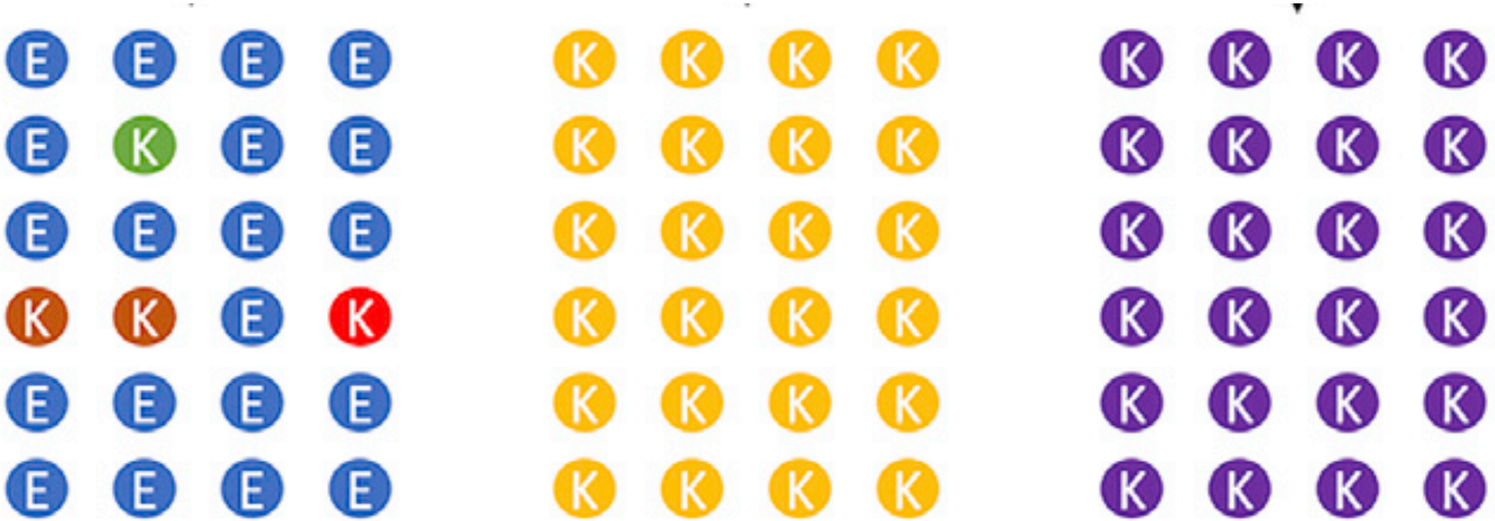
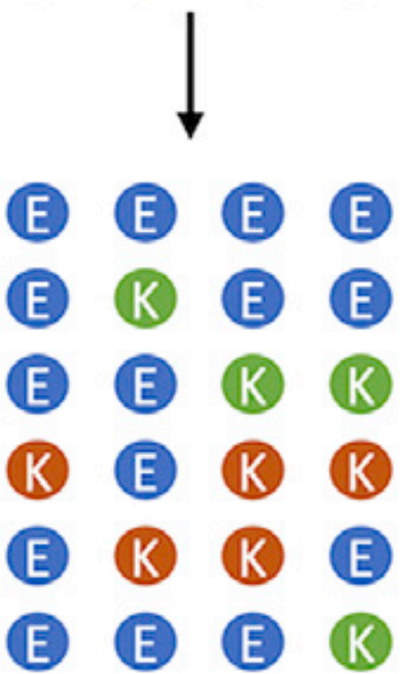
December 2019
November 2020
May 2021

Martin et al., 2021, Cell 184, 5189–5200 The emergence and ongoing convergent evolution of the SARS-CoV-2 N501Y lineages



March 2021

E to K associated positive selection signal detectable even when only considering alpha sequences

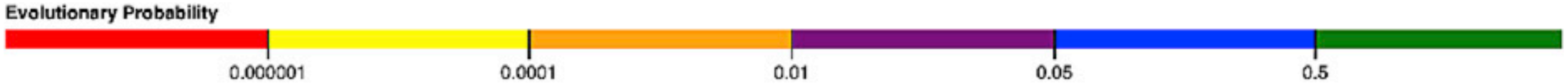


June 2021

K more than doubles in frequency between March and June 2021, reiterating that K provides a fitness advantage: K at this site is added to the 501Y meta-signature along with various mutations at 34 other similarly evolving genome sites

Used data up to February to define 34 convergent sites between three N501Y lineages

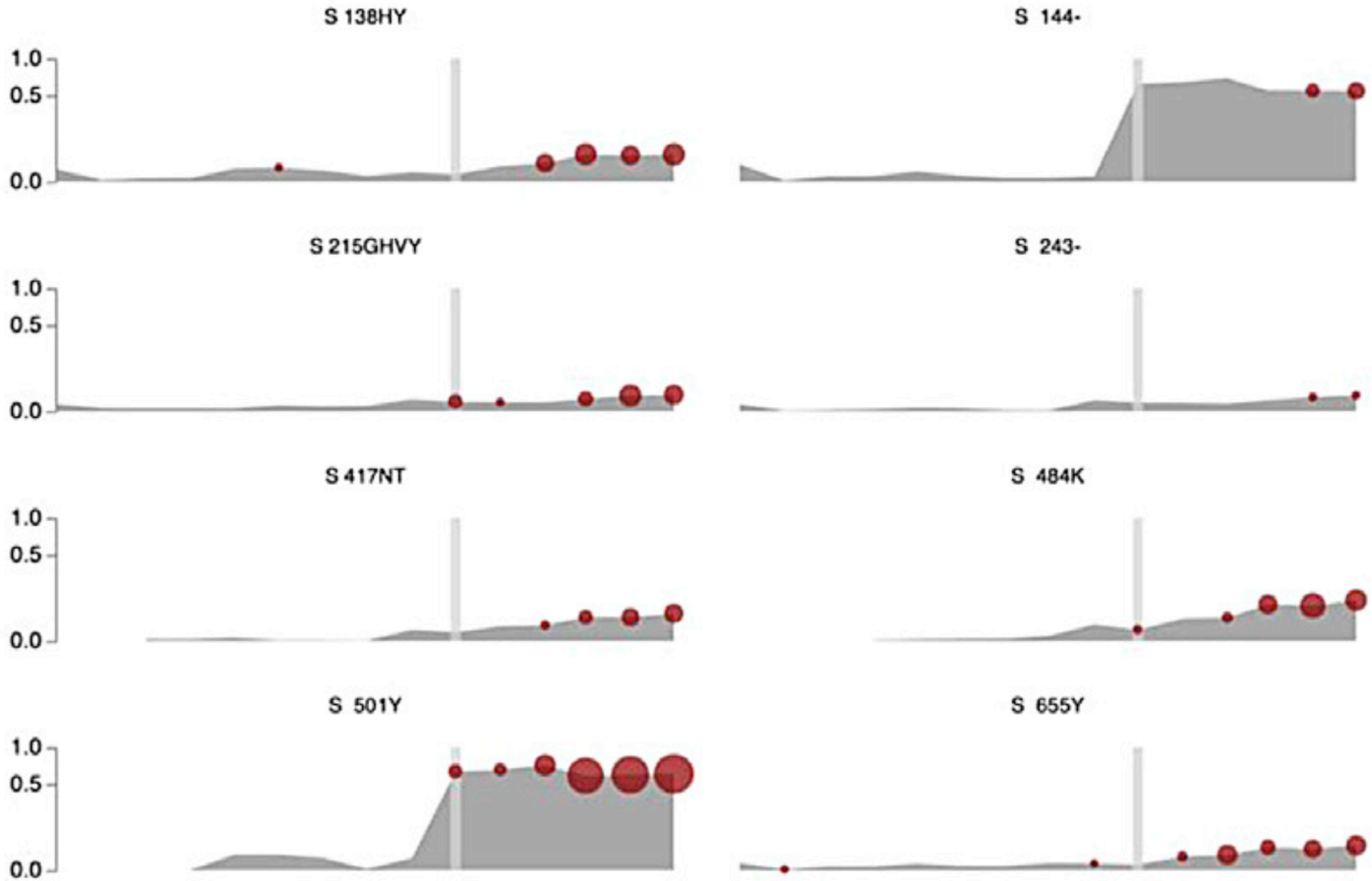
Used data up to June to validate convergent sites



Nucleotide	Site	V1	V2	V3	V1 subs to	V2 subs to	V3 subs to
21574	S/5	✓	✓	✓	F	F	F
21613	S/18	✓	✓	✓	F	F	F
21619	S/20			✓		T I	N
21637	S/26	✓		✓	S	R	S
21799	S/80	✓	✓		A	A D S	
21853	S/98	✓	✓		F	F	S
21973	S/138	✓	✓	✓	H Y	Y	Y D
22129	S/190			✓			S
22204	S/215	✓	✓		G	G V D H	
22810	S/417		✓	✓		N K	T K
23011	S/484	✓	✓	✓	K Q	K E	K
23062	S/501	✓	✓	✓	Y N E	Y N	Y N

Selection legend

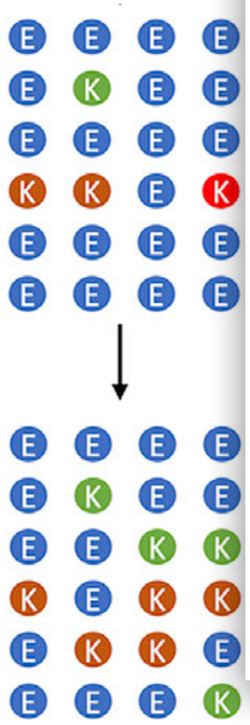
1. ✓ : Signtature mutation
2. ✓ : MEME support
3. ✓ : convergent subsitutions to another lineage (no MEME support)
4. ✓ : convergent subsitutions to another lineage AND MEME support

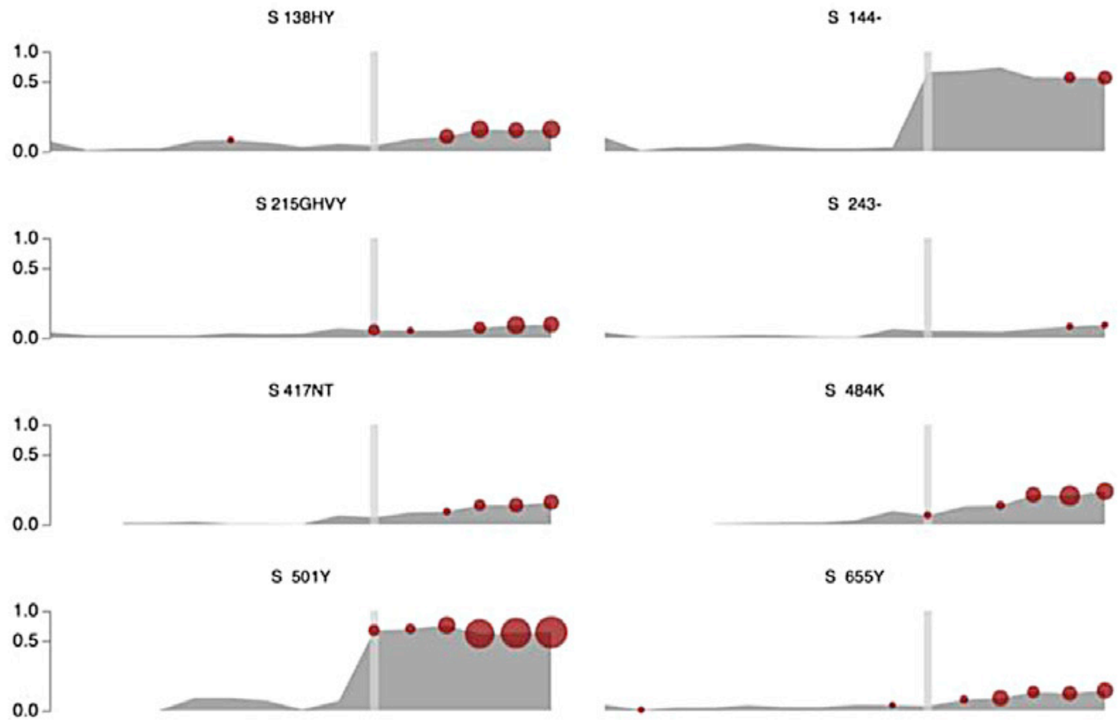


"In total, 20/47 of the analyzed convergent mutations that were suggested by our global and lineage-specific positive selection analyses to have contributed to the fitness of 501Y lineage viruses prior to March 2021 more than doubled in frequency in at least one of the lineages between 15 March and June 1, 2021"

December 2019 | November 2020 | May 2021

Selective shift, 501Y VOC





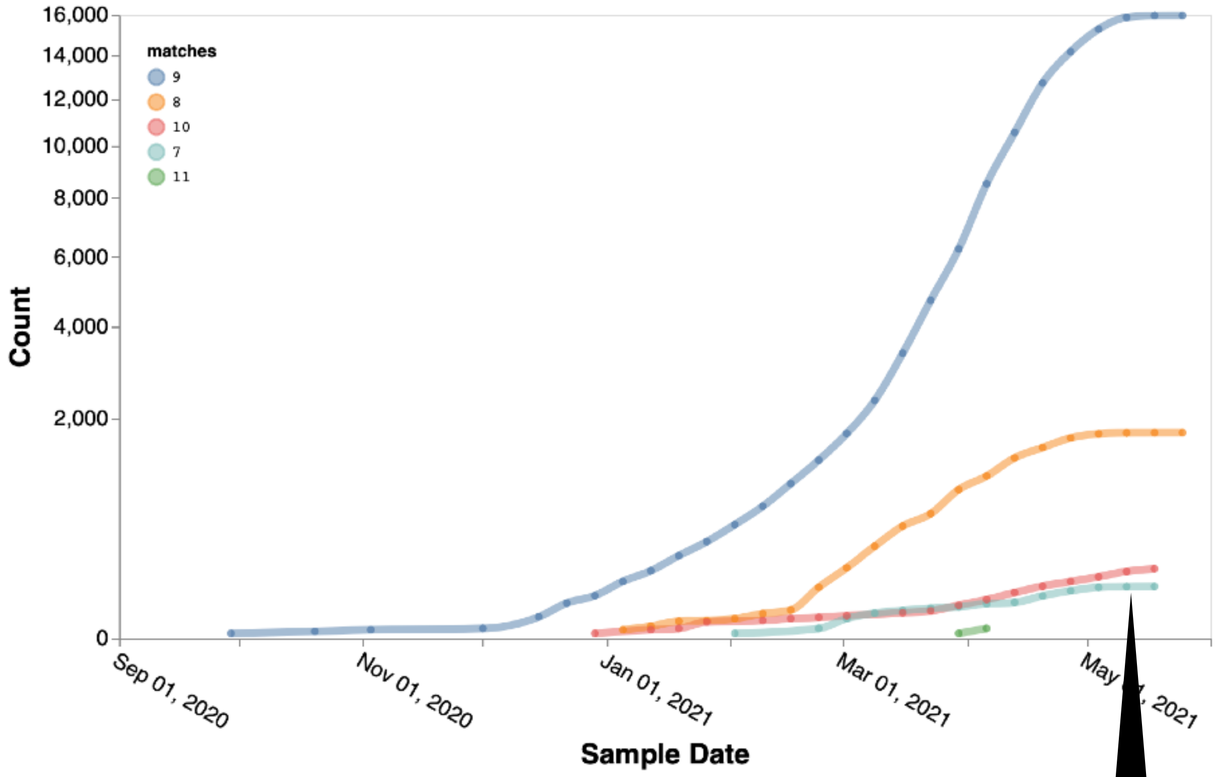
"In total, 20/47 of the analyzed convergent mutations that were suggested by our global and lineage-specific positive selection analyses to have contributed to the fitness of 501Y lineage viruses prior to March 2021 more than doubled in frequency in at least one of the lineages between 15 March and June 1, 2021"

Used data up to June to validate convergent sites

Martin et al., 2021, Cell 184, 5189–5200 The emergence and ongoing convergent evolution of the SARS-CoV-2 N501Y lineages

December 2019 | November 2020 | May 2021

Selective shift,
501Y VOC



Sequences acquiring additional mutations in Spike (V3)

Martin et al., 2021, Cell 184, 5189–5200 The emergence and ongoing convergent evolution of the SARS-CoV-2 N501Y lineages