Abstract

Analytical solutions to time dependent Smoluchowski- like equation for Bicoid morphogen gradient in Fruit fly patterning.

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Morphogen gradients provide embryonic tissues with positional information by inducing target genes at different concentration thresholds and thus at different positions. [1] The fate of embryonic cell in Drosophila Melanogaster (Fruit fly) is determined in a concentration-dependent manner. [2] The Bicoid protein gradient plays a crucial role in determining the anterior body pattern of *Drosophila* embryos. This gradient is the classic example of morphogen-mediated patterning of a developing metazoan and serves as a major topic for mathematical modeling. Bicoid can be a simple case of reaction-diffusion system. The variation in morphogen concentration across the embryo defining the anterior posterior segments, obeys simple reaction diffusion equations. The reaction being the degradation of Bicoid protein with some rate which is produced at source following which it diffuses along the anterior-posterior axis. Several biophysical models that rely on production, diffusion and degradation have been formulated to account for the observed dynamics of the Bicoid morphogen gradient in *Drosophila melanogaster* embryos. [3] Moving ahead with the idea, later a lot of theoreticians and experimental work has started to reveal how the system in Fruit fly uses such positional information to generate precisely in both time and space.[4,5] started formulating different models to understand this gradient formation in details and till today they are trying to understand it in a better way. The talk would be concerned with findings that directly relate to the biophysical models that discuss the production, diffusion and degradation of the Bicoid Gradient. Also, I would try to develop a quantitative intuition about morphogen diffusion and present a simple model showing how the concentration distribution varies with time.

References

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