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Radiation Effects on Bacterial Cells

A study was made of recent, significant advances concerning the effects of radiation on bacterial cells, with specific emphasis on the fundamental aspects of radiation damage.

The study is concerned with the physicochemical and biochemical mechanisms which alter or modify the effects of high-energy radiation on living cells. Any progress in this area is significant, since it allows insight into the functioning of cells and contributes to the solution of such human problems as radiation effects, carcinogenesis, lethality, life shortening, the prevention and therapy of radiation damage, and the use of radiation as a therapeutic agent.

The results of the study are contained in a report which covers the modification of radiation sensitivity by oxygen, moisture, and temperature, linear energy transfer, chemical and biological modifiers, and post-irradiation factors. An in-depth discussion is presented emphasizing the importance of optimizing bacterial treatment with glycerol.

For radiation damage studies, single-cell organisms, in this case bacteria, are used. They can be controlled and manipulated with a precision unattainable with multicellular organisms.

Lethality, the failure of the single cell to give rise to a visible colony of cells, is used as the endpoint measure, as it is easily scored and has a direct relationship to dose. Using proper exposure chambers and gas handling systems, the water content, gaseous atmospheres, and temperature of the cells can be controlled before, during, and after irradiation.

A major goal of many biologists is to discover methods of reducing radiation damage by adding chemical compounds. The alcohols, in particular glycerol, profoundly modify cellular sensitivity. For both spores and vegetative cells, glycerol definitely affects all three classes of radiation damage (oxygen-dependent, free radical, and oxygen-independent). The presence of glycerol causes the lowest inactivation constants observed and glycerol is effective with or without the presence of oxygen. It appears to take the place of water in the cell and when there, protects the cell better than water can.

Notes:

1. Additional information is contained in *Some Recent Advances in the Radiation Biology of Bacteria*, by E. L. Powers, The Radiologic Clinics of North America, vol. 3, no. 2, p. 197–208, August 1965.
2. This information may be of interest to persons or organizations concerned with radiobiological research or applications.
3. Inquiries concerning this innovation may be directed to:

   Office of Industrial Cooperation
   Argonne National Laboratory
   9700 South Cass Avenue
   Argonne, Illinois 60439
   Reference: B68-10169

   Source: E. L. Powers
   Biological and Medical Research Division
   (ARG-10064)

Patent status:

Inquiries about obtaining rights for commercial use of this innovation may be made to:

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