Philippa Borrill

Philippa Borrill is a Group Leader at the John Innes Centre, Norwich, UK. The Borrill group focuses on understanding the wheat genome to improve the nutritional value of wheat grain. Philippa was awarded the SEB's 2022 President's Medal for the Plant Section.

Tell us about your background. How did you first become interested in plant science and wheat genomics?

I first became interested in plant science during my undergraduate degree at the University of Cambridge where I had inspiring lecturers who taught me about a wide range of plant science topics. During the summer of my second year, I was fortunate to go to Cold Spring Harbor Laboratory for a summer internship where I worked with Professor Dave Jackson on cell-to-cell protein trafficking – being immersed in a research environment really encouraged me to pursue plant science as a career and I realised I wanted to work on an applied aspect for my PhD. When I joined the John Innes Centre as a rotation PhD student I worked in a few different labs and I learnt that wheat was starting to undergo a revolution in genomic resources. I was lucky to start working on this crop at an exciting time when a whole range of new possibilities were emerging for scientific discoveries in this species.

What is your lab working on currently?

My group works on wheat, which not only provides over 20% of calories in the human diet but is also an important source of nutrients including protein and minerals like iron and zinc.

Our current research aims to understand the genetics controlling the nutritional value of wheat grain, which we can then apply to improve the nutrient content of wheat alongside increasing yield. We are also interested in how the multiple gene copies in polyploid wheat interact to influence phenotypes of agronomic importance. We use a wide range of techniques from field-trials, through to molecular biology and genomics.

What does a typical day look like for you?

A typical day would involve meeting with one or two members of my lab to discuss their research, talking about their latest results and how to move forward with the project. I normally spend some time writing or analysing data - perhaps working on a proposal for a grant, a student project or a manuscript. Quite often I will meet with collaborators, either academics or scientists working in the plant breeding industry to discuss ongoing projects.

What do you most enjoy about your work?

I love talking about experiments and recent discoveries with members of my lab group. It's exciting to bring together what we know and think about how to tackle our next research questions, perhaps using new tech-

Above: Wheat trials at the John Innes Centre in Norwich, UK. Philippa is flying a drone which is used to take photos for image analysis of plant growth traits over the growing season.

niques or consulting with experts in the field. It's also very rewarding to see lab members developing a wide range of skills throughout their time in the lab so that they are equipped for their next career steps. I appreciate the variety of tasks I do as part of my job- for example today I met some lab members to talk about their research, was interviewed for Farming Today on the BBC about some of our latest research and gave a tour of the lab and greenhouses to a prospective student- no day is ever the same which is great. I also value the chance to attend conferences where I learn about the latest scientific discoveries and meet colleagues from all around the world.

Above: Close up of a mature wheat ear in the cultivar Kronos.

> "The importance of understanding the biology of a major crop species in order to make improvements in farmers' fields helps to motivate me"

What do you find most challenging?

Each generation of wheat takes several months to grow and most of our research involves adult plants so it can be slow going. This means that sometimes it can be hard to appreciate the progress we are making on a day to day basis. However, the importance of understanding the biology of a major crop species in order to make improvements in farmers' fields helps to motivate me.

What is your lab hoping to work on in the future?

We hope to build a deeper understanding of the molecular mechanisms controlling gene expression in wheat, and how this contributes to the plant's characteristics in the field. Since we only sequenced the wheat genome in the last 5 years, there is a lot to discover regarding gene functions in wheat, and it will be exciting to see how we can apply this to tailor new wheat varieties to different uses and changing environmental conditions.

What advice would you give to aspiring scientists in this area?

Be open to learning and trying out new techniques- I didn't expect to work so much on genomics but this has proved to be a very fruitful and exciting area for me. Also, working with others is critical- many of the biggest advances have been made by large collaborations involving many scientists so I would recommend to learn how to work with people from diverse backgrounds and scientific areas which can really boost your outlook and research.

Selected Publications from SEB Journals

Borrill P, Harrington SA, Uauy C. 2018. Applying the latest advances in genomics and phenomics for trait discovery in polyploid wheat. The Plant Journal 97, 56-72.

Buss W, Ford BA, Foo E, Schnippenkoetter W, Borrill P, Brooks B, Ashton AR, Chandler PM, Spielmeyer W. 2020. Overgrowth mutants determine the causal role of gibberellin *GA2oxidaseA13* in *Rht12* dwarfism of wheat. Journal of Experimental Botany 71, 7171-7178.

Fahy B, Siddiqui H, David LC, Powers SJ, Borrill P, Uauy C, Smith AM. 2018. Final grain weight is not limited by the activity of key starch-synthesising enzymes during grain filling in wheat. Journal of Experimental Botany 69, 5461-5475.