ABSTRACT

A fractal analysis is presented for the binding and dissociation (if applicable) of (a) different bradykinin concentrations (in nM) in solution to bradykinin B2 receptors immobilized on a resonant waveguide grating (RWG) biosensor surface (Feng et al., 2006), (b) mbetaCD cholesterol in solution to KeLa cells cultivated on a gold-coated prism surface (Ziblat et al., 2006), and (c) a calcium+FRET-based calcium biosensor employing troponin C. TN-XL fluorescence was observed in vivo in this case (Mank et al., 2006). Both single- and dual-fractal analysis were used. The dual-fractal analysis was used only when the single-fractal analysis did not provide an adequate fit. The fractal dimension provides a quantitative measure of the degree of heterogeneity present on the biosensor chip surface. The fractal dimension for the binding and the dissociation phase is not a typical independent variable, such as analyte concentration that may be directly manipulated. It may be considered as a derived variable. An increase in the fractal dimension value or the degree of heterogeneity on the biosensor surface, leads in general, to an increase in the binding rate coefficient. For example, for the binding of different bradykinin concentrations in solution in the 8-128 nM range (Feng et al., 2006), and for a dual-fractal analysis the binding rate coefficient, k2 exhibits a 6.57 order of dependence on the fractal dimension, Df or the degree of heterogeneity that exists on the biosensor surface. This indicates that, in this case at least, the binding rate coefficient, k2 is very sensitive to the fractal dimension or the degree of heterogeneity that exists on the biosensor surface.