# Reply to Comment on "Distribution of Temperature in Globular Molecules, Cells, or Droplets in Temperature-Jump, Sound Velocity, and Pulsed LASER Experiments"

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While we agree with the conclusions of this paper,[1] we do not agree with the way in which the term pseudoadiabatic is used. While eq 1 estimates the instantaneous temperature distribution, a measurement such as that of the compressibility as determined from sound velocity measurement gives the ensemble average property over all the molecules in question, not the instantaneous value. On strictly thermodynamic grounds, instantaneous departures from equilibrium do not necessarily add up to nonequilibrium conditions. An important question is the time taken to make the measurement. If the heat flows in question are complete within a small fraction of the period of the ultrasound wave and the condition for adiabaticity given in ref 2 holds, then the measurement of compressibility may accurately be termed adiabatic. If the heat flows occur over significant portions of the period of the wave and are of sufficient magnitude, then the terms pseudoadiabatic or isothermal are appropriate. In the case of T-jump phenomenon, an ultrasound compressibility determination is adiabatic. Thus, it is not correct to say that the compressibility determined for a protein in its "natural" state is pseudoadiabatic when the method of Pinfield and Povey[2] is used.

However, the protein folding phenomenon is capable of transferring acoustic energy between cycles since its time constants (500 $\mu$s to 100 ms) are much greater than the period of an ultrasound wave (50 $\mu$s to 5 ns). This phenomenon is associated with changes in the protein tertiary structure that occur during denaturation for example. In this case it is correct to characterize the compressibility determined from ultrasound velocity as pseudoadiabatic, even when corrected for thermal scattering. A paper is in preparation in which new data will be presented supporting this view.

## References and Notes

(1) Nölting, B. *J. Phys. Chem. B* **1998**, *102*, 7506−7509.

(2) Pinfield, V. J.; Povey, M. J. W. *J. Phys. Chem. B* **1997**, *101*, 1110−1112.

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