

Vesicle recycling model with membrane remain factor

A simple two pool model of spontaneous vesicle recycling. It is a simplified version of the model published in [Sara et al 2005](#).

Here we change the model from Sara 2005 to remove the pool of empty-recycled vesicles. Instead, recycled vesicles go back into the loaded vesicle pool

We assume three pools:

- u_1 : Vesicles currently in the resting state
- u_2 : Vesicles currently activated/merged with the the pre-synaptic membrane
- u_3 : Vesicles currently being recycled after endocytosis

in addition we have three parameters:

- α : activation/exocytosis rate of vesicles in u_1
- β : recycling rate from the membrane back to the resting pool
- σ : vesicle endo-cytosis from the memebrane rate

PlotlyBackend()

vesicle_recycle! (generic function with 1 method)

```
• function vesicle_recycle!(du, u, p, t_span)
•      $\alpha, \beta, \sigma = p.\alpha, p.\beta, p.\sigma$ 
•      $du[1] = -\alpha * u[1] + \beta * u[3]$            # vesicles in the resting pool
•      $du[2] = +\alpha * u[1] - \sigma * u[2]$        # vesicles currently merged with the membrane
•      $du[3] = +\sigma * u[2] - \beta * u[3]$          # currently being recycled vesicles
• end
```

Setting the initial state of the system

```
u0 = Float64[
    1: 1.0
    2: 0.0
    3: 0.0
]
```

```
t_span = (0.0, 1200.0)
```

```
p = (  
   $\alpha$  = 0.0008  
   $\beta$  = 0.5  
   $\sigma$  = 1.67  
)
```

```
• # initial parameters
```

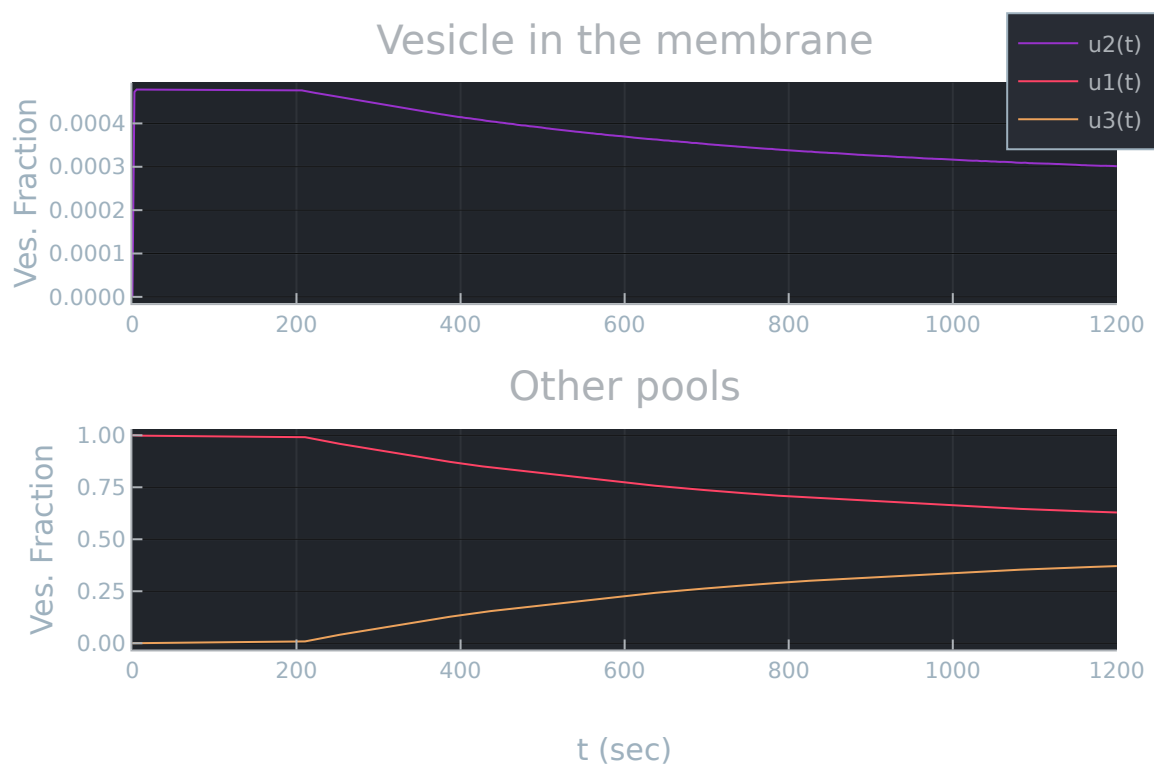
```
p = ( $\alpha$ =0.0008,  $\beta$ =0.5,  $\sigma$ =1.67)
```

α after LPA application:

β after LPA application:

σ after LPA application:

time of LPA application: 200



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