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AN INTEGRATED PLATFORM FOR VIRUS DETECTION AND VACCINE  
PRODUCTION: APPLICATIONS FOR COVID-19

病毒檢測及疫苗同步產生平台：創造新冠肺炎新解方

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**Yu-Chan Chao 趙裕展, Ph.D.**

RESEARCH FELLOW AT INSTITUTE OF MOLECULAR  
BIOLOGY, ACADEMIA SINICA  
DISTINGUISHED RESEARCH FELLOW, MINISTRY OF  
SCIENCE AND TECHNOLOGY, TAIWAN

Dr. Yu-Chan Chao received his Ph.D. from the Department of Entomology, University of Arkansas, and completed his postdoctoral training at Cold Spring Harbor Laboratory and Cornell University. He is currently a Research Fellow at the Institute of Molecular Biology at Academia Sinica in Taipei, Taiwan, ROC. He is also a joint Chair professor of National Chung-Hsing University and was selected as an Outstanding Research Fellow by the Ministry of Science and Technology of Taiwan. Dr. Chao has been studying insect virology for long years, especially focusing on baculovirus gene regulation, protein engineering, and baculovirus-mediated membrane protein presentation. He has also published many papers in the *Journal of Virology* and other journals (including *Nature*). In addition to scientific activities, Dr. Chao served as the Deputy Director of the Institute of Molecular Biology from 2002 to 2005 and Dean of the College of Life Sciences at National Chung Hsing University from 2005 to 2007. He has served as an editor for several journals, including the *Journal of Virology* (2015-2021). He is currently a council member of the International Congress of Entomology.



ABSTRACT

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The severe coronavirus disease COVID-19 caused by SARS-CoV-2 has spread worldwide and significantly affects human lives. To tackle it, we have developed a combined detection and vaccination system. We displayed both spike (S) and nucleocapsid (N) proteins from SARS-CoV-2 either on the envelope of baculovirus or insect cell membranes. Insect cells displaying S or N proteins were then used to generate a cell-based ELISA (C-ELISA) that accurately detects COVID-19 in patient sera. Furthermore, baculovirus presenting S (S-Bac) or N (N-Bac) proteins represent immediate vector vaccines for disease prevention. Since this combined platform circumvents the protein purification process inherent to conventional ELISA and membrane-displayed proteins maintain appropriate conformations, our system provides superior serum detection and vaccine applications. We have also used baculovirus to construct an antigen library in which all major antigens from 29 human/animal-infecting virus families are displayed on insect cells. This antigen library can be used as a comprehensive detection system for various patient sera. Moreover, if our library detects an unknown disease, the corresponding viral antigen can be displayed on baculovirus as a vaccine. Thus, our comprehensive vaccine-ready detection system is an innovative breakthrough not only for the control of COVID-19 but also other emerging viral diseases.