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New Emmes Research Offers Insights Into How Adjuvants Increase Avian Flu Vaccine Effectiveness

Paper Reflects Systems Biology Analysis Assessing Responses to a Vaccine Adjuvant

Rockville, MD – July 13, 2017 – The Emmes Corporation today announced that Johannes Goll (co-lead author), Travis Jensen and Heather Hill made significant contributions to a recent paper summarizing new research on a vaccine for the H5N1 avian flu. The research was featured on the front page of the *Proteomics* journal.

Emmes, together with Vanderbilt University, used a "systems biology" approach that examined changes in both gene and protein expression in several human immune cell types simultaneously over time. The research was funded by the National Institute of Allergy and Infectious Diseases, which is part of the National Institutes of Health.

Ultimately, the results from these types of system biology studies will help develop better and more personalized vaccines and result in a greater understanding of how the human immune system responds to vaccines, adjuvants and infectious agents.

The overall goal of this study was to better understand how the adjuvant AS03 enhanced H5N1 avian flu vaccine by integrating multiple genomics and proteomics ("-Omics") technologies. The *Proteomics* paper, which addressed the results from the protein analysis, followed earlier research that summarized gene expression findings.

According to Dr. Anne Lindblad, president and chief executive officer of Emmes, "These efforts

continue to strengthen our bioinformatics portfolio. We've invested in our infrastructure to support reproducible and scalable bioinformatics research, and we hope further research will result in better, more personalized vaccines."

Other Emmes systems biology efforts involve clinical trials to assess -Omics responses to vaccines addressing a different form of avian flu (H7N9), as well as filovirus and yellow fever vaccines.

About the Research

Fatality rates for H5N1 avian flu have been as high as 80%, yet vaccines developed following the same procedures as seasonal flu are not very effective when given alone. Several studies have found that adjuvants, chemicals that stimulate the immune response, can increase the effectiveness of H5N1 avian flu vaccines. How adjuvants do this is not well understood.

The research addressed whether large scale systems biology approach generating over two terabytes of raw data describing temporal changes in thousands of white blood cell molecules from 20 vaccinated individuals (half with AS03 adjuvant) could provide the answer.

The previously conducted transcriptomics research had revealed strong AS03-specific stimulation of gene expression responses in three types of white blood cells, neutrophils, monocytes and dendritic cells, 24 hours following vaccination. Some of these responses were correlated with later generation of protective levels of antibodies. The most recent proteomic analysis confirmed that in the group that received the adjuvant, there was an increase in a particular biological function of white blood cells referred to as "antigen processing and presentation." This event occurs when white blood cells digest and process a foreign invader to enhance the immune response against it. This proteomic finding was noted to occur two days after the corresponding transcriptomic signal.

Together these analyses provided evidence that AS03 administered with H5N1 avian flu vaccine stimulated subsets of white blood cells to increase expression of genes and proteins that improve uptake and processing of antigens. In addition to this key finding, the results provided details about the timing and composition of several other important immune system-related processes that were activated in response to AS03 and how the activation differed between immune cell types.

Emmes served as the Statistical and Data Coordinating Center for this research, with Heather Hill serving as project manager. The analysis of the multi-terabyte dataset was devised and carried out by the Emmes bioinformatics team, led by Johannes Goll who was co-lead author on both publications. The bioinformatics team used scalable cloud resources to store, analyze and integrate the vast amounts of -Omics data required for the study.

This study was conducted by the Vaccine and Treatment Evaluation Unit at Vanderbilt University (Contract HHSN272200800007C), with data analysis performed by the Statistical and Data Coordinating Center for Clinical Research in Infectious Diseases at The Emmes Corporation (Contract HHSN272201500002C). Both contracts are supported by the National Institute of Allergy and Infectious Diseases, part of the National Institutes of Health.

About Emmes

We collaborate with our clients to produce valued, trusted scientific research. Our team members at Emmes are passionate about making a difference in the quality of human health, and we have supported more than a thousand studies across a diverse range of diseases since our formation in 1977. Our research is contributing to a healthier world. For more information, visit www.emmes.com.