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UC San Diego News Center

July 01, 2016 | By Doug Ramsey

# UC San Diego, Human Vaccines Project Harness Advances in Machine Learning

## Calit2's Qualcomm Institute to host July 8 workshop on technologies for vaccine development

The Human Vaccines Project is teaming with the University of California San Diego to apply advances in machine learning to solve critical problems impeding the development of vaccines and therapeutics for a wide range of diseases.

The Human Vaccines Project (Project) is a new global public-private partnership of academic research centers, industry, non-profits and government agencies designed to accelerate the development of next-generation vaccines and immunotherapies.

On Friday, July 8, the California Institute for Telecommunications and Information Technology (Calit2) Qualcomm Institute (QI) will host an invitation-only Workshop on Human Vaccines and Machine Learning (HVML) in Atkinson Hall on the UC San Diego campus. The workshop will bring together top academic researchers and partners in the vaccine development community from the biotech and pharmaceutical industries, as well as experts from top software companies and IT research organizations.

*Human Vaccines Project president and CEO, Wayne C. Koff.*

"The Human Vaccines Project has embarked on a decade-long, $1 billion mission to decode the human immune system," said Wayne C. Koff, Ph.D., President and CEO of the Human Vaccines Project. "Information technology, machine learning and computational biology all hold important keys to developing vaccines against immune-mediated diseases, including global killers such as HIV and tuberculosis (TB), emerging diseases such as Zika and pandemic flu, cancers, allergies and autoimmune disorders."

Under a scientific plan endorsed by 35 of the world's leading vaccine scientists, the Project aims to apply recent advances in machine learning and data science to speed vaccine development.

"Applying machine learning should accelerate the development of new vaccines and therapies for a wide range of pressing diseases," said UC San Diego computer scientist and physicist Larry Smarr, director of Calit2. "In addition to machine learning, experts in Big Data analytics, pattern recognition, genomics and bioinformatics can also help us understand the fundamental principles of effective human immunity, and enable the design of highly-targeted vaccines."

Vaccines are among the most effective health interventions. They have helped eradicate smallpox, nearly eliminate polio, and prevent tens of millions of deaths globally.

On June 21, the Project and Vanderbilt University Medical Center announced a groundbreaking clinical trial aimed at decoding the human "immunome," the genetic underpinnings of the immune system. "For the first time," observed the Project's Koff, "we have the technological tools to undertake such an ambitious project." The trials will be the cornerstone of the Project's Human Immunome Program.

*Calit2 director Larry Smarr.*

Vanderbilt Vaccine Center Director James Crowe, Jr., M.D., will oversee the initial clinical trials, and his team will collaborate with the Project's research partners in La Jolla, including the J. Craig Venter Institute (JCVI), La Jolla Institute for Allergy and Immunology (LJI), The Scripps Research Institute (TSRI), as well as UC San Diego's Qualcomm Institute, School of Medicine, and San Diego Supercomputer Center (SDSC).

SDSC and JCVI will also constitute the project's Global Bioinformatics Core, a hub and archive to house an expected tidal wave of genomic and other data from research labs and clinical trials as well as new tools for analyzing that data. For the Vanderbilt-led trials, the number of genetic sequences for receptors on white blood cells alone could reach into the billions, and scientists will need new tools and instruments to parse that data.

The Workshop of Human Vaccines and Machine Learning will focus on technologies to analyze Big Data of all kinds. Machine learning is the most obvious, and scientists have been experimenting with machine-learning tools for vaccine development for more than a decade. Machine learning typically involves 'training' a computer or robot on millions of actions so that the computer learns how to derive meaning from the data as time goes on.

“For the last 30 years we have been probing the immune system to define which molecular structures or epitopes the immune system recognizes,” says Professor Alessandro Sette, Dr. Biol. Sc., who heads the Center for Infectious Disease at La Jolla Institute and also co-leads the National Immune Epitope Database (IEDB). “By bringing together a team of experts who are uniquely qualified to parse large datasets, the Human Vaccine Project will help ring in a new era of rational vaccine design.”

*Michael Norman*

“Machine learning has been helpful in early target discovery and immunology but determining targets of immune response is still a far cry from identifying subsets of targets that may be good candidates for formulation as a vaccine,” added SDSC Director Michael Norman. “Advanced technologies can address such issues, but we also need multidisciplinary approaches and teams of medical researchers and information technologists working closely together and speaking a common language despite their diverse backgrounds. SDSC has a long history doing this, and so we are very happy to be a part of this important project.”

“With the convergence of innovations in genomics, immune monitoring technologies and now machine learning, we now have an unprecedented opportunity to understand how to direct the immune system against some of our most challenging diseases,” said Dr. Koff, “and transform how we treat and prevent disease.”

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