A MULTI ANGLE LIGHT SCATTERING APPARATUS FOR THE MONITORING OF RAPID STRUCTURAL CHANGES IN BIOLOGICAL SYSTEMS IN REAL TIME

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The physiological function of biological systems is often coupled to or accompanied by structural changes which may sometimes be used to "probe" the physiology of the system. In instances where the structural domains of these changes are too small to be visible under the light microscope, frequently light scattering has been applied successfully as a rapid, gentle, but unfortunately relatively unspecific method to monitor such changes. For example, in isolated photoreceptor outer segments a number of different, rapid, light induced structural changes have been discovered and studied using light scattering techniques.

To increase the specificity of the light scattering technique it would be desirable to be able to monitor rapid light scattering increments in real time at a number of scattering angles simultaneously. For this purpose we have designed a "multi angle light scattering flash photolysis apparatus" with the following properties: 8 scattering angles, selectable between 0 and 45^{o} (for particles whose dimensions are close to the wavelength of the scattered light, this angular region contains most of the scattering information) can be monitored simultaneously with a time resolution of 160µsec per data point. The amplitude resolution depends upon the amount of light available at a particular scattering angle. For small angles it is better than $5x10^{-5}$, even for very diluted suspensions where multiple scattering can be neglected.

A 2cm diameter parallel light beam of 840nm, obtained from a high power LED and a collimating condenser, passes through a thermostated cylindrical cuvette of 2cm diameter and .5 cm pathlength. An aspheric lens placed directly behind the cuvette collects the scattered light and focusses it on to photodiodes, which are arranged on concentric circles in the focal plane of the lens. Each of these photodiode circles measures light scattered at a particular angle. By changing the focal length of the aspheric lens the angular resolution of the 8 concentric circles can be varied.

The photocurrents produced by the photovoltaic devices are fed into a logarithmic current to voltage converter, followed by a rapid, automatic DC offset compensation and a further amplification step which amplifies only the small changes on top of the large DC component. A multichannel signal averager records the data from 8 channels simultaneously and stores them.