


 Swiss  
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Research

## Coronavirus Variants: What's Next?

### SARS-CoV-2 Variants: Escape from Antibody Classes 1 to 3

Detection	Name	Class 1	Class 2	Class 3	Other (RBD)
Britain	Alpha	-	-	-	N501Y
South Africa	Beta	K417N	E484K	-	N501Y
Brazil (P1)	Gamma	K417T	E484K	-	N501Y
India	Delta	-	-	L452R	T478K
Nepal	Delta +	K417N	-	L452R	T478K
California	Epsilon	-	-	L452R	-
New York	Iota	-	E484K	-	S477N
Peru	Lambda	-	F490S	F490S L452Q	-

Swiss Policy Research (July 2021), based on Greaney et al. (2021)

Coronavirus variants: Escape from antibody classes 1 to 3 (SPR, based on [Greaney et al.](#))

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**So far, no variant has achieved escape from all three major antibody classes.**

**Please note:** This is a scientific analysis; it does not support “fear mongering”.

Existing coronavirus variants – including the British, South African, Brazilian and Indian variants – have shown some gradual changes in infectiousness, virulence, and immune escape. Relative transmission advantages are often [only transitory](#), until collective immunity has caught up.

Some of the existing variants – notably the South African, Brazilian (P1), Nepalese and Peruvian variants – have managed to escape two out of three major antibody classes, reducing vaccine effectiveness; but so far, no variant has managed to escape all three antibody classes (see above).

Such a triple-escape variant may arrive next autumn or winter and could potentially lead to increased rates of vaccine breakthroughs and re-infections, especially in regions that have not yet faced the Brazilian or South African ‘class 2’ escape variants. The actual impact will also depend on the effectiveness of [cellular immunity \(T cells\)](#), which may be somewhat broader.

Furthermore, a triple-escape variant will, for the first time, raise the question of a potential antibody-dependent disease enhancement (ADE), as vaccinated people, in particular, will have very high levels of non-neutralizing antibodies, whose behavior remains somewhat uncertain. ADE has been observed [with SARS-1 vaccine candidates](#), but not yet with SARS-2 vaccines.

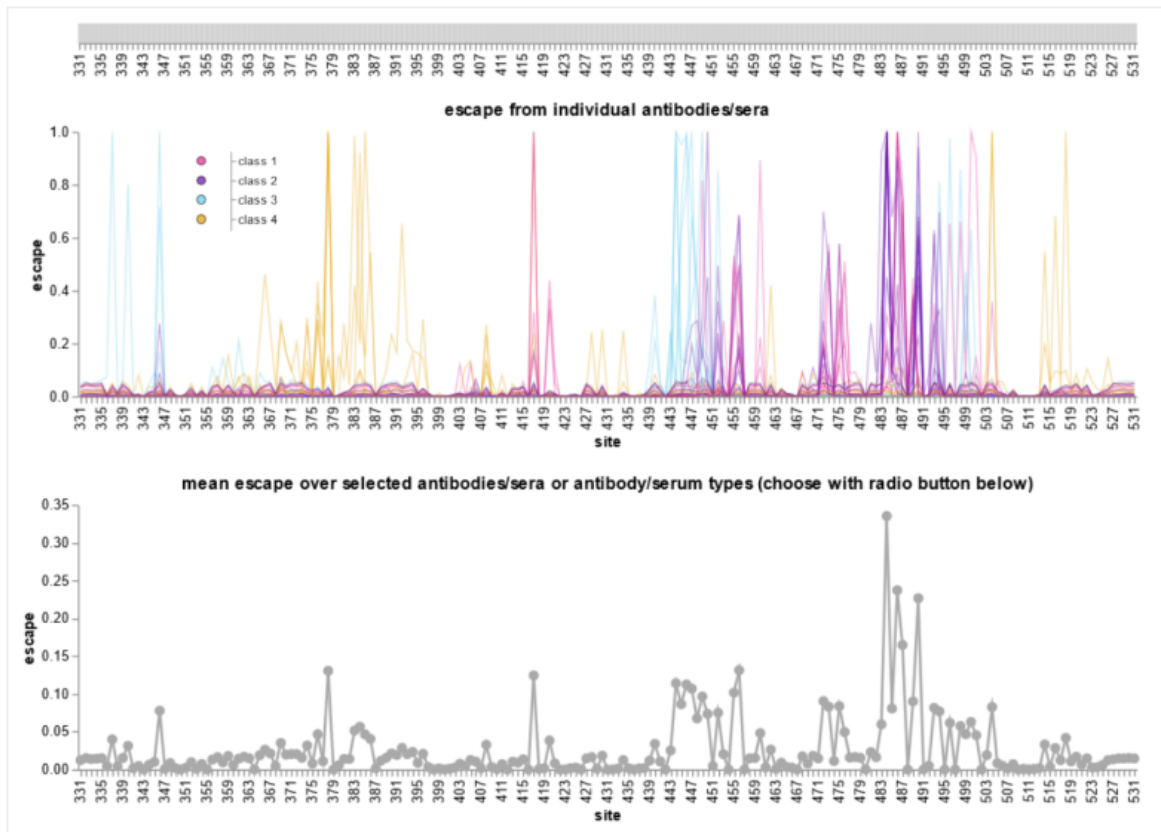
In terms of escape mutations, the coronavirus has already played many of its best ‘cards’, including the powerful 484 escape mutation found in the South African, Brazilian and New York variants and the 490 mutation in the [Peruvian variant](#). In terms of receptor binding affinity – which may or may not increase infectiousness and virulence – there are a few more options left (see charts below).

Existing and future coronavirus variants once again highlight the importance of effective and affordable [early treatment options](#) for high-risk people and low-income nations, as monoclonal antibody therapies are [losing effectiveness](#) and vaccines will require updated boosters.

**See also:** [The mysterious summer wave driven by the “Indian variant”](#) (June 2021)

## Figures

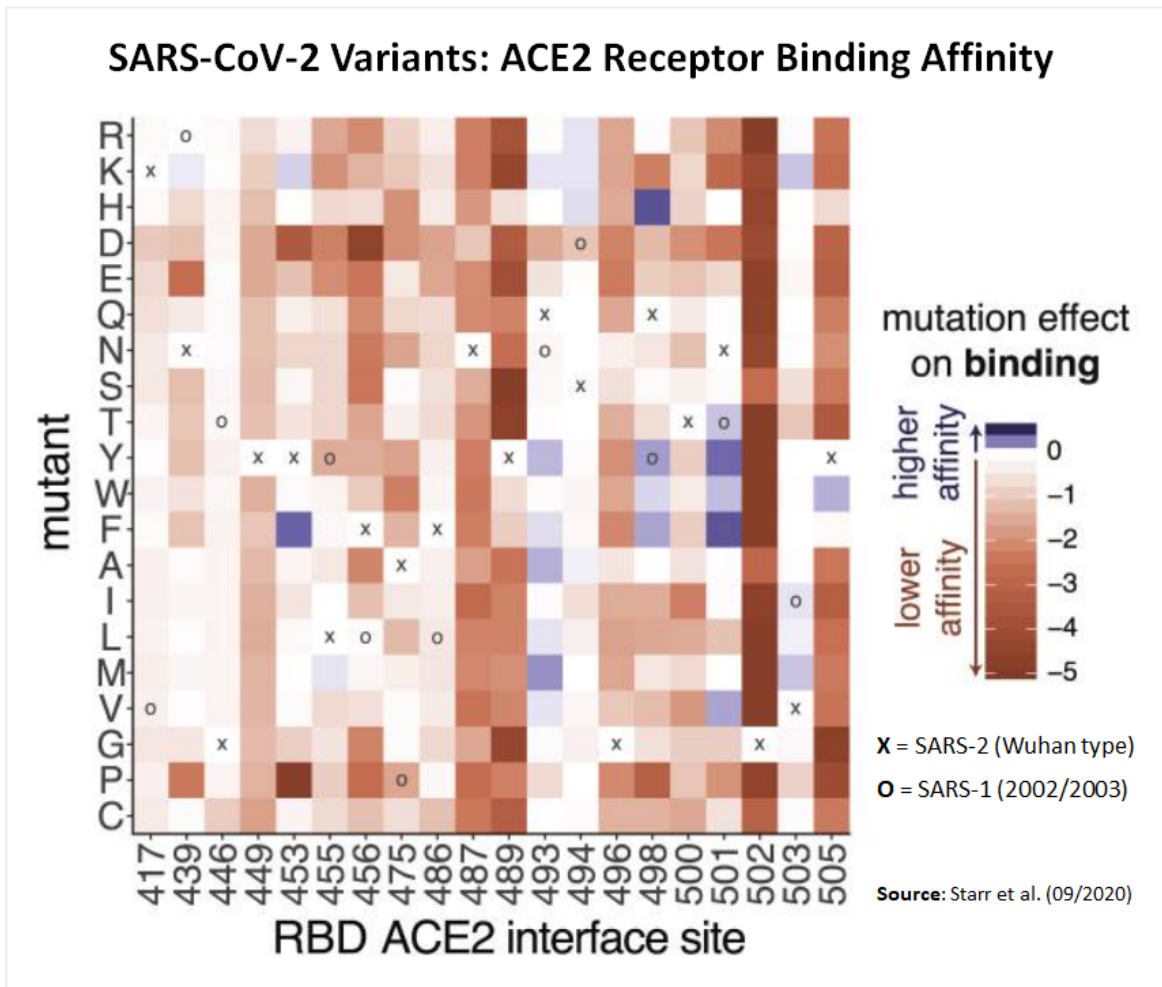
### 1) Coronavirus escape mutations (per antibody class and overall)



Coronavirus escape mutations, per antibody class and overall ([Bloom lab](#))

## 2) Coronavirus mutations increasing or decreasing ACE2 receptor binding affinity

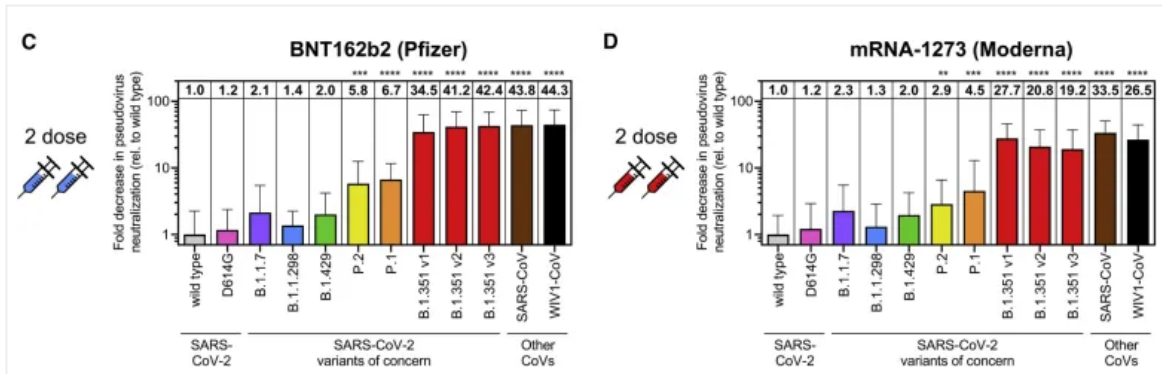
Mutations increasing (blue) or decreasing (red) ACE2 receptor binding affinity. An increased receptor binding affinity may increase or decrease virulence and infectiousness.



Coronavirus mutations and their effect on ACE2 receptor binding affinity (Starr et al.)

### 3) RNA vaccines: Reduced neutralization against new virus variants

Covid RNA vaccines: reduction in neutralization of variants (x-fold reduction).  
 P.1/P.2: “Brazilian” variants; B.1.351.V1-3: “South African” variants (Source: Garcia-Beltran).



Covid RNA vaccines: Reduction in neutralization of variants (x-fold reduction). P.1/P.2: “Brazilian” variants; B.1.351.V1-3: “South African” variants (Source: Garcia-Beltran)

See also

- [Facts about Covid](#)

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- [Covid early treatment](#)

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