Engineered multivalent self-assembled binder protein against SARS-CoV-2 RBD

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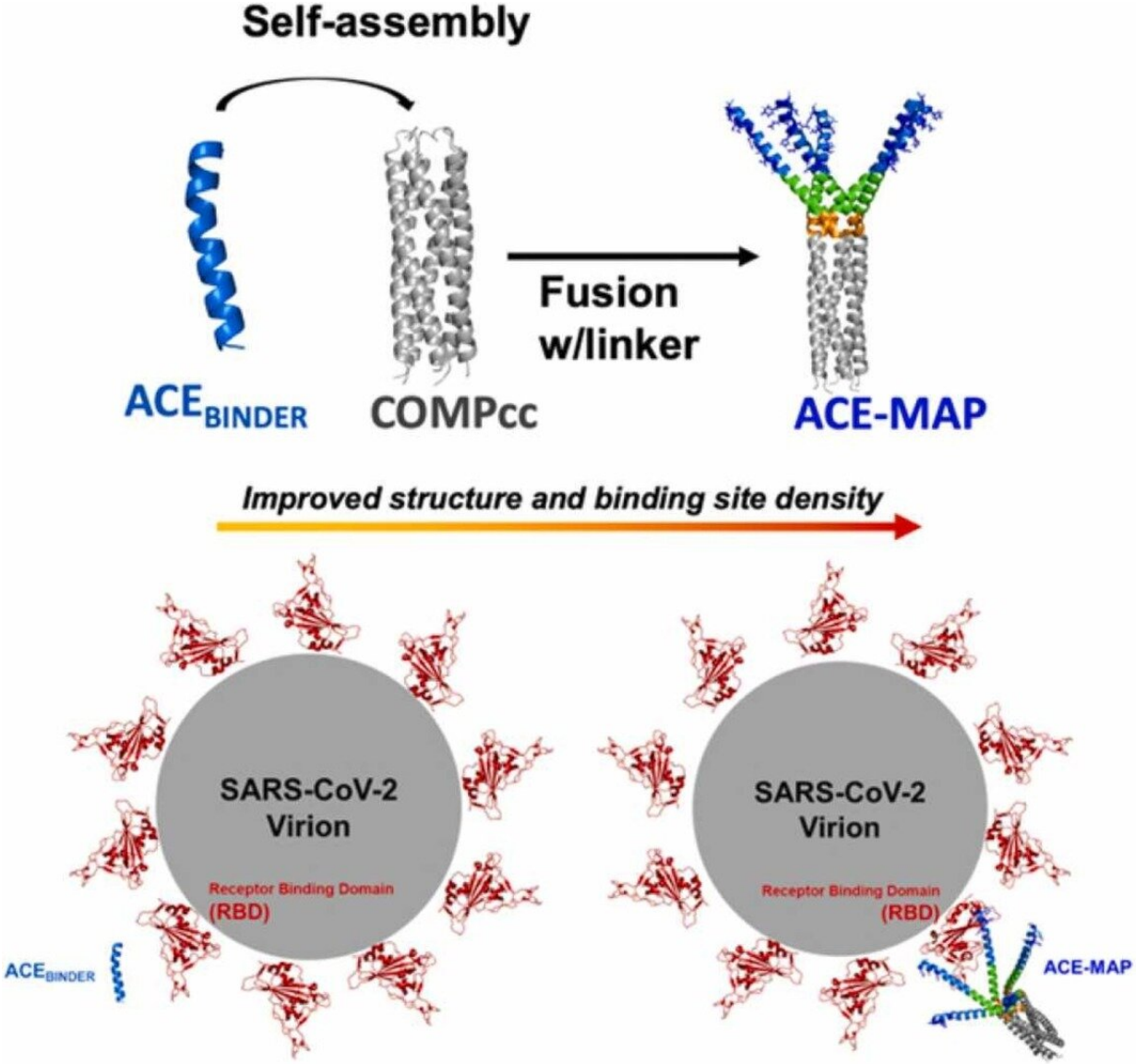

Graphical abstract. Credit: *Biochemical Engineering Journal* (2022). DOI:

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Since it appeared in 2019, COVID-19 has claimed over 6 million lives and upended society across the globe. The condition, caused by the SARS-CoV-2 virus, attacks cells in the lungs, heart and brain, among other organs. Researchers soon realized that the disease affected these organs so dramatically because its distinctive spikes binded to the angiotensin-converting enzyme 2, or ACE2 receptor. The protein—common in those organs—provides the entry point for the coronavirus to hook into and infect cells.

ACE2 receptors were thus the obvious choice when testing for or treating COVID-19. By recreating the ACE2 and introducing it to an infected body, the virus would bind to the protein, revealing itself in a test or occupying itself with a "fake" receptor. But relying on the ACE2 protein alone may not provide sufficient binding to find and fight the virus.

Now, researchers from across NYU and led by Jin Kim Montclare, Professor of Chemical and Biomolecular Engineering at NYU Tandon, have created a new protein that has an increased ability to bind to viruses, creating a more efficient tool in the fight against COVID-19. The secret is creating a version of ACE2 that mimics a multivalent assembled protein (MAP). Multivalent assembled proteins are like naturally occurring antibodies. Their bodies have multiple sites that can link and bind to the viruses they are trying to attack, making them far more effective at hooking into their targets.

The ACE-MAP the team designed utilizes a coil-shaped cartilage oligomeric matrix protein, a nanomaterial that Montclare's lab has used before in different applications. When fused with part of ACE2 across

the coils surface, they found that the new materials greatly increased the valency compared to ACE2 alone, potentially binding to multiple virus bodies at a time rather than a single one.

This new material has potential uses in both detection and treatment. Because the biomaterial is so much more effective at attaching themselves to viral bodies, it would require fewer of them compared to the natural antibodies currently used in tests and therapeutics. This technology has possible uses in testing for and treating other diseases with known receptors and a similar structure, such as HIV. Ongoing research will confirm the effectiveness of ACE-MAP in other models, and may be a key component of the fight against COVID-19 in the future.

More information: Dustin Britton et al, Engineered Multivalent Self-Assembled Binder Protein Against SARS-CoV-2 RBD, *Biochemical Engineering Journal* (2022). DOI: 10.1016/j.bej.2022.108596

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