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Electronic Plants ('E-Plants') – a New Initiative Within Organic Bioelectronics

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Organic Bioelectronics has emerged in the past few years as a complimentary branch of the Bioelectronics field. Merging the mechanical flexibility of 'soft' materials with electrically- and ionically conducting organic semiconductors allows for devices such as Organic Electrochemical Transistors (OECTs) and Organic Electronic Ion Pumps (OEIPs). Traditionally, the field has been focused on mammalian applications, in the form of, for example conducting polymer neural interfaces for improved brain signal recordings, or suppression of pain signals via precise delivery of neurotransmitters [1].

On the other hand, electrical engineering of plants has been largely overlooked compared to the animal kingdom. Plants are very complex and functional electrical-ionic self-healing and self-defending systems. Their importance is immense: not only our food, living environments and raw materials, but also our primary energy carriers originate from the photosynthetic energy-capturing process of plants. Therefore, enhanced functionality of plants for agricultural, scientific, and even energy-harvesting purposes has a great potential.

Our group has very recently started to explore a new branch of Organic Bioelectronics, termed 'Electronic Plants (E-Plants)'. The first E-Plant paper has generated a worldwide success [2]. This study demonstrated the engineering possibilities of electronics inside the vascular system of plants: electrical- and ion conductors, OECTs, and simple logic circuits inside the water-transporting xylem channels, as well as electrochromic pixels inside leaves. Our prime conducting materials are based on the commercially available poly(3,4-ethylenedioxythiophene) (PEDOT).

In this seminar, after a brief introduction to Organic Bioelectronics, I will discuss the details of the first E-Plant study [2]. Then, I give an insight into the new and exciting projects currently ongoing in our lab within E-Plants, such as: control of liquid flow inside leaves via surface acoustic wave (SAW) technology and energy harvesting from photosynthesis.

References

[1] Simon et al. Chem. Rev., 2016, 116 (21), pp 13009–13041
[2] Stavrinidou et al. Sci. Adv. 2015;1:e1501136

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：財団法人九州先端科学技術研究所（ISIT）
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