

Electronic supplementary materials

Title:

Modeling indicates degradation of mRNA and protein as a potential regulation mechanisms during cold acclimation

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Content:

Model Code

Model ODEs

Model Code

This code can be executed in python using the Stimator package.

```
from stimator import read_model, solve
```

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
```

```
model1 = """
```

```
vin3: -> mRNA , rate = k3
```

```
vin4: -> Protein , rate = k4*mRNA
```

```
vout6: mRNA -> , rate = k6*mRNA
```

```
vout7: Protein -> , rate = k7*Protein
```

```
k3 = 0.25
```

```
k4 = 0.25
```

```
k6 = 0.5
```

```
k7 = 0.1
```

```
#k3 = 2.5
```

```
#k4 = 2.5
```

```
#k6 = 1
```

```
#k7 = 1
```

```
init: (mRNA = 2.5, Protein = 6.25)
```

```
!! Protein mRNA
```

```
"""
```

```
M = read_model(model1)
```

```
print M
```

```
S = M.solve(tf=500)
```

```
print S
```

```
#S = np.array(S)
```

```
#print S.shape
```

S.plot(show=True)

Model ODEs

The reactions in the model are as follows:

mRNA import: $\rightarrow \text{mRNA}$, rate = k_1

Protein production: $\rightarrow \text{Protein}$, rate = $k_3 \cdot \text{mRNA}$

mRNA degradation: $\text{mRNA} \rightarrow$, rate = $k_2 \cdot \text{mRNA}$

Protein degradation: $\text{Protein} \rightarrow$, rate = $k_4 \cdot \text{Protein}$

The ODEs, which follow from these reactions, are as follows:

$$\frac{d}{dt}[\text{mRNA}] = k_1 - k_2 \cdot \text{mRNA}$$

$$\frac{d}{dt}[\text{Protein}] = k_3 \cdot \text{mRNA} - k_4 \cdot \text{Protein}$$