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LETTER TO THE EDITOR

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Severe acute respiratory syndrome coronavirus-2 and its structural proteins

To The Editor,

We read with great interest a review that provides a systematic evaluation of the most recent *in vitro* and *in vivo* investigations targeting severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) cell entry, although authors showed that SARS-CoV-2 has five structural proteins including the S (spike), M (membrane), N (nucleocapsid), and E (envelope) proteins, and the HE (hemagglutinin esterase) in fig. 2 (Seyedpour et al., 2021). However, based on the scientific evidence which is described in this letter, SARS-CoV-2 lacks HE so it cannot be considered as a structural protein in SARS-CoV-2 (Chan et al., 2020; Mittal et al., 2020; Zandi et al., 2021).

Recently a novel coronavirus called SARS-CoV-2 causes coronavirus disease 2019 (COVID-19) as a global pandemic (Navand et al., 2020). SARS-CoV-2 is considered the seventh human coronavirus. Coronaviruses belong to *Coronaviridae* family which are classified in four genera: alpha-, beta-, gamma-, and delta-coronaviruses. In coronaviruses, only some beta-coronaviruses contain HE (Chan et al., 2020). There are five subgenera Embecovirus, Sarbecovirus, Merbecovirus, Nobecovirus, and Hibecovirus in beta-coronavirus genus. Both SARS-CoV and SARS-CoV-2 are members of beta-coronaviruses of Sarbecovirus, MERS-CoV is a beta-coronavirus of Merbecovirus, although OC43-CoV and HKU1-CoV are beta-coronaviruses of the Embecovirus (Committee ICoToVE, 2020; Frutos et al., 2021; Zhang et al., 2021).

The genome of coronaviruses is 26–32 kb in length. The genome of SARS-CoV-2 codes four structural proteins: S, E, M, N, and several accessory proteins: ORF3a, 3b, 6, 7a, 7b, 8, 9b, 9c, and 10. SARS-CoV-2 does not contain HE gene (Chan et al., 2020; Zhang et al., 2021). However, other beta-coronaviruses such as HKU1-CoV and OC43-CoV of Embecovirus subgenera bear HE gene and can encode HE (Hulswit et al., 2019).

In conclusion, SARS-CoV-2 as a beta-coronavirus of Sarbecovirus lacks HE and encodes four structural proteins thus HE cannot be used as a drug target against COVID-19.

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