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In Memoriam

## In Memoriam: Arnold H. Greenberg, MD, Ph.D. 1941–2001

Dennis G. Dyck<sup>a</sup> and Dwight M. Nance<sup>b,\*</sup>

<sup>a</sup>*Health Research and Education Center, Washington State University Spokane, Spokane, WA 99210, USA*

<sup>b</sup>*Department of Physical Medicine and Rehabilitation, Susan Samueli Center for Complementary and Alternative Medicine, UCI College of Medicine, Orange, CA 92868, USA*

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Arnold grew up on a dairy farm in a small rural town in Eastern Manitoba, Canada. He studied medicine at the University of Manitoba and trained as a pediatric Resident and Fellow at Johns Hopkins Hospital in Baltimore. He subsequently received a Ph.D. in Immunology at the University of London, England.

He returned to Winnipeg to join the Manitoba Institute of Cell Biology where he became Director from 1988 to 1999. His early research in tumor immunology resulted in the discovery of a new class of large granular lymphocytes which later became known as natural killer cells. Later, and until his death he continued to make ground-breaking discoveries in molecular biology related to apoptosis and cell death. As Director of the Manitoba Institute of Cell Biology, he worked tirelessly to develop a world-class cancer research institute which is well known and respected for the caliber of its scientists and students.

Although Arnold would not have referred to himself first and foremost as a psychoneuroimmunologist, he was a catalyst for the development of such a program at the University of Manitoba. Arguably, he had a wider influence on the development of the field and participated in many of the early scientific meetings of the Society. In the mid-1980s when the field was developing, Arnold was one of only a few immunologists who were genuinely curious about brain-immune interactions. He was convinced that from a functional perspective that bi-directional communication between the brain and the immune system was not only possible, it was necessary. Dennis Dyck was introduced to Arnold by a psychology department colleague, Lorna Sandler. Arnold had de-

veloped an NK tumor elimination model in mice that appeared well suited and potentially sensitive to behavioral manipulations. An initial series of studies was proposed to look at the effects of inescapable tail-shock on the elimination of NK sensitive tumors. Building on the work of Seligman and colleagues as well as Sklar and Anisman, the early work showed that acute tail-shock indeed suppressed the elimination of NK sensitive tumors, but that more chronic exposure actually led to improved host resistance. Theoretical concepts of opponent processes, derived from Solomon Corbitt, were invoked to explain the adaptation phenomenon and this led to studies on conditioned tolerance of poly IC induced natural killer cell activation. Arnold was extremely impressed and continually amazed by the responsiveness of immune responses to environmental cues and the phenomenon of conditioning. However, he was never content with a phenomenological descriptive approach. He was driven to develop and test mechanistic models. This led him often to be critical of the PNI field, which he felt was not moving quickly enough to adopt a mechanistic perspective. When Dwight Nance joined our research group several years later the research program moved in a decidedly more mechanistic direction and this greatly pleased Arnold. This work focused on the role of cytokines in central signaling and in turn the influence of central signals on splenic immune responses via sympathetic pathways.

The impact that Arnold had on his collaborators and students was tremendous. He was brilliant, tireless, and he modeled a style of scientific inquiry that was rigorous, imaginative, and fun. Arnold was a strong personality and a leader. There were many evening research meetings with the research group. These were always stimulating, challenging, and enjoyable. Arnold

\*Corresponding author. Fax: 714-456-2998  
E-mail address: [dnance@uci.edu](mailto:dnance@uci.edu) (D.M. Nance).

was a serious person who did not suffer fools lightly, but he also laughed easily and enjoyed life that went beyond research. He loved music, art, literature and was a vigorous and accomplished racquetball and tennis player. Above all, he loved his wife Faye and his family.

Arnold was active until the time he died. Even as he battled colon cancer, he continued to give seminars, supervise graduate students, participate in thesis exams, and publish. He was well funded from both Canadian and US sources for his scientific work and was instru-

mental in generating critical support for the development of The Institute. Before Arnold died he established the Dr. Arnold Greenberg Lectureship Fund at CancerCare Manitoba, with the hope of continuing the legacy he started at the Manitoba Institute of Cell Biology. As he wished, the fund is being used to invite outstanding scientists to inspire and challenge new investigators and students. We will always remember him as a friend, colleague, and the best collaborator we ever had.