

X-ray Microscopy and Chromosome Research

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Observation of thick biological specimens in their natural aqueous environment has been one of the major subjects for X-ray microscopy (XRM). Among those specimens, eukaryotic chromosome is one of the most attractive ones for XRM for the following reasons: a) It has characteristic hierarchical structures from DNA to a chromosome with the sizes ranging from nanometer to micrometer level; b) some of the intermediate structures have actually been still in controversy even by using current high resolution imaging methods such as electron microscopy and atomic force microscopy; and c) XRM is an imaging method to obtain transmitted images of specimens at the resolution-range compatible with the most size levels of hierarchical structures in a chromosome. Thus, X-ray microscopy is expected to have potential to give some new information on the architecture of a chromosome. Numerous attempts to visualize both dry and hydrated chromosomes from various organisms have been made using various types of XRM. However, most of them have not been necessarily attempted to clarify the organizing processes from nucleosomes to a chromosome. As a result, there have been few discoveries to add to the knowledge of the chromosome structures obtained mainly by electron microscopy for understanding the architecture of a chromosome despite that the resolution of XRM has already been accomplished to the level of several ten nanometers. Based on the review of the past studies on chromosomes using XRM including our works, we will discuss the problems of X-ray microscopy for the study of chromosome structures and to propose some approaches to solve the problems.