Our Immune System, Vaccines, and Vaccine Strategies for AIDS and COVID-19

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Constantly vigilant, our immune system recognizes and controls infections to protect us from disease. Furthermore, we have a capacity for immunological memory, which enables our immune system to "remember" a pathogen we have encountered in the past, and to make a more rapid and vigorous defensive response should we encounter that same disease again. Vaccines tap into this natural capacity for immunological memory. I'll briefly review our ongoing work at Los Alamos National Laboratory to contribute to global vaccine efforts for HIV-1 and COVID-19. The rapid evolution and extraordinary diversity of HIV provides particular challenges for developing an AIDS vaccine, and our work focuses on strategies to contend with that diversity. By contrast, SARS-CoV-2, the virus that causes COVID-19, has evolved very slowly during the pandemic, although even this limited diversity can be important. We are tracking emerging viral diversity to help design appropriate reagents to ensure that COVID-19 vaccines and therapeutics currently under development will remain relevant over the coming year. Using our tracking tools, last April we identified a SARS-CoV-2 variant that appeared to be more transmissible than the original form. This viral variant was subsequently shown to be more infectious experimentally, and has now become the globally dominant form of the virus.

Bio

Dr. Bette Korber is a Laboratory Fellow at the Los Alamos National Laboratory in the Theoretical Biology and Biophysics Group. Her work focuses on viral evolution, the human immune response to infection, and vaccine design. She leads an interdisciplinary team that provides bioinformatics, theoretical, and statistical support in collaborative efforts with experimental researchers, working primarily on HIV, but also on ebola, hepatitis C, and influenza. Like so many, she has recently begun to work on coronaviruses in response to the global pandemic. Some highlights from of her work include vaccine designs to cope with viral diversity, characterizing the evolution of HIV under immune pressure during infection, and developing sequence-based signature analyses methods that include phylogenetic corrections to compensate for founder effects. Her mosaic HIV vaccine design is currently being evaluated in a Phase 2b human clinical trial called Imbokodo. Some of her awards and honors include: the E.O. Lawrence Award, the Dept. of Energy's highest scientific honor (2004); the Secretary of the Dept. of Energy Award for her work on the Ebola Task Force (2017); the Richard P. Feynman Innovation Prize (2018); R&D 100 Scientist of the Year (2018); and Battelle's Inventor of the Year (2019).