GATERSLEBEN LECTURE (double)

Tuesday, March 18, 2025 2 PM **Place: Lecture Hall, IPK Gatersleben**

Speaker: **Prof. Dr. Andrew Leitch**
Professor of Plant Genetics and Co-director of MSc Plant and Fungal Taxonomy Diversity, School of Biological and Behavioural Sciences, Queen Mary University of London, UK

Title: *"Ecological filtering through genome size and potential mechanisms driving genome downsizing after polyploidy"*

My research over 30 years has focused on the ecological and evolutionary implications of genome size and polyploidy. My research includes studies on the organization of plant genomes, particularly the evolution of repetitive sequences in the context of polyploidy. I have in the last decade focused on the ecological consequences of polyploidy, particularly the role polyploidy plays in nutrient-GS interactions. My studies have been on a range of organisms, from crops (e.g. wheat) to charismatic species, including orchids, bluebells, *Welwitschia*, baobabs and more.

Abstract: Despite the enormous genome size variation encountered in angiosperms, most species have smaller genomes than would be expected given the incidence of polyploidy and (retro)transposition in their ancestries, suggestive of evolutionary selection against large genome sizes. Whilst much is written about advantages of polyploidy, cell and nuclear scaling associated with polyploidy may present ecological challenges for the establishment of polyploids, impacting their evolution. This talk first explores ecology and evolution of plants, dependent on genome size and incidence of ancestral ploidy, focussing in particular on nutrient limitation. We show from grassland nutrient that species with large genomes are favoured in the presence of nitrogen and phosphate fertilizers, suggestive of ecological selection against large genomes, especially polyploids with large genomes, when nutrients are limiting (as in most soils of the world). But it is unknown if such ecological selection translates to evolutionary selection against large genomes, because available data suggests that following polyploidy there are only small rates of DNA loss per generation (4–70 Mb/million years, <500 bp/generation). This poses a problem as to how evolutionary selection might act, given that the size of even the smallest plant genome is three orders of magnitude larger than these DNA losses. We propose that a solution to this problem might be that genome downsizing is an emergent property of polyploidy, which, over time, has ecological advantages to plants growing in nutrient-poor habitats.

Speaker: **Dr. Ilia Leitch**
Trait Diversity and Function, Royal Botanic Gardens, Kew, Richmond, London, UK

Title: *"Plant genome size diversity and how this impacts evolution, distribution, and survival"*

The overall goals of my research are focussed on seeking to understand the causes and evolutionary and ecological consequences of the extensive diversity in genome size (GS) encountered in land plants. To achieve this, my research includes [1] investigating the underpinning drivers of genomic diversity at the molecular level, especially for species with giant genomes; [2] determining the extent of GS diversity between species, and [3] exploring how GS impact at the whole plant level to influence how, when, and where plants grow and respond to global change. I am also involved in (i) the Plant Tree of Life project, (ii) the plant component of the Darwin Tree of Life project, and (iii) lead the generation and collation of genome size data for the Plant DNA C-values database.

Abstract: Across the diversity of life-on-earth, species belonging to Kingdom Plantae are notable for their huge diversity of genome sizes (1C nuclear DNA amount), with values ranging ~11,800-fold from ~12.5 Mbp – 148 Gbp. In seeking to understand the biological significance and consequences of such diversity, biologists have been estimating genome sizes for over 70 years, with data now available for over 16,000 species. This talk will provide insights into how such immense genome size diversity is distributed across the tree of plant life. In addition, it will highlight some of the ecological and evolutionary consequences of such diversity, especially for species with large genomes which can experience nuclear-, cellular- and organism-level constraints that may limit their phenotypic plasticity and ecological niche. Finally, it will discuss the results from our recent large-scale comparative analysis across angiosperms showing how genome size plays a role in impacting a species' risk of extinction and hence the distribution and survival of global plant biodiversity.

Prof. Dr. Nils Stein (organizer) **Prof. Dr. Andreas Houben (host)**

Zoom Link: https://ipk-gatersleben-de.zoom-x.de/j/68832778742?pwd=SflKJijZzDmyfc96QBYVXzGNa4Hben.1
Meeting-ID: 688 3277 8742 / Kenncode: 265095

If you are interested in personal discussions with the speakers please contact Nicole Wahle (phone: 039482/5219, email: wahle@ipk-gatersleben.de) beforehand.