MARTIN BLANK earned PhDs in physical chemistry (1957) from Columbia University and in colloid science (1960) from University of Cambridge. He came to the department in 1959, retired as Associate Professor in 2011 and is now a Special Lecturer. His research has been on membranes, transport processes, excitation, and recently on health effects of electromagnetic radiation (EMR). His book on health effects of EMR is due out at the end of 2013.

During his tenure, he had short-term appointments at 11 universities around the world, as well as at five industrial research labs and the US Office of Naval Research. He also organized many meetings, including two World Congresses on Electricity and Magnetism in Biology and Medicine, 4 Erice (Italy) Courses on Bioelectrochemistry, and he started the Gordon Research Conferences on Bioelectrochemistry. He has been Chairman of the Organic and Biological Division of the Electrochemical Society, President of the Bioelectrochemical Society, President of the Bioelectromagnetics Society, and has been on editorial boards of Journal of the Electrochemical Society, Bioelectrochemistry and Bioenergetics, Electromagnetic Medicine and Biology. He was editor of the 2009 special issue of Pathophysiology on EMR. He has published over 200 papers and reviews, as well as twelve edited books on electrical properties of biological systems, including the Proceedings of the First World Congress on "Electricity and Magnetism in Biology and Medicine", "Electromagnetic Fields: Biological Interactions and Mechanisms". He was one of the organizers of the online Bioinitiative Report, and edited the 2009 update in Pathophysiology.

Current Research

Electromagnetic radiation (EMR) has been used therapeutically for accelerated healing and pain control, but they have also been associated with adverse health effects. To understand these biological effects, we have been studying the interaction of low frequency EM fields with cells at both the cellular and molecular levels. Our studies with cells have shown that power frequency (60Hz) fields induce stress genes and stress response proteins in cells. The stress response is a protective mechanism induced by harmful environmental stimuli and is characterized by the synthesis of specific proteins that assist the renaturation and transport of damaged proteins. Our studies suggest that EMR initiates the stress response by interacting with electrons within DNA. We have identified a 900 base pair segment associated with the response to EMR, that when removed, eliminates the response, and when transfected into a reporter construct, causes the construct to become EMR responsive. We have also investigated EMR interactions at the molecular level through effects on three reactions, electron transfer in cytochrome oxidase, ATP hydrolysis by the Na,K-ATPase, and the Belousov-Zhabotinski (BZ) reaction (the catalyzed oxidation of malonic acid). All three reactions show:

EMR accelerates the reaction rate, i.e., electron transfer rate

EMR competes with the chemical force driving the reaction, so the effect of EMR varies inversely with the reaction rate

Interaction thresholds are low, comparable to levels found in EMR-cancer epidemiology studies

Effects vary with frequency, and there appear to be different optima for the reactions studied: ATPase (60Hz), cytochrome oxidase (800Hz), BZ (250Hz)

These properties, in addition to stimulation of DNA in the cellular stress response, are consistent with EMR effects on many biological systems through interaction with electrons moving during redox reactions and also within DNA. The ubiquity of EMR reactions with DNA and the low observed reaction thresholds indicate the need for greater caution and control over the spread of EMR in the environment.

Selected Publications

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