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Selected Publication

Bo Zhou, Changdong Liu, Zhiwen Xu, and Guang Zhu* (2012) Structural basis for homeodomain recognition by the cell cycle regulator Geminin. *Proc. Natl. Acad. Sci. USA*. 109 23 8931-8936

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Research Aims and Interests

Molecular Mechanism of Human DNA Replication and Related Diseases

Proper organ development requires the precise regulation of both the total number of cells (cell proliferation) and the types of cells (cell differentiation). During cell proliferation, Cdt1 mediated loading of DNA helicase (Mcm2-7) to replication origins is required for DNA replication. And Hox gene activation is necessary for embryonic cell differentiation. It has been shown that these two processes are linked through the cell cycle-regulator Geminin and the homeodomain-containing transcription factors Hox. Many DNA viruses replicate their DNA in host cells by exploiting the human DNA replication system. We are interested in determining the detailed structure-functions of proteins and nucleic acids that play roles in human DNA replication initiation and related diseases.

By applying biochemical and biophysical techniques, especially, nuclear magnetic resonance (NMR) spectroscopy, we have solved the solution structures of Geminin-Hox, Orc6-DNA, G-quadruplex and Cdt1-Mcm6 complexes, and elucidated the structure-functions of these proteins and nucleic acids in human DNA replication initiation. In addition, we have found that histone H4-K20 methyltransferase SET8 is a new cell-cycle regulator and plays an important role in the developmental program of metazoans. In future, we will continue to conduct research in this direction.