Heating up DNA ...

DNA is a highly dynamic molecule in which the base pairs, which carry the genetic information, fluctuate widely. This can lead to a temporary breaking of a base pair and a local separation of the two strands. Local openings of the double helix - important for ordinary biological function - may be activated by heating. At a certain temperature, the openings extend over the full molecule and result in a complete separation of the two strands. This remarkable transition is called the “melting” of DNA. It was observed soon after the discovery of the double helix and - in spite of significant research over the last fifty years - still presents significant challenges. A recent study using neutron diffraction techniques - similar in spirit to the x-rays used in the original discovery of the double helix - was successful in providing some essential missing structural information. Results suggest that, even at temperatures slightly above melting, large pieces of the double helix extending over approximately 100 base pairs remain intact.
The neutron scattering experiment was performed at the Laue-Langevin institute in Grenoble by a multinational, multidisciplinary team which included TPCI's Nikos Theodorakopoulos, a condensed matter theorist. The results, reported in a recent issue of Physical Review Letters, can be interpreted in terms of current theoretical ideas about the mesoscopic structure and dynamics of DNA; according to them, the double helix behaves collectively as a chain of coupled nonlinear oscillators. As the temperature is raised, the oscillators' vibrational frequencies become suddenly soft and the chain "melts".

Journal Reference:

Andrew Wildes, Nikos Theodorakopoulos, Jessica Valle-Orero, Santiago Cuesta-López, Jean-Luc Garden, Michel Peyrard.
Thermal Denaturation of DNA Studied with Neutron Scattering,
Physical Review Letters, 2011; 106 (4)
DOI: 10.1103/PhysRevLett.106.048101

See also:
story in ScienceDaily: http://www.sciencedaily.com/releases/2011/01/110124120848.htm