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Abstract for an Invited Paper
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High Resolution Field Cycling NMR in Biopolymers in Solution: Current and Potential Applications.

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I have been exploring the feasibility and utility of performing high resolution relaxation and cross-relaxation (NOE) in an unmodified shared commercial NMR instrument (PNAS 101:17066-17071) in collaboration with Mary Roberts of Boston College and Elan Eisenmesser of Brandeis. We can move a sample from 11.7 T to low (fringe) field 40- 80 cm above the commercial probe, and back, in 0.3 to 0.5 sec. I am making the system move the sample more gently, to avoid protein denaturation, using a stepping-motor timing-belt linear-motor. I will review our initial papers on a DNA octamer, and phospholipid vesicles using phosphorus NMR. We emphasize phosphorus, in part, because relaxation studies over a wide range can make behavior of this biologically important species more readily interpretable than at high field alone. Then I will discuss a range of biochemical experiments, not yet done, using the full capability of our commercial instrument for multidimensional preparation and detection before and after field-cycling, and utilizing other nuclear species (H, C, and N). These involve especially use of electron-paramagnetic species and/or studies of small molecules in fast binding exchange with larger ones, and/or increased hetero-NOE effects at low field, to get new information on dynamics and structural preferences. Predictably we have found that, once we start to work on a specific biopolymer problem, we think of more things to do than we expected at first.