

# A STOCHASTIC PROCESS ARISING IN THE STUDY OF MUSCULAR CONTRACTION

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## 1. Introduction

Assume two parallel line segments of indefinite length, one of which is fixed and the other of which is movable, moving in a linear direction, parallel to the fixed line. Along the fixed line there are special points equally spaced which we shall denote as positions. Similarly, on the moving line, there exist equally spaced points which we denote as sites. A site may be in either of two states which we refer to as vacant or filled. After a site's initial state, which is determined, it can change states only after interactions with the positions along the fixed line in the following manner. A site which is vacant can become filled at certain positions. Call these "load" positions. Similarly, a site which is filled can become vacant at the remaining positions. We denote these as "release" positions. We assume an arbitrary fixed starting position on the fixed line with the positions numbered consecutively beyond the starting position and, further, the release and load positions alternate so that the odd numbered positions are release positions and the even numbered ones are load positions. Then, under certain assumptions stated in the next section, the question posed is the probability a site will be filled (or vacant) after a transit of  $n$  positions. The model will then be extended to the case where a site can be in any one of  $(m + 1)$  states and the analogous question posed is the probability the site will be empty, filled or in any arbitrary state  $j$  after a transit of  $n$  positions.

The model given above is related to the following theory concerning the mechanism of muscular contraction as discussed by Podolsky [1]. A muscle fibril, as seen under the electron microscope, consists of alternating thick and thin filaments. It is assumed that sites exist along the two kinds of filaments at which certain chemical interactions occur at the molecular level. The sites on the thin filaments are capable of binding certain molecules and when a site containing the molecule approaches a site on the thick filament an interaction (splitting off of the molecule) may or may not take place.

Observations on the living muscle suggest that during shortening there is