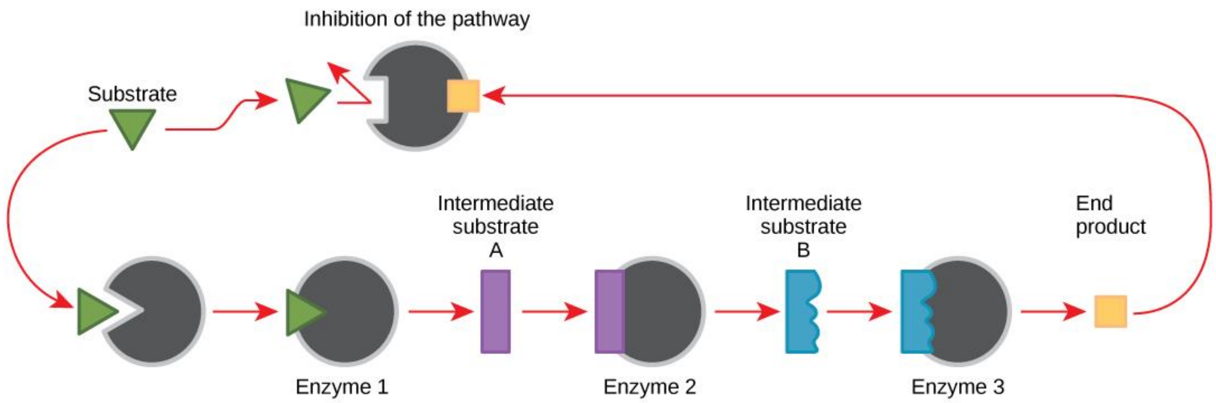
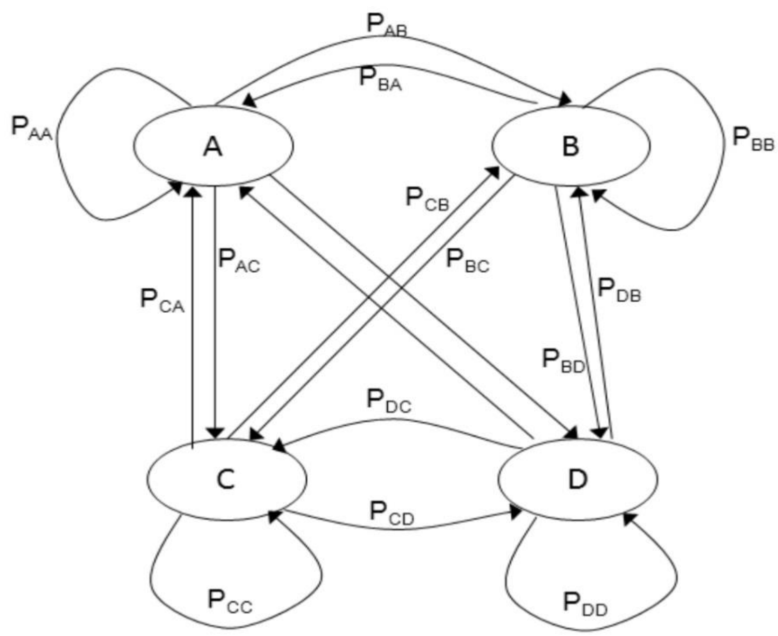


For simplicity assume that we are modelling the above reaction involving three enzymes.

The Markovian process with have 4 states: substrate, intermediate substrate A, intermediate substrate B, and the end product. This can be visualized below:



$$\mathbf{P}=\begin{bmatrix} p_{AA} & p_{AB} & p_{AC} & p_{AD} \\ p_{BA} & p_{BB} & p_{BC} & p_{BD} \\ p_{CA} & p_{CB} & p_{CC} & p_{CD} \\ p_{DA} & p_{DB} & p_{DC} & p_{DD} \end{bmatrix}$$

Where substrate = A, intermediate substrate A = B, intermediate substrate B = C, and end product = D.

P represents the transition matrix that will be used to calculate the probability distribution at any given time among the 4 states. *NOTE:* Paa represents the probability that some enzyme in state A will stay in state A after a given cycle (this is a discrete-time Markovian process), and Pca represents the probability that an enzyme will transfer from state A to state C after a given cycle.

The Markov Property.

For any positive integer n and possible states $i_0,\, i_1,\, \ldots,\, i_n$ of the random variables,

$$P(X_n = i_n \mid X_{n-1} = i_{n-1}) = P(X_n = i_n \mid X_0 = i_0,\, X_1 = i_1,\, \ldots,\, X_{n-1} = i_{n-1}).$$