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Exploring Structure of Human Chromosomes Using Fluorescence Lifetime Imaging

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Abstract : Chromatin condensation is maintained by DNA-based proteins and some divalent cations (Mg^{2+}, Ca^{2+}, etc.). Condensation process during cell division maintains structural and functional organizations of chromosomes by transferring genetic information correctly to daughter cells. Fluorescence Lifetime Imaging (FLIM) technique measures the fluorescence decay of fixed human chromosomes by calculating the lifetime of fluorophores at a pixel x of the arrival of each photon as a function of time delay t, following excitation with a laser pulse. Fixed metaphase human chromosomes were labelled with DNA-binding dye, DAPI and later DAPI fluorescence lifetime measured using multiphoton microscopy. 5 out of 23 pairs of human chromosomes shown shorter lifetime at the centromere region, differentiating proportion of compaction along the length of chromosomes. Different lifetime was observed in a condensed and de-condensed chromosome. It clearly indicates the involvement of divalent cations in the process of condensation.

Keywords : divalent cations, FLIM (Fluorescence Lifetime Imaging), human chromosomes, multiphoton microscopy
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