# Affine Gap Penalties

$$M[i,j] = \text{match}(i,j) + \max \begin{cases} M[i-1,j-1] \\ X[i-1,j-1] \\ Y[i-1,j-1] \end{cases}$$

match between x and y

If previous alignment ends in match, this is a new gap

$$X[i,j] = \max \begin{cases} \text{gap\_start} + \text{gap\_extend} + M[i,j-1] \\ \text{gap\_extend} + X[i,j-1] \\ \text{gap\_start} + \text{gap\_extend} + Y[i,j-1] \end{cases}$$

gap in x

$$Y[i,j] = \max \begin{cases} \text{gap\_start} + \text{gap\_extend} + M[i-1,j] \\ \text{gap\_start} + \text{gap\_extend} + X[i-1,j] \\ \text{gap\_extend} + Y[i-1,j] \end{cases}$$

gap in y