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“Precise interpretation of noisy morphogen gradients”

Morphogen gradients play a vital role in biology by specifying position in embryonic development. However, the factors that influence the shape of a morphogen profile remain poorly understood. Since morphogens should provide precise positional information, one significant factor is the robustness of the profile to noise. We compare three experimentally relevant classes of morphogen profiles (linear, exponential, algebraic) to see which is most precise when subject to both external embryo-to-embryo fluctuations and internal fluctuations due to intrinsically random processes such as diffusion. We find that both the kinetic parameters and the overall gradient shape (e.g. exponential versus algebraic) can be optimised to generate maximally precise positional information. Furthermore, we have confirmed experimentally that the Bicoid morphogen gradient is near optimal for precise positioning in the *Drosophila* embryo. We then extend these results to investigate the precision of pre-steady-state morphogen interpretation. Morphogens that are transcription factors are found to be particularly sensitive to internal fluctuations when measured prior to steady-state. However, morphogens interpreted by cell-surface receptors can typically be decoded prior to steady-state without significant decrease in positional precision of gene boundaries, so long as the system regulates fluctuations in when interpretation occurs. We predict that Bicoid, a transcription factor morphogen in *Drosophila*, is unlikely to be interpreted significantly before obtaining steady-state.

Dienstag, 02. Februar 2010, 14.00 c.t.

Gebäude E2 6, Seminarraum E.04

Alle Interessenten sind herzlich eingeladen.

Die Sprecher des Graduiertenkollegs
Manfred Lücke und Ludger Santen

**Strukturbildung und Transport
in komplexen Systemen**