Division of Plant Sciences

University of Dundee

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Over the three short years of its existence, the Division of Plant Sciences has doubled in size to around 50 people. This growth reflects great success in external grant acquisition by all of the Principal Investigators (PIs). Many of these grants involve collaborations with SCRI scientists, supporting continued and developing interactions. The international profile of the Division of Plant Sciences has been enhanced by PI's collaborations with top research groups around the world, organisation of national and international scientific meetings, and presentation of our research at such meetings. Finally, we have been particularly active in public engagement at a local level this year, taking part in the University of Dundee Botanic Garden Fun Day and the College of Life Sciences Doors Open Day where children and the general public discovered that even plants have DNA (they extracted it from raspberries) and learned about current ideas and activity in biofuels and bioenergy.

The MRes course 'Crops for the Future' had its first intake of four students in September 2009. This joint venture between the Division of Plant Sciences and SCRI exploits our unique combination of expertise in cutting-edge plant and crop science. The course was very positively reviewed by our external examiner and the second intake of students arrived this September. In 2010 we were awarded a BBSRC Masters Training

Botanic Garden Fun Day – making raspberry DNA.

Grant of £334k to fund UK/EU student participation on this course. This was the biggest such award given out in the UK and will enhance the development of the course and its wider recognition.

We were very pleased to welcome Edgar Huitema, a Royal Society of Edinburgh Fellow, who joined the Division last October. He has quickly established his research group which seeks to exploit the model organism *Phytophthora capsici* and study basic processes that underpin disease establishment and virulence in plants. Edgar made two successful grant

Nuffield Bursary student – Marie Abraham.

Nuffield Bursary student – Ewan Barrack.

applications (Royal Society and BBSRC) to support his research and has recruited two PhD students and hosted three interns. In the summer, the lab supervised Ewan Barrack, a 5th year pupil from Arbroath High School, who completed a five-week training period funded by a Nuffield Bursary.

Paul Birch's lab has won a major collaborative grant worth £1.7M to find resistance genes from wild potato species which will provide effective (durable) disease control against *Phytophthora infestans*. Phytophthora causes late blight, the number one disease of the world's third largest food crop, potato. It causes an estimated £5 billion a year in chemical control costs and crop losses. The collaboration involves scientists from SCRI and the Sainsbury lab in Norwich. A major breakthrough was the identification of the first host defence protein target of an effector protein from a filamentous plant pathogen and the mode-of-action for the effector. The work reveals that eukaryotic plant pathogens can manipulate the host ubiquitination machinery (as bacterial pathogens are known to do) in order to switch off key defence processes. Among other collaborators, the main author of this work, Jorunn Bos, has recently joined SCRI as a Royal Society of Edinburgh Fellow.

Gordon Simpson's lab discovered that FPA, one of the regulators of flowering, controls the site of cleavage and polyadenylation of mRNA. Unusually, FPA appears to affect alternative processing of long non-coding antisense RNAs embedded at the locus encoding the floral repressor, FLC. This work was published in *Developmental Cell*. A preview article (James Manley,

Claire Halpin and Abdellah Barakate – planning molecular constructs.

Columbia University, New York) said the work "has the potential to provide a significant new mechanism of gene control, not only in signalling when a plant will flower, but also more generally in animals as well as plants". Gordon's lab has built on this discovery to ask how widespread alternative sites of RNA 3' end formation are in plants using genome-wide RNA sequencing in a collaboration with Geoff Barton's bioinformatics group.

In John Brown's lab, the major focus is on alternative splicing (AS) and its role in gene expression. The lab has shown that alternative splicing is far more prevalent in plants than previously thought and that it significantly affects gene expression in many plant processes. AS therefore needs to be taken into account in plant and crop research on processes such as growth and development, responses to environmental stress, and pests and pathogens. For example, circadian rhythms allow organisms to anticipate daily changes in environmental conditions and optimise timing of metabolic processes in the day–night cycle. The alternative splicing expertise and systems in the Dundee lab have been key in the discovery, by collaborators in Argentina, of a link between the circadian clock and alternative splicing (published in *Nature* in November 2010). John's lab also hosted a Nuffield Bursary student, Marie Abraham, for a summer molecular biology project.

Over the last two years, Claire Halpin's research group has expanded to 18 researchers and her major projects on bioenergy and meiosis are making good progress. One highlight of 2010 has been the harvesting and phenotyping of a large polytunnel experiment of 640 spring barley genotypes which will enable her team to identify quantitative trait loci for straw biofuel production potential using association genetics. Both the biofuel project and Claire's LOLA project on barley recombination have made extensive use of the SCRI barley transformation facility and her group are currently characterising many novel and potentially useful transgenic lines.

Andy Flavell's lab has been using association genetics to isolate genes responsible for grain size in spring barley. This requires a combination of field trials, high throughput SNP marker analysis and 'next generation sequencing' of presumptive gene candidates in a collection of around 400 barley cultivars. Andy has developed a new approach for this. His lab has published key papers describing the properties of the SNP marker diversity parameters within the barley germplasm and the genetic diversity of field pea (*Pisum*) and its relationship to the geographic distribution of the genus.

Our Emeritus and Associate members have been very active in the last year, producing many publications and giving presentations at meetings around the world. Janet Sprent was awarded an Honorary Doctorate by the Swedish Agricultural University, Uppsala. John Raven spent a productive March in the School of Plant Biology in the University of Western Australia as part of his five year appointment as an Honorary Professor at UWA. Lyn Jones is involved in the collaborative development of methods (thermal and RGB imaging and high resolution reflectance spectroscopy) for the rapid field phenotyping of cereals for stress tolerance in the field with the Australian High Resolution Plant Phenomics Centre in Canberra.