Water Vapor Condensation and the Thermal Set Point in Interacting Biological Systems: An Unacknowledged Link

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We have examined data from 31 interacting biological systems, 35 sequence-specific dipeptide hydrophobic interactions, and micellization in six surfactants and found a unique linear third order fitting function, $\Delta G°(T) = \alpha + \beta T^2 + \gamma T^3$, that applies the basic laws of thermodynamics to all interacting biological systems. Each interacting biological system will have a thermal set point, (T_S), where the bound unavailable energy $T\Delta S^o = 0$. At this point, the maximum work can be accomplished and the system is at its most stable. We were the first to report that, for water vapor condensation, the thermal set point falls at 260 K and the compensatory temperatures, T_h and T_m (or T_{cond}), are found to be 30 K and 380 K. It would appear that the thermal set point of any interacting biological system must fall between the limits of 30 K and 380 K. Only between these limits, where $\Delta G°(T) = 0$, is the net chemical driving force favorable for biological interactions to occur. Each such interacting system confirms the existence of a thermodynamic molecular switch wherein a change of sign in $\Delta Cp^o(T)$ leads to a true negative minimum in the Gibbs free energy change of reaction, and determines the behavior of other thermodynamic functions. Application of the universal linear third order fitting function (or general linear T^3 model) allows one to evaluate how the thermal set point of any interacting biological system is established and maintained on a molecular level. It is essential to any effective analysis of the thermodynamic processes underlying all biological interactions.

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