

# QUANTITATIVE APPROACHES TO THE CELL DIVISION PROCESS

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## 1. Introduction

It was only three decades ago that the English scientist Turing expounded some of the basic concepts of computing machines. Today, thanks to a number of outstanding mathematicians, but particularly the late John von Neumann, we have sufficient theoretical knowledge to give instructions for building a machine that could duplicate itself. If one tried to build a self-duplicating machine with our present technical knowledge, this might perhaps be some  $10^{15}$  to  $10^{18}$  times as large as a typical living cell; yet cells have apparently continuously performed the feat of self-duplication for possibly 500 million years. The actual process of cell division is still almost as obscure to us as it was when Anton van Leeuwenhoek, using his newly invented microscope, recognized a yeast cell as a living entity.

The author cannot make claim to expertness in the field of mathematical statistics. This article is presented merely to expose some of the problems one may encounter when attempting to experiment with unicellular organisms. It will become apparent that not only do we need to refine our quantitative, observational techniques to give us insight into phenomena at the level of single molecules, but also it seems to be of interest further to develop and use mathematical methods for the solution of biophysical problems which can treat many thousands of variables simultaneously.

The problem of cell division and cell proliferation is qualitatively similar for all kinds of cells.

In mitotic division, utilizing nutrient materials and energy supply available in the medium, all essential cell components double themselves and the end result is two more or less identical living cells. Detailed description of the cell proliferation process is available in many books and reviews (see, for example, [1] and [2]). There is, however, enormous variation in the morphological, physiological, and biochemical details of the process. This variation is characteristic not only of each genus of each species, but the same cell can exhibit astonishing

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