

## **C** Immune system abnormality, inflammation

### Summary

Even today, more than 60 years since the atomic bombings, changes to the immune system—namely to cell-group constitution and cellular functions—associated with radiation exposure in survivors are observed. Such changes represent declines in adaptive immunity primarily mediated by T lymphocytes, and mild inflammatory states caused by activation of innate immunity. How and by what mechanisms radiation affects the immune system over the long term are issues that are not well understood. However, most of the changes to the immune system observed in association with radiation exposure are similar to the immune system's appearance as it weakens over time with aging (immunosenescence), suggesting the possibility that immunosenescence is accelerated in the A-bomb survivors due to their radiation exposure. For example, thymic function declines with aging, leading to reduced naïve T-cell numbers in blood due to decreased T-lymphocyte production. In A-bomb survivors, naïve T-cells decrease in relation to increasing radiation dose. The same phenomenon is also seen in patients who undergo radiotherapy and in survivors of the Chernobyl nuclear accident. In the natural aging process, the inflammatory reaction involving innate immune cells is enhanced, and in the A-bomb survivors, levels of inflammatory proteins and cytokines in the blood are elevated with increasing radiation doses. Consequently, those exposed to radiation have an increased inflammatory response associated with accelerated immunological aging, which may lead to increased risk of inflammation-related disease. Many of the diseases experienced in excess among A-bomb survivors occur at increased frequency with increasing age, and for that reason it is necessary to further investigate how such diseases might involve immunological aging caused by radiation.