberystwyth (http://www.aber.ac.uk/en/ibers/))
- Anup Mistry (former MSc project student)
- Kiran Kaur Bansal (former summer student)
- Erika Yamada (former summer student)
- Emma Smiles (former project student now teaching)
- Joshua Neve (past project student now doing a PhD in Leeds with Stefan Kepinski (http://www.plants.leeds.ac.uk/groups_kep.html))

Other activities

Research

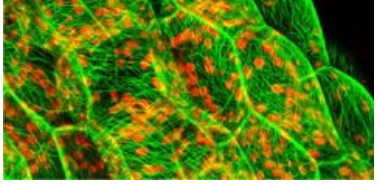


Juliet is a **BBSRC Research Committee panel C** core member, and formerly part of the **UK Genomic *Arabidopsis* Resource Network (GARNet) committee** (http://www.garnetcommunity.org.uk/advisers/juliet-coates (http://www.garnetcommunity.org.uk/advisers/juliet-coates))

Outreach

She enjoys sharing her science with schools and the wider public and is a **STEM ambassador for** Birmingham and Solihull (**http://www.stemnet.org.uk/home.cfm (http://www.stemnet.org.uk/home.cfm)** ; http://www.thinktank.ac/landing.asp?section=407&sectionTitle=Thinktank+STEM+Centre)

She also produces scientific images as art and has won several competitions (e.g. **http://www2.warwick.ac.uk/fac/sci/physics/outreach/sciencesnaps/ (http://www2.warwick.ac.uk/fac/sci/physics/outreach/sciencesnaps/)** and **http://www.bscb.org/?url=imagecompetition/winners (http://www.bscb.org/?url=imagecompetition/winners)**)



Winning image in Science Snaps competition

Juliet has written a chapter for "The New Optimists" – a popular science book, and gave an interview, "Adaptable Algae and Magic Moss", which can be viewed at at **http://newoptimists.com/2010/08/09/the-history-of-moss-and-future-of-algae/#more-1326 (http://newoptimists.com/2010/08/09/the-history-of-moss-and-future-of-algae/#more-1326)**

Equality

Juliet is a member of the University of Birmingham Advancing Equality in Employment (AEiE) steering group, and the University's **Athena SWAN (http://www.athenaswan.org.uk/)** working group. She chairs the School of Biosciences Athena SWAN working group, which recently obtained a **Bronze (http://www.birmingham.ac.uk/schools/biosciences/news/2013/27Sep-School-of-Biosciences-achieves-Athena-SWAN-Bronze-Award.aspx)** award.

Outside work, Juliet looks after her son, and when she has any energy left, gardens, swims, runs, does yoga and knits.

Publications

Moody LA, Saidi Y, Smiles EJ, Bradshaw SJ, Meddings M, WinnPJ, **Coates JC**. (2012)

***ARABIDILLO* gene homologues in basal land plants: species-specific gene duplication and likely functional redundancy.**

Planta, doi 10.1007/s00425-012-1742-7

Saidi Y, Hearn TJ, **Coates JC.** (2012)

Function and evolution of "green" GSK3/shaggy-like kinases.

Trends in Plant Science 17 p.39-46 (epub ahead of print)

Coates JC, Moody LA, Saidi Y. (2011)

Plants and the earth system – past events and future challenges.

New Phytologist 189 p.370-383

Nibau C, Gibbs DJ, Bunting KA, Moody LA, Smiles EJ, Tubby JA, Bradshaw SJ, **Coates JC.** (2011)

ARABIDILLO proteins have a novel and conserved domain structure important for the regulation of their stability.

Plant Molecular Biology 75 p.77-92 (epub ahead of print)

Straschil U, Talman A, Ferguson DJP, Bunting KA, Xu Z, Bailes E, Sinden RE, Holder AA, Smith EF, **Coates JC,** Tewari R. (2010)

The armadillo repeat protein PF16 is essential for flagellar structure and function in *Plasmodium* male gametes

PLoS One 5 e12901

Tewari R, Bailes E, **Coates JC.** (2010)

Armadillo protein evolution: lessons from little creatures (Invited review)

Trends in Cell Biology 20 p.470-81

Møller IS, Gilliham M, Jha D, Mayo GM, Roy SJ, **Coates JC**, Haseloff J, Tester M. (2009)

Shoot Na^+ exclusion and increased salinity tolerance engineered by cell type-specific alteration of Na^+ transport in *Arabidopsis*.

The Plant Cell 21 p.2163-2178

Coates JC. (2008)

Green evolution: the key to a new generation (Invited book chapter)

In: *The New Optimists* – a popular science book. *(ed Keith Richards, Linus Publishing)* p.93-96

Nibau C, Gibbs DJ, **Coates JC.** (2008)

Branching out in new directions: the control of root architecture by lateral root formation (Invited Tansley Review)

*New Phytologi*st 179 p.595-614

Ubeda-Tomás S, Swarup R, **Coates J**, Swarup K, Laplaze L, Beemster GT, Hedden P, Bhalerao R, Bennett MJ. (2008)

Root growth in *Arabidopsis* requires gibberellin/DELLA signalling in the endodermis.

Nature Cell Biology 10 p.625-628

Coates JC. (2007)

Armadillo repeat proteins: versatile regulators of plant development and signaling (Invited book chapter)

In: *Plant Cell Monographs* 10: *Plant Growth Signalling (eds Bogre L and Beemster G; Springer)* p.299-314

Coates JC, Laplaze L, Haseloff J. (2006)

Armadillo-related proteins promote lateral root development in *Arabidopsis*.

PNAS 103 p.1621-1626

Harwood AJ, **Coates JC.** (2004)

A prehistory of cell adhesion (Invited review)

Current Opinion in Cell Biology 16 p.470-476

Coates JC. (2003)

Armadillo repeat proteins: beyond the animal kingdom (Invited review).

Trends in Cell Biology 13 p.463-471

Coates JC and deBono M. (2002)

Antagonistic pathways in neurons exposed to the body fluid regulate social feeding in *C. elegans*.

Nature 419 p.925-928.

Coates JC, Grimson MJ, Williams RSB, Bergman W, Blanton RL, Harwood AJ. (2002)

Loss of the b-catenin homologue *aardvark* causes ectopic stalk formation in *Dictyostelium*.

Mechanisms of Development 116 p.117-127

Coates JC, Harwood AJ. (2001)

Cell-cell adhesion and signal transduction during *Dictyostelium* development.

J. Cell Sci 114 p.4349-4358

Grimson MJ, **Coates JC,** Reynolds JP, Shipman M, Blanton RL, Harwood AJ. (2000)

Adherens junctions and b-catenin-mediated signalling in a non-metazoan organism.

Nature 408 p.727-731 **(Joint first author)**

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