Title
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Authors
ERIKSSON, S
TETIN, S
VOSS, E
et al.

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**Abstract**

Many rapid reactions in biology, and especially in protein folding, have been studied with stopped-flow (or concentration jump) techniques. We have developed an instrument that combines the millisecond stopped-flow mixing capabilities of a commercial unit (Biologic) with the picosecond resolution of fluorescence from a laser-based, frequency-domain fluorometer. The advantages of frequency domain fluorescence lifetime detection of millisecond reaction kinetics include: 1) utilization of the full fluorescence signal (sensitivity equivalent to steady-state measurements); 2) a frequency range suitable for resolution of complex lifetime schemes; 3) at a given frequency, two independent measurements of the lifetime (phase and modulation) are obtained. Our hybrid mixing instrument offers a variable time base, single or multiple shot averaging, facile frequency selection, a variety of detection modalities (transmission; fluorescence intensity, polarization, lifetime or anisotropy). To test its operation in the millisecond regime, we examined the ligand binding of ANS to albumin and fluorescein to IgG 4-4-20. This work was performed at the Laboratory for Fluorescence Dynamics (LFD) at the University of Illinois at Urbana-Champaign (UIUC). The LFD is supported by the NIH (RR03155) and by UIUC.