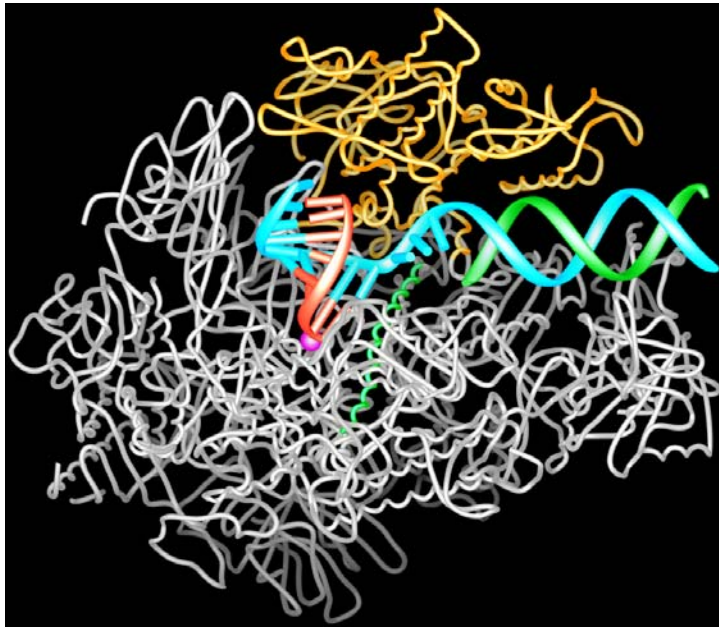
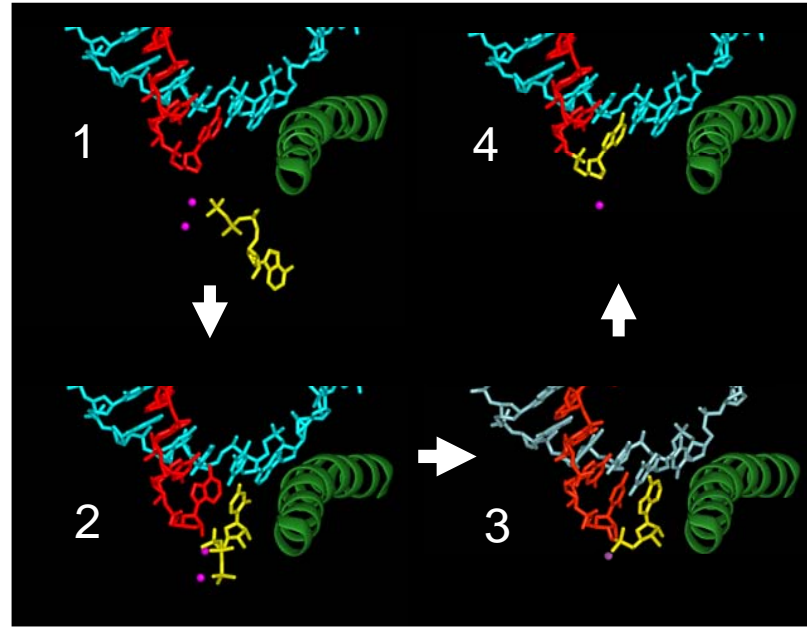




Roger Kornberg wins the 2006 Nobel Prize in Chemistry



RNA Polymerase (grey and orange) unwinds genetic blueprint DNA (blue and green), makes RNA copy (red) from template DNA strand (blue)



1) Nucleotides (yellow) enter Polymerase; 2) rotate into the active site; 3) chemically react matching the template DNA (blue); 4) growing the RNA strand (red)

- RNA Polymerase is a large multi-protein molecular transcription machine
- Genetic information encoded in DNA is transcribed into messenger RNA
- Transcription is essential to all life, cellular metabolism
- Extremely high fidelity of RNA (only 1 error in 1,000,000 nucleotides)
- Mistakes can lead to cancer and other diseases
- Recent x-ray data collected at SSRL using high-throughput screening robotics
- 3-D structural models reveal the transcription process at the atomic level

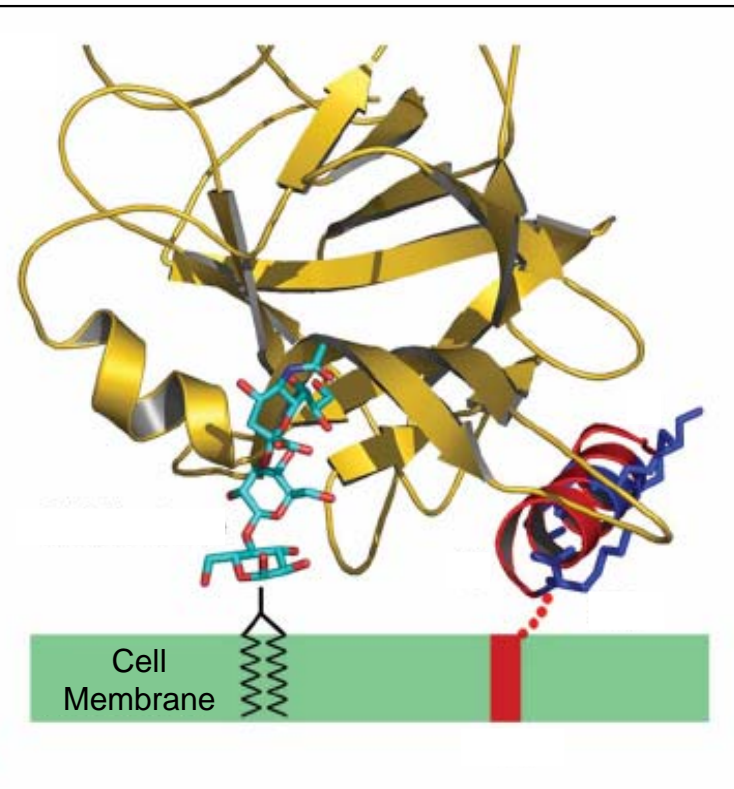
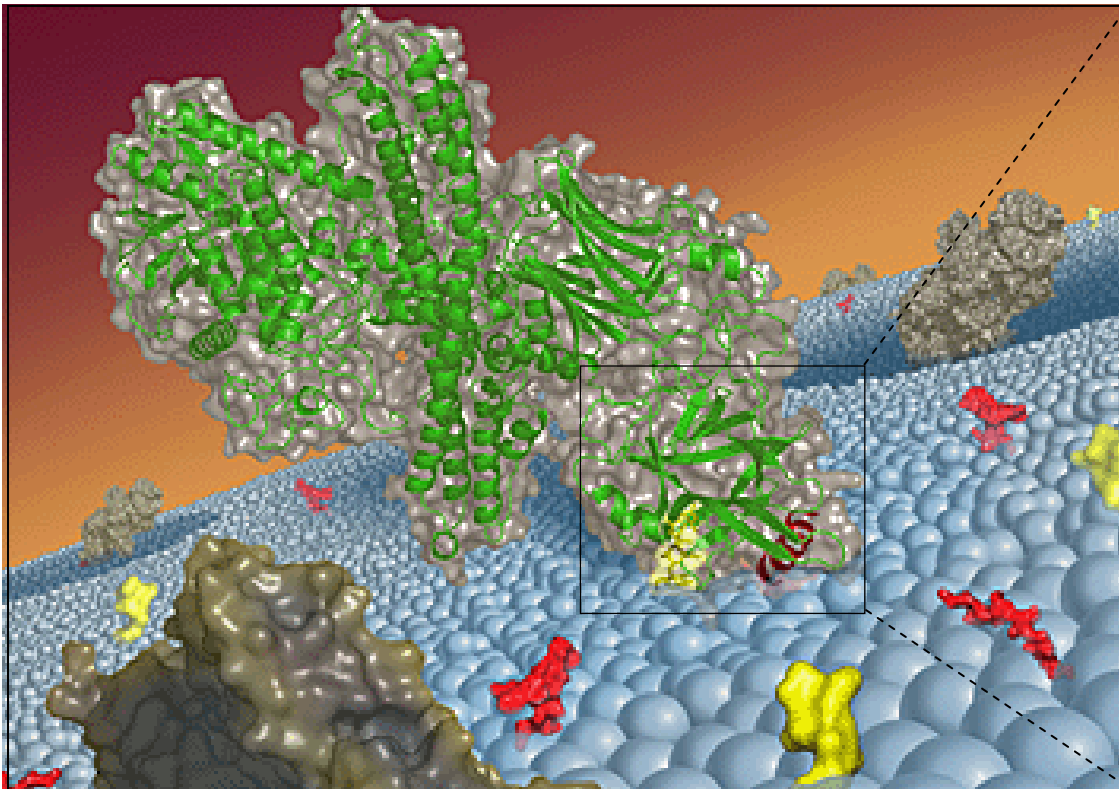
Primary Citations:

Cramer, P., Bushnell, D.A. and Kornberg, R.D. *Science* **292**, 1863 (2001)

Gnatt, A.L., Cramer, P., Fu, J., Bushnell, D.A. and Kornberg, R.D. *Science* **292**, 1876 (2001)

Westover, K.D., Bushnell, D.A. and Kornberg, R.D. *Cell* **119**, 481 (2004)

Wang, D., Bushnell, D.A., Westover, K.D., Kaplan, C.D. and Kornberg, R.D. *Cell* **127**, 941 (2006)



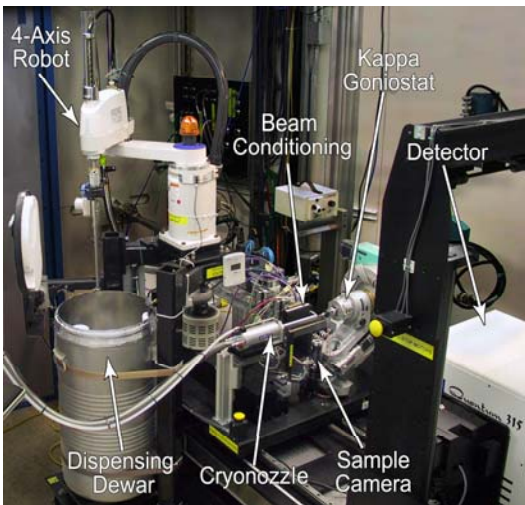
Botulinum Neurotoxin B – defeating a potential biological weapon

- Most potent toxin known to mankind
- Binds to nerve cell receptors causing infection, paralysis and potential death
- Atomic structure reveals two sites required for binding on the cell membrane surface
- Extremely potent anti-toxins and vaccines can be developed that block both sites simultaneously
- Chemically modified neurotoxins are in use as therapeutic agents for neurological disorders

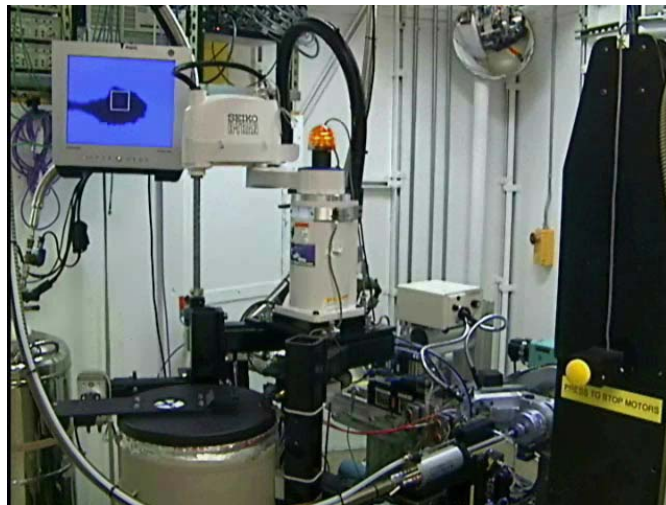
Primary Citations:

Jin, R., Rummel, A., Binz T. and Brunger, A.T. *Nature* **444**, 1092 (2006)

Chai, Q., Arndt, J.W., Dong, M., Tepp, W.H., Johnson, E.A., Chapman E.R. and Stevens, R.C. *Nature* **444**, 1096 (2006)



Standard automated equipment for Macromolecular Crystallography experiments at SSRL



Frozen crystal samples are mounted and screened on the x-ray equipment using an automated robotic arm



Experiments are controlled remotely from the researcher's home laboratory, or anywhere in the world

SSRL supports and develops x-ray facilities for Macromolecular Crystallography

- A robot is used to automatically mount frozen crystal samples
 - 288 frozen samples can be stored in the experimental x-ray hutch
 - Samples are screened to find the best diffracting crystal
 - Experimenters can run experiment from anywhere in the world
-
- Increased efficiency = Accelerated scientific results
 - Increased data quality = Better understanding of protein/drug function
 - Remote control = Travel time and cost savings for researchers

Primary Citations:

McPhillips, T.M, McPhillips, S. E., Chiu, H -J., Cohen, A.E., Deacon, A. M., Ellis, A. M., Garman, E., Gonzalez, A., Sauter, N.K., Phizackerley, R.P., Soltis S.M. and Kuhn, P. *J. Synchrotron Rad.* **9**, 401 (2002)
 Cohen, A.E., Ellis, P.J., Miller, M.D., Deacon, A.M. & Phizackerley, R.P. *J. Appl. Cryst.* **35**, 720 (2002)