Reframing the Project

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1 20 October

Identify regimes of RNA production where flow is observed.

- $\mathrm{d}t_{\mathrm{max}} = 0.1$
- $t_{\mathrm{end}} = 500$
- $c_0 = 3.6$

Parameter	Values
k_{prod}	$\{0.01, 0.1\}$
σ_{prod}	$\{2.5\}$
$x_{\mathrm{p},0}$	$\{0, 2, 4, 6, 8, 10\}$

- Nucleus grows significantly
- $k_{\mathrm{prod}} = 0.01$ negligibly slow dynamics
- $k_{\mathrm{prod}} = 0.1$ observable slow flow

- Deformation more observable for $x_{\mathrm{p},0} \ll$

Parameter	Values
k_{prod}	$\{1.0, 2.0, 3.0, 4.0, 5.0\}$
σ_{prod}	$\{4.0\}$
$x_{\mathrm{p},0}$	$\{6, 8, 10\}$

- Nucleus grows significantly
- $k_{\mathrm{prod}} \geq 1$ condensate nucleation at the origin
  - When $x_{\mathrm{p},0} = 6, 8$ – seed fuses with nucleated
    - Fused condensate forms elongated/deformed condensate
  - When $x_{\mathrm{p},0} = 10$ – seed dissolves
- Once condensate is at the nucleus, increasing k_{prod} increases condensate size

2 21 October

Increase simulation time to see more dynamics and check if no flow is truly stationary.

- $\mathrm{d}t_{\mathrm{max}} = 0.1$
- $t_{\mathrm{end}} = 6000$
- $c_0 = 3.6$

Parameter	Values
k_{prod}	$\{0.01, 0.1, 1.0\}$
σ_{prod}	$\{2.5, 4.0, 8.0\}$
$x_{\mathrm{p},0}$	$\{0, 2, 4, 6, 8, 10\}$

- Nucleus grows significantly
- $k_{\mathrm{prod}} = 0.01$ negligibly slow flow
- $k_{\mathrm{prod}} = 0.1$ observable flow
- $k_{\mathrm{prod}} = 1$ nucleation at the origin

No flow is probably not truly stationary.

3 22 October

A problem was that the condensate becomes so large it elongates at a length scale commensurate to the protein-promoter distance. Decrease condensate size by decreasing seed concentration.

- $\mathrm{d}t_{\mathrm{max}} = 0.1$

Parameter	Values

Parameter	Values
k_{prod}	$\{0.01, 0.1, 1.0\}$
σ_{prod}	$\{2.5, 5.0\}$
c_s	$\{5, 5.5\}$
$x_{\mathrm{p},0}$	$\{2, 4, 6, 8, 10\}$

Seed concentration has negligible effect on condensate size.

4 23 October

Instead of decreasing seed concentration, we decrease background protein concentration to be closer to the lower binodal point.

- $\mathrm{d}t_{\mathrm{max}} = 0.1$

Parameter	Values
k_{prod}	$\{0.05, 0.5, 0.1\}$
c_0	$\{3.5, 3.525, 3.55, 3.75\}$

Background protein concentration controls condensate size.

5 20 November

Using a smaller discretization of production rate and background protein concentration, we plot a phase diagram.

- $\mathrm{d}t_{\mathrm{max}} = 1$

Parameter	Values
k_{prod}	$\{0.025, 0.05, 0.075, 0.1, 0.25, 0.5\}$
c_0	$\{3.51, 3.52, 3.53, \cdots, 3.64\}$

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- $\mathrm{d}t_{\mathrm{max}} = 1$

Parameter	Values

Parameter	Values
$\tilde{k}_{ep}$	$\{0.001, 0.005, 0.01\}$
σ_{well}	$\{0, 0.1, 0.5, 1\}$
k_{prod}	$\{0.25, 0.5\}$

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- $k_{\text{prod}} = 0.1$

Parameter	Values
$\tilde{k}_{ep}$	$\{10^{-n}, 5 \times 10^{-n} \quad \text{for } n = 1, 2, \cdots, 8\}$
σ_e	$\{1, 3, 4, 5\}$

Parameter	Values
k_{prod}	$\{0.1, 0.25, 0.5\}$
c_0	$\{3.52, 3.54, 3.56\}$
$\tilde{\chi}_{\text{PR}}$	$\{0.01, 0.1, 1\}$

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- $\mathrm{d}t_{\max} = 0.1$

Parameter	Values
c_0	$\{3.52, 3.54, 3.56\}$
$\tilde{\chi}_{\text{PR}}$	$\{0.05, 0.1, 0.5\}$

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- $\mathrm{d}t_{\max} = 1$

Parameter	Values
k_{prod}	$\{0.1, 0.5\}$
$\tilde{\chi}_{\text{PR}}$	$\{0.1, 0.5\}$
$\tilde{k}_{ep}$	$\{0.01, 0.05, 0.1, 0.5\}$
$r_{e,0}$	$\{0, 10\}$

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- $\mathrm{d}t_{\mathrm{max}} = 1$

Parameter	Values
$\tilde{k}_{ep}$	$\{0.0001, 0.0005, \cdots, 0.5, 1\}$
σ_e	$\{1, 3, 4, 5\}$