

July 1969



# AEC-NASA TECH BRIEF



AEC-NASA Tech Briefs describe innovations resulting from the research and development program of the U.S. AEC or from AEC-NASA interagency efforts. They are issued to encourage commercial application. Tech Briefs are published by NASA and may be purchased, at 15 cents each, from the Clearinghouse for Federal Scientific and Technical Information, Springfield, Virginia 22151.

## Internal and Ancestral Controls of Cell-Generation Times

Studies of the generation-time distribution for individual bacterial cells, and the degree to which the generation times of related individuals are associated, have been reported (1). Associations are revealed between the generation times of cells for an intermediate period, as demonstrated by both lateral and longitudinal correlations between related cells; that is, between cells all within the same generation, or between ancestors and progeny. This information is required for development of adequate models for the kinetics of growth of cell populations.

The generation time of a cell is the period between successive cell divisions; that is, the period between the birth of the cell by fission of its parent and the later instant of its own fission. In practice, generation times are measured by recording of the development of some particular cell state at maturity or state during or near fission, as the individual cells are observed at successive times. This state must be carefully chosen, for any variability in its passage causes a corresponding loss of resolution in the measured generation-time distribution and leads to an unduly negative correlation between successive generation times.

Clearly generation times are not entirely independent as was assumed in earlier models; nor do generation times of progeny continue indefinitely to be significantly dependent upon their remote ancestors. Rather there are associations between the generation times of cells for an intermediate period: some three generations in bacterial cultures. This fact was demonstrated in both lateral and longitudinal correlations between related cells.

The dependence of the generation times of daughter cells upon those of their mothers is usually not revealed in correlation tests, but this dependence becomes evident when the cell sizes at division are considered. These results show that generation times of

progeny are influenced by nongenetic factors transmitted from their ancestors; and that at least two of these factors are necessary to account for the absence of correlation between mother and daughter, with opposite effects upon the generation times of daughter cells.

Since other kinds of cells have similar distributions of generation time, similar kinds of dependence are expected for them.

### Reference:

1. H. E. Kubitschek, "Cell generation times: Internal and ancestral control," in Proc. 5th Berkeley Symp. Math. Statistics Probability 1965-66 (Univ. of Calif. Press).

### Notes:

1. This information may interest companies concerned with sterilization or fermentation, and medical-research laboratories.
2. Inquiries may be directed to:

Office of Industrial Cooperation  
Argonne National Laboratory  
9700 South Cass Avenue  
Argonne, Illinois 60439  
Reference: B69-10205

Source: H. E. Kubitschek  
Biological and Medical Research Division  
(ARG-10326)

### Patent status:

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

Mr. George H. Lee, Chief  
Chicago Patent Group  
U.S. Atomic Energy Commission  
Chicago Operations Office  
9800 South Cass Avenue  
Argonne, Illinois 60439

Category 04