**What is Photosystem II and Photoactivation?**

Dr. Robert Burnap from Oklahoma State University is a well-known microbiologist who actively studies the water oxidation processes of photosystem II. In his recent publication of “Photoactivation: The Light-Driven Assembly of the Water Oxidation Complex of Photosystem II,” we are able to read about his findings of the significance of photosystem II, as well as the photoactivation process. What are these terms? Well, lucky for us, Dr. Burnap sat down for an interview and was able to give us more information about these topics that drive his research!

In plants, photosystem II is the system that absorbs the light and energy that the sun radiates. This process energizes the electrons that are necessary for photosynthesis to occur for plants. The plant takes in the hydrogen from the biosphere and from water, and this chemical energy drives the plant to function properly. If that does not explain the significance of plants and photosystem II, maybe the fact that they provide the oxygen we breathe might spark an interest? That is right, photosystem II is the reason that we are alive! This system is what provides the necessary output in order for us to breathe, and without photosystem II’s production of oxygen, we would not be able to survive. Now that the importance of photosystem II is covered, let’s move to the complicated part. In the summer when it gets too hot and the sun is beaming, our skin is at risk of a sunburn. Unfortunately for plants, the light from the sun can be just as harmful, and become so intense that it damages the plant. The proteins in photosystem II can become irreversibly damaged by intense exposure to light [2]. Under this constant damage, the plant is always in need of repair. Luckily, the photoactivation process is able to fix it. When asked in the interview of the significance of this process, Dr. Burnap referred to this process as “the Achilles heel of all plants.” We all know that the Achilles heel is essential for our bodies to have the ability to walk, and to perform simple everyday tasks. If the photoactivation system is as essential to the plant as the Achilles heel is to the human body, it must be very important for the plant to function. Through this process, ions are able to flow into the water-oxidation complex of plants and in turn, allowing the plant to continue to function.

In his publication, Dr. Burnap mentioned a kinetic model of photoactivation. When asked about this, he explained that the model was a test that gave off bursts of light, some at high intensities and some low. The photoactivation process was proved to show low efficiency at both low light intensities and extremely high ones. But, at intermediate levels, the process reached a maximum efficiency. So what is the overall significance of this kinetic model of photoactivation? In simple terms, it can be used as a means of testing the limits and levels at which photoactivation is able to continue to function [1].

To conclude the interview, Dr. Burnap was asked what he enjoyed most about this research, and to explain what he found to be the most interesting of his discoveries. He explained how he always had an interest in plants and how they function. He went on to describe it by saying “it’s a puzzle,” and he is intrigued by “how it works at a molecular level.” He elaborated and stated “I like solving the puzzle, and seeing how all of the pieces of the puzzle function, and then put all the pieces together.” Through his research of photosystem II and the photoactivation process, the pieces of the puzzle seem to come together.

References

[1] Bao H, Burnap RL (2016) Photoactivation: The light-driven assembly of the water oxidation complex of photosystem II. Front Plant Sci. 7:578-91. doi: 10.3389/fpls.2016.00578

[2] Govindjee, Kern, Jan F, Messinger, Johannes, and Whitmarsh, John. (Feb 2010) Photosystem II. In: eLS. John Wiley & Sons Ltd, Chichester. http://www.els.net [doi: 10.1002/9780470015902.a0000669.pub2]