Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

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Letter to the editor

SARS-CoV-2 and enhancing antibodies

To the Editor,

Human coronaviruses (CoV) are common, and some of them are associated with mild respiratory infections including common cold [1]. In contrast, other CoV infections including the severe acute respiratory syndrome (SARS), the Middle East respiratory syndrome (MERS) and the recent COVID-19 are characterised by a higher pathogenicity in certain human populations and may be lethal. CoV infections were shown to induce an effective antibody response, however in addition to neutralising antibodies also enhancing antibodies were described, e. g., in the case of SARS-CoV [2] and MERS-CoV [3]. Antibody-dependent enhancement (ADE) occurs when antibodies facilitate viral entry into host cells. ADE has been observed for a variety of viruses, most notable flaviviruses [4]. In the case of MERS-CoV, neutralising antibodies bind to the viral envelope protein and mediate viral entry into IgG Fc receptor-expressing cells. In persons infected by SARS-CoV enhancing antibodies and neutralising antibodies may partly counteract each other´s function. It is still unclear whether common CoV, SARS-CoV, MERS-CoV and SARS-CoV-2 have related antigens and whether antibodies against one virus may cross-react with the others. In the case, cross-reactive enhancing antibodies exist, the infection with the new SARS-CoV-2 may be enhanced by these pre-existing antibodies against common CoV.

Common CoV circulate every year in the human population [1] and it sounds logical that the amount of anti-CoV antibodies including potentially enhancing antibodies is higher in older persons. This may explain the fact that an SARS-CoV-2 infection in older persons is more severe compared with that in children who may not have had an infection with common CoV. There is clear evidence that children get infected by SARS-CoV-2, but only a few children suffer severely from COVID-19 [6].

The assumption of ADE with pre-existing enhancing antibodies against common CoV may also explain why in some regions the infection rate with SARS-CoV-2 and its pathogenicity is higher compared with other regions. These affected regions may be regions with a higher prevalence of common CoV in the last years.

The assumption of ADE of SARS-CoV-2 infections may be tested easily *in vitro,* adding in infection experiments sera from elderly and younger people with and without previous CoV infections.

Transmission of antibodies from individuals who recovered from SARS-CoV-2 infection is under development as possible therapy. Although first clinical studies in China did not reveal negative results [5], certainly because the neutralising antibodies are vastly outnumbered, it is theoretically possible, that also enhancing antibodies are transmitted, worsening the disease.

The possible existence of enhancing antibodies is also of importance for the development of a vaccine against SARS-CoV-2. To induce enhancing antibodies after immunisation of a healthy person is certainly not the goal of this preventive measure.

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Joachim Denner*
Robert Koch Institute, Berlin, Germany
E-mail address: DennerJ@rki.de.

* Corresponding author.

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