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An Analytic Study of Molecular Motion in Cell Membranes ZIYA KALAY, Consortium of the Americas for Interdisciplinary Science and Dept. of Physics, Univ. of New Mexico, Albuquerque, NM USA , LUCA GIUGGIOLI, Dept. of Engineering Mathematics, Univ. of Bristol, Bristol, UK , PAUL PARRIS, Missouri Univ. of Science and Technology, Rolla, MO USA, VASUDEV KENKRE, Consortium of the Americas for Interdisciplinary Science and Dept. of Physics, Univ. of New Mexico, Albuquerque, NM USA — We present a theoretical calculation to describe the confined motion of transmembrane molecules in cell membranes. Understanding the motion of membrane-associated molecules, e.g. various types of receptors, has great modern relevance in cell biology. Our study is divided into two parts. In the first, we consider motion in an ordered system and in the second, we investigate the effects of disorder by employing an effective medium approximation. Both are based on Master equations for the probability of the molecules moving as random walkers, and leads to explicit usable solutions including expressions for the molecular mean square displacement and effective diffusion constants. As a result, the calculations make possible, in principle, the extraction of confinement parameters such as mean compartment sizes and mean intercompartmental transition rates from experimentally reported published observations.

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