

**MOLECULAR MEDICINE PROGRAM, SICKKIDS  
&  
BHT ORGANIZATION SPECIAL SEMINAR**

**JOHN SPENCE, FRS**

**Richard Snell Professor of Physics and Regents Professor,  
Arizona State University**

**Director of Science,**

**National Science Foundation BioXFEL Science and Technology Center**

***MOLECULAR MOVIES FROM X-RAY LASERS :  
VIRUSES, GPCRs, ENZYMES, RNA, PHOTOSYNTHESIS***

I'll summarize the latest findings from the time-resolved diffraction studies we have conducted within the NSF's BioXFEL seven-campus consortium using the world's five X-ray free electron lasers. By out-running radiation damage, the intense femtosecond XFEL hard-X-ray pulses avoid the need to freeze samples (and so immobilise them), allowing us to image molecular dynamics under near-physiological conditions. We study both light-sensitive proteins and chemical reactions. For Photoactive Yellow protein we have obtained a movie of a protein wriggling as it absorbs a photon, as for the first event in human vision. By using micron (or sub-micron) crystals we are able to rapidly diffuse a substrate into an enzyme crystal and then take X-ray Bragg snapshots during the enzyme catalysis with atomic resolution. For single-particle studies we can operate without the need for crystallization, injecting one virus per shot across the pulsed beam. I'll also describe the compact XFEL under construction at ASU. For reviews, see Spence IUCrJ 4, p.322 (2017) and Nanni et al Phys Rev Accel. 21, 014401 (2018).

**HOSTS: DRs. JEAN-PHILIPPE JULIEN & JEFF LEE**

**THURSDAY OCTOBER 31, 2019**

**2:00-3:00 PM**

**MSB 2172 (MEDICAL SCIENCES BUILDING)**

**UNIVERSITY OF TORONTO, 1 KING'S COLLEGE CIRCLE**



**Molecular  
Medicine**

