

# Free Boundary Problems Arising in Biology

**Avner Friedman**

Distinguished University Professor  
Department of Mathematics  
The Ohio State University

## Resumen

Recent years have seen a dramatic increase in the number and variety of mathematical models describing biological processes. Such models aim to produce, by simulations, results that are in agreement with experimental data, and develop new hypotheses that could be tested experimentally. Some of the mathematical models are formulated in terms of systems of PDEs and give rise to new and interesting mathematical questions. These include not only existence, uniqueness and regularity of solutions, but also proving biologically-motivated properties of the solutions. This is particularly the case when the domain where the system of PDEs to be solved varies with time and its boundary is not known in advance. Such free boundary problems are well known in elasticity, in phase transition, and in fluid dynamics. In recent years new free boundary problems (FBPS) appeared in mathematical models of biological processes. In this talk, I will describe recent models which arise in cancer, wound healing, atherosclerosis and the risk of cholesterol, granulomas in tuberculosis, and abdominal aorta aneurism. I will briefly explain the biological questions, how the mathematical models address these questions, new rigorous mathematical analysis that was inspired by the models, and finally, I will suggest open mathematical problems.