Life Science
Medical Biology

Synchrotron radiation (SR) provides valuable techniques for investigating medical biological structures and functions. In this section, we selected five representative reports classified into two categories. The first category includes reports on the application of SR X-ray diffraction to the analyses of muscle and bone functions, and the second category includes reports on the application of SR microangiography and micro-CT to the imaging of tumor microvasculature and the peripheral lung structure.

(1) Wakayama *et al*. investigated the structural changes of contractile proteins in skeletal skinned muscle fibers during relaxation induced by the photolysis of caged ATP by the high-speed X-ray diffraction method. They showed that after the photolysis of caged ATP, myosin molecules simply detach from actin. (2) Pearson *et al*. analyzed actin-myosin crossbridge dynamics by the X-ray diffraction recording of beating rat hearts with left ventricular (LV) volume and pressure. They indicated that X-ray diffraction techniques offer more sensitive information on differences in crossbridge dynamics at the fiber level than at the macrolevel. (3) Todoh *et al*. showed wide-angle and small-angle scattering of X-ray diffraction from hydroxyapatite and collagen of cortical bone specimens, respectively. They analyzed the strain changes of both materials against applied dynamic strain, and results indicated differences in the maximum strain, elastic module and time response between the two materials. (4) Tokiya *et al*. performed an image analysis of the microvasculature of rat mammary adenocarcinoma transplanted to the inferior epigastric wall in athymic nude rats. They evaluated microvessels of 20~30 μm diameter and found differences in vascular density structure and extravasation among nontreated, b-FGF-treated, anti-VEGFR neutralizing antibody-treated and irradiated groups. (5) Ikura *et al*. analyzed the peripheral lung structure obtained from human autopsy specimens of pulmonary hypertension, emphysema and normal control. The 3D microstructures of alveolar walls, air-blood barriers and capillaries were obtained by SR CT. They found that the CT images well correlated with histological findings in both normal and pathological models.

Collectively, SR diffraction, microangiograhy and CT provide nano- and micron-level, novel information in medical biology.

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