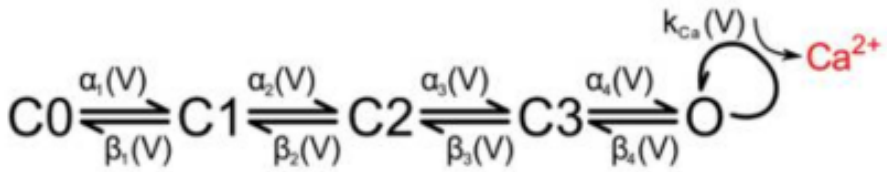
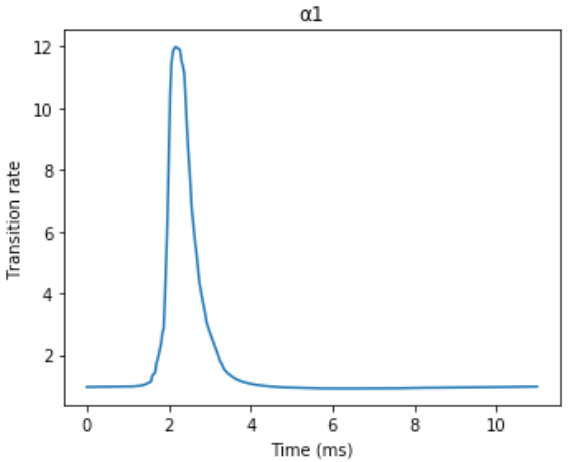
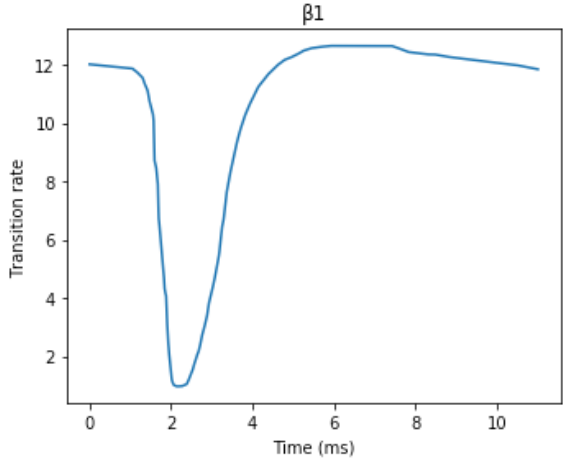
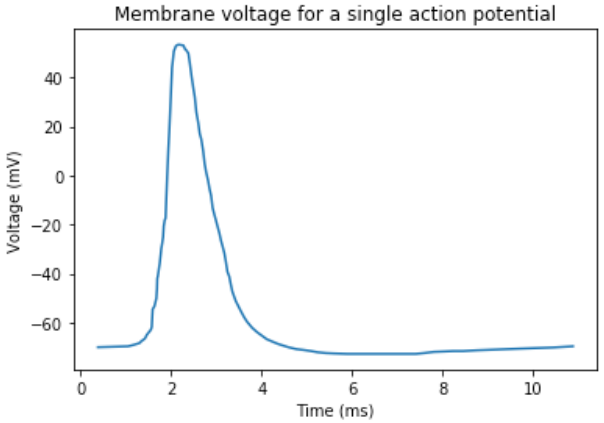
Detailed Markov Model

Voltage-Gated Calcium Channel





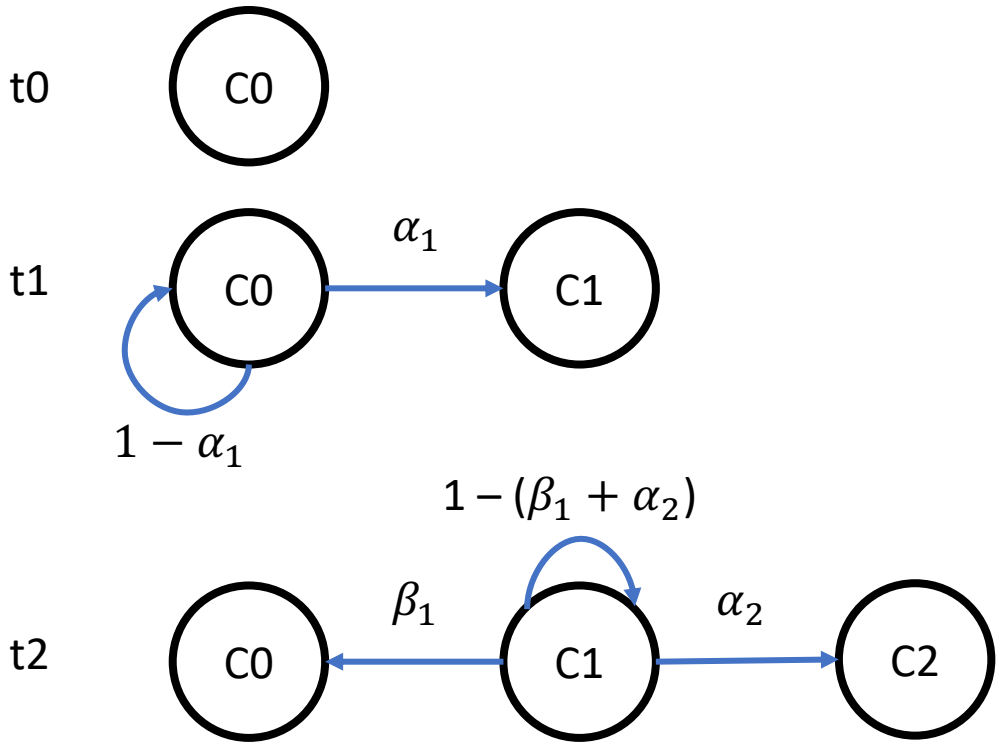


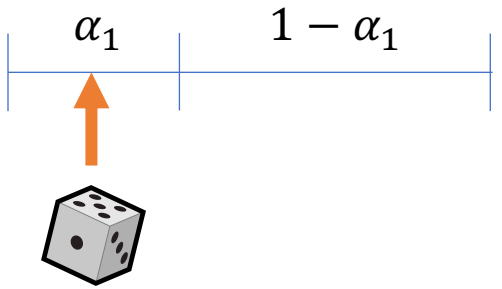


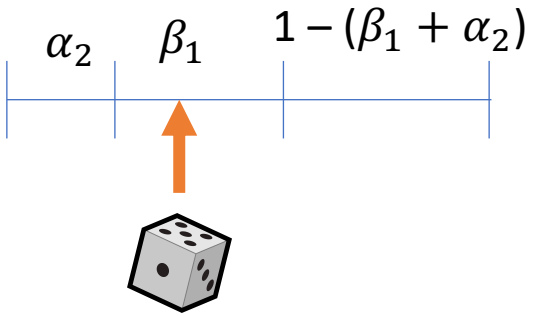
Transition rates: $\alpha_i(V) = \alpha_{io} \exp(V/V_i)$ $\beta_i(V) = \beta_{io} \exp(V/V_i)$

Transition probabilities: $\alpha_i \Delta t$ $\beta_i \Delta t$

Voltage-Gated Calcium Channel







1. Sample for Unif
2. Compare to probabilities to find out

Similarly: Multinomial Distribution

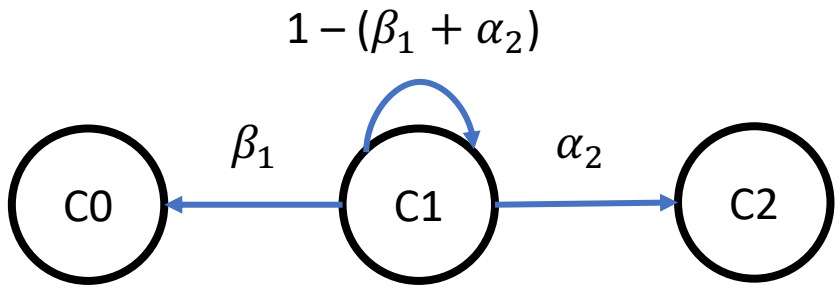
- Probability distribution of the outcomes from a **multinomial experiment**.
  - *k* possible outcomes each with a probability p_k
  - *n* trials
  - The probability each event E_i occurs n_i times given the probability for that outcome is p_i

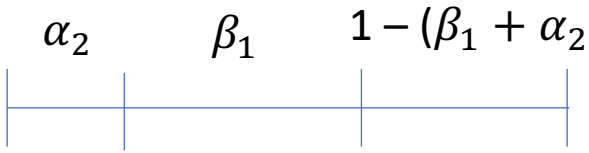
$$P = \frac{n!}{n_1!n_2!...n_k!}(p_1^{n_1}p_2^{n_2}...p_k^{n_k})$$

  - Distribution gives probability of getting a certain an outcome a certain number of times for all the trials
  - *Thus* sampling gives the number per outcome

1. Sampling gives outcome

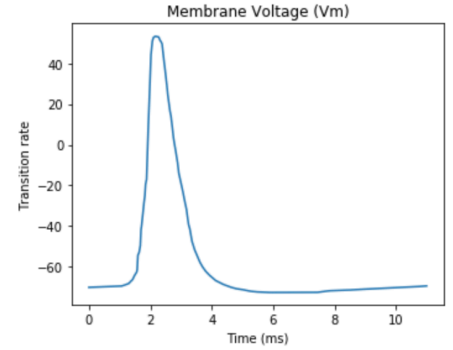
Voltage-Gated Calcium Channel

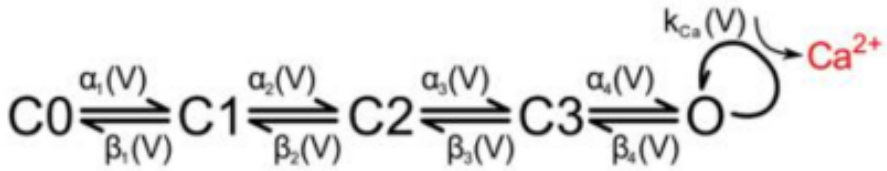


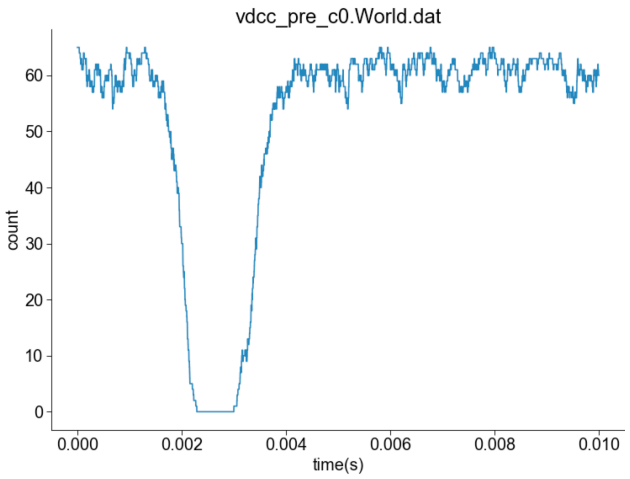


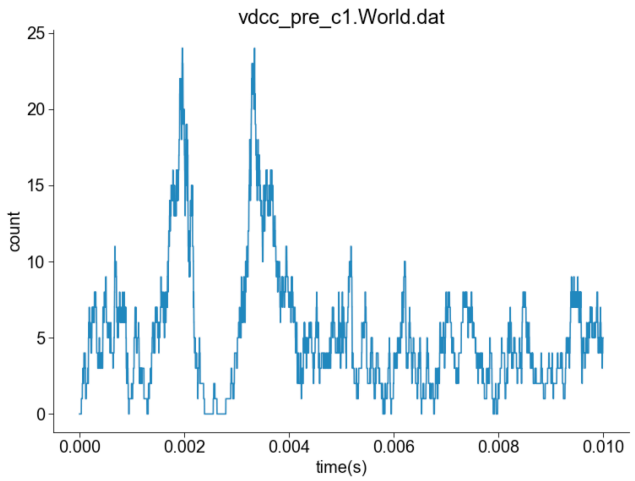
n = 1 channel	0	1	0	$\sum = 1$
n = 20 channels	4	9	7	$\sum = 20$

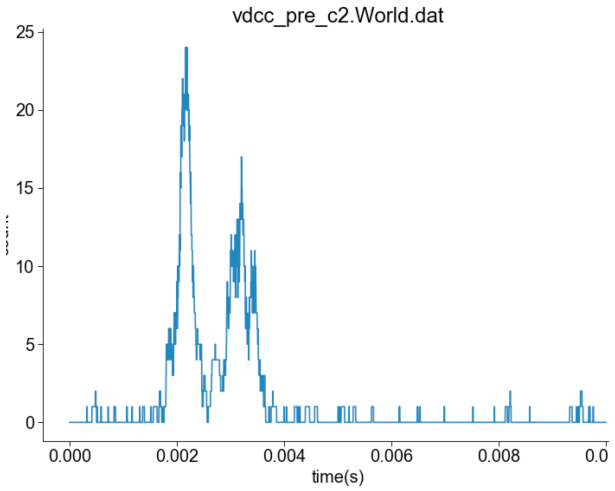
Voltage-Gated Calcium Channel

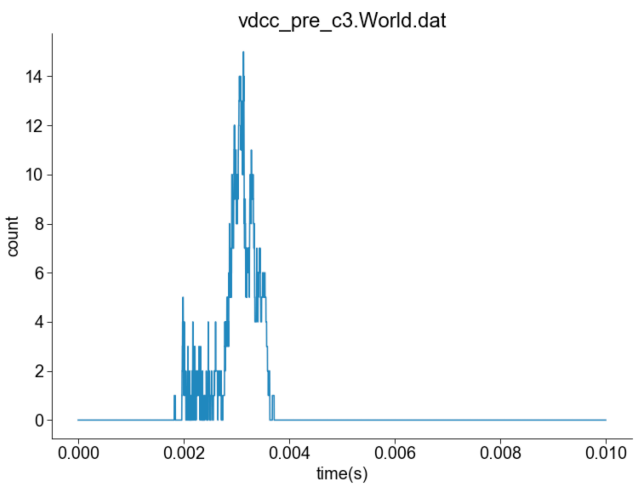




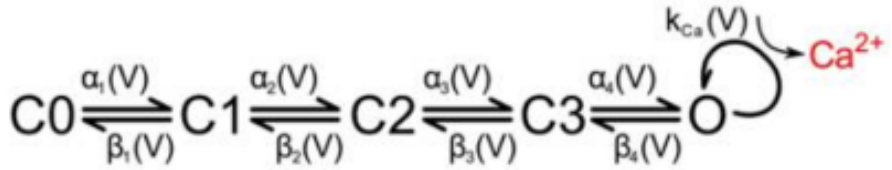


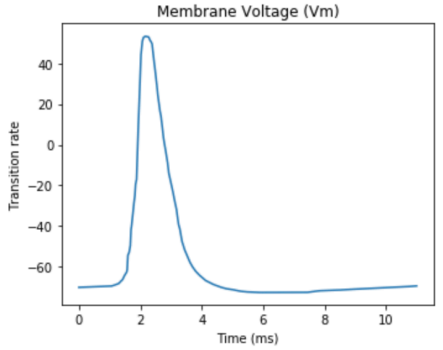


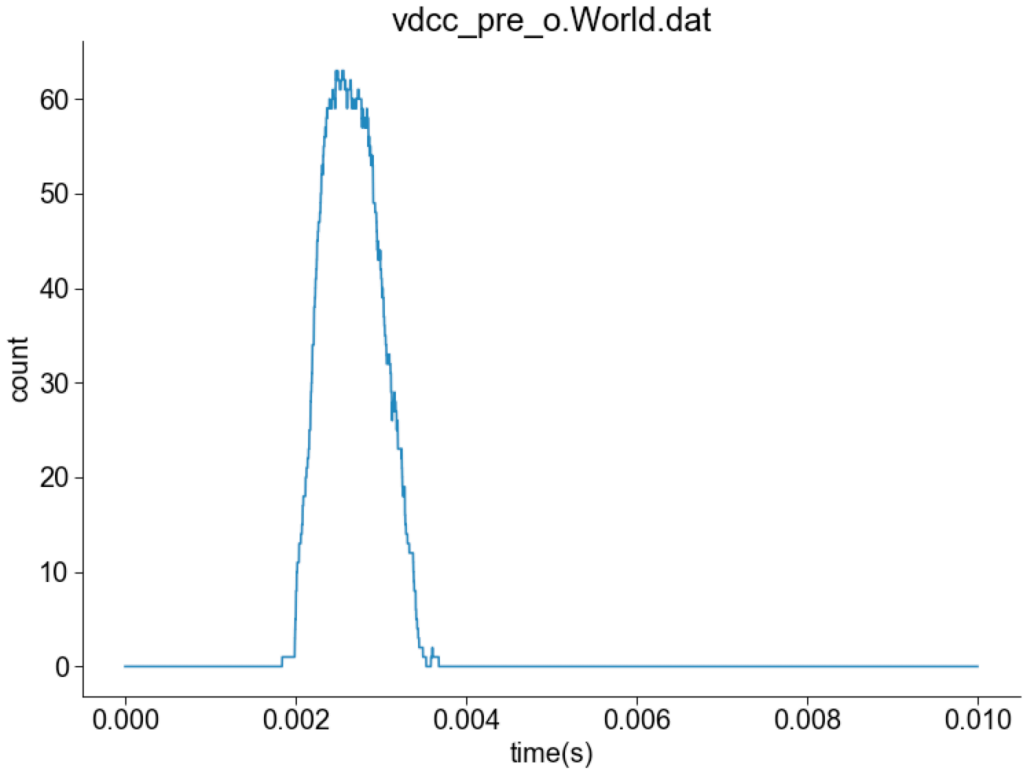


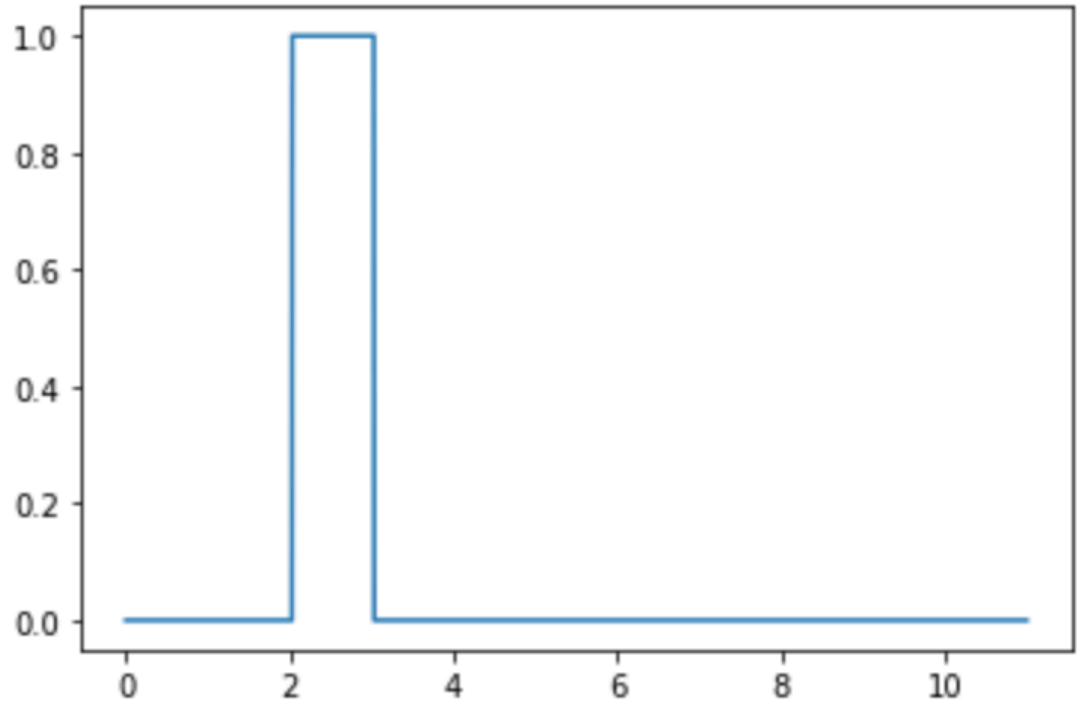


Voltage-Gated Calcium Channel

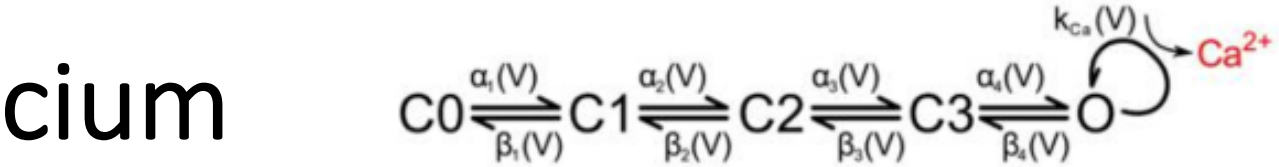




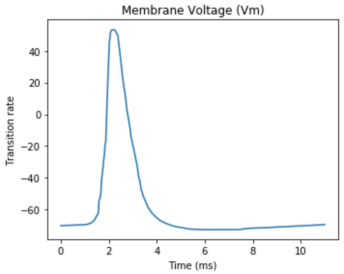


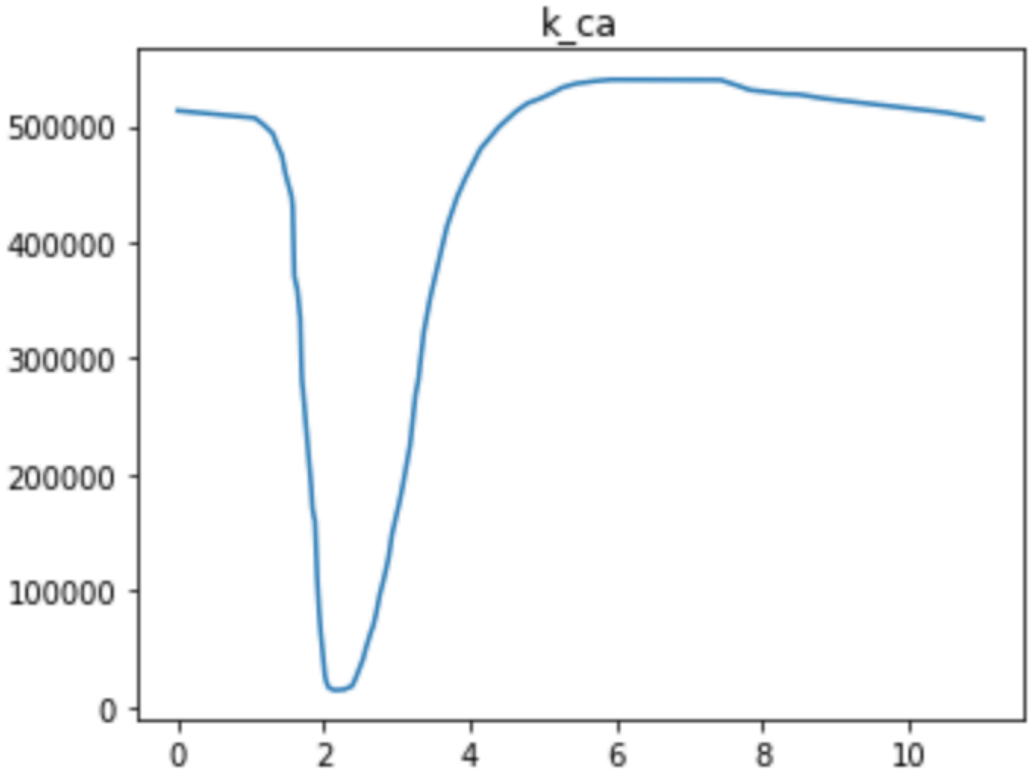


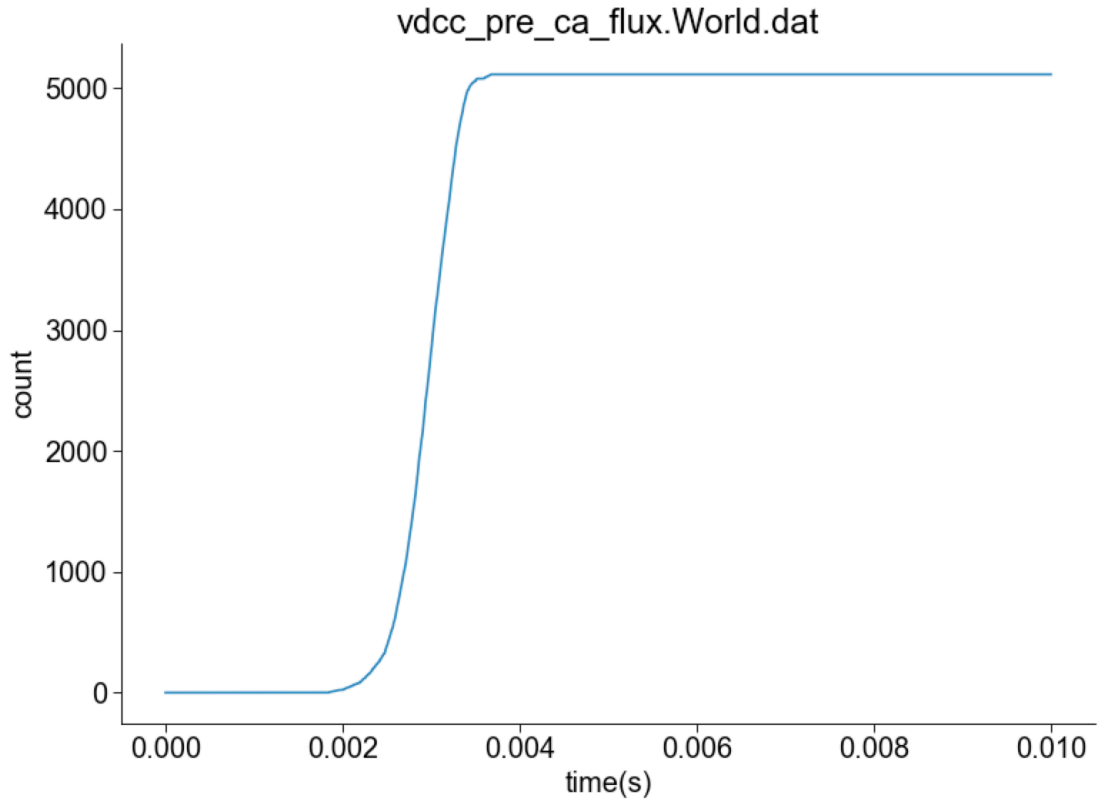
Calcium



$$VDCC_{open} \xrightarrow{k_{Ca}(V)} VDCC_{open} + Ca^{2+}$$

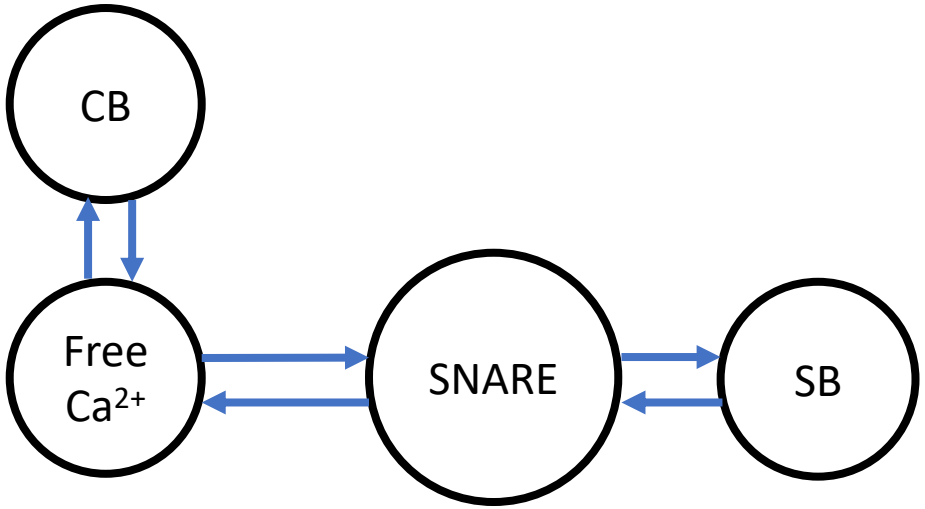






Calcium

calbindin bound



At the SNARE complex