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Animal models in HIV vaccine research: Helpful heuristics or ethical prerequisite?

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Abstract

The use of animal models to develop a vaccine against HIV/AIDS has paralleled the historical development of the polio vaccine in many ways. In both cases, the use of animal models proved misleading secondary to species differences, yet similarities between species were also discovered. The search for a vaccine against HIV/AIDS has been ongoing for three decades whereas the polio vaccine effort consumed over three decades. Conversely, the last thirty years have seen important advances in fields such as complexity science, evolutionary and developmental biology, and genetics in general. Advances in genetics include the significance of gene networks, gene regulation and expression, epigenetics, pleiotropy, and the role of modifier genes. Based in part on these advances, along with empirical studies in clinical medicine, we now understand why very small differences among species account for profound diversity in the response to drugs and disease. In clinical medicine, there is currently an emphasis on *personalized medicine*, as disease and drug responses have been observed to differ among humans and even between monozygotic twins. Interestingly, the reasons we see intra-species diversity in such responses are conceptually identical to why we see inter-species differences.

The question that must be addressed when contemplating the use of animal models for vaccine development regards the exact role of the model. Is there scientific support for the notion that success or failure of a vaccine in an evolutionarily related hominid has predictive value for humans? Is the model being used merely as a stimulus for ideas, a heuristic? If the model is merely a heuristic, then it may reveal information that eventually assists in developing a vaccine. However, historically such models have shown a higher probability of yielding information of no value to vaccine development or information that is profoundly misleading regarding the human system. Thus, the rationale for the model has scientific as well as social implications.

Biography

Ray Greek obtained his MD from the University of Alabama at Birmingham in 1985 and completed a residency in anesthesiology in 1989 at the University of Wisconsin. He completed board certification in Anesthesiology in 1990 with added certification in Pain Management in 1993. He has taught in the Departments of Anesthesiology at the University of Wisconsin-Madison and Thomas Jefferson University in Philadelphia. He is the president and co-founder of Americans For Medical Advancement (AFMA). AFMA is a not-for-profit organization that promotes biomedical research based on critical thinking and our current understanding of science in general including evolutionary and developmental biology, complex systems, and genomics along with a sound basis in philosophy of science. He has authored or coauthored five books, over 30 articles, and is a reviewer for several journals.