High Flux Beamline, BL40XU

The most important feature of BL40XU is that very high x-ray flux can be used in various experiments. On this concept, the basic design of BL40XU was decided to use the fundamental undulator radiation as a quasi-monochromatic x-ray beam so that the use of the crystal monochromator was eliminated. The flux, when the ring current was 100 mA, was estimated to be $10^{15}$ photons/sec at 12 keV. The flux density was calculated to be on the order of $10^{17}$ photons/sec/mm$^2$.

X-ray diffraction recordings from a single sarcomere within an isolated myofibril

Dr. Hiroyuki Iwamoto (JASRI/SPring-8) and his research team succeeded in recording X-ray diffraction patterns from a single sarcomere within an isolated myofibril of striated muscle, by using the High Flux Beamline, BL40XU, of SPring-8 (Fig. 2).

A striated muscle cell consists of a large number of myofibrils (2-3 μm in diameter), which in turn consist of a large number of sarcomeres (2-3 μm in length) connected in series (Fig. 1). A sarcomere is the minimum functional building block of muscle, and its volume is only ~10 μm$^3$. X-ray diffraction recording from such a minute, hydrated, unstained biological specimen is unprecedented. In the earlier diffraction recording from a single myofibril by the same research team, the specimen contained ~1,000 sarcomeres. Therefore, this result represents a 1,000-fold gain. This success opens the possibility of in situ structural analysis of similarly-sized organelles in the cell.


Fig.1 Structure of vertebrate skeletal muscle (striated muscle)

Fig.2 A series of diffraction patterns recorded from a single sarcomere

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