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Multiple Quantum Relaxation Probes of Protein Dynamics on Multiple Timescales RANAJEET GHOSE, City College of New York — Several effects may lead to significant differences between the relaxation rates of zero-quantum coherences (ZQC) and double-quantum coherences (DQC) (collectively known as multiple-quantum coherences) generated between a pair of spin 1/2 nuclei in solution. These include the interference between the anisotropic chemical shifts of the two nuclei participating in formation of the ZQC or DQC, the individual dipolar interactions of each of the two nuclei with the same proton, and the slow modulation of the isotropic chemical shifts of the two nuclei due to conformational exchange. Motional events that occur on a timescale much faster than the rotational correlation time (picosecond-nanosecond) influence the first two effects, while the third results from processes that occur on a far slower timescale (microsecond-millisecond). An analysis of the differential relaxation of ZQC and DQC is thus informative about dynamics on the fast as well as the slow timescales. We present here a set of NMR experiments that measure the differential relaxation of ZQC and DQC involving several backbone and sidechain nuclei in proteins. These measurements provide significant insight into the complex dynamic modes that exist in the protein backbone and sidechains. A detailed understanding of these dynamic modes may provide clues into the role of dynamics in modulating protein function.

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