Vaccination against coronavirus

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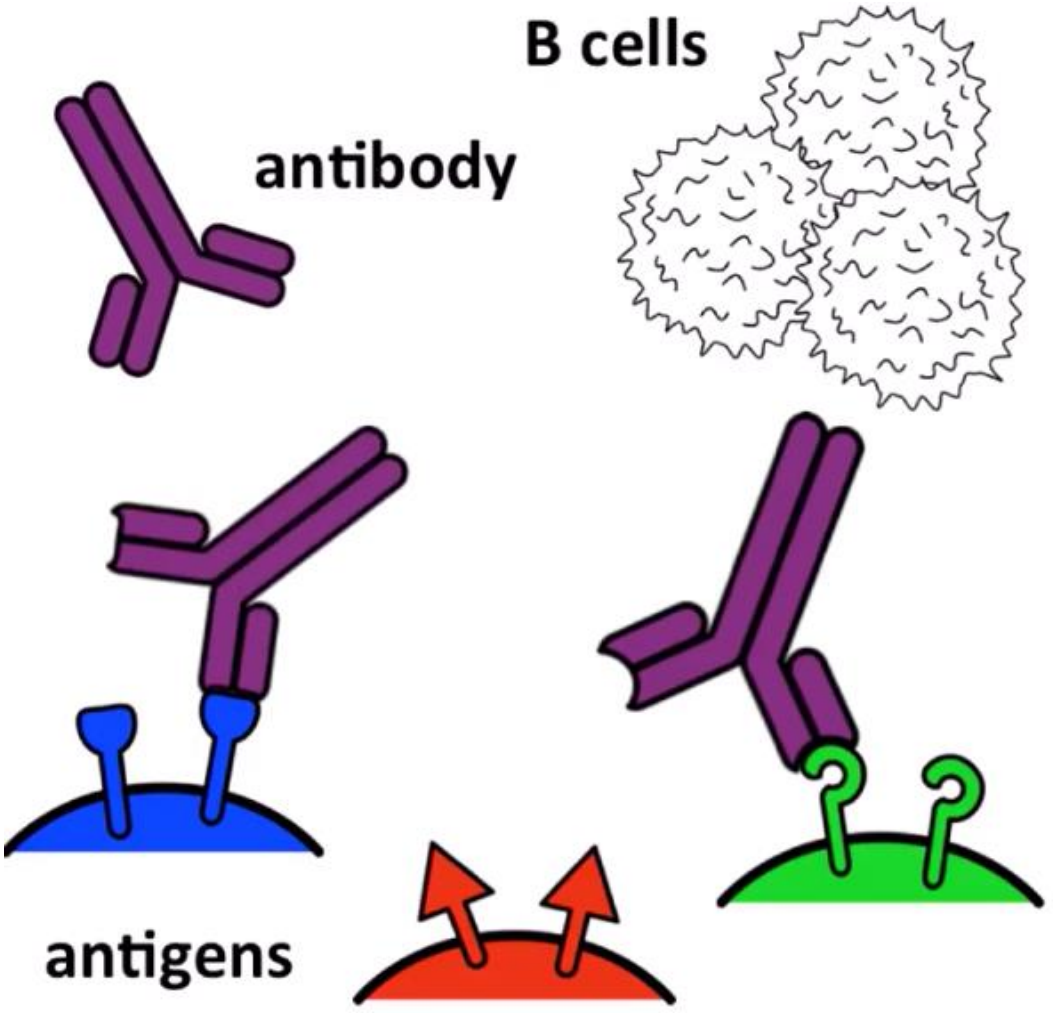
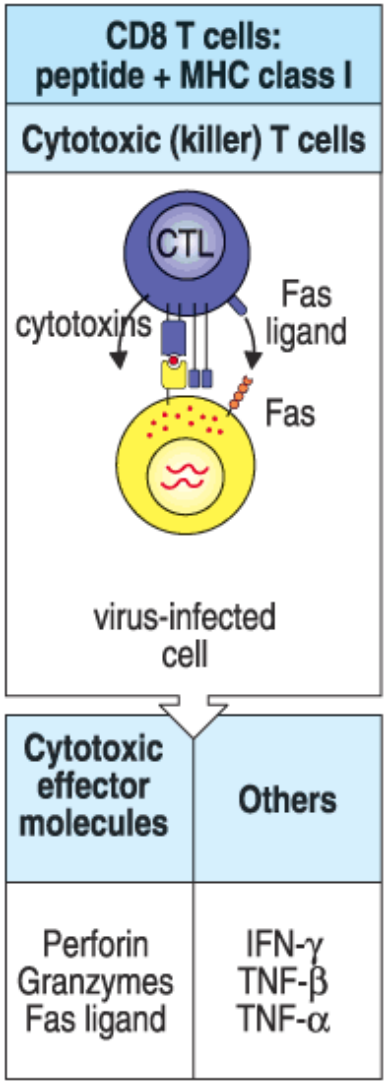
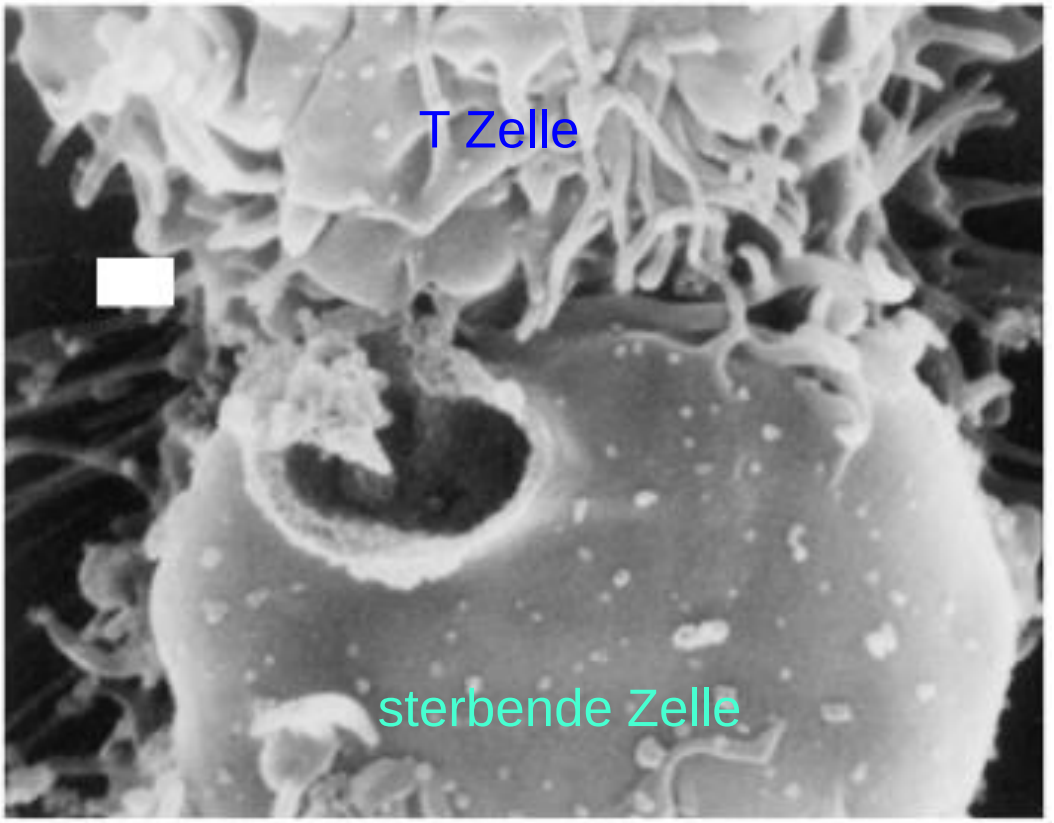
Antibodies (produced by B cells) bind to antigens on microbes.

They block microbes and/or mediate their destruction by other immune cells



$CD8^+$ T Zellen (Killer Zellen) → Zerstören von infizierten Zellen

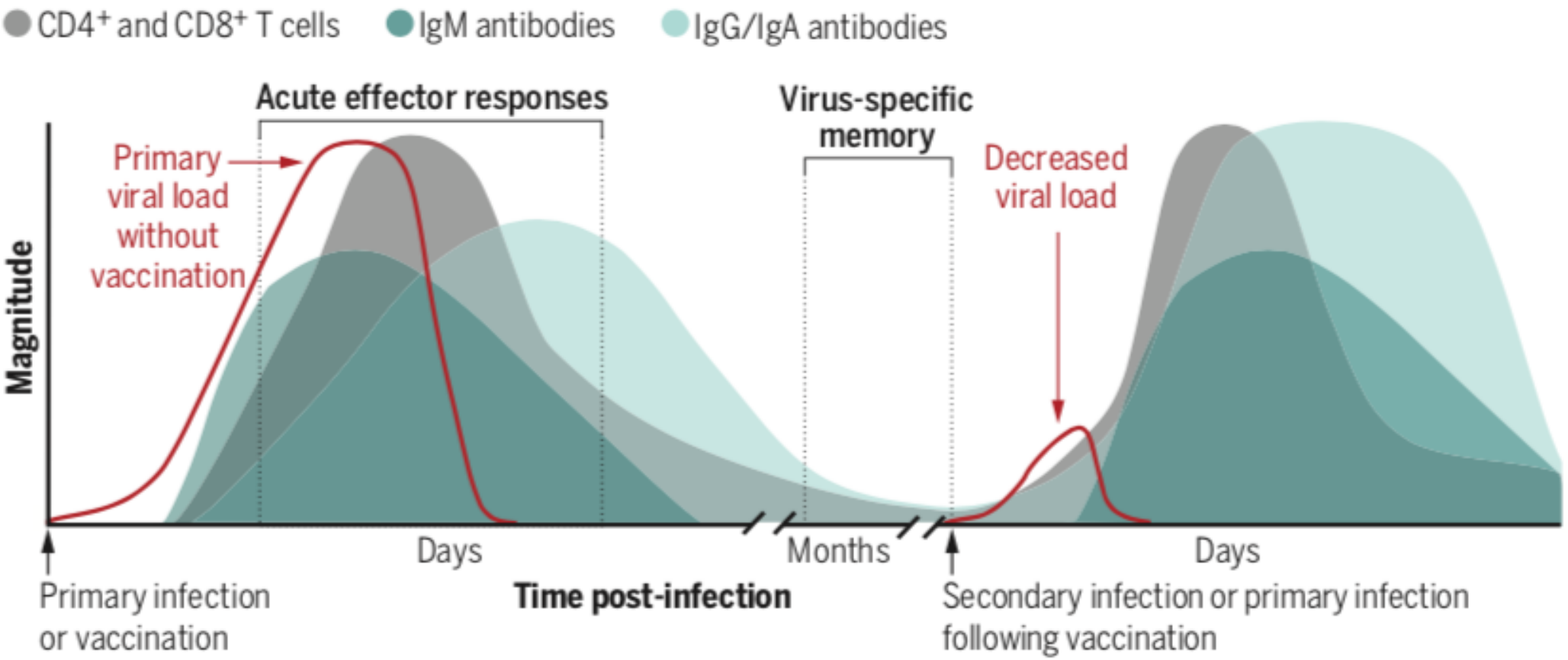




Cytotoxizität (Killing)

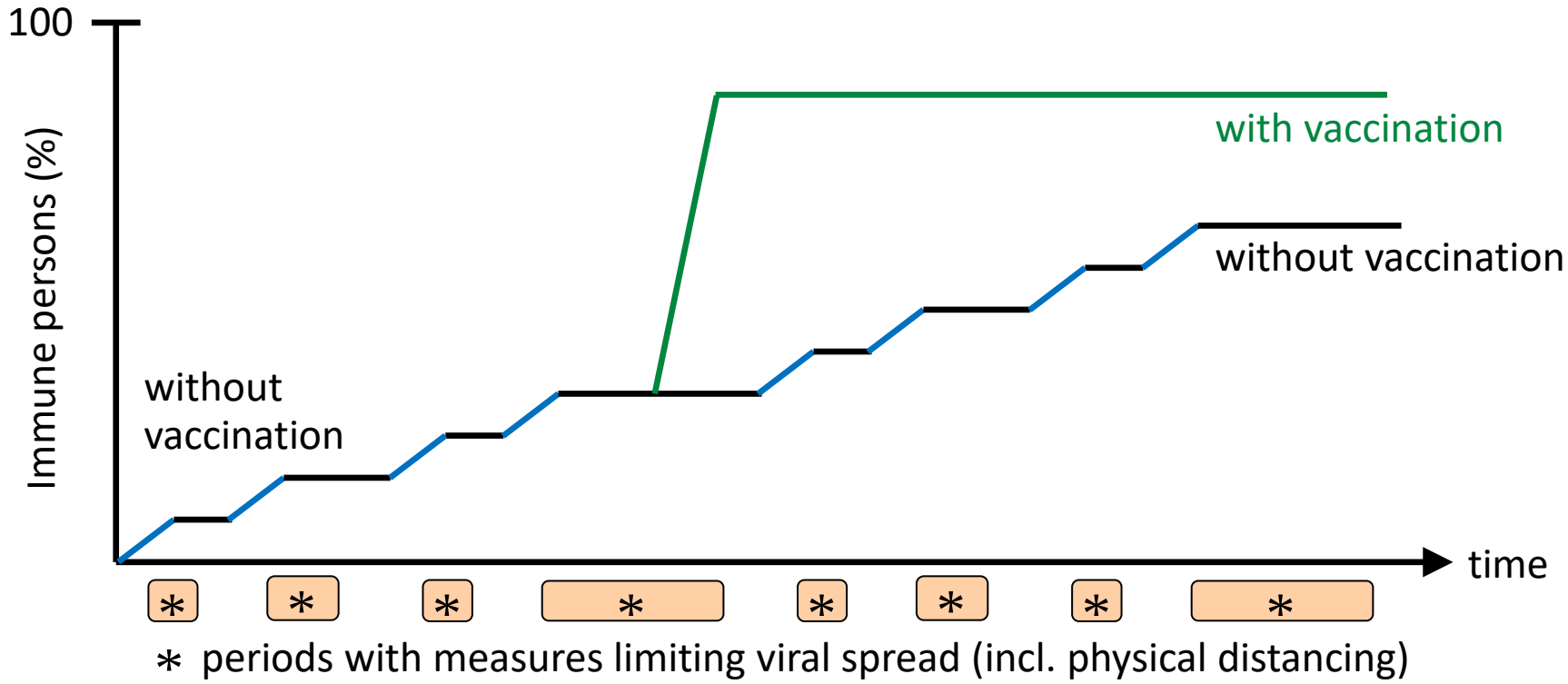
Adaptive immune responses to viral infections

Adaptive immune responses control and eliminate viral infections that have outpaced innate immune control. Days after infection, virus-specific cytotoxic $CD8^+$ T cells migrate to the site(s) of infection, where they kill virally infected cells. Early-responding B cells produce and release virus-specific immunoglobulin M (IgM) antibodies; $CD4^+$ T helper cells promote class-switching of germinal center B cells from IgM to IgG or IgA virus-specific antibody production. After virus clearance, a pool of memory IgG/IgA B cells and T cells remain (virus-specific memory) and are rapidly reactivated upon reinfection with the same virus. Vaccination aims to generate protective adaptive immune memory without the need for a bona fide primary infection.



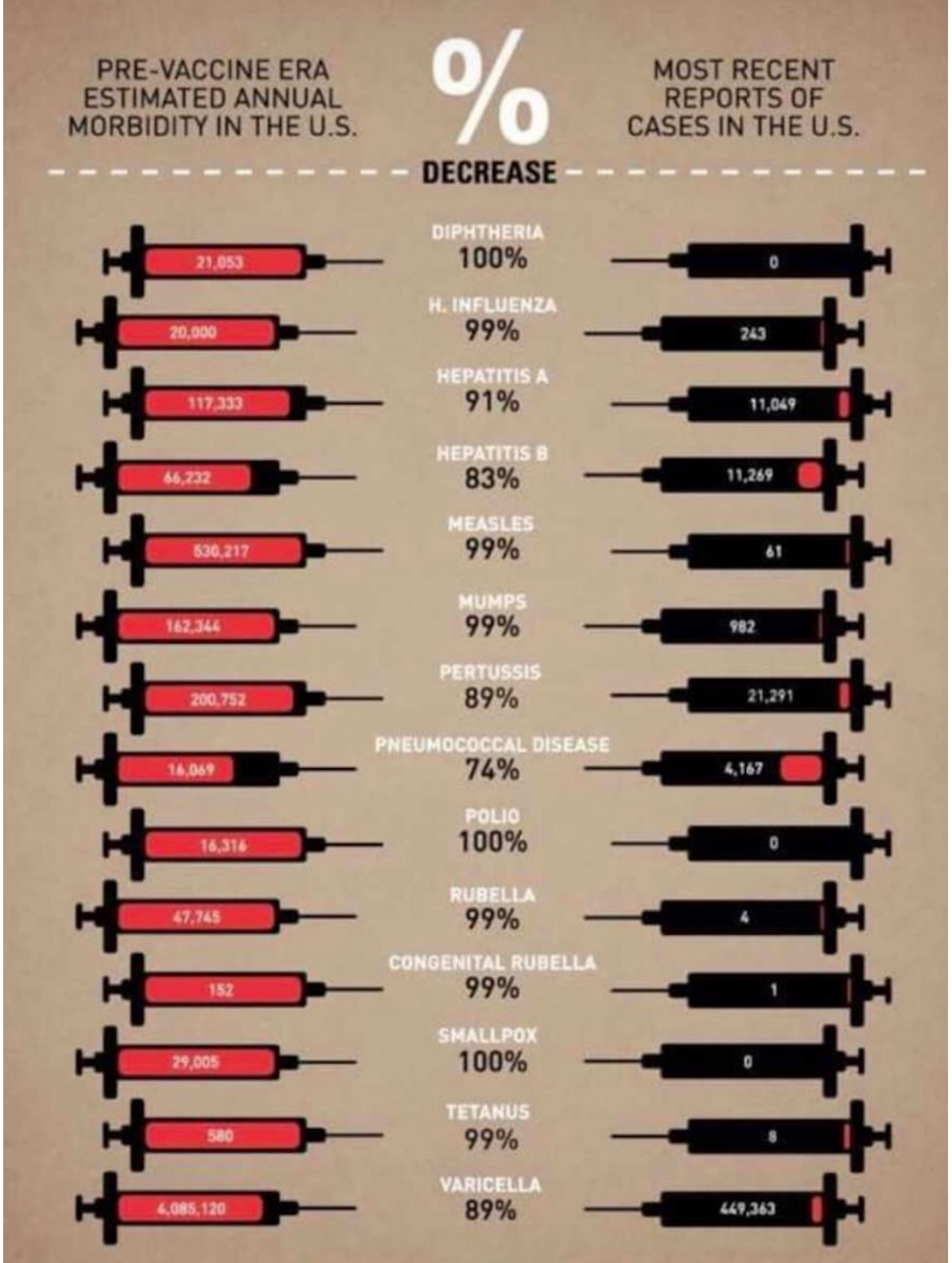
Hope, J.L., and L.M. Bradley. 2021. Lessons in antiviral immunity. Science (New York, NY). 371:464–465. doi:10.1126/science.abc8511.

Population immunity induced by infection and vaccination



Speiser et al. Vaccines 2020 8 (3) 10.3390/vaccines8030404

Vaccines have enormous merits in avoiding wide-spread dangerous diseases



Coronavirus Vaccine Tracker

By Carl Zimmer, Jonathan Corum and Sui-Lee Wee Updated Sept. 13, 2021

Researchers are currently testing **104 vaccines** in clinical trials on humans, and 33 have reached the final stages of testing. More than 75 preclinical vaccines are under active investigation in animals.

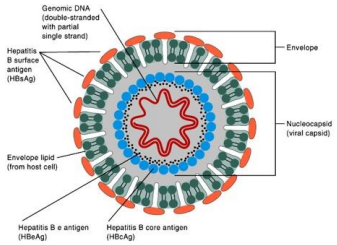
https://www.nytimes.com/interactive/2020/science/coronavirus-vaccine-tracker.html

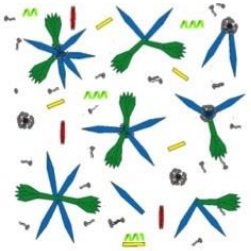
COVID-19 information of Swissmedic:

https://www.swissmedic.ch/swissmedic/de/home/news/coronavirus-covid-19.html

Vaccination: active immune therapy against COVID-19

Protein Vaccine

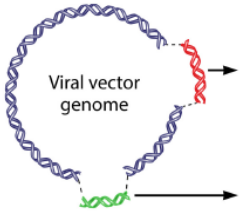


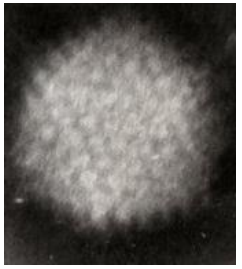


HBV, Influenza
Tetanus

Novavax

Vector

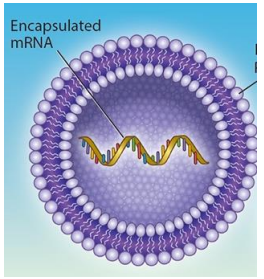


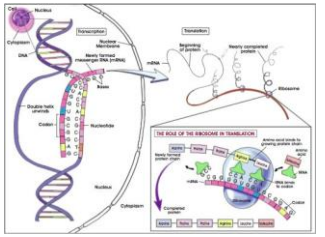


Ebola

Oxford/AstraZeneca
Johnson & Johnson
Harvard/Janssen

mRNA Vaccine





SARS-CoV-2

Moderna
BioNTech/Pfizer

kindly provided by Dr. Christoph Berger, University of Basel

COVID-19 vaccines in Switzerland

Type: mRNA vaccine

19.12.2020: Swissmedic approval of Comirnaty® (BioNTech/Pfizer)

12.01.2021: Swissmedic approval of Spikevax® (Moderna)

Vaccination by two intramuscular injections, with ca 4 week interval

Aim: Rapid protection from the pandemic virus

Long-term protection is secondary, it may require additional ‘booster’ injections

Protection: 95% (as of day 7-14 after second injection)

Duration of protection:

At least 9 months (Phase 1/2), at least 6 months (Phase 3)

No formal information on long-term protection

This and more slides were kindly provided by Dr. Urs Karrer, Kantonsspital Winterthur

An Uncertain Public — Encouraging Acceptance of Covid-19 Vaccines

N Engl J Med 2021 384:1483

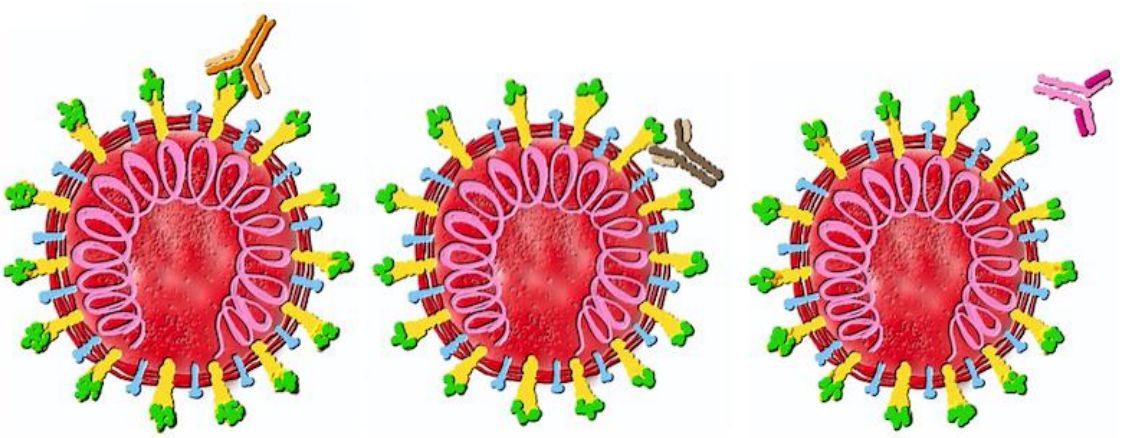
Gillian K. SteelFisher, Ph.D., Robert J. Blendon, Sc.D., and Hannah Caporello, B.A.

Trust in Sources of Vaccine Information	Percentage of Respondents
How much do you trust each of the following sources for information about coronavirus vaccines? A great deal/Quite a bit¶	
Health professionals, including doctors, nurses, and pharmacists	58
Dr. Anthony Fauci	48
CDC	46
FDA	41
HHS	38
WHO	36
Joe Biden	33
Pharmaceutical companies	20
Donald Trump	16
News media	16

Data from 39 US nationally representative, randomized polls (8.2020-2.2021)

Convincing people to get vaccinated: clinical physicians, rather than pharmaceutical companies, political leaders, or even medical scientists, should be at the fore of education and outreach strategies.

Antibody binding and virus neutralization



Antibody specific for	S_{RBD}	S_{other}	N
can bind the virus	+	+	-
can neutralize the virus	+	+/-	-

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Lost immunity: 2 possible principle reasons

1. After infection, one may loose the antibodies relatively quickly (within about one year), such that re-infection becomes possible.

   This is likely the case for SARS-CoV-2.
   It applies to all known coronaviruses.

2. The virus mutates so strongly that the immune memory becomes useless (“immune escape”).

   Complete immune escape is unlikely for coronaviruses,
   but some mutations can nevertheless lead to partial immune escape.

Variants of SARS-CoV-2

Variants of Concern

B.1.1.7	alpha
B.1.351	beta
P.1	gamma
B.1.617.2	delta

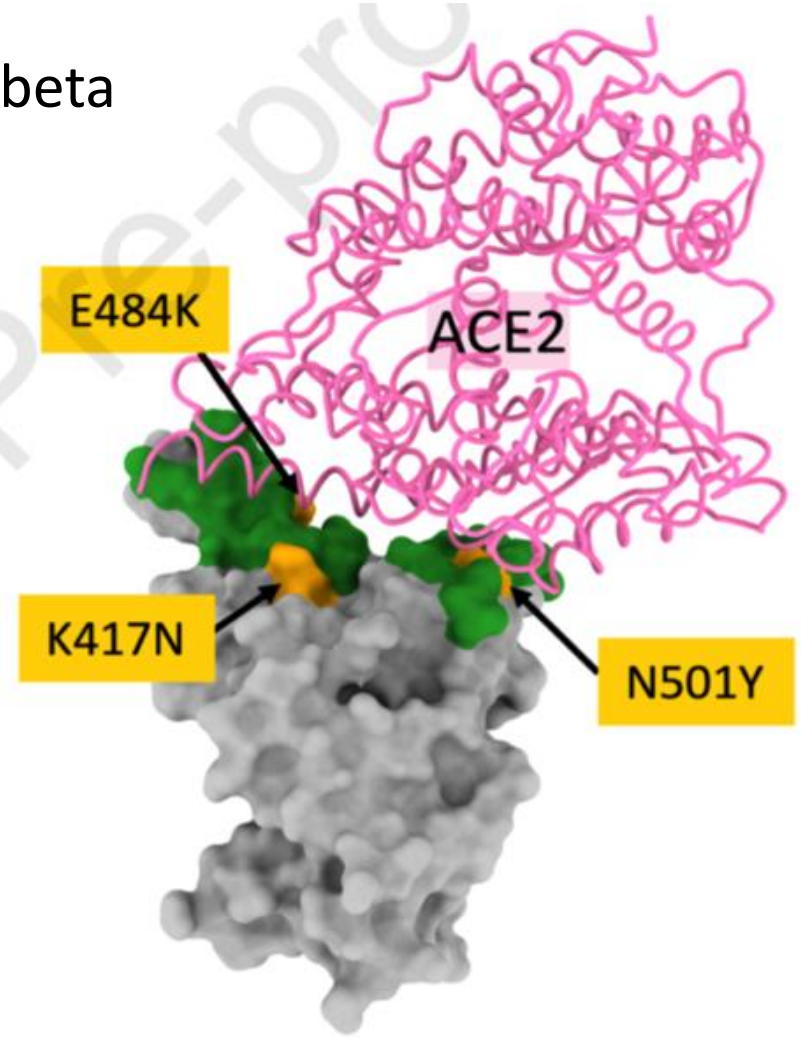
Variants of Note

A.23.1
B.1.525

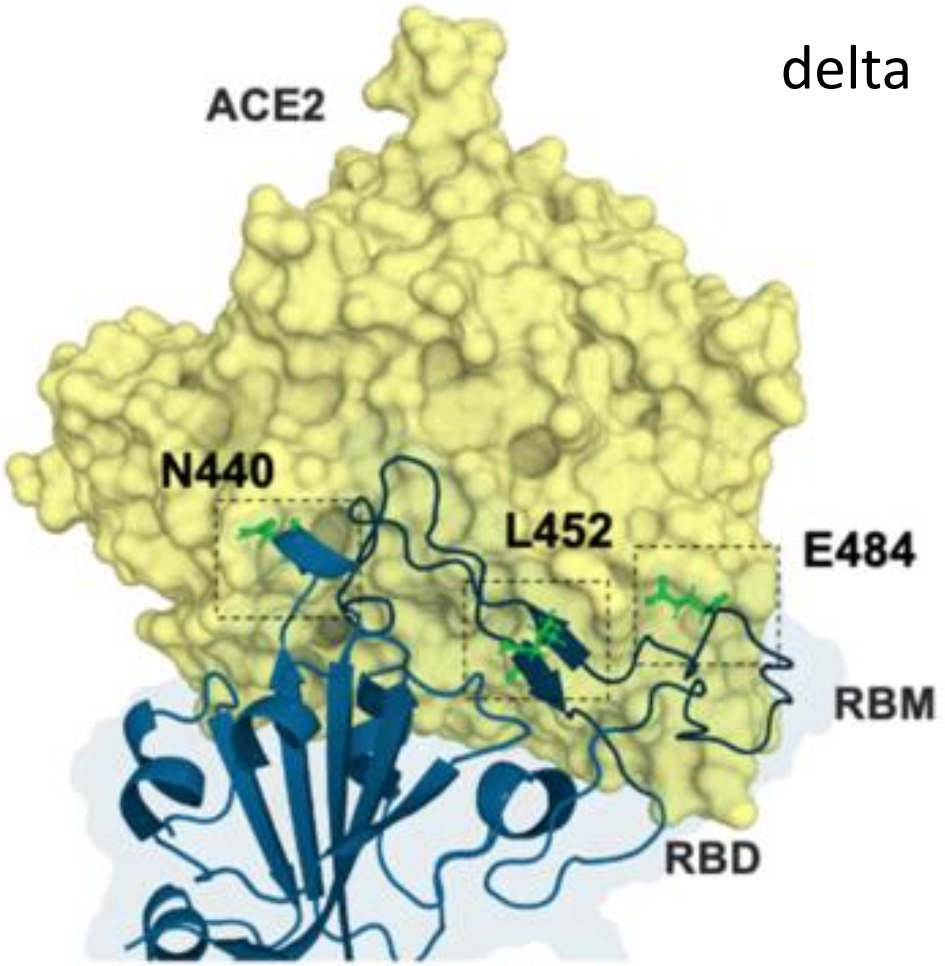
https://cov-lineages.org/index.html#global_reports

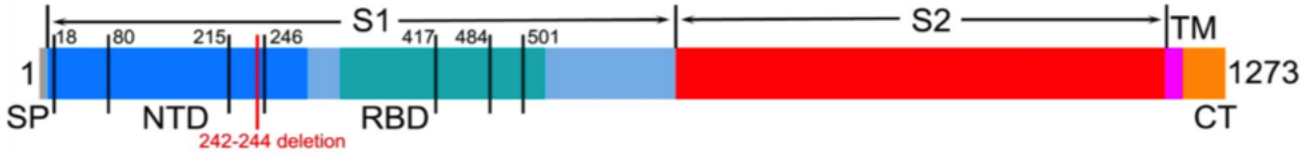
Mutations in the receptor binding domain (RBD) of SARS-CoV-2 variants

beta



delta

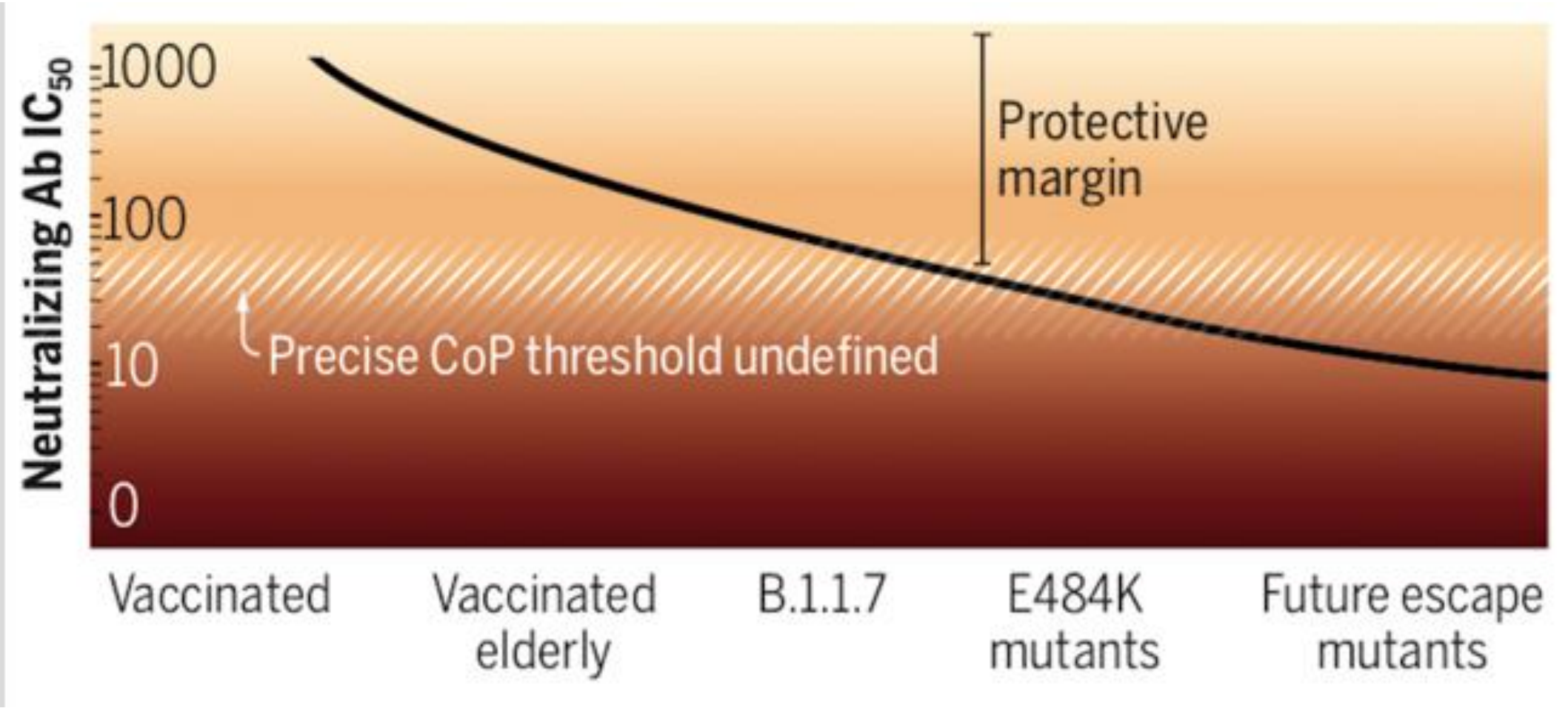




Decreasing neutralizing antibodies – decreasing protection

Current vaccination ok

Additional vaccination needed



Thank you!

To all the countless dedicated people who help reducing the pandemic damage

For your attention