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Mapping Immune and Viral Dynamics in Nonhuman Primates: An Exciting Set of Tools and Glimpse into Personalized Medicine

Francois Villinger[a], Philip Santangelo[b], Thomas Hope[c]
New Iberia Research Center, University of Louisiana at Lafayette, New Iberia[a]
Wallace H Coulter Dept of Bioengineering, Emory University, Atlanta[b]
Feinberg School of Medicine, Northwestern University, Chicago[c]

Abstract

Rodent models of disease and vaccine have provided a wealth of scientific advances thanks to their genetic characterization, rapid reproduction, the ability to knock genes in and off and their small size. However, findings from these defined models do not always faithfully translate to the clinic, highlighting the need for confirmation of therapeutic strategies and vaccines in outbred models closer to man. Nonhuman primates (NHP) sharing >95% genetic homology to humans provide such critical model, yet the ability to fully exploit these models requires increased characterization and improvement of investigative techniques. We have developed novel imaging tools which allow for the non invasive mapping of immune events and viral replication in total body and in real time. Moreover these techniques can be combined to target biopsy collections and a whole body to single cell analytical approach to interrogate viral infections such as HIV or COVID19.

In the current fight to cure HIV, these techniques are highly sensitive for the detection of residual viral turnover under antiretroviral therapy (ART) in select tissues. Moreover, this approach also identifies functional viral reservoirs from which virus rapidly rebounds upon ART interruption, long before virus is detectable in blood, allowing for a more precise elucidation of mechanisms underlying the lack of viral eradiation even after prolonged ART and a delineation of organs and cells fueling the reservoir at a whole body level.

These approaches can also be applied to monitor the pharmacodynamics of drugs, vaccines and therapeutic modalities such as monoclonal antibodies or mRNA and the proteins they encode, contributing to the mechanistic elucidation of treatment success vs failure after in vivo administration. Last but not least, given the outbred nature of nonhuman primate models, these techniques will pave the way for conducting and monitoring future personalized therapies.