Live

How to hit HIV where it hurts

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Abstract: HIV continues to wreak havoc around the world, especially in poor countries. A vaccine is urgently needed to overcome this major global health challenge. I will describe key challenges that must be confronted to achieve this goal. I will then focus on some work that aims to address a part of these challenges by bringing together theory and computation (rooted in statistical physics), consideration of structures of multi-protein assemblies, basic immunology, and human clinical data. The results of these studies suggest the design of immunogens that could be components of vaccines that might elicit immune responses which might be able to hit HIV where it hurts upon natural infection. I shall also briefly touch upon some scaling laws that describe HIV evolution, which are reminiscent of Hopfield dynamics and other branches of inquiry.

Biography: Arup K. Chakraborty is the Robert T. Haslam Professor of Chemical Engineering, Physics, Chemistry, and Biological Engineering at MIT. He is the founding Director of MIT's Institute for Medical Engineering and Science. He is also a founding steering committee member of the Ragon Institute of MIT, MGH, and Harvard, and an Associate Member of the Broad Institute of MIT & Harvard. After obtaining his PhD in chemical engineering at the University of Delaware, and postdoctoral studies at the University of Minnesota, he joined the faculty at the University of California at Berkeley in December 1988. He rose through the ranks, and ultimately served as the Warren and Katherine Schlinger Distinguished Professor and Chair of Chemical Engineering, Professor of Chemistry, and Professor of Biophysics at Berkeley. He was also Head of Theoretical and Computational Biology at Lawrence Berkeley National Laboratory. In September 2005, Arup moved to MIT. His entire career has been focused on research at the intersection of disciplines. After a successful early career working on molecular engineering of catalysts and polymers, in 2000 Arup turned his attention to immunology. The central theme of his research over the past sixteen years is the development and application of theoretical/computational approaches, rooted in physics and engineering, to aid the quest for mechanistic principles in immunology, and then harness this understanding to aid the design of vaccines against mutable pathogens (e.g., HIV). A characteristic of his work is the impact of his studies on experimental immunology and clinical studies (he collaborates extensively with leading immunologists). Arup's work at the interface of the

physical, life, and engineering sciences has been recognized by many honors that include a *NIH Director's Pioneer Award*, the *E.O. Lawrence Memorial Award for Life Sciences*, the *Allan P. Colburn and Professional Progress awards* of the American Institute of Chemical Engineers, a *Camille Dreyfus Teacher-Scholar* award, a Miller Research Professorship, and a *National Young Investigator* award. Arup was elected a member of the *National Academy of Sciences* and the *National Academy of Engineering* for different bodies of work. He is also a Fellow of the *American Academy of Arts & Sciences* and the *American Association for the Advancement of Science*. He serves on the US Defense Science Board.

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