

branes, it may be possible to push P_i to high levels. Therefore, at low ΔP_M values, flux increases with ΔP_M ; however, at high ΔP_M values, filtration flux drops as a result of the decrease in velocity. Figure 11.23 describes optimal values of ΔP_M resulting in the maximum UF or MF rate for various solute concentrations.

In the absence of gel formation, the filtration flux increases linearly with ΔP_M . Figure 11.24 depicts the variation of filtration flux (J) with ΔP_M . At low ΔP_M values, J increases linearly with ΔP_M because of the absence of gel polarization. However, at high ΔP_M , gel formation takes place, and gel resistance (R_G) increases with increasing ΔP_M , resulting in a constant filtration flux (J) over a large range of high ΔP_M values. At higher solute concentrations, flux levels off at lower ΔP_M values.

The *rejection coefficient* of an ultrafilter is defined as

$$R = \frac{C_B - C_F}{C_B} = 1 - \frac{C_F}{C_B} \quad (11.73)$$

where C_F is the concentration of the solute in the filtrate. When $C_F = 0$, only water passes through the filter and $R = 1$, which is complete solute rejection. If $C_F = C_B$, complete solute transfer to the filtrate takes place and $R = 0$ (no rejection). Usually, $0 < R < 1$ and is closer to 1 (i.e., $R \approx 0.95$ or 0.98). The value of R is a measure of the selectivity of the membrane for certain solutes. Selective separations of various compounds can be achieved using membranes with the right molecular-weight cutoff. Figure 11.25 depicts the variation of the rejection coefficient (R) with MW of the solute. For $MW > 10^5$ and $MW < 10^3$, $R = 1$ and $R = 0$, respectively. That is, the membrane allows complete passage

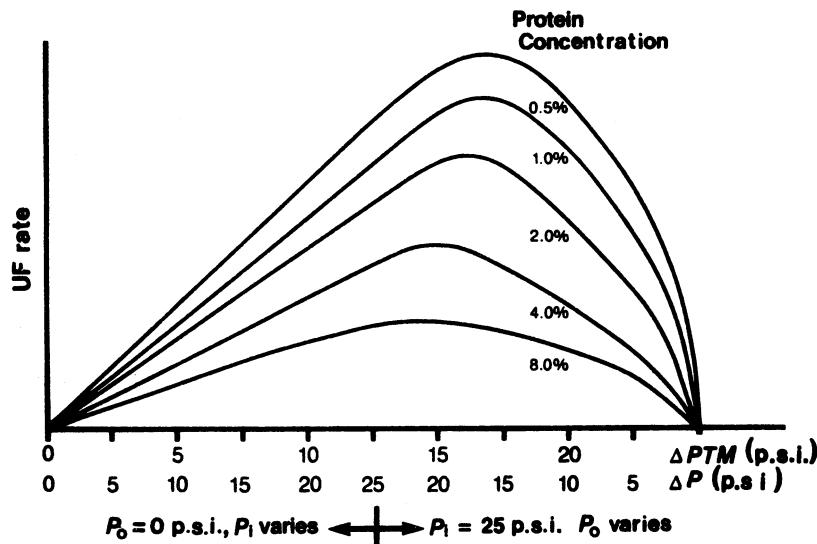


Figure 11.23. Filtration flux optimized as a function of transmembrane pressure at varying solute concentrations and fixed maximum inlet pressure. (With permission, from R. S. Tutunjian, in M. Moo-Young, ed., *Comprehensive Biotechnology*, Vol. 2, Elsevier Science, London, 1985.)