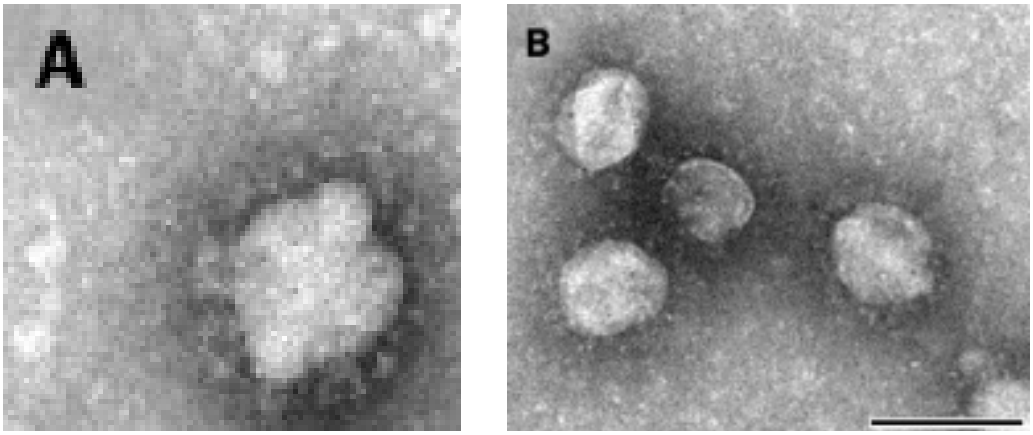
Application of VN-ADS technology to coronavirus detection (images & explanation)

Jeremy J. Ramsden

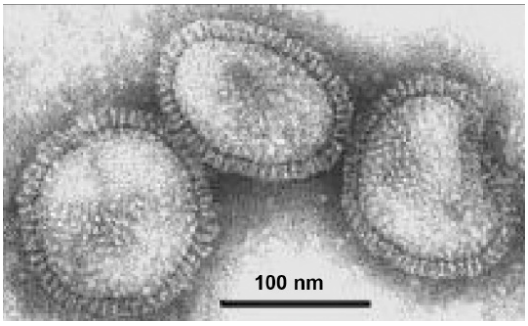
12 March 2020

1. Image of coronavirus



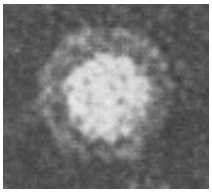
Negative-contrast electron micrograph of SARS-CoV isolated from nasal swabs of infected macaques; negatively stained with phosphotungstic acid, bar=100 nm. From Kuiken et al. (2003). Note the typical club-shaped surface projections, 10–20 nm long (easier to see in expanded left-hand image A).

2. Image of influenza virus



Tranmission electron micrograph of influenza A virus. From Wang & Li (2016). The surface projections are much more densely packed than in coronaviruses.

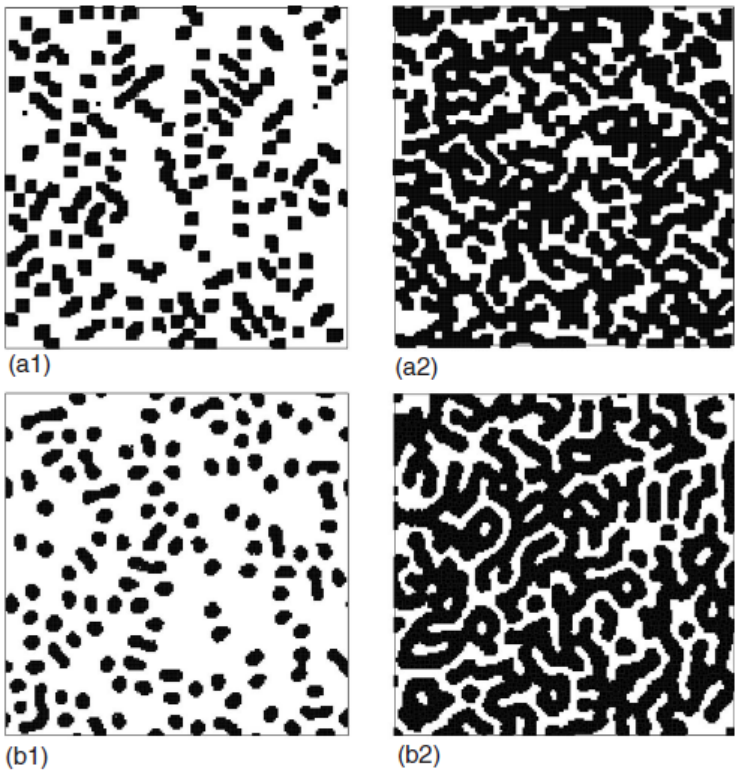
3. Image of rhinovirus



From Kapikian (1972).

4. Explanation of design of capture materials for coating the optical fibre ends

Just like a text can be reduced to a sequence of vowels (V) and consonants (C)—e.g. “Hello” becomes CVCCV—a virus surface coating can be reduced to an arrangement of two types of chemical species—we can call them B (black) and W (white). B attracts W and repels other B and W attracts B and repels other W. For the sake of illustration consider that the arrangement of coronavirus is like pattern a1 below, and the arrangement of influenza virus like a2. The optical fibre is then coated with the complementary arrangement of B and W. The fabrication of precise complementary patterns is not presently achievable with high throughput, and in any case the viruses, being soft, do not present a rigid pattern. Fortunately it has been shown experimentally[1] that good binding discrimination to proteins can be achieved even with random complementary arrangements. Thus, with b1 and b2 representing different optical fibre coatings, they will bind differently to a1 and a2. The coatings created using the VN ADS methodology are not random, but we can readily generate a huge variety of different ones. The first step is to screen them for differential binding to the different viruses. Given the vast repertoire of patterns that we can generate, success in finding suitable coatings is inevitable.



From Jiang et al. (2007).

[1] Aggarwal, N., Lawson, K., Kershaw, M., Horvath, R. and Ramsden, J.J. Protein adsorption on heterogeneous surfaces. Appl. Phys. Lett. 94 (2009) 083110.