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Mathematical modeling of bacterial attachment to surfaces: Biofilm initiation

The development of bacterial biofilm is a multi-stage process consisting of five stages, namely, initial attachment of bacteria to surfaces or interfaces, irreversible attachment, first maturation, second maturation and the detachment of bacteria. Our interest in this work, is to model the biofilm initiation. In the early stage at low bacterial density, we use a stochastic model to describe the bacterial movement towards the interfaces. Then when the density is significantly high we develop a non-linear system of partial differential equations of Keller-Segel type model to illustrate more biological facts such as chemotaxis and sensing chemicals production. The numerical simulations to the models show that the sensing chemicals are highly concentrated in the interfaces which attract more bacteria to the boundaries, and this makes a good agreement with the biological observations.

REFERENCES

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