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A coronavirus protein transforming into a nanoparticle, a key player for covid-19 vaccine

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Coronavirus were found in the mid-1960s that can infect both humans and animals (birds and mammals), whereas seven coronaviruses are known to infect humans, such as Betacoronavirus HCoV-OC43 and HCoV-HKU1 and Alphacoronavirus HCoV-229E. Novel coronavirus-2019 (2019-nCoV) was first identified from a patient with pneumonia, related to the cluster of acute respiratory illness cases from Wuhan, China with close relation to SARS-CoV and genetically clusters within the genus Betacoronavirus, subgenus Sarbecovirus. A vaccine to prevent COVID-19 is the best hope for ending the pandemic. Presently, there is no vaccine to prevent infection with the COVID-19 virus.

One of the proteins on the virus, located on the characteristic COVID spike - has a component called the receptor-binding domain (RBD). That is antibodies against this part of the virus have the potential to the neutralize the virus.

It seems likely that a vaccine could induce high-levels of antibodies against the RBD. To achieve this goal is to use the RBD protein itself as an antigen, that is, the component of the vaccine that the immune response will be directed against.

It was hypothesized that by converting the RBD into a nanoparticle (similar in size to the virus itself) instead of letting it remain in its natural form as a small protein, it would generate higher levels of neutralizing antibodies and its ability to generate an immune response would increase.

A group of scientists developed a technology that makes it easy to convert small, purified proteins into particles by using small nanoparticles formed from naturally-occurring fatty components, or liposomes. In the new study, the researchers included cobalt-porphyrin-phospholipid (CoPoP), a special lipid within the liposomes that enables the RBD protein to rapidly bind to the liposomes, forming more nanoparticles that generate an immune response.

A previous study revealed that when the RBD was converted into nanoparticles, it maintained its correct, three-dimensional shape and the particles were stable in incubation conditions similar to those in the human body. High antibody level was induced when laboratory mice and rabbits were immunized with the RBD particles. For enhancing the immune response, only the approach with particles containing CoPoP gave strong responses, whereas other vaccine adjuvant technology does not have the capacity to convert the RBD into particle-form.

In conclusion, this method could assist information of future vaccine design that targets this specific antigen.

Biography

Dr. Cheepsattayakorn graduated Doctor of Medicine from Chiang Mai Medical School, Chiang Mai University, and Chiang Mai, Thailand in 1986. He then further had trained in Internal Medicine, Pulmonology, and Radiology at Chiang Mai University Medical School. Recently, on October 26, 2019, he was bestowed the Gold Medal Award (First-Class Award) from the Chiang Mai University Medical School Alumni Association in Chiang Mai, Thailand for his academic and medical practice excellence for cerebrating the 60th Anniversary of the Chiang Mai University Medical School, Chiang Mai, Thailand that was established on October 28, 1959. He has numerous certified Fellowships from the Royal Colleges of Physicians of Edinburgh, London and Thailand, Royal College of Physicians and Surgeons of Glasgow, American College of Physicians, and American College of Chest Physicians.