Stationary solutions to a chemotaxis–consumption model with realistic boundary conditions

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The talk we discuss the behavior of the concentration of some bacteria n (for example of the species *Bacillus subtilis*), whose otherwise random motion is partially directed towards higher concentrations c of a signaling substance (oxygen) they consume. After a transition phase, the system can be described using the stationary chemotaxis model

$$\begin{cases} 0 = \Delta n - \nabla \cdot (n \nabla c) \\ 0 = \Delta c - nc \end{cases}$$

on a bounded domain Ω. Previous studies of chemotaxis models with consumption of the chemoattractant (with or without fluid) have not been successful in explaining pattern formation even in the simplest form of concentration near the boundary, which had been experimentally observed.

Following the suggestions that the main reason for that is usage of inappropriate boundary conditions, this talks considers no-flux boundary conditions for n and the physically meaningful condition

$$\partial_\nu c = 1 - c$$

for the signaling substance c.

In the talk, we discuss the existence and uniqueness of non-constant solutions for any given mass $\int_\Omega n > 0$. In the special case of Ω being a ball, the solutions n and c are strictly convex.

References

[1] M. Braukhoff and J. Lankeit. Stationary solutions to a chemotaxis–consumption model with realistic boundary conditions. arXiv:1902.01167. Submitted for publication. 2019.

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