

Course 565 / 665 Lecturer prof. Cavagnero
 Day 4 12 04 Date 9:55 am
 Notes Taken By J. Hong Total Number of Pages

Dependence of G on T

$$G = H - TS \quad H = G + TS \quad \text{recall.} \quad S = -\left(\frac{\partial G}{\partial T}\right)_P$$

at constant P : $H = G - T\left(\frac{\partial G}{\partial T}\right)_P$

$$\left(\frac{\partial(G/T)}{\partial T}\right)_P = \frac{1}{T}\left(\frac{\partial G}{\partial T}\right)_P - \frac{G}{T^2} = \frac{-1}{T^2}\left(G - T\left(\frac{\partial G}{\partial T}\right)_P\right)$$

$$\left(\frac{\partial(G/T)}{\partial T}\right)_P = -\frac{H}{T^2} \quad \text{Gibbs-Helmholtz eqn.}$$

For a process,

$$S_A = -\left(\frac{\partial G_A}{\partial T}\right)_P, \quad S_B = -\left(\frac{\partial G_B}{\partial T}\right)_P$$

$$\Delta S = S_B - S_A; \quad \Delta G = G_B - G_A$$

$$\Delta S = -\left(\frac{\partial \Delta G}{\partial T}\right)_P$$

and $\left(\frac{\partial(\Delta G/T)}{\partial T}\right)_P = -\frac{\Delta H}{T^2}$

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H, S are T -dependent ~~are~~ for proteins...

$$G(T) = H(T) - TS(T)$$

recall. $C_p = \left(\frac{\partial H}{\partial T}\right)_P \xrightarrow{\text{const. } P} \int_{T_R}^T C_p dT = C_p \int_{T_R}^T dT = \int_{H_{T_R}}^{H_T} dH$

$$(H_T - H_{T_R}) = C_p (T - T_R)$$

$$dS = \frac{dQ}{T} \underset{\text{const. } P}{=} \frac{dH}{T}$$

$$C_p = \left(\frac{\partial H}{\partial T}\right)_P = T \left(\frac{\partial S}{\partial T}\right)_P \Rightarrow \frac{C_p}{T} = \left(\frac{\partial S}{\partial T}\right)_P$$

$$C_p \int_{T_R}^T \frac{dT}{T} = \int_{S_{T_R}}^{S_T} dS \Rightarrow S_T - S_{T_R} = C_p \ln \frac{T}{T_R}$$

$$G(T) = H(T) - TS(T) = \cancel{H(T)} - TS$$

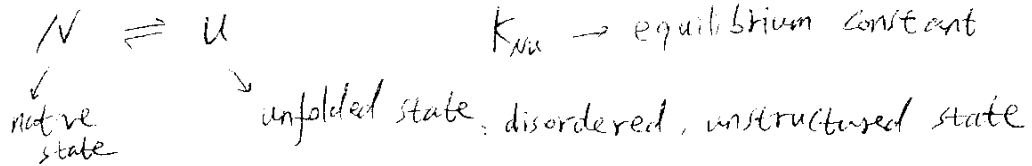
$$= C_p (T - T_R) + H_R - T \left[C_p \ln \frac{T}{T_R} + S_{T_R} \right]$$

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Protein stability



For protein folding:

$$G \rightarrow \Delta G_{nu}$$

$$C_p \rightarrow \Delta C_{p,nu} \quad S_{T,R} \rightarrow \Delta S_{R,nu}$$

$$H_{T,R} \Rightarrow \Delta H_{R,nu}$$