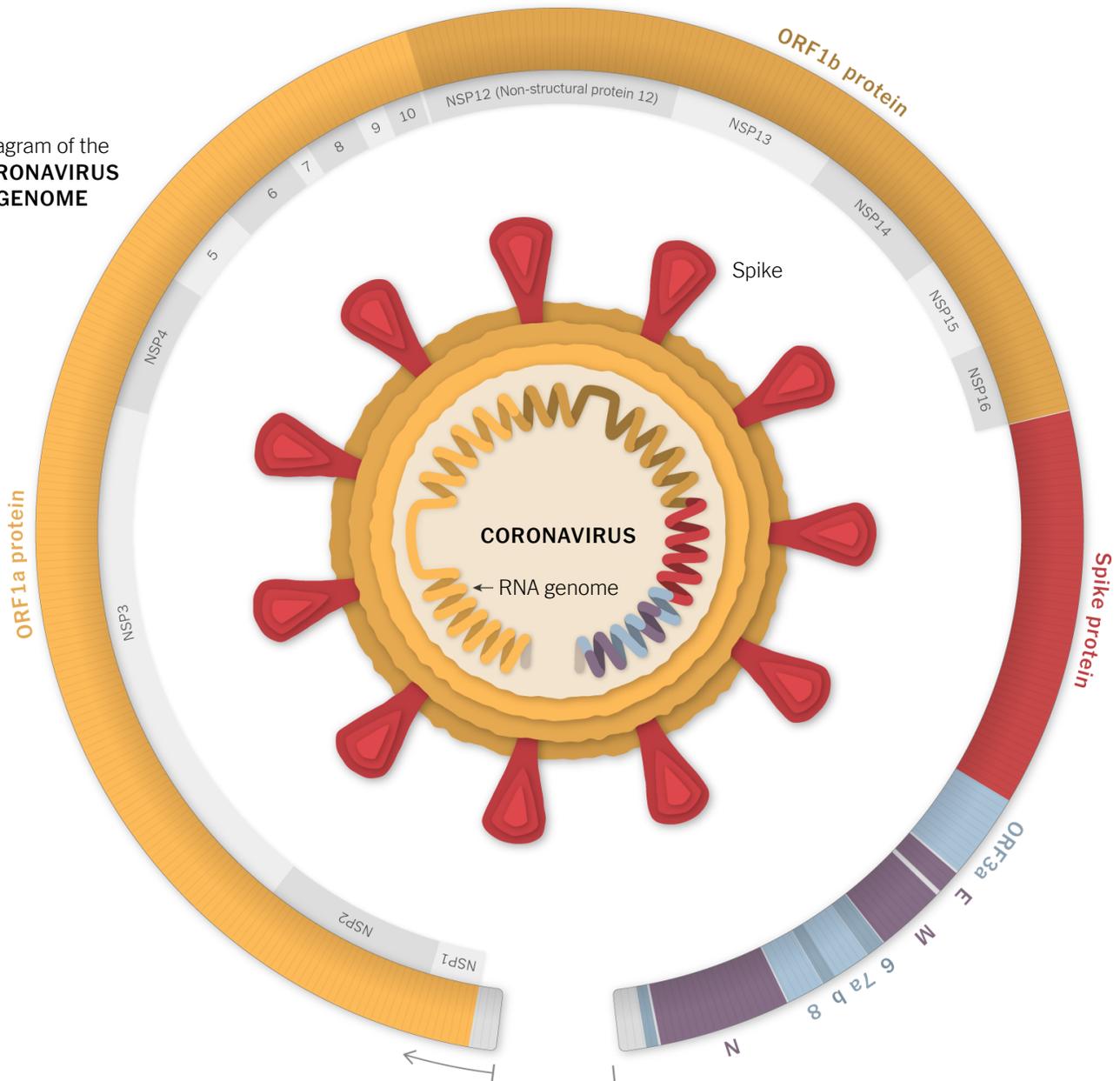


Coronavirus Variants and Mutations

By Jonathan Corum and Carl Zimmer Updated March 22, 2021

Each coronavirus contains nearly 30,000 letters of RNA. This genetic information allows the virus to infect cells and hijack them to make new viruses.

Diagram of the
CORONAVIRUS
GENOME



As an infected cell builds new coronaviruses, it occasionally makes tiny copying errors called **mutations**. Scientists can track mutations as they are passed down through a **lineage**, which is a branch of the viral family tree.

A group of coronaviruses that share the same inherited set of distinctive mutations is called a **variant**. If enough mutations accumulate in a lineage, the viruses may evolve clear-cut differences in how they function. These lineages come to be known as **strains**. Covid-19 is caused by a coronavirus strain known as SARS-CoV-2.

Over the course of the pandemic, a number of variants of SARS-CoV-2 have arisen. Some of them are raising worries that they may draw out the pandemic or make vaccines less effective.

News and updates

March 5	Scientists find the E484K mutation in a sample from Portland, Oregon.
Feb. 23	Added the B.1.526 variant, which is spreading in New York City.
Feb. 23	Studies suggest that a variant discovered in California is more contagious.
Feb. 17	Maryland confirms its first case of the P.1 variant.
Feb. 16	Massachusetts confirms its first case of the B.1.351 variant.
Feb. 15	Added the Q677 spike mutation, which was found in several lineages in the U.S.
Feb. 15	B.1.351 is confirmed in a Connecticut resident hospitalized in New York City.
Feb. 13	Studies suggest B.1.1.7 is likely more deadly than other circulating variants.
Feb. 11	Illinois and North Carolina confirm their first cases of the B.1.351 variant.
Feb. 7	South Africa stops using AstraZeneca's vaccine against the B.1.351 variant.
Feb. 7	The B.1.1.7 variant is doubling every 10 days in the United States.

Variants of concern

Lineage	Variant name	Status
B.1.1.7	Variant of Concern 202012/01, or 501Y.V1	Emerged in Britain in December and thought to be roughly 50 percent more infectious.
B.1.351	501Y.V2	Emerged in South Africa in December. Reduces the effectiveness of some vaccines.
P.1	501Y.V3	Emerged in Brazil in late 2020. Has mutations similar to B.1.351.
B.1.427,	CAL.20C	Common in California and thought to be about 20 percent more

Variants of interest

Lineage	Variant name	Status
B.1.525	—	Spreading in New York. Carries some of the same mutations as B.1.1.7.
B.1.526	—	Spreading in New York. One version carries the E484K mutation, another carries S477N.

Mutations that may help the coronavirus spread

Lineage	Mutation	Status
B.1	D614G	Appeared in early 2020 and spread around the world.
Several	N501Y	A defining mutation in several lineages, including B.1.1.7, B.1.351 and P.1. Helps the virus bind more tightly to human cells.
Several	E484K or “Eek”	Appears in several lineages. May help the virus avoid some kinds of antibodies.
Several	K417	Appears in several lineages, including B.1.351 and P.1. May help the virus bind more tightly to cells.
Several	L452R	Increasingly common in California, but not yet shown to be more infectious.
Several	Q677	Found in seven U.S. lineages, but not yet shown to be more infectious.

Variants of Concern

Coronaviruses that appear to be more infectious or cause more severe disease than other circulating coronaviruses.

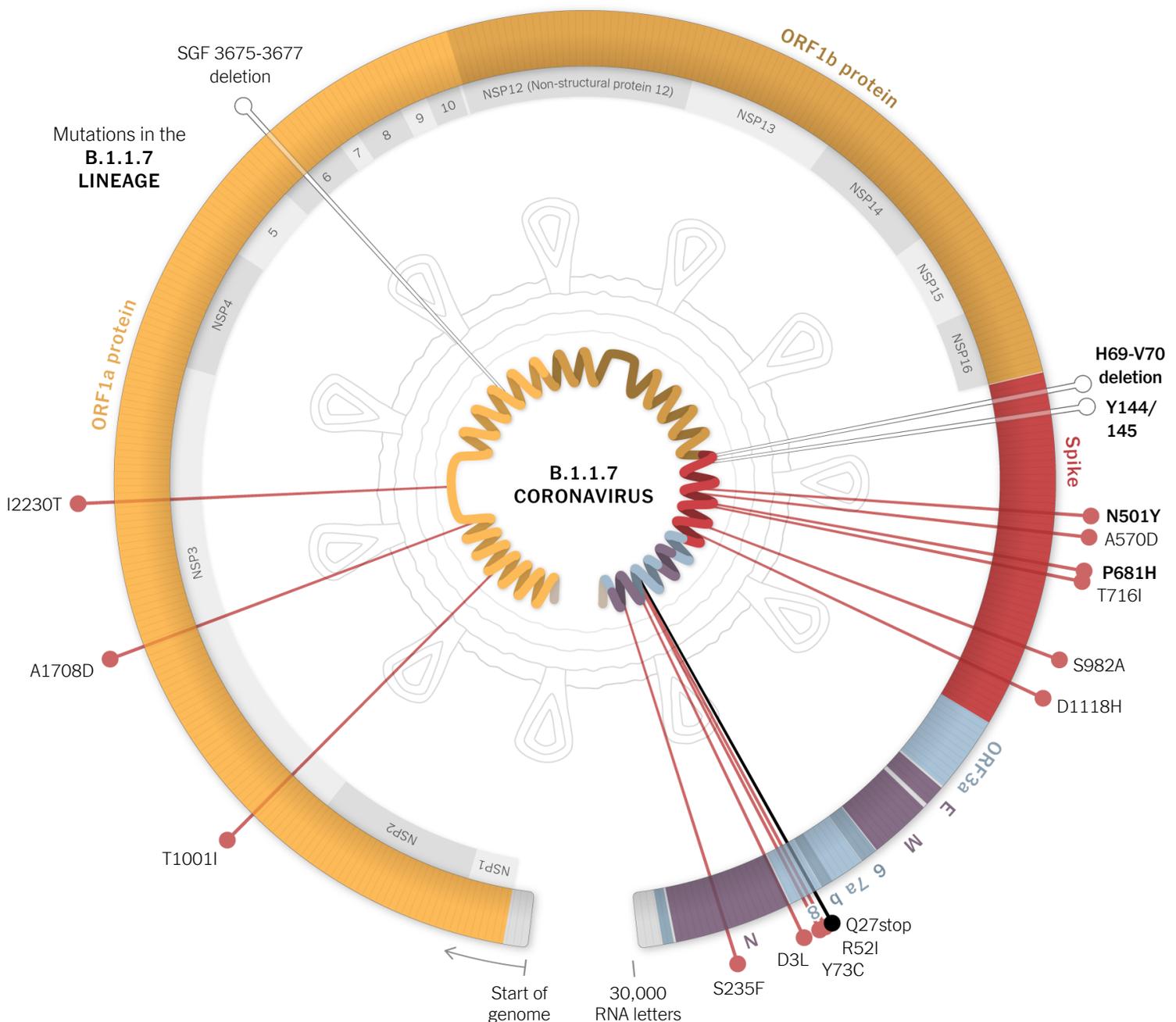
The B.1.1.7 Lineage

This group of coronaviruses came to light in Britain, where it was named **Variant of Concern 202012/01**. The variant is also known as **20I/501Y.V1**, or simply called **B.1.1.7**.

Coronaviruses from the B.1.1.7 lineage are thought to be 30 to 50 percent more infectious than other variants in circulation today. They are also likely to be more deadly, based on studies in Britain.

After its discovery in December, it quickly emerged in other countries and surged at an exponential rate. It is doubling in the United States every ten days. Preliminary evidence suggests that B.1.1.7 is about 55 percent more deadly than other variants. But testing suggests that vaccines still work well against it.

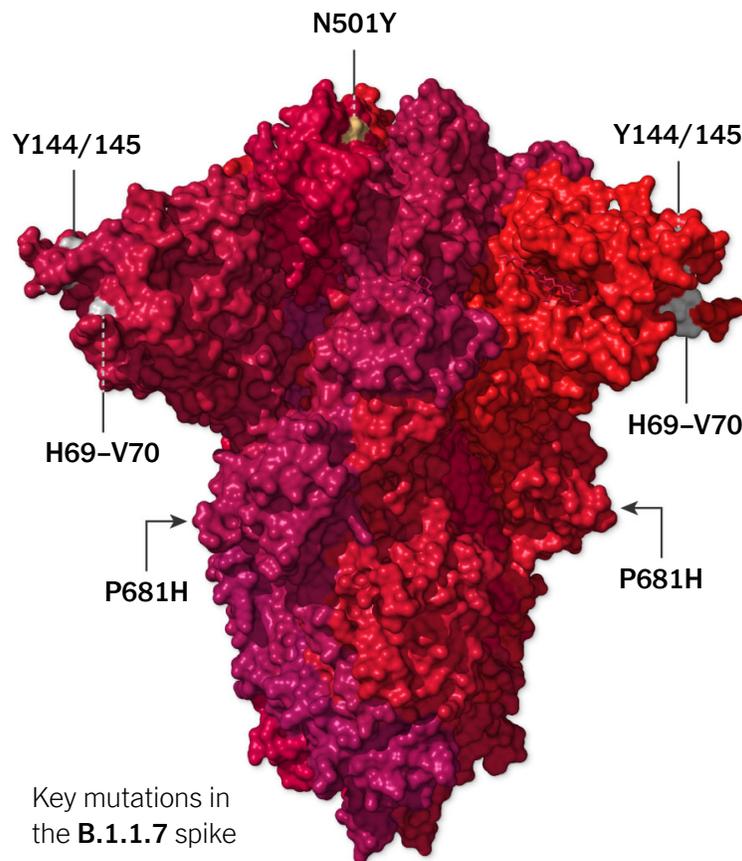
B.1.1.7 appears to be more infectious thanks to several mutations in its spike protein, which the coronavirus uses to attach to cells.



KEY MUTATIONS IN B.1.1.7

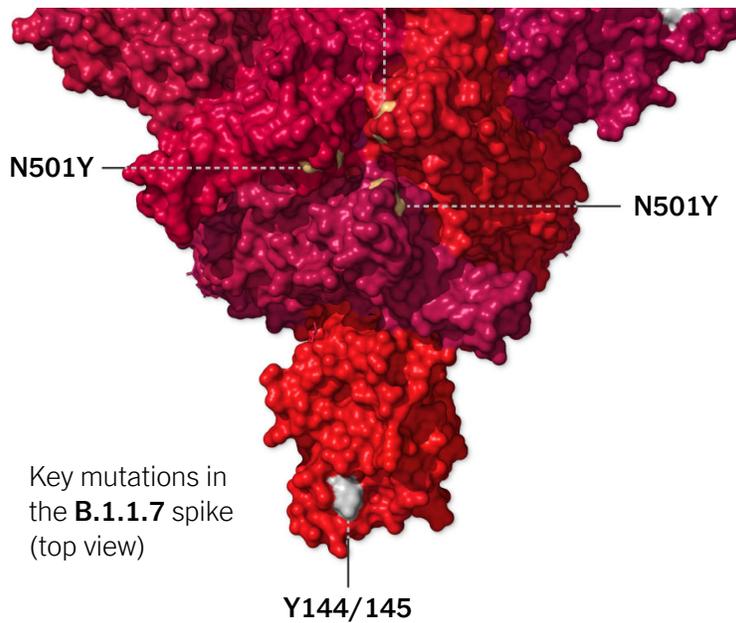
Mutations in the spike protein include:

- **N501Y**, which helps the virus latch on more tightly to human cells. But the mutation is not likely to help the virus evade current vaccines.
- **P681H**, which may help infected cells create new spike proteins more efficiently.
- The **H69–V70** and **Y144/145** deletions, which alter the shape of the spike and may help it evade some antibodies.



It takes three spike proteins to form one spike, so each mutation appears in three places:

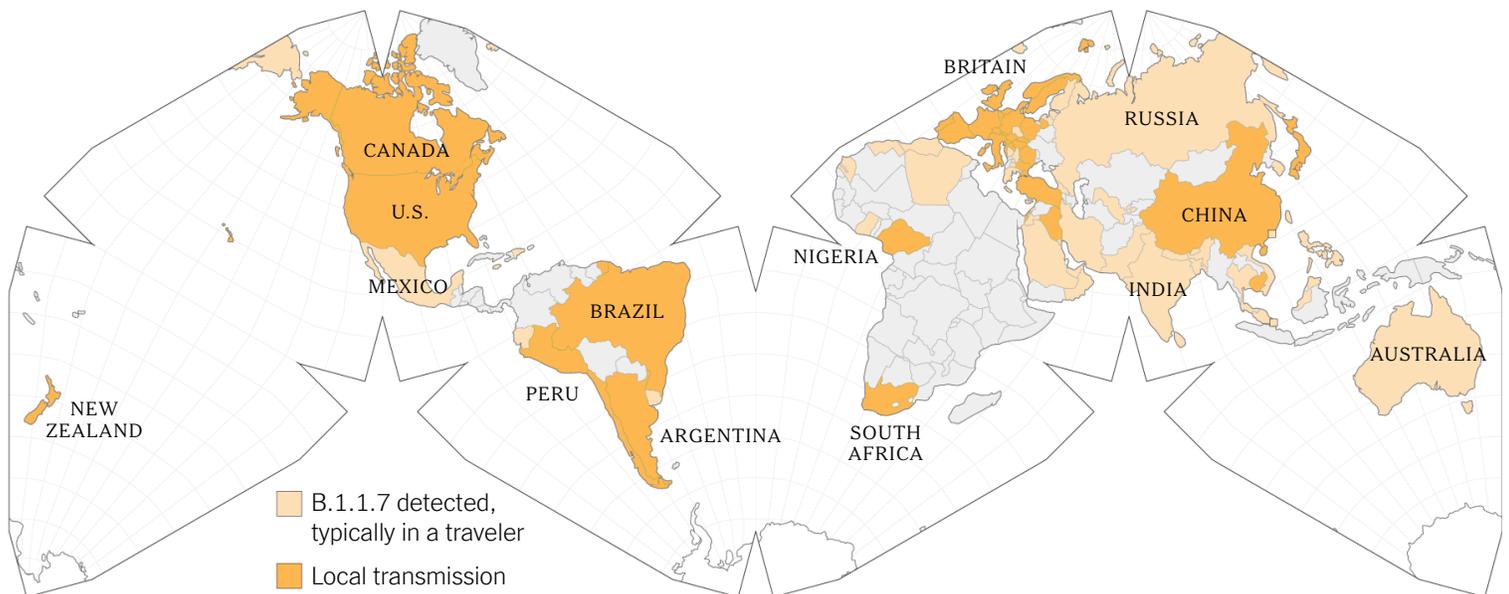




For more on the B.1.1.7 mutations, see: **Inside the B.1.1.7 Coronavirus Variant.**

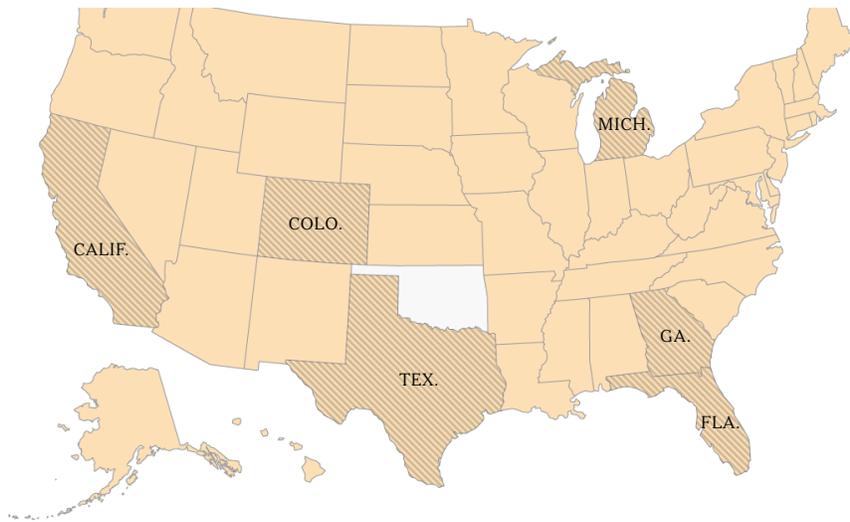
WHERE B.1.1.7 HAS BEEN FOUND

The variant was first detected in the United Kingdom in December, and a look back at previous samples found it as early as Sept. 20.



B.1.1.7 has now been detected in over 90 countries. It was first reported in the United States in January, and has now reached at least 49 states.





The Centers for Disease Control and Prevention has warned that B.1.1.7 could become the predominant source of all infections in the United States by March.

RECENT COVERAGE OF B.1.1.7

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How British Scientists Found the More Infectious Coronavirus Variant · Jan. 16, 2021

Countries Brace for Impact of More Coronavirus Variants · Jan. 16

Inside the B.1.1.7 Coronavirus Variant · Jan. 18

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The Virus Variant Spreading in Britain May Make Vaccines Less Effective, Study Shows · Feb. 1

Virus Variant First Found in Britain Now Spreading Rapidly in U.S. · Feb. 7

U.K. Virus Variant Is Probably Deadlier, Scientists Say · Feb. 13

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