

## **Abstract**

# **A FRACTAL ANALYSIS OF BINDING AND DISSOCIATION KINETICS OF GLUCOSE AND RELATED ANALYTES ON BIOSENSOR SURFACES**

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A fractal analysis is used to model the binding and dissociation kinetics of connective tissue interstitial glucose, adipose tissue interstitial glucose, insulin, and other related analytes on biosensor surfaces (Vogt et al., 2004). The analysis provides insights into diffusion-limited analyte-receptor reactions occurring on heterogeneous biosensor surfaces. Numerical values obtained for the binding and the dissociation rate coefficients are linked to the degree of heterogeneity or roughness (fractal dimension,  $D_f$ ) present on the biosensor chip surface. The binding and dissociation rate coefficients are sensitive to the degree of heterogeneity on the surface. For example, for the binding of plasma insulin, as the fractal dimension value increases by a factor of 2.47 from  $D_{f1}$  equal to 0.6827 to  $D_{f2}$  equal to 1.6852, the binding rate coefficient increases by a factor of 4.92 from  $k_1$  equal to 1.0232 to  $k_2$  equal to 5.0388. An increase in the degree of heterogeneity on the probe surface leads to an increase in the binding rate coefficient. A dual-fractal analysis is required to fit the binding kinetics in most of the cases presented. A single fractal analysis is adequate to describe the dissociation kinetics. Affinity (ratio of the

binding to the dissociation rate coefficient) values are also presented. Binding rate coefficients for interferents for the detection of glucose like uric acid, acetaminophen, and ascorbic acid are also presented using glucose biosensors based on carbon nanotube (CNT) nanoelectrode ensembles (NEEs) (Y. Lin et al., 2003) The analysis should assist in the development of probes for the reliable and quantitative detection of glucose and its interferents which is essential in diabetes management, and in the subsequent prevention of complications that arise if this ailment is left untreated.