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Modeling of Chemotaxis in Porous Media. UTTAM KUMAR, SUBRAMANIAM PUSHPAVANAM, Indian Institute of Technology Madras, Chennai, India — Peritrichous bacterial motility is characterized by a sequence of run and tumble events. In the presence of chemical gradients, tumble frequency gets reduced, and the bacteria population experiences a drift towards higher concentration of chemoattractants (favourable chemicals). The understanding of the movement of bacteria in porous media like agar gel is important to develop a point of care devices. Here, how the microbe's motility gets affected due to collision with solid walls is not clearly understood. How the microbe's motility gets altered due to pore size distribution is unknown. In this work, we model the movement of bacteria in a porous medium based on the continuous-time random walk (CTRW) approach. This result in the system being described by a fractional differential equation. Here we present a mathematical model that incorporates changes of bacterial motility as exhibiting anomalous diffusive behaviour in porous media. We use a finite difference numerical method for solving the governing fractional differential equations. These model equations are relevant in the context of biological systems with crowding. We also design a diffusion-based microfluidic device for generating a steady and stable concentration gradient for studying chemotaxis in agar gel, which contains a fluid-filled porous medium. Results obtained from numerical simulation are compared with experimental data. **Keywords:** Chemotaxis, Fractional calculus, Anomalous diffusion, Random walk. ***References***

1. Bhattacharjee, T. & Datta, S. S. Bacterial hopping and trapping in porous media. *Nat. Commun.* **10**, 2075 (2019).

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