hyponatremia ("water intoxication")

1. serum osmolality decreases
2. cells try to maintain gradients by:
   i. Na+ leaves cell
   ii. Water diffuses into cell
3. fluid in lungs, swelling of brain tissue, coma, death…

**Equilibrium Potential**

Nernst Equation (in V):

\[
E_x = \frac{0.058}{z} \log \frac{[X]_{\text{out}}}{[X]_{\text{in}}}
\]

Goldman Equation (in V):

\[
V_m = 0.058 \log \frac{P_K [K^+]_{\text{out}} + P_{Na} [Na^+]_{\text{out}} + P_{Cl} [Cl^-]_{\text{in}}}{P_K [K^+]_{\text{in}} + P_{Na} [Na^+]_{\text{in}} + P_{Cl} [Cl^-]_{\text{out}}}
\]

- Calculate for a given type of ion using the simplified Nernst Equation:

\[
E_x = \frac{0.058}{z} \log \frac{[X]_{\text{out}}}{[X]_{\text{in}}}
\]

\[
E_{Na^+} = \frac{0.058}{1} \log \frac{[Na^+]_{\text{out}}}{[Na^+]_{\text{in}}}
\]

\[
E_{Na^+} = \frac{0.058}{1} \log \frac{120 \text{ mM}}{10 \text{ mM}} = 0.63 \text{ V} = 63 \text{ mV}
\]

remember Equilibrium potential (\(E_x\) in mV) when \([X] \text{ gradient = electrical gradient}\)