# Diffusion of 35%-glucose solution in skin

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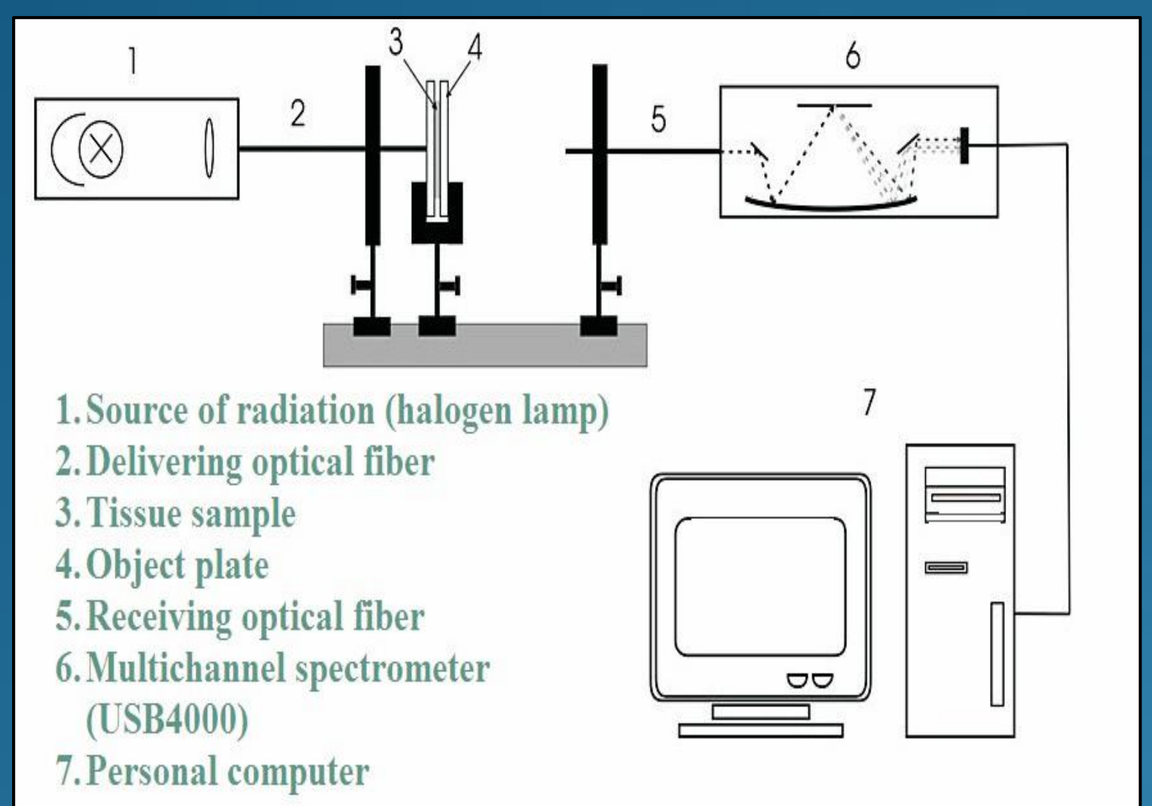
**Motivation:**

The possibility of selective translucence of the superficial skin layers is very useful in developing functional imaging and therapeutic techniques. A potential benefit of the optical clearing is the improvement of laser therapeutic techniques that enable sufficient light penetration to a target embedded in tissue. Combination of optical clearing with laser radiation can reduce the laser fluences required for a therapeutic effect. Goal of the study is to measure the diffusion coefficient of glucose in skin tissue.




**Method for determination of glucose diffusion coefficient:**

Penetration of glucose in skin was described in the framework of the free diffusion model

$$\frac{\partial C(x,t)}{\partial C} = D\frac{\partial^2 C(x,t)}{\partial x^2} \qquad \textit{Diffusion equation}$$

$$C(0,t) = C_0 \quad \text{and} \quad \frac{\partial C(l,t)}{\partial x} = 0 \qquad \textit{Boundary conditions}$$

$$C(x,0) = 0 \qquad \textit{Initial condition}$$

Solution of the diffusion equation can be reduced to the form

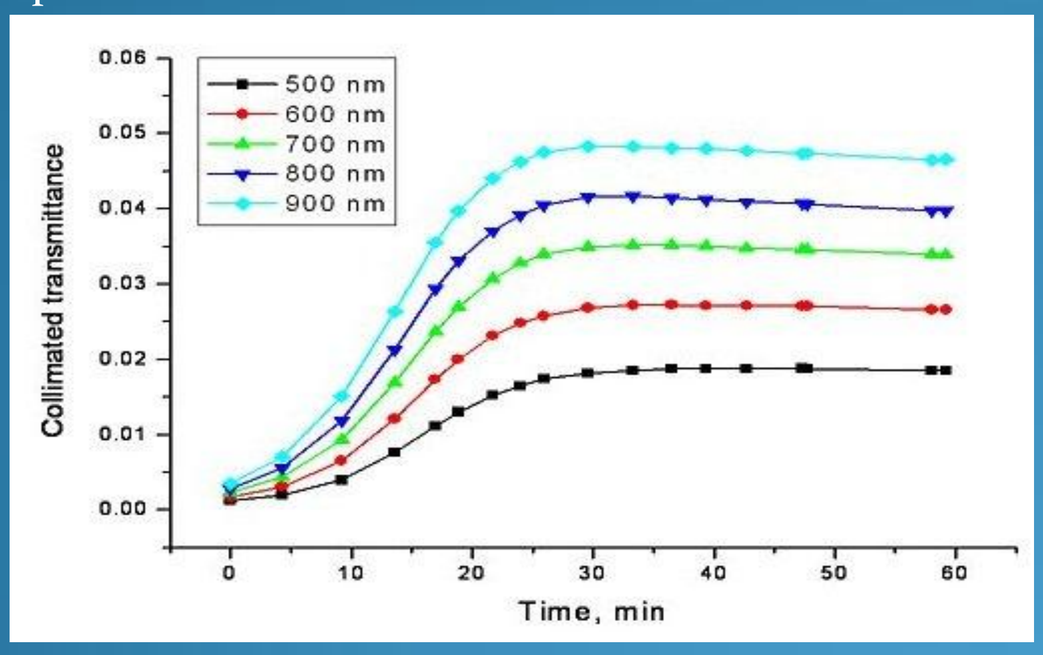
$$C(t) \approx C_0\left(1 - \exp\left(-t/\tau\right)\right)$$

$$\tau = \frac{4l^2}{\pi^2 D} \qquad D = pD_0 = (1-\varphi)D_0$$

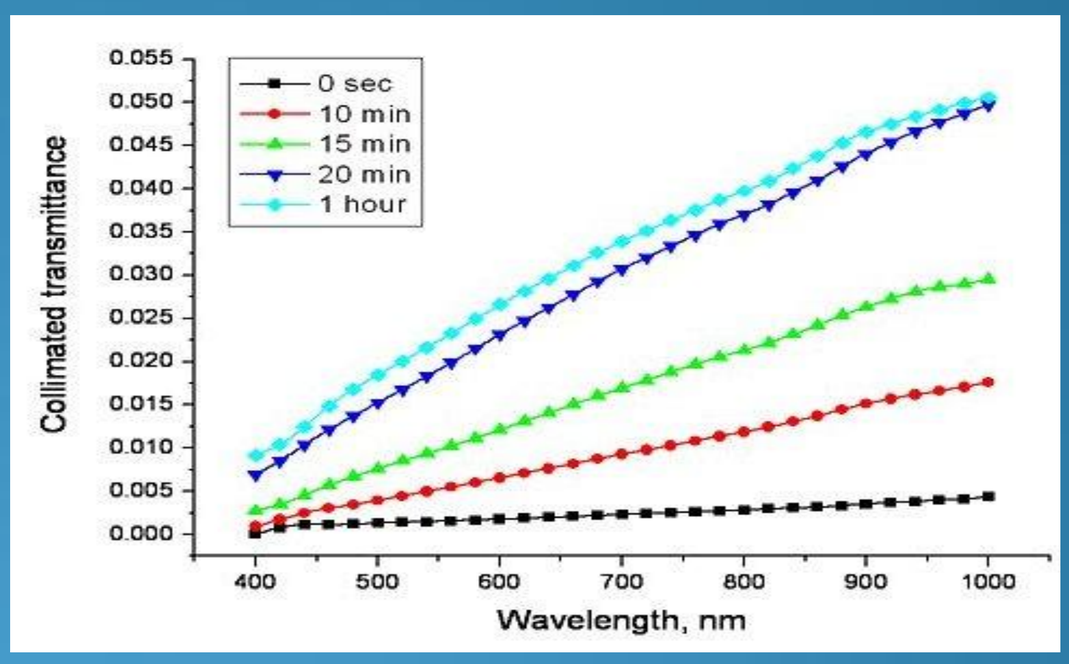
$\tau$ is diffusion time constant, sec; $p$ is the permeability coefficient of skin; $\varphi$ is volume fraction of scatterers; and $D_0$ is glucose diffusion coefficient within interstitial fluid, cm²/sec

**Materials and methods:**

For study ten rat skin samples have been used. The temperature was about 20°C . Measurements of collimated transmittance have been performed using s commercially available spectrometer USB-4000 (Ocean Optics, USA) in the spectral range 400-1000 nm. As a clearing agent 35% aqueous solution of glucose was used. The results are presented at the graphs.




The time-dependent transmittance of the rat skin measured at different wavelength concurrently with administration of glucose solution




The transmittance spectra of the rat skin measured concurrently with administration of glucose solution at different time intervals

**Acknowledgments**

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