Applications of Aquaphotomics in Biodiagnostics, Biomeasurements and Biomonitoring

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Conventional approach to diagnostics, measurements of biomarkers and monitoring of health status of biological organisms can at the moment be described as reductionistic. Expansion of genomics, proteomics, lipidomics and other "omics" disciplines reflect well the dominant idea in biological sciences that living processes are governed by nucleic acids, proteins, lipids and other single biomolecules. Consequently, the efforts in development of novel biomeasurement technologies are directed towards detection and quantification of these "recognized" biomolecules and the same trend is present in spectroscopy-based methods which are, due to the possibility of non-invasive, real time measurements, highly sought after.

Despite that biological organisms are highly aqueous environments, water is still not considered a biomolecule in its own right, and is usually considered to be inert medium where important biochemical reactions occur, as if in vacuum. Understandably, in light of this predominant scientific thought, the research methods tend to overlook all the information that can be extracted from the water, which is especially true for spectroscopy.

With the development of aquaphotomics - a science dedicated to improve our understanding of water-light interaction [1], the properties of water as an active natural biological matrix are being slowly uncovered. This novel research field particularly stimulated development of vis-NIR spectroscopy as a tool for water observation in biological organisms and opened new possibilities for biodiagnosis, biomeasurements and biomonitoring which are all based on the, so called, water-mirror approach [1].

This approach is based on the findings that water as a dominant medium in living systems, adapts to every physical or chemical change and this is reflected in its spectrum [2]. Thus, the spectrum of biological water enables indirect measurements of numerous analytes simultaneously, while also offering a novel possibility of tracking health status or diagnosis of disease based on the changes in the water matrix of body fluids or tissues. The same approach is applicable for all biological systems equally and this lecture will illustrate the possibilities of aquaphotomics by providing examples of applications in the fields of plant biology, animal husbandry and medicine.

By utilizing the information coming from the water in biological organisms, the aquaphotomics offers alternative – holistic approach to biodiagnostics, biomeasurements and biomonitoring which could have significant impact on development of novel biomeasurement technologies.

References

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