Mean field analytical model.

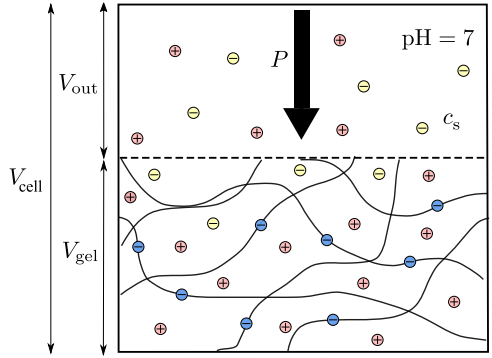

Figure 1: The hydrogel in equilibrium with a bath of aqueous solution

- Free energy of a hydrogel chain

$$F = F_{conf} + F_{int} + F_{ion}$$

- Conformational entropy

$$F_{\text{conf}} = \frac{3}{2}\frac{R^2/(b^2N) - 1}{1 - R^2/(b^2N^2)} - \frac{3}{2}\ln\left(\frac{R^2}{b^2N}\right)$$

- Steric interactions

$$F_{\text{int}} = \frac{N}{c_{\text{p}}}\left[(1 - c_{\text{p}})\ln(1 - c_{\text{p}}) - \chi c_{\text{p}}^2\right]$$

$$F_{ion} = \frac{N}{c_{\text{p}}}\sum_i \left(c_i^{in}\ln\frac{c_i^{in}}{c_i^{out}} + c_i^{out} - c_i^{in}\right)$$