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Thermal transport and structural transitions in biological molecules

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Structural transitions appear everywhere: proteins fold, nanotubes collapse, DNA denatures, ice melts, and so on. In biology, these transitions play a role in processes such as transcription and also determine protein function. Yet, at the same time, they give examples of highly *nonlinear processes* that are challenging to model and understand. I will discuss one such transition - the denaturation of DNA, where its double stranded form unravels into two single strands. There are many models that can describe certain aspects of this transition equally well, such as the fraction of bound base pairs versus temperature. I will show, however, that two well-known models yield drastically different predictions for thermal transport. The latter can then be used to "peek inside" DNA and understand what is happening during the denaturation transition. Thus, on the one hand, thermal transport gives a method to probe structural transitions in biological molecules and other materials. On the other hand, molecular systems and materials with nonlinear structural transitions also give opportunities for developing novel thermal devices.

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