

■ Participants' report

A Summary from the 2nd UV4Plants Network Meeting at Bled, Slovenia

Louise M Ryan¹, ORCID: [0000-0002-5335-2638](https://orcid.org/0000-0002-5335-2638)

Neha Rai², ORCID: [0000-0002-4972-9332](https://orcid.org/0000-0002-4972-9332)

Yan Yan², ORCID: [0000-0003-0520-1621](https://orcid.org/0000-0003-0520-1621)

¹The School of Biological, Earth and Environmental Sciences, University College Cork, Ireland

²ViPS and DPPS, Organismal and Evolutionary Biology, Faculty of Biological and Environmental Sciences, University of Helsinki, Finland

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The 2nd network meeting of the International Association of Plant UV Research took place in the picturesque and touristic town of Bled in Slovenia. The conference was organized by UV4Plants and Prof. Alenka Gaberščik and her group of the University of Ljubljana. The meeting drew many researchers together from all across Europe, U.S.A and other continents to discuss and share ideas on recent advances in plant UV research. The two-and-a-half-day conference was divided into seven categories of research including molecular, biochemical and physiological aspects of UV-B responses, the interaction between UV-B and other factors, ecology and evolutionary aspects, and last but not the least application of knowledge. Altogether, there were 23 oral presentations and several posters discussing the latest ongoing research. In this article, we are summarizing some of the interesting oral and poster presentations, an enlightening discussion session, and an excursion to the beautiful Lake Cerknica and Rakov Škocjan area.

In the sessions on the molecular and biochemical aspects of UV-B response, we learned about how UVR8 inhibits stem elongation through regulation of PHYTOCHROME INTERACTING FACTORS (PIFs) and inhibition of auxin biosynthesis (K. Franklin). UVR8

monomerization, which is the immediate step after UV-B perception was studied at the level of the purified protein, plant extracts and whole plants, and included the study of the role of various tryptophans of UVR8 in UV-B mediated responses (L. A. Diaz-Ramos). Furthermore, the role of the E3 ubiquitin ligase ARIADNE 12 was discussed in long-term adaptation to UV-B (M.T. Hauser), and the role of vitamin B6 derivatives in plant acclimation to supplemental UV-B (G. Czégény). The biochemical aspect introduced interesting questions regarding the physiological function of UVR8 under ambient solar conditions. The crucial function of UVR8 is indicated by the presence of the gene across angiosperms and algal genomes (Å. Strid). Thus far, incomplete knowledge exists regarding the structure and function of UVR8 as studies have mainly been done on UVR8 produced in *E. coli*, and not in plants. In this context, experiments were done to show the difference between UVR8 protein produced in plant and bacteria (Å. Strid). As we progressed further in the sessions the studies were not limited to the UVR8 photoreceptor and UV-B waveband. In fact, the role of both UVR8 and Cryptochromes (blue/UV-A) photoreceptors were discussed in Arabidopsis plants, exposed to the short and long-term of UV-B,



Figure 6.1: A view of the alpine Lake Bled and serene Bled Island (Photo credit: N. Rai).



Figure 6.2: Image of Pletna boats on Lake Bled. These are traditional boats made only by the locals of Bled (Photo credit: L.M. Ryan).

UV-A and blue radiation (N. Rai).

This brought us to some interesting presentations related to the physiological aspect of plant-UV responses. UVR8-modulated physiological responses like phototropism (F. Vandenbussche) and sunlight acclimation (L. O. Morales) were reported, and the ecological importance of these responses was discussed. Additionally, the level of UV-transmittance and accumulation of UV-absorbing flavonoids in Okra was discussed in terms of diurnal solar UV fluctuations. This highlights the importance of natural plant abilities to UV-shield using specific compartments (S. Neugart). After this, we learned about how UV-B interacts with other factors. In today's changing climate, the modulation of UV-responses by drought and temperature is of high significance (M.A.K. Jansen). Continuing with drought and UV-B interactions, R. G. Guevera-González talked the audience through the importance of studying these interacting factors on the performance of *Capsicum annuum* L., the chili pepper. Interacting factors cause plant responses like phenolic and gene expression alterations. We also learnt that not only does water availability and UV radiation cause differing responses in different food crops, but also within a plant, like the differing uptake of various elements (M. Grašič).

On the ecological side of UV-B research, presentations covered studies on three distinct ecological settings and questions: the role of photodegradation and the interaction with other environmental factors as cooperative drivers of litter decomposition in drylands (P. W. Barnes); how the changes of the composition of different solar light wavelengths along latitudes day length and time of the year affect the understory seedling phenology (C. C. Bresford); how UV-B as an important factor drives alpine plants to adapt to harsh condition at high altitudes according to the research with *Saxifraga hostii* at two different altitudes in Julian Alps area (T. T. Sedej).

In the session concerning the evolutionary aspects of UV-B research, we learned that UV radiation pressure was an important evolutionary factor when aquatic organisms colonized land, together with water shortage (J. Martínez-Abaigar). An interesting talk by F. Peschek showed us different strategies for UV-B adaptation in non-UV-B screening green algae: UV-B-induced DNA damage was repaired by photoreactivation with greater efficiency compared to that in green macroalgae with UV-B screening capacity. In the third talk, a common garden experiment was reported on. The experiment conducted in New Zealand and Germany, with multiple species, was used to reveal the role of UV-B as a selecting factor in plant invasion (M. Hock).

In the knowledge application session, UV-B and UV-A were proposed as tools to improve plant quality in cucumber (M. Qian) and to improve phenolic profiles in peach fruit (M. Santin). We also gained knowledge about the effects of different climate screens and shade nets on the light quality and composition in controlled environments, and thus how big of an impact they can have on horticulture, and especially on crop performance (T. Kotilainen).

Apart from oral presentations, we had attendees sharing high quality works in the poster session. A separate room was designated for the poster session and throughout the conference. Poster presenters were given two-minute "flash-talks" to advertize their posters during the conference. A separate poster session was then held with refreshments where all attendees could discuss and ask questions about the posters they found interesting. This was a highly informative session held in an informal and enjoyable way. Each of the posters fitted well into one of the seven oral presentation sessions. Posters answered a wide range of interesting questions related with UV research: how UV-induced genes prompt long-term UV-B acclimation? How grapevine phenolic content responds to daily environmental changes?



Figure 6.3: The Church of St. Martin with the stunning snow-capped Julian Alps as a backdrop (Photo credit: N. Rai).

How are different cool-season turfgrasses affected by UV-B? What are of UV radiation and reduced rainfall on naturally growing *Erica scorpia*, a species of heath in the Mediterranean? What is the effect of altitude on the content of UV-B absorbing compounds in *Pinus* spp. pollen grains? How does the maternal effect of solar UV modify the response of *Vicia faba* to UV-B and blue light? And how does post-harvest UV-B exposure affect the metabolic content of peach fruit?

To summarize the conference and bring everyone's talks, questions, posters and discussions together, a large discussion session was conducted by M. Robson. All conference attendees were split into two break-out groups, depending on their specialized area of research. The discussion aim was to spark conversation and debate amongst the UV4Plants community about the future of plant-UV research, in terms of unsolved ques-

tions and knowledge gaps. The group notes were then categorized into practical and basic questions.

G. Jenkins and F. Vandenbussche led a group discussion specific to the molecular, biochemical and physiological responses of plants to UV. This group initiated their discussion by postulating possible novel areas of research in a "post-UVR8-discovery world", from unspecific multipurpose mechanisms and novel photoreceptors and crosstalk, to establishing specific roles for UVR8. The group also delved into the area of standardizing our UV-methodology as a community. Should there be uniformity in experimental procedures? Should there be standard guidelines and normalized result presentation?

The second group discussion was based on ecological research and plant production, led by P. Barnes and M. Jansen. The group ad-



Figure 6.4: First stop on the conference excursion, Prof. Alenka Gaberščik gives a detailed background to Lake Cerknica (Photo credit: Y. Yan).

dressed the questions: How will the changing climate affect plant UV exposure in a “post-ozone-depletion world”? How will plant UV-B responses interact with other environmental responses? A key issue brought forward, reflected throughout the conference, is the knowledge gap between plant-UV research and horticultural application. How do we make use of UV to enhance plant production, a commercial reality? How do we link our low PAR growth chamber experiments to high PAR natural environments? A research-horticulture interface would break boundaries between commercial producers and scientific information.

One topic that both groups covered was the upscaling of our experiments, so that the results reflect the natural world. Ultimately conference attendees agreed that we must enhance our scientific capabilities and under-

standing. We must scale experiments to allow for a reliable link not only within and between plants but across spatial and temporal scales, ecosystems and environments. This will allow us to capture a more detailed and comprehensive picture of how nature responds to and uses UV.

The ideas generated during the discussion session will also contribute to a perspective article in the special issue of *Photochemical and Photobiological Sciences* journal.

Apart from the scientific sessions and discussions, the conference also gave ample opportunities to socialize and network with fellow researchers during the long breaks between the sessions and the Gala dinner. During the Gala dinner, we got a chance to listen some of the traditional Slovenian music, which maintained a relaxed atmosphere throughout.

The conference successfully ended with an excursion to Lake Cerknica and Rakov Škocjan area. The intermittent lake Cerknica is a unique karst phenomenon characterized by inter-annual water level fluctuation. It dries up in summer and then floods for the rest of the year. This phenomenon is due to the special system of underground lakes interconnected with the system of a siphon. The time we visited in April, the lake was still full of water. We were astonished to learn about the hidden mechanisms, in the Lake Cerknica Museum, behind the appearing and disappearing lake that almost looks like magic. The Rakov Škocjan valley was a karst valley created by collapsing of the ceiling of a karst cave, we enjoyed a walk around the forest and a sightseeing of the remaining natural bridge of the karst cave.

In nature, we, as plant biologists, still never cease to be amazed and overcome with awe by all the beauty and secrets that nature has to offer.

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Figure 6.5: Conference attendees having fun on the way to the Museum of Lake Cerknica (Photo credit: Y. Yan).



Figure 6.6: Intermittent lake, Lake Cerknica, glistening in the Slovenian sun (Photo credit: L.M. Ryan).