

PS 2

1.a) mRNA & protein balance eq. (given in lec. notes)

mRNA.....

balance $\dot{m}_i = r_{xi} u_i - (\mu + \theta_{m,i}) m_i + \lambda_i \quad \textcircled{1} \quad i=1, 2, \dots, N.$

protein

balance: $\dot{p}_i = r_{pi} w_i - (\mu + \theta_{p,i}) p_i \quad \textcircled{2}$

μ is the dilution term. for the cell free system in the problem,

it has a constant volume $p = V_i, \dot{p} = 0$

in lecture. $\mu = \beta^+ \beta, \dot{p} = 0 \Rightarrow \therefore \mu = 0.$

$\therefore \textcircled{1} \quad \dot{m}_i = r_{xi} u_i - (\cancel{0} + \theta_{m,i}) m_i + \lambda_i$

$\textcircled{2} \quad \dot{p}_i = r_{pi} w_i - (\cancel{0} + \theta_{p,i}) p_i$

\therefore it's well mixed

\Rightarrow we have $\dot{m} = r_x u - \theta_m m + \lambda$

$\dot{p} = r_p w - \theta_p p$

#1 b) Parameters

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{
  "host_type": "cell_free",

  "biophysical_constants": {

    "transcription_saturation_constant": {
      "value": "0.54",
      "units": "mu{M}",
      "bionumbers_reference": ""
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    "mRNA_half_life_in_hr": {
      "value": "0.290833",
      "units": "hr",
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    "protein_half_life_in_hr": {
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      "units": "hr",
      "bionumbers_reference": "BIND:111930"
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      "units": "mu{M}",
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      "units": "s",
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    "RNAPII_concentration": {
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    "value": "0.067",
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  "ribosome_concentration": {
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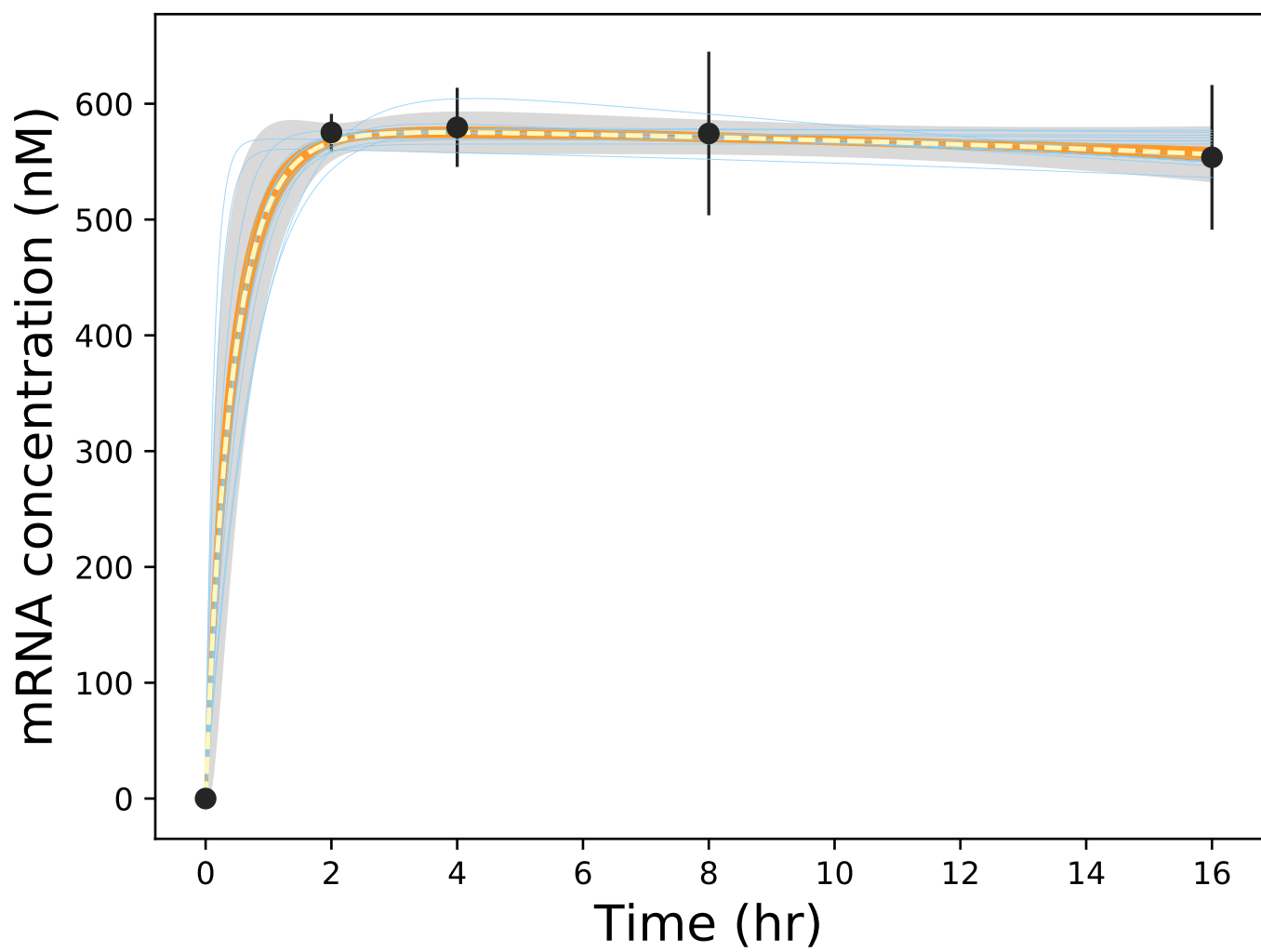
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  "characteristic_protein_length": {
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    "units": "aa",
    "bionumbers_reference": ""
  }
}
```

#1 c) mRNA



#1 c) Protein

