The thickness of the unstirred diffusion layer outside particles (tissues) depends on the biocatalyst (cell) distribution in the particles

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The concentration of a metabolite that is consumed (produced) in a small particle (cell) with biocatalysts can be measured outside the particle with microelectrodes.
We have constructed an apparatus consisting of an inverted microscope, a measuring cell and a micromanipulator that moves O_2-microelectrodes (1) with tip diameter 1-2 µ for such measurements.
With this we have determined the thickness of the diffusion layer and its dependence on the relative velocity particle/solution outside particles of different geometry (spherical, cylindrical) with immobilized glucose oxidase (EC 1.1.3.4.) as a model system (2). In this case the enzyme (biocatalyst) was homogeneously distributed in the particles.
Outside particles where the biocatalysts are not homogeneously distributed the diffusion layer thickness was found to decrease when the average distance between the biocatalysts (cells) increased, so that their diffusion layers do not overlap.
From the concentration gradient in the diffusion layer the rate of metabolic consumption in the particles can also be determined. These findings have implications for the description of the kinetics of systems with immobilized biocatalysts, carrier mediated transport systems and for the analysis of contact inhibited cells (3).

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