



AEC-NASA TECH BRIEF



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Investigation of Temperature Dependence of Development and Aging

A paper is presented giving an analysis and theoretical discussion of published data on the temperature dependence of maturation rates, plus metabolic and mortality rates in insects.

This paper asks how living poikilothermic systems are affected in their aging and longevity by operating at different constant ambient temperatures. An attempt is made to put the effects of temperature on aging into context with the effects of temperature on essential life processes such as maturation and energy metabolism, and on the failure of those processes, as manifested in gene mutation, developmental anomaly, and mortality during development.

It is shown that the rate of aging per calorie expended increases on either side of a temperature optimum, and that this increase is complementary to the decrease in energetic efficiency of maturation of insects as temperature is displaced from optimum. Failures of vital processes, such as mutations, developmental anomalies, and developmental death also exhibit a temperature minimum. The temperature for optimum function (highest energetic efficiency and lowest failure rate) is found to be always within the temperature range to which that insect species is adapted.

These phenomena are proposed to be a result of the increase in organizational entropy as temperature is displaced from an optimum value. This increase is proposed to be a result of an irreducible heterogeneity of activation energies of enzyme-catalyzed reactions.

The general hypothesis is advanced that aging in biological systems is a consequence not of metabolic activity *per se*, but rather of the production of entropy concomitant with metabolic activity. Thus, aging can no longer be considered as a question of *how much*

metabolic work; it is also a function of *how well* the work is done, in thermodynamic and informational terms.

Notes:

1. The paper, entitled "The Complementarity of Entropy Terms for the Temperature-Dependence of Development and Aging," has been presented by George A. Sacher of Argonne National Laboratory, Argonne, Illinois.
2. This information may be of interest to governmental agencies, research biochemists, and medical foundations working in the field of aging.
3. Reference: Additional details are contained in *Annals of the New York Academy of Sciences*, vol. 13., article 2, p. 680-712 (February 6, 1967)
4. Inquiries concerning this innovation may be directed to:

Office of Industrial Cooperation
Argonne National Laboratory
9700 South Cass Avenue
Argonne, Illinois 60439
Reference: B69-10022

Source: G. A. Sacher
Biological and Medical Research Division
Argonne National Laboratory
(ARG-10145)

Patent status:

Inquiries about obtaining 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-



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The AEC-NASA Tech Brief program is designed to provide a forum for the exchange of technical information between the Atomic Energy Commission and the National Aeronautics and Space Administration. The program is intended to facilitate the transfer of technology and expertise between the two agencies, thereby promoting the development of new and improved technologies for both space exploration and energy production.

TECHNICAL BRIEFING ON THE DEVELOPMENT OF A HIGH-TEMPERATURE MATERIALS PROGRAM

The following information was presented at a technical briefing held on [Date] at the [Location]. The briefing was attended by representatives from the Atomic Energy Commission, the National Aeronautics and Space Administration, and other interested parties. The purpose of the briefing was to discuss the progress of the High-Temperature Materials Program and to identify areas for further research and development.

The program is currently in the early stages of development and is expected to be completed by [Date]. The program will focus on the development of new materials that are capable of withstanding the extreme temperatures and pressures encountered in space exploration and energy production. The program will also involve the development of new testing techniques and the establishment of a database of material properties.

The program is being funded by the Atomic Energy Commission and the National Aeronautics and Space Administration. The program is being managed by the [Agency Name]. The program is expected to have a significant impact on the development of new and improved technologies for both space exploration and energy production.

The program is being implemented through a series of research and development projects. The program is expected to result in the development of new materials that are capable of withstanding the extreme temperatures and pressures encountered in space exploration and energy production. The program is also expected to result in the development of new testing techniques and the establishment of a database of material properties.

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