

$$= [\text{AH}^+]_{\text{w}}(V_{\text{w}} + a \cdot V_{\text{w}} + a \cdot P \cdot V_{\text{L}})$$

$$[\text{AH}^+]_{\text{w}} = \{(V_{\text{w}} + V_{\text{L}})[\text{A}]_{\text{T}}\} / \{V_{\text{w}} + a \cdot V_{\text{w}} + a \cdot P \cdot V_{\text{L}}\} \quad (9)$$

From equations 7 and 9,

$$[\text{A}]_{\text{L}} = \frac{a \cdot P(V_{\text{w}} + V_{\text{L}})}{V_{\text{w}} + a(V_{\text{w}} + P V_{\text{L}})} [\text{A}]_{\text{T}} \quad (10)$$

According to the Van't Hoff model, the depression of the phase transition temperature ($-\Delta T_{\text{c}}$) is proportional to the molal concentration of solute $[\text{A}]_{\text{L}}$ in the solvent DPL.

$$-\Delta T_{\text{c}} = k'[\text{A}]_{\text{L}}' \quad (11)$$

The density of DPL is close to unity and show a value of 1.0305. When the volume of the solute is much smaller than the solvent, equation 11 becomes

$$-\Delta T_{\text{c}} = k[\text{A}]_{\text{L}} \quad (12)$$

From equations 10 and 12, we obtain

$$-\Delta T_{\text{c}} = \frac{a \cdot P(1 + V_{\text{L}}/V_{\text{w}})}{1 + a(1 + P V_{\text{L}}/V_{\text{w}})} k[\text{A}]_{\text{T}} \quad (13)$$

When $p\text{H} - pK_{\text{a}} \gg 2$, $[\text{AH}^+]_{\text{w}}$ becomes negligible in equation 8

and equation 13 reduces to

$$-\Delta T_{\text{c}} = \frac{P(1 + V_{\text{L}}/V_{\text{w}})}{1 + P \cdot V_{\text{L}}/V_{\text{w}}} k[\text{A}]_{\text{T}} \quad (14)$$

By rearranging,

$$\frac{[\text{A}]_{\text{T}}}{-\Delta T_{\text{c}}} = \frac{1}{k} \left(\frac{1}{P} + \frac{V_{\text{L}}}{V_{\text{w}}} \right) / \left(1 + \frac{V_{\text{L}}}{V_{\text{w}}} \right) \quad (15)$$

In the present experiment, $V_{\text{L}}/V_{\text{w}} \ll 1$. For example, the highest concentration of DPL was 5 mM and $V_{\text{L}}/V_{\text{w}} = 3.562 \times 10^{-3}$. Therefore,

$$\frac{[\text{A}]_{\text{T}}}{-\Delta T_{\text{c}}} = \frac{1}{k} \left(\frac{1}{P} + \frac{V_{\text{L}}}{V_{\text{w}}} \right) \quad (16)$$

By plotting $V_{\text{L}}/V_{\text{w}}$ against $[\text{A}]_{\text{T}}/-\Delta T_{\text{c}}$, a straight line should be obtained, and the values for k and P are obtained from the slope and the intercept of the straight line.

From equations 1 and 14, the phase transition temperature, T_{c} , at a $p\text{H}$ value of x in the presence of local anesthetics can be computed by,

$$T_{\text{c}} = 41.29 - 0.026x - k \frac{P(1 + V_{\text{L}}/V_{\text{w}})10^{x-pK_{\text{a}}}}{1 + (1 + P \cdot V_{\text{L}}/V_{\text{w}})10^{x-pK_{\text{a}}}} [\text{A}]_{\text{T}} \quad (17)$$

Erratum

An error appeared in the article "Urinary Excretion of Morphine during and after Valvular and Coronary-artery Surgery" in the March 1977 issue. The third and second lines from the bottom of page 167 in the left hand column now read ". . . while those of patients with mitral-valve and aortic-valve disease were extubated 14.6 ± 3.1 and 20.9 ± 6.3 hours postoperatively." They should read ". . . while those of patients with aortic-valve and mitral-valve disease were extubated 14.6 ± 3.1 and 20.9 ± 6.3 hours postoperatively."