Claude Moore Programs on Physics in Medicine

Current Themes→Lectures→ Book Chapters→ Working Groups

Neuroscience, Electrodynamics and Cellular Biology: - The Mind and the Brain
The Pathways to Cognition, Sensory Perception and Bio-Feedback

This could be considered the most fundamental theme, in the sense that electrodynamics is at the core of all human functionality, from cognition through muscular dynamics, heart rhythm, and cochlear discrimination of frequencies in sound, to the sense of touch. This theme can build on an initial lecture on single-cell electrostatics and electrodynamics, and work its way into specific applications involving cognition, sensory perception and bio-feedback…integrating neuroscience, physics and cellular biology

The Integrated Cardiovascular-Pulmonary System:
The Underlying Principles of Physics and Engineering That Make It Work

This theme is replete with first-principle cause-effect unknowns, from the controlling forces that influence charge distribution on the surface and within cells, to charge movement in cellular tissue giving rise to electrodynamic forces and muscular activity (as in the critically-synchronized pumping action of the heart). This is a coupled mechanical, electrodynamic and fluid-mechanical system with well-defined underlying force principles that a series of lectures would address…with immediate clinical interests in the areas of vascular disease and arrhythmias.

Cancer and Oncology – The Making of a Cancer Cell

The fundamental forces and guiding principles of electrostatics and electrodynamics, diffusion, hydrodynamics, and interactive surface physics from cellular birth through mutation and metastases, to cure. How, for example, do the physical forces vary with cancer-cell geometries, nuclear sizes, and surface characteristics, and in turn influence the activation of invasion and metastases, modulate cellular signaling, and enable replicative immortality?

Nanotechnology – The Physical Forces Influencing the Efficiency, Effectiveness and Specificity of Drug Delivery to Cancer Cells

This will include a series of lectures concentrated on a description and analysis of the forces at play (electrostatic/electrodynamic, physical/kinetic, thermodynamic, fluidic, etc.) and their relative roles in the overall drug-delivery process. In this regard, the lectures will be designed to show how these individual forces contribute to the challenge for targeted nanocarriers - "to simultaneously achieve high targeting specificity and delivery efficiency". As an example, a series of lectures would progressively trace through a schematic phenomenological diagram of the entire process and describe/specify/quantify the active physical forces at play in each step through which a targeted protocell delivers an encapsulated cargo specifically to a cancel cell of interest

Energetic Particle, Electromagnetic Radiation and Ultrasound Effects on Human Cells and Tissue Diagnostic and Treatment Devices: The Good, the Bad and the Evil

The foundation of this theme is in the science of energetic-particle and penetrating field and wave interactions with biological materials – on the cellular scale, the membrane scale and the tissue scale, with biological, medical and human safety applications…everything from UV-induced melanoma to the diagnoses and treatment of diseases with energetic particles, electromagnetic radiation and focused ultrasound

Infectious Diseases – Transport, Immunology and Immunotherapy

This involves the underlying physics principles in everything from viral transport in gaseous and liquid media, and the effectiveness of masks, to surface-contact lifetimes. All scales of interactions are involved from atomic to organic functionality and immune stimulation and T-cell transport therapy in a complex system of cells, molecules and tissues distributed throughout the body.