PL1

Cytometry of DNA damage in relation to cell cycle and apoptosis
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The methods aimed to detect DNA damage in individual cells, estimate its extent and relate it to the cell cycle phase and induction of apoptosis will be reviewed. They include the assays used to reveal DNA fragmentation during apoptosis as well as the approaches to detect DNA damage such as formation of DNA double-strand breaks (DSB) induced by genotoxic agents. The induction of DSB provides a signal for histone H2AX phosphorylation on Ser-139; the phosphorylated H2AX is named gamma-H2AX. In some instances the presence of DSB also activates ATM-kinase through its autophosphorylation on Ser-1981. Immunocytochemical detection of gamma-H2AX and/or ATM-S1981(P) are the most sensitive probes to reveal induction of DSB. When assayed by multiparameter cytometry in combination with analysis of cellular DNA content and caspase-3 activation they allow one to correlate in individual cells the extent of DNA damage and repair with the cell cycle phase and with activation of apoptotic pathway. The data will be presented that reveal H2AX and ATM phosphorylation in response to induction of DSB by: (i) ionizing radiation; (ii) DNA topoisomerase I and II inhibitors and other antitumor drugs; (iii) mutagens/carcinogens; (iv) selective DNA UV-induced photolysis upon BrdU incorporation. Also presented will be strategies to distinguish the induction of gamma-H2AX by extrinsic genotoxic factors from the “programmed” expression of gamma-H2AX and from the apoptosis-associated DNA fragmentation. Applications of gamma-H2AX- and ATM-S1981(P)-multiparameter cytometry focused on detection of DNA damage in tumor and normal cells during radio- or chemo-therapy may provide an early marker predictive of tumor response to treatment.

PL2

Biochemistry and genetics of bacteria and bacteriophages: implications for biology of eukaryotic organisms and medicine
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Although bacteria and bacteriophages have been used as model organisms in molecular biology for many years, importance of studies on these organisms has been questioned since eukaryotic models became available. However, it appears that biochemical and genetic studies on bacteria and phages may still be very important in understanding basic mechanisms of biological systems. Moreover, such studies provided many unexpected discoveries directly influencing human health. Examples of results obtained in experiments in which bacteria or bacteriophages were used as models, and which were then employed to understand molecular mechanisms of processes occurring in eukaryotic cells (including human cells) will be presented. Moreover, direct influence of results of studies on bacteria and phages on medical problems will be discussed. The latter subject encompasses, between others: (i) localisation of genes of many bacterial toxins (e.g. Shiga toxins) in genomes of bacteriophages occurring in bacterial chromosomes as prophages, (ii) using bacterial models for studies on human mutations that cause serious diseases, (iii) considering bacteriophage genetic networks in preparation of models to predict severity and progress of human genetic diseases, (iv) using microbiological assays in studies on understanding of mechanisms of action of some natural products that reveal a protective action against neurodegenerative disorders, and (v) bacteriophage therapy.