Contribution of the immune system to bystander and non-targeted effects of ionizing radiation.

Abstract:
Considerable progress has recently been achieved in the understanding of molecular mechanisms involved in cellular radiation responses and radiation mediated microenvironmental communication. In line with that, it has become more and more obvious that X-irradiation causes distinct immunological effects ranging from anti-inflammatory activities if applied at low (<1 Gy) doses to harmful inflammatory side effects, radiation-induced immune modulation or induction of anti-tumour immune responses at higher doses. Moreover, experimental and clinical evidences indicate that these effects not only originate from direct nuclear damage but also include non-(DNA) targeted mechanisms including bystander, out of field distant bystander (abscopal) effects and genomic instability. The purpose of the present review is to elucidate immune responses that are initiated or affected by ionizing radiation, with a special emphasis on anti-inflammatory and abscopal effects and the induction of stress-induced anti-tumour immunity.