Coherence Monitor – Searching for the Light of Life

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Objective: A quasi real-time detection system to monitor biological samples or cells exposed to physico-chemical stressors has been designed and built in a first version. The detection principle is based on release of electromagnetic emissions originating from live biotic structures.

Methods: The detector essentially consists of a highly sensitive Photo Multiplier that has been tied up with essential peripherals for applications in the bio-medical field. Doing so required the implementation of temperature and humidity sensors, a Peltier-operated sample holder, electro-mechanical shutters, broad- and narrow-band illumination sources and a band-pass filter for selecting specific wavelengths.[1]

Results: In a first series of test trials it was possible to document responses of:
i) a terrestrial symbiont organism (lichen) to diesel exhaust particles,
ii) to monitor the response pattern of a marine inverterbrate (scleractinian coral) undergoing temperature stress,
iii) to investigate emission patterns of selected oocytes (unfertilized chicken eggs) and
iv) ultimately, to observe four different cell lines undergoing medium change and TNF-a exposure in various concentrations.[2]

Outlook: In order to provide the most flexibility of this tool, the current upgrading by implementing a tailor-made software-solution (LabView©) into the existing hardware, will further improve and extend the already available modes of measurement. In its final version it is intended to use this tool in the field of ontogenesis/morphogenesis (e.g. photon flux density in developmental biology), to study cell metabolism (photon flux variations in tumor vs. normal cells), to determine dose-effect relations in pharmacology as well as toxicology (photon spikes in response to chemical agents), investigate fractal properties in ecosystems (bio-communication) and eventually for the elaboration of novel parameters in food quality (organic vs. conventionally grown produce).

References:

[1] Madl P. (2014) Detection and measurement of biogenic ultra-weak photon emission. in: Fels, D. Cifra M. Scholkmann F (eds) Field of the Cells (2015): 55-70.
[2] Madl P, Geppert M. Verwanger T (2016) Oscillations of ultra-weak photon emission from cancer and non-cancer cells stressed by culture medium change and TNF-α: dose and cell-type dependence – submitted to European Journal of Biophysics.