**Reaction-diffusion systems**

*Key concepts: mass action kinetics, local activation/long-range inhibition, Turing patterns, pattern triggering*

A fundamental concept in cell polarity is the idea of self-organisation, meaning that the polarity proteins that are displaying patterns play a fundamental role in the organisation of these patterns

Turing’s work showed that a system of just two chemical species can give rise to complex patterns, provided that they react with each other in a certain way and exhibit differential diffusion kinetics. At the time the biological mechanisms were unclear. He referes to these chemical species as ‘genes’

This work was later generalised by Gierer and Meinhardt. Emphasised the concepts of long range inhibition versus short range activation which has been influential in enhancing intuitive understanding

Local activation

There are a number of molecular configurations by which this can be achieved. At a most basic level, a protein is able to directly promote it’s own local enrichment (self-amplification). More complex schemes are possible, such as a double negative feedback. Species A inhibits species B which inhibits species A. In this way, a local enrichment of species A can be amplified via a reduction in inhibition from species B.

Long-range inhibition