Photoreactivity of 5-iodouracil-containing DNA-Sso7d complex

Takanori Oyoshi¹, Hiroshi Sugiyama¹ and Andrew H.-J. Wang²
¹Division of Biofunctional Molecules, Institute of Biomaterials and Bioengineering, Tokyo Med. and Den. University, Tokyo 101-0062, Japan and ²Department of Cell and Structural Biology, University of Illinois at Urbana-Champaign, IL 61801, USA

ABSTRACT
X-ray structure of DNA-Sso7d complex indicated that binding of this protein causes sharp DNA bending. In order to examine whether this protein also causes DNA bending in solution, photoreactions of 5'-substituted DNA in the presence and the absence of Sso7d protein were investigated. It was found that the unusual intrastrand hydrogen abstraction at methyl of adjacent thymine occurred efficiently at the observed bending site of crystal structure.

INTRODUCTION
DNA local conformations are believed to play an important biological role in processes such as gene expression.¹ Since several structures of DNA-protein complex have been solved by X-ray or NMR, DNA bending induced by transcription factors is one of the most important local conformations in DNA.² However, the precise biological functions of bent DNA have not been fully understood presumably due to lack of an appropriate detection method in a living cell system. Utilization of photochemical reaction of iodouracil (5'-U)-containing DNA which directly reflects the DNA local conformations would be promising. Recently, the crystal structure of the complex composed of DNA octamer and the hyperthermophile chromosomal protein Sso7d has been solved.³ The structure reveals that Sso7d binds in minor groove, causing a sharp kinking (60°) which results from the intercalation of specific hydrophobic side chains into base pair.

RESULTS AND DISCUSSION
The inspection of X-ray structure of the Sso7d-DNA complex suggest that 5'-U in this complex would have a unique photoreactivity due to the sharp kinking at T-T base pair compared with B-form DNA.⁴ Therefore, the photoirradiations of 5'-U-substituted DNA in the presence and the absence of Sso7d were examined. In the absence of Sso7d, the photoirradiation of d(GTAAT₅UAC)₂ provided C₁' and C₂' oxidation products. In the presence of Sso7d, the formation of C₁' and C₂' oxidation products were suppressed and the formations of three new products (1-3) were observed. The products 1 and 2 were found to be formyluracil-containing octamer and hydroxymethyl-containing octamer, respectively, those are resulted from hydrogen abstraction of T₅-Me by uracil-5-yl radical. To the best of our knowledge this is the first example of hydrogen abstraction of base by uracil-5-yl radical. The product 3 was found to be racemic mixture of 2' hydroxylated products which are resulted from C₂' hydrogen abstraction. Inspection of X-ray structure suggests that hydrogen of the T₅-Me and C₂'β are in close proximity to uracil-yl radical whereas C₁'- and C₂'α-hydrogen are far from uracil-yl radical. It is concluded that the unusual intrastrand hydrogen abstraction of T₅-Me by uracil-5-yl radical occurred efficiently at the observed bending site of crystal structure.
REFERENCES


