

$$\Delta F = F - F^{(\text{ref})} = k_B T \left[-\log \frac{p_{\text{active}}(c)}{p_{\text{active}}(c^{(\text{ref})})} - \log \frac{R}{R^{(\text{ref})}} + \frac{\Delta \varepsilon_{RA} - \Delta \varepsilon_{RA}^{(\text{ref})}}{k_B T} \right]$$