Rebecca A. Dewhirst

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Education

Ph.D Plant biochemistry; University of Edinburgh, UK **2016**

BSc (Hons) Biology (First class); University of York, UK **2011**

Research experience

Post-doctoral; Lawrence Berkeley National Laboratory, USA 2019-present

Supervisor: Dr Kolby Jardine

Investigating cell wall methylation and acetylation in relation to methanol and acetic acid emissions from poplar trees.

- Analysis of volatile emissions from leaves using GC-MS
- Analysis of volatile emissions from leaves using PTR-MS
- Biochemical analysis of methyl and acetyl esterification of plant cell walls
- Use of ^{13}C metabolite tracer experiments to investigate plant emissions and central metabolism.

Post-doctoral; University of Exeter, UK 2016-2019

Supervisor: Prof Claire Belcher

Investigating the biochemical drivers of flammability in a range of pine species as part of a multi-disciplinary team. Focussing particularly on analysing the volatile terpenes.

- Extraction and GC-MS analysis of volatile compounds (including terpenoids)
- Extraction and analysis of various plant compounds including lignin and flavonoids using spectrophotometric methods.
- Analysis of flammability metrics of plant material using cone calorimeter and micro-calorimeter.
- Conducting field-work in Spain and USA, including developing collaborations with US Forest Service.

PhD; University of Edinburgh, UK 2011-2015

Supervisor: Prof Stephen Fry

Biochemical characterisation of metabolic pathways of ascorbic acid and the investigation of the fate of ascorbate degradation products in harvested salad leaves and plant cell-suspension

cultures. Entitled ‘formation and subsequent metabolism of ascorbate oxidation products in vitro and in plant cells’.

- Analytical chemistry techniques such as HPLC, TLC and further chromatographic methods employed to characterise plant-derived compounds.
- Purification, characterisation and identification of ascorbic acid degradation products and metabolic pathways, using biochemical techniques such as high-voltage paper electrophoresis.
- Developed a robust radiochemical tracer assay for a novel enzyme activity involving the cell wall and carried out characterisation of novel compounds, including polysaccharides, produced from this activity.
- Experience of industry through CASE placement, involving monitoring the level of ascorbic acid in salad plants throughout the industrial washing process with biochemical assays.
- Successfully collaborated with Chemistry department, for mass spectrometry and NMR spectroscopy of purified ascorbate derivatives.

Final year BSc project; University of York **2010-2011**

Supervisor: Prof Ottoline Leyser

Characterisation of shoot branching in multi-parent inbred recombinant lines of Arabidopsis thaliana.

- Using semi-quantitative PCR methods to determine the role of specific genes involved in shoot branching in recombinant in-bred Arabidopsis lines.
- Investigating the effect of nitrate concentration on physiological characteristics of various lines of Arabidopsis.

Research assistant; Operation Wallacea, Honduras **2010**

Assisting on conservation projects in Honduras.

- Experience of field work, collecting and analysing biological samples, including the use of molecular PCR methods, from a cloud forest research site.

Outreach and teaching

Tutor for The Brilliant Club (a charity encouraging pupils from under-represented groups to attend universities). I devised and delivered a short (6 tutorials) university-style course on my post-doctoral subject of fire ecology for 14-year old students. This included a final essay which I graded as if it was a university level assignment. **2017-2018**

Representing the university as a demonstrator at Edinburgh International Science Festival, presenting hands-on activities relating to various aspects of biological research, especially aimed at a family audience. **2014-2015**

Created, designed and implemented an outreach activity based on my PhD research as part of the Research Communication in Action program. I delivered this activity at a schools event during the Physiological Society Topic Meeting on Obesity (Newcastle, UK) and at local science festival events (Midlothian, UK). **2014**

Demonstrating in 1st, 2nd and 3rd year undergraduate and Masters level practical classes at University of Edinburgh. I was the sole demonstrator for 30 students in the 3rd year Evolution and Ecology of Plants course, and one of a team of demonstrators for 70 2nd year students in The Green Planet course and the 1st year course Origin and Diversity of Life, including plant biology classes at the Botanic Gardens in Edinburgh. **2012-2015**

Taught techniques, including high-voltage paper electrophoresis to other lab members and visiting students. **2012-2015**

Marking 1st year undergraduate essays at the University of Edinburgh, on the topic of evolution and natural selection. **2013-2015**

Conference presentations and seminars

RA Dewhirst. Adaptations and drivers of plant flammability. *Dynamic Earth Seminar Series* (Portsmouth, UK) (Invited seminar) **2018**

RA Dewhirst, N Smirnoff, CM Belcher. Biochemical traits affecting flammability in pine species. *Fired-UP workshop* (Edinburgh, UK). (Conference oral presentation) **2018**

RA Dewhirst, N Smirnoff and CM Belcher. The volatile compound content of pine species adapted to different fire regimes. *7th Association of Fire Ecology International Fire Congress* (Orlando, USA) (Conference oral presentation) **2017**

RA Dewhirst and SC Fry. The degradation of vitamin C by reactive oxygen species. *Free Radicals and Nutrition Meeting* (Stuttgart, Germany). (Poster presentation) **2015**

RA Dewhirst and SC Fry. A role for vitamin C derivatives in cell wall cross-linking. *13th International Plant Cell Wall Meeting* (Nantes, France) (Poster presentation) **2013**

RA Dewhirst and SC Fry. The in vitro reaction of vitamin C with reactive oxygen species. *Young Researcher Food Sector Event* (Edinburgh, UK) (Poster Presentation) **2012**

Awards

Exploratory engagement award (**2018**) – Internal funding to conduct a collaborative pilot study with the US Forest Service, including field work in an experimental forest in New Jersey, USA, and biochemical analysis in Exeter, UK.

BBSRC CASE studentship (**2011-2015**)

Poster prize Royal Society of Chemistry (**2015**)

Publications

RA Dewhirst, SC Fry. **2018**. Oxalyltransferase, a plant cell-wall acyltransferase activity transfers oxalate groups from ascorbate metabolites to carbohydrates. *The Plant Journal*. 95(4), 743-757.

RA Dewhirst, SC Fry. **2018**. The oxidation of dehydroascorbic acid and 2,3-diketogulonate by distinct reactive oxygen species *in vitro*. *The Biochemical Journal*. 475, 3451-3470

RA Dewhirst, GJJ Clarkson, SD Rothwell, SC Fry. **2017**. Novel insights into ascorbate retention and degradation during the washing and post-harvest storage of spinach and other salad leaves. *Food Chemistry*. 233, 237-246.

A Karkonen, RA Dewhirst, CL Mackay and SC Fry. **2017**. Metabolites of 2,3-diketogulonate delay peroxidase action and induce non-enzymic H_2O_2 generation. *Archives of Biochemistry and Biophysics*. 620, 12-22.

M Haworth, CM Belcher, D Killi, RA Dewhirst, A Materassi, A Raschi and M Centritto. **2018**. Impaired photosynthesis and increased leaf construction costs may induce floral stress during episodes of global warming over macroevolutionary timescales. *Scientific Reports*. 8, 6206.

CM Belcher, SL New, C Santin, SH Doerr, RA Dewhirst, MJ Grosvenor and VA Hudspith. **2018** What can charcoal reflectance tell us about energy release in wildfires and the properties of pyrogenic carbon? *Frontiers in Earth Science*. 6, 169.

RA Dewhirst, N Smirnoff, CM Belcher. Pine species that support crown fire regimes have lower leaf-level terpene contents to support the success of reproduction *via* serotiny. (in preperation)

RA Dewhirst, SC Fry. Characterisation of the non-oxidative degradation pathway of ascorbate. (in preparation)