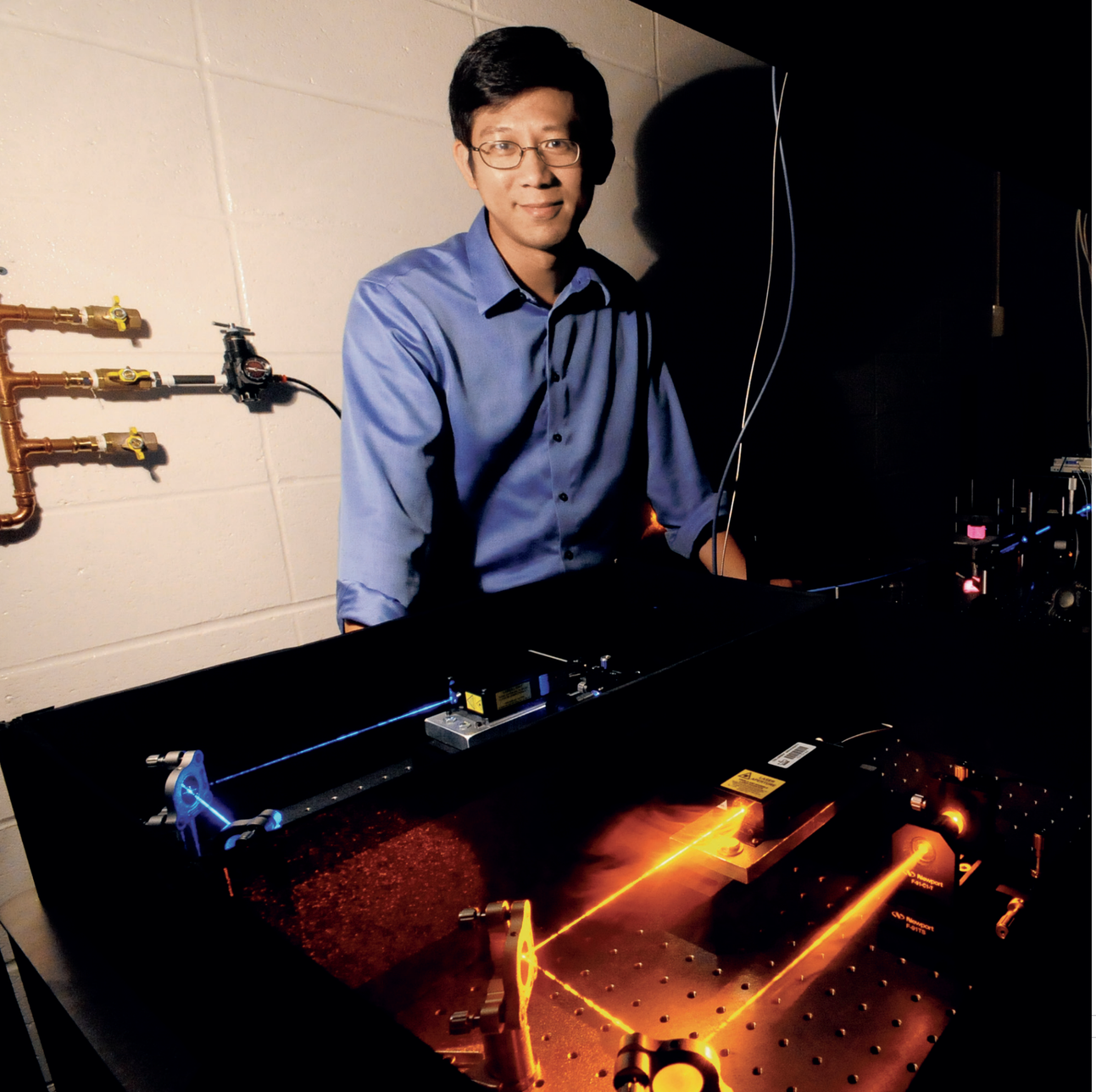

Seeing Proteins at Work

JUNG-CHI LIAO

Assistant Professor of
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Nearly three million people in the United States are infected each year with the hepatitis C virus, the major cause of liver cancer. Worldwide, roughly three percent of the population is infected. Jung-Chi Liao is making progress toward the effort to find an effective treatment for the virus. He has focused his research on exploring the DNA helicase—or enzymes—of the hepatitis C virus.

Liao's work is related to the recent discovery of a peptide that inhibits the functioning of the hepatitis C virus enzyme NS3 helicase, providing new insights. Specifically, several hot-spot residues have been identified to convert ATP energy to separate the virus's DNA. Liao is currently conducting comparative studies among different helicases to better understand the variations of coupling mechanisms.

Based on his discovery of dynamical coupling mechanisms and the resulting different conformations, pharmaceutical companies may now be able to identify better drug candidates to inhibit ATP binding sites of hepatitis C virus NS3 helicase. In 2007, Liao was invited by InterMune Inc., one of the major biotechnology companies focusing on drug development for hepatitis C virus infections, to give a seminar presentation of this work.

Liao, who heads Columbia's Liao Research Group, joined Columbia Engineering in 2008 after posts as a research associate in the Department of Bioengineering at Stanford University and as a postdoctoral fellow in molecular and cell biology at the University of California, Berkeley. He says his lab integrates the knowledge of theoretical modeling, molecular and cell biology, and advanced imaging techniques to understand how single molecules play roles in cellular functions as well as the underlying protein structure-function relationship. Their research areas include nanoscale optics, molecular motors and Induced Pluripotent Stem (iPS) Cell Reprogramming.

"Our lab is interested in shedding light on the molecular pathways involved in this process of reprogramming," said Liao. "We hope to identify important transcription factors and signaling pathways crucial to the process to help better understand the specifics of reprogramming and to better control it for clinical use. In an innovative interdisciplinary approach of combining mechanical engineering with biology, we are using high-resolution microscopy to shed light on this event by tracking single molecules."

His research interests are concentrated on how mechanical forces play roles in molecules and cells, using both computational and experimental methods to study molecular motors and related cellular functions. "The focus of my work is to integrate computational modeling and simulation with biological imaging techniques to study dynamics of molecular motors," he said.

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