Global number of reported smallpox cases

The number of reported cases is lower than the number of actual cases. This is due to limited testing and reporting and challenges in the attribution of the cause of death.

Our World in Data

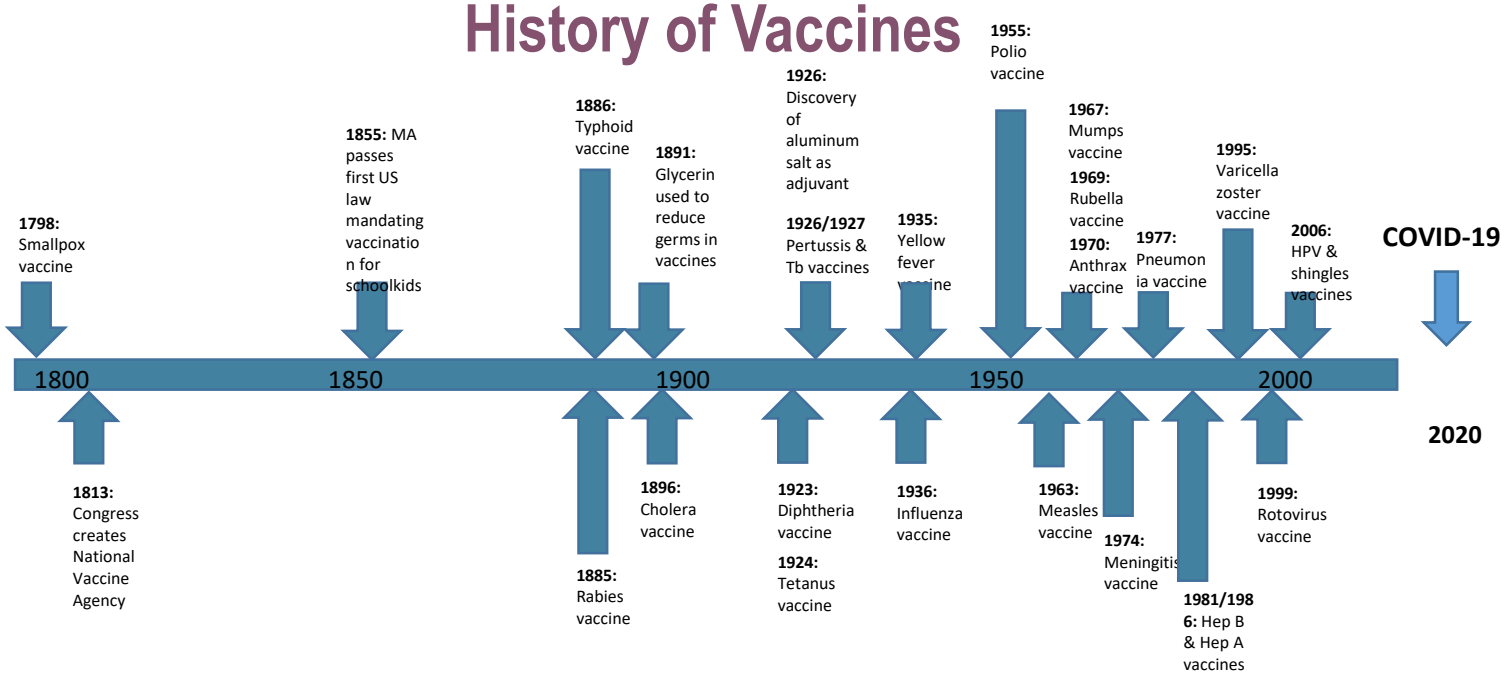
600,000
500,000
400,000
300,000
200,000
100,000
0
1920
1940
1960
1980
2000
2016
World

Source: World Health Organization (2011)

about 250 years ago life expectancy started to increase. In 1900, mankind had already reached a life expectancy of approximately 50 years (3). Nowadays, a child born in a high-income country can expect to live 85 years. The additional 35 years of life that we gained during the last century are substantially due to the conquest of infectious diseases, which used to kill 50% of people before the age of 20. These were viral diseases such as smallpox, rabies, measles,

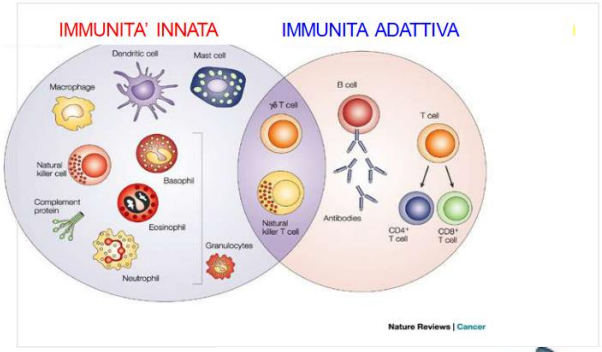
A.Tagliabue & R.Rappuoli 2018

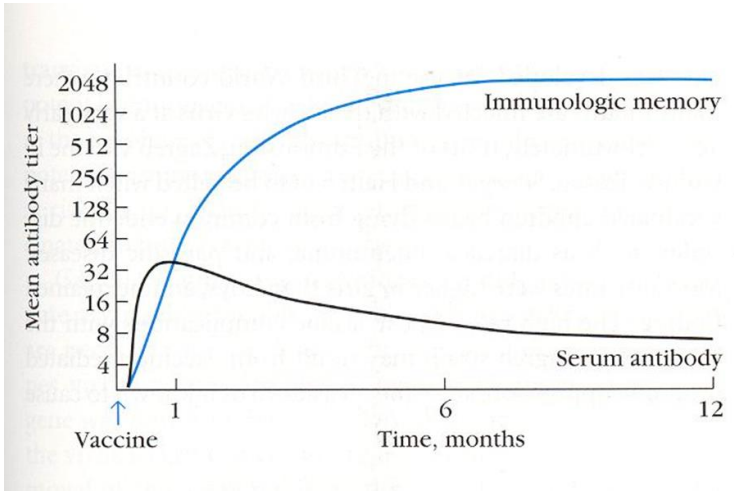
History of Vaccines

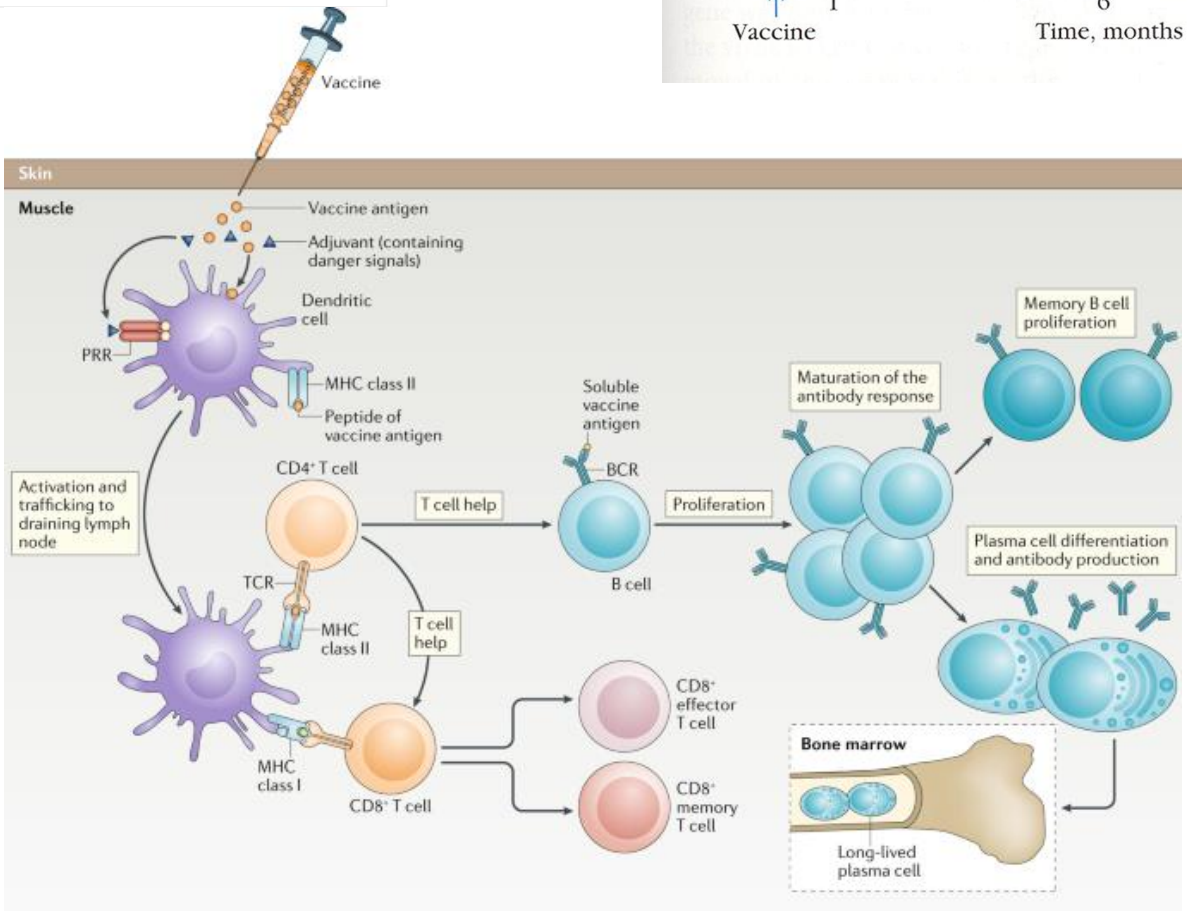


*Note that this timeline is abbreviated to give an overview of vaccine development and the recent explosion of discovery

IL SISTEMA IMMUNITARIO



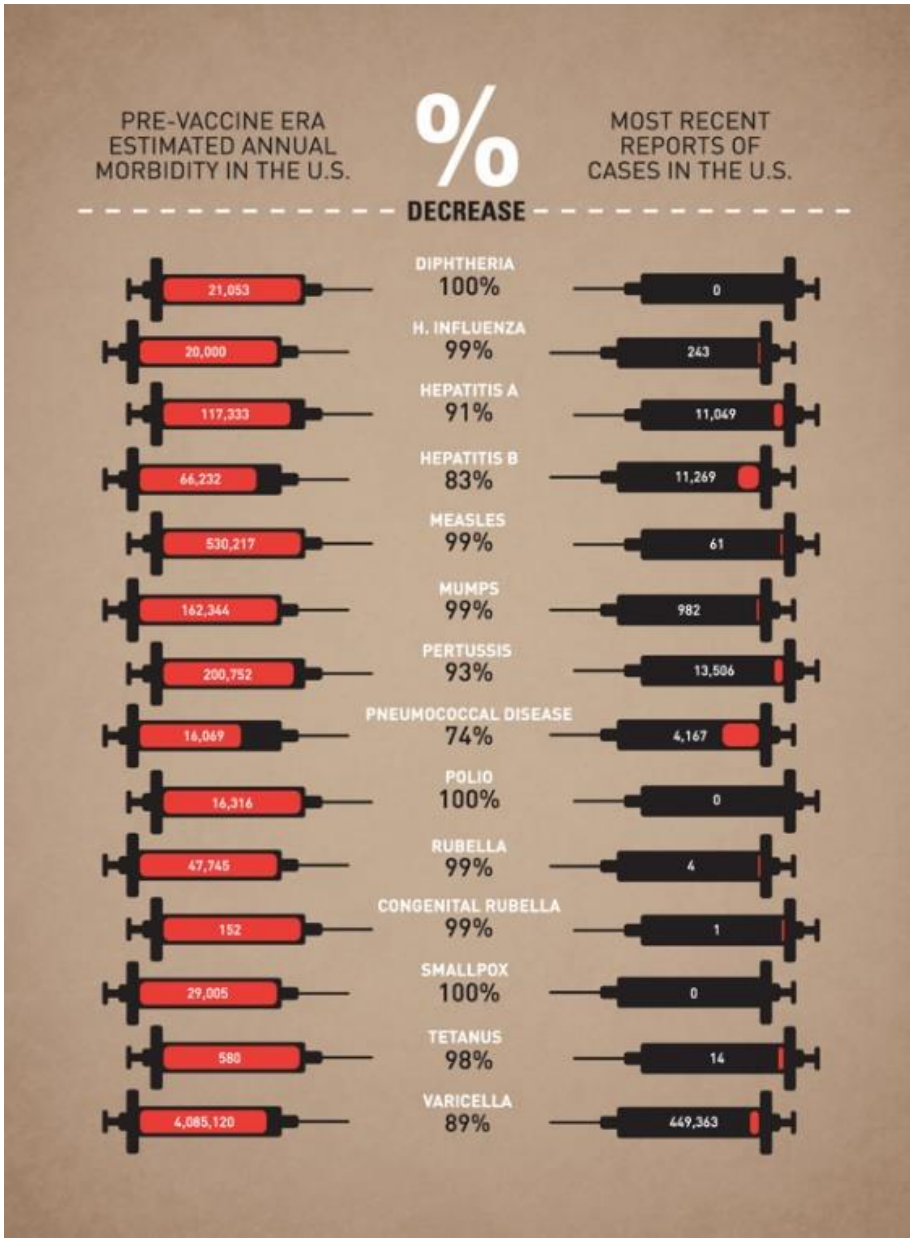




Sorveglianza

- Impatto della vaccinazione
- Effectiveness del vaccino
- Effetti della pressione selettiva prodotta dal vaccino, con eventuale emergenza di ceppi che sfuggono all'effetto del vaccino
- Sicurezza, eventi avversi, reazioni avverse

Vaccine Effectiveness



Graphic created by Leon Farrant based on CDC data

Eventi avversi e reazioni avverse

Evento avverso (Adverse Event Following Immunization, AEFI)

Evento indesiderato dopo vaccinazione (non necessariamente è presente una relazione causale)

Reazione avversa

Evento indesiderato di cui è dimostrata la relazione causale con la vaccinazione

Necessario distinguere tra **relazione causale** (= rapporto causa-effetto) e **temporale** (= dovuta al caso)

		Evento	
		Si	No
Vaccinazione	Si	a	b
	No	c	d

Frequenza dell'evento negli individui vaccinati $= \frac{a}{a + b}$

Frequenza dell'evento nei non vaccinati $= \frac{c}{c + d}$

La pandemia di COVID-19 in Italia

Giampiero Carosi, Roberto Cauda, Andrea Pession, Guido Antonelli

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Indice

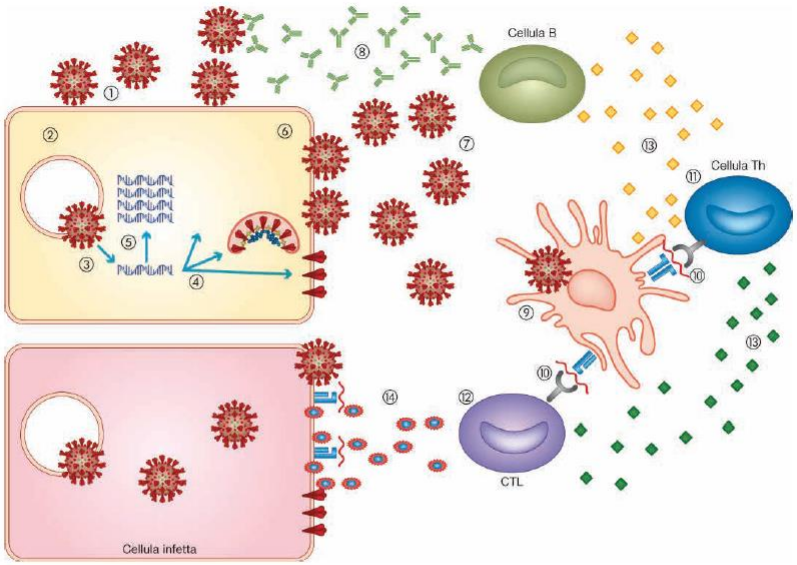
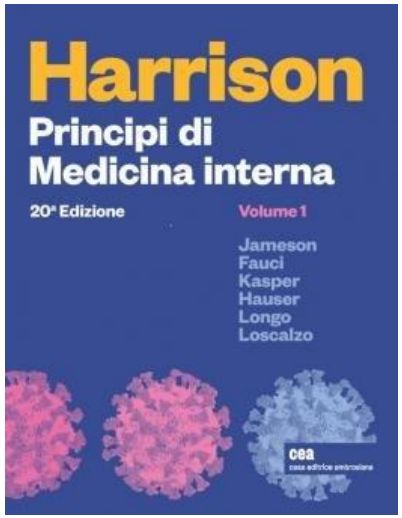
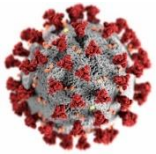


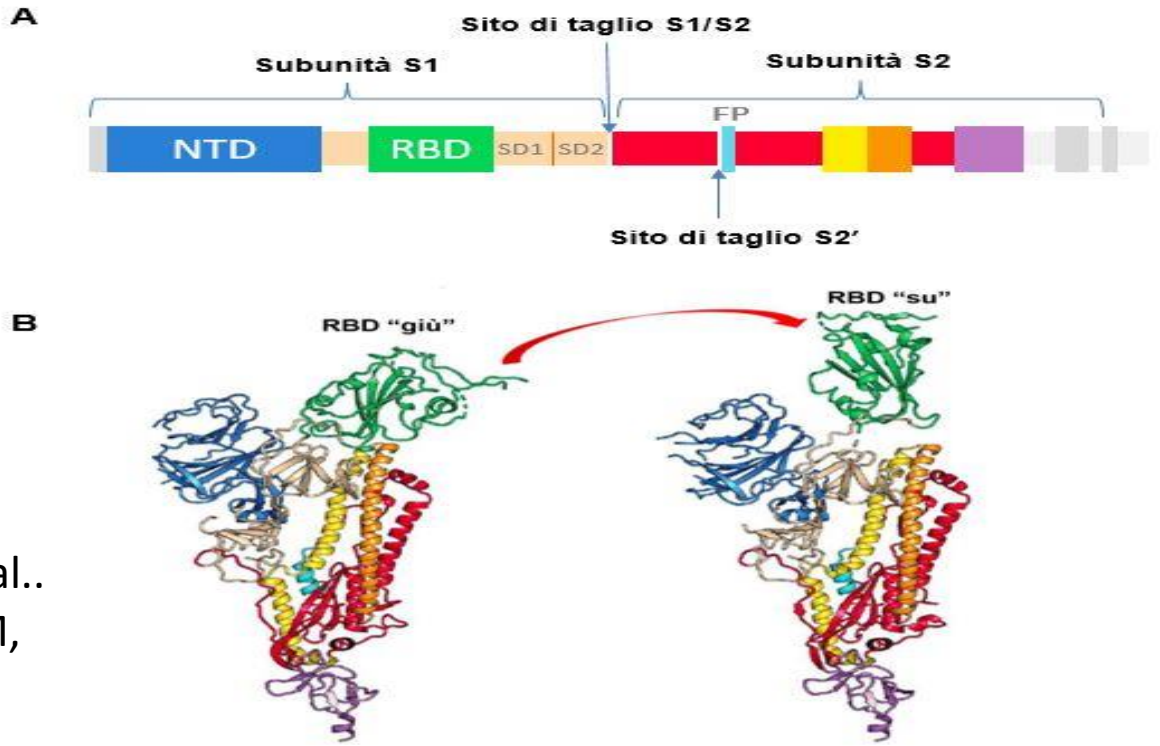
Figura 18 Principali passaggi del ciclo vitale virale e dello sviluppo della risposta immunitaria. (**1**) Adesione del virione di SARS-CoV-2 alla superficie cellulare tramite il recettore cellulare ACE2. (**2**) Ingresso nella cellula. Le proteine virali possono essere riconosciute dai recettori dell'immunità innata (per es. TLR3, TL4 e TL7), portando al rilascio dei pattern molecolari associati al pericolo, all'attivazione della risposta immunitaria e dei pathway antivirali dell'immunità innata. (**3**) Fusione della membrana e rilascio dell'RNA all'interno della cellula. (**4**) Traduzione dell'RNA per produrre le proteine virali. (**5**) L'RNA viene copiato e unito alle proteine del nucleocapside. (**6**) Assemblamento dei virioni figli. (**7**) Riconoscimento della glicoproteina *spike* e della proteina del nucleocapside (proteine strutturali) dal recettore del linfocita B. (**8**) Il linfocita B produce anticorpi leganti la glicoproteina *spike* e anticorpi neutralizzanti rivolti contro la regione RBD della glicoproteina *spike*. (**9**) Captazione del virus da parte della APC. (**10**) Presentazione degli antigeni ai linfociti T, inclusi gli epitopi delle proteine strutturali e non. (**11**) Attivazione dei linfociti Th. Attivazione dei CTL. (**13**) Il linfocita Th produce citochine (principalmente IFN-γ, IL-2 e TNF-α). (**14**) Riconoscimento e *killing* delle cellule infettate da parte dei CTL. (*Modificata da Poland G.A. et al., SARS-CoV-2 immunity: review and applications to phase 3 vaccine candidates, Lancet, 396(10262):1595-1606, 14 novembre 2020.*)

ISBN 978-88-08-82037-2 - Harrison Principi di Medicina interna 20ª edizione - 2021 CEA



Spike e RBD di SARS-CoV-2





Montemiglio et al..
Zanichelli SIBBM, 2020

ACE, ACE 2 functions and SARS-CoV-2

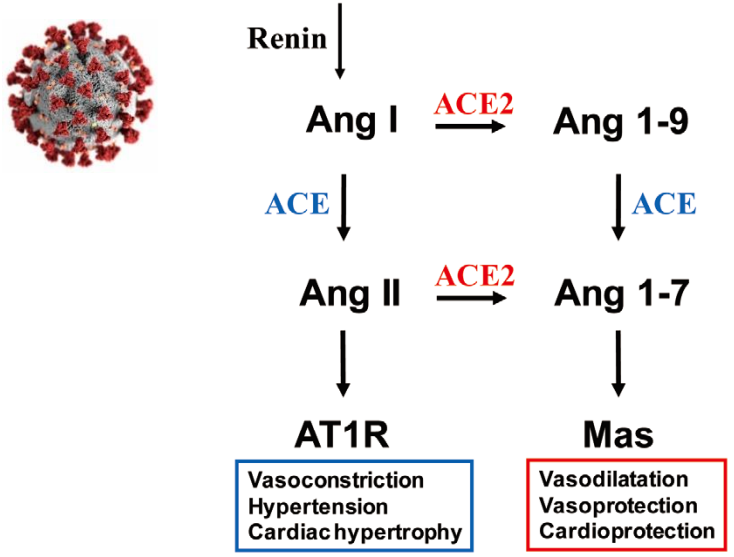


Fig1a

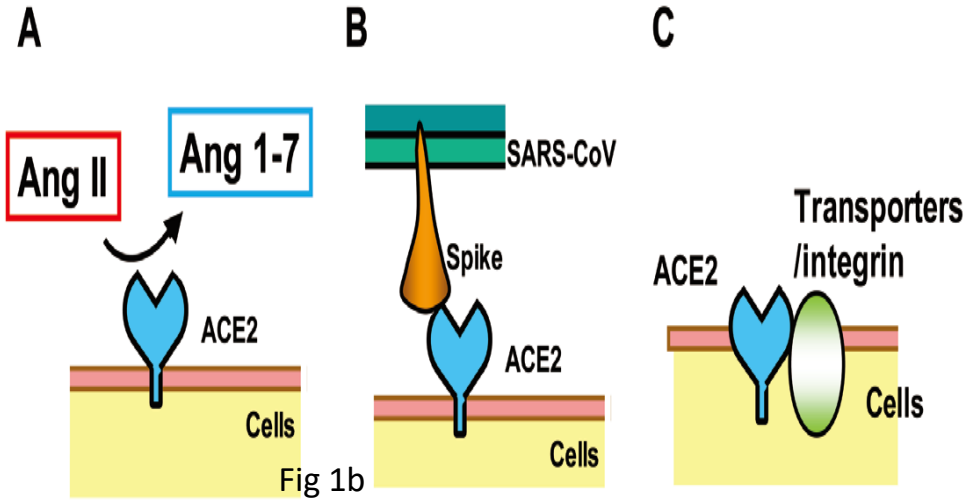


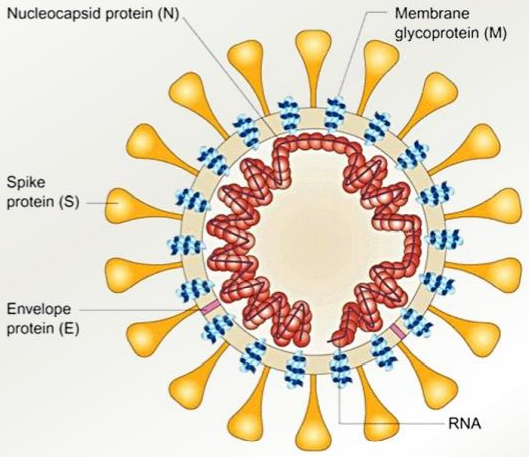
Fig 1b

Cassone A, Gucciardo D, Cauda R.Pathog Glob Health. 2020 May 18;114(4):165-167.

Infection-induced immunity to COVID-19

Infection-induced immunity to COVID-19:

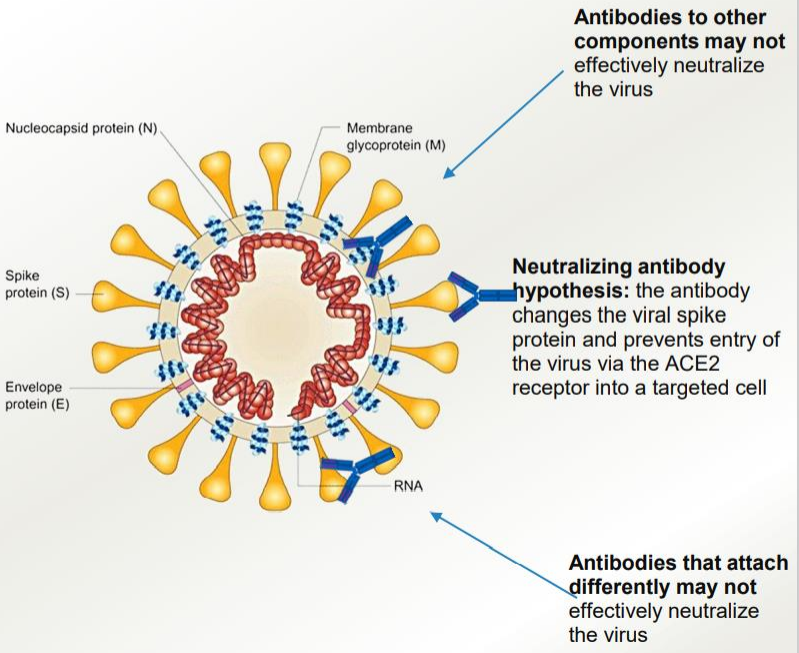
- lasts many months[1,2]
- is multi-faceted and generates antibodies against the spike protein plus other non-structural proteins (Nucleoprotein (N), Matrix protein (M), Envelope protein (E))
- induces systemic immunity and mucosal immunity

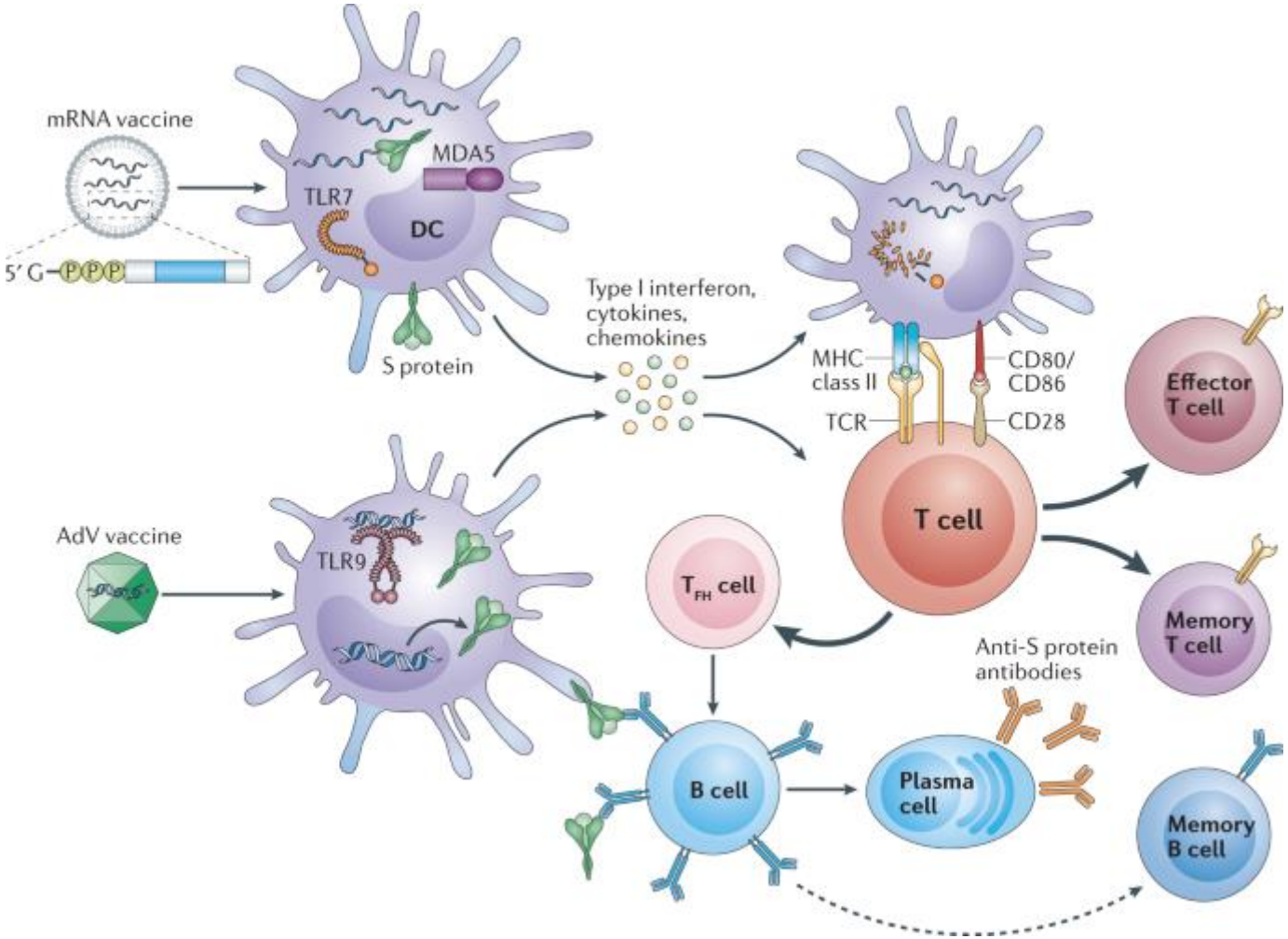


https://www.bmj.com/content/373/bmj.n1605
https://www.nature.com/articles/s41586-021-03696-9

Vaccine-induced immunity to COVID-19

- COVID-19 vaccines induce neutralizing antibodies against the spike protein
- When SARS-CoV-2 is encountered naturally, neutralizing antibodies bind to the SARS-CoV-2 spike protein and block the virus from entering and multiplying in the cell
- A ‘weaker’ immune system (e.g. in elderly people or those with underlying health problems) may result in delayed and low stimulation of the antibody response after vaccination
- Current COVID 19 vaccines induce systemic immunity only and no mucosal immunity




mRNA vaccine
5′ G–PPP
MDA5
TLR7
DC
S protein
Type I interferon,
cytokines,
chemokines
MHC
class II
CD80/
CD86
TCR
CD28
Effector
T cell
T cell
AdV vaccine
TLR9
T$_{FH}$ cell
Memory
T cell
Anti-S protein
antibodies
B cell
Plasma
cell
Memory
B cell

Timeline of mRNA technology and key figures in vaccine development

Dr. Katalin Karikó begain studying mRNA technology for humans at Temple, then UPenn

First iPhone

Facebook launches

SARS-CoV-1

MERS

Dr. Kizzmekia Corbett appointed to NIH Vaccine Research Center after years of working on viruses and vaccines

Dr. Graham and Dr. Corbett get genetic code for virus to create structure-based SARS-CoV-2 vaccine with Moderna

SARS-CoV-2

1990s **2000** **2002** **2005** **2012** **2013** **2014** **2017** **2020**

Dr. Barney Graham, head of Vanderbilt AIDS Vaccine Evalution Unit, recruited as one of founders of NIH Vaccine Research Center

First camera phone

Twitter launches

Dr. Karikó and Dr. Drew Weissman created successful synthetic mRNA delivery system

Dr. Graham and Dr. Jason McLellan solved way to modify RSV virus prefusion spike protein to allow for successful structure-based vaccine

Dr. Karikó joins BioNTech to oversee mRNA research

Dr. McLellan (UT Austin) and Dr. Andrew Ward (Scripps Research) figured out coronavirus prefusion spike structure

Dr. Graham partners with Moderna for mRNA MERS vaccine

@ScrippsSHARCs https://cen.acs.org/pharmaceuticals/vaccines/tiny-tweak-behind-COVID-19/98/i38

I VACCINI E IL LORO RUOLO NEL MANTENIMENTO
DELLO STATO DI SALUTE DELLA COMUNITA'

EVIDENZE SCIENTIFICHE E VACCINAZIONI

- IL RUOLO DEL SISTEMA IMMUNITARIO NELLA PROTEZIONE POST-VACCINALE

FERNANDO AIUTI

Professore Emerito Univ."Sapienza" Roma

Corso organizzato da SIMEDET

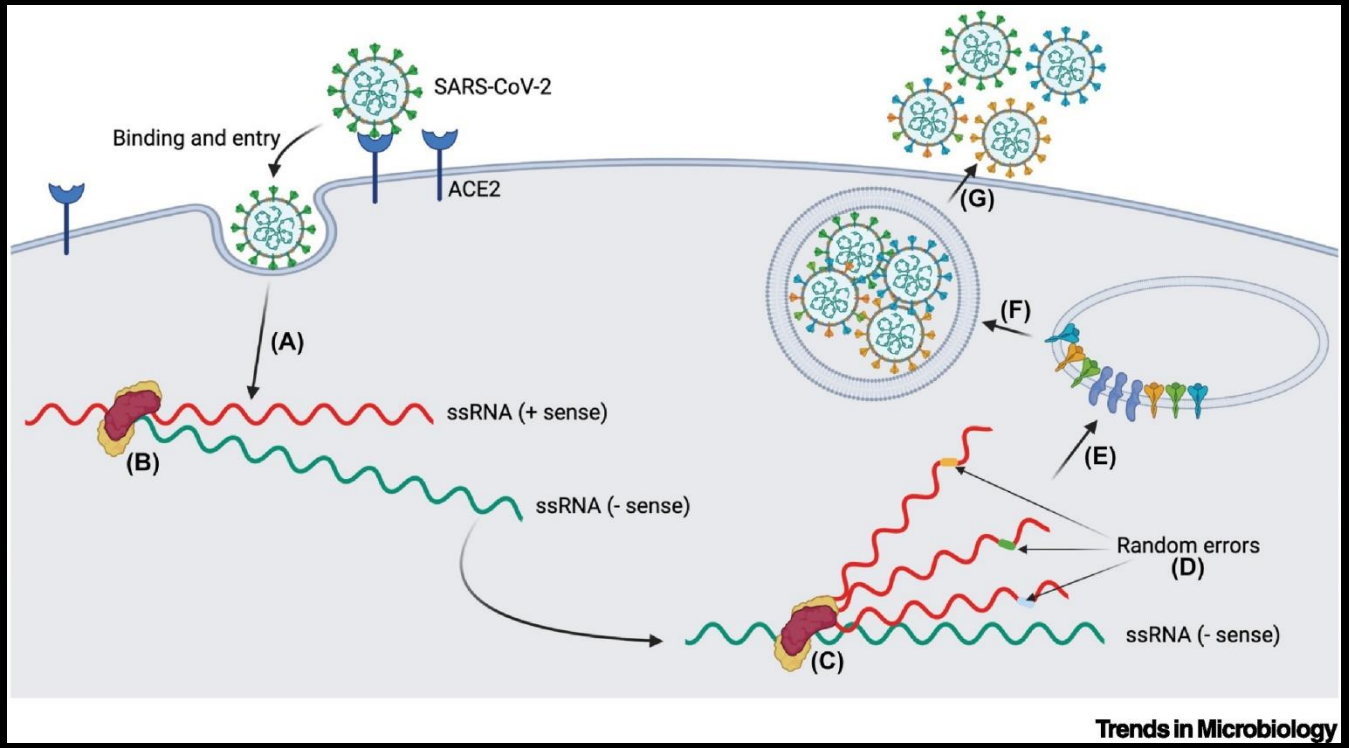
Vicariato di Roma Casa Bonus Pastor

Roma 10 ottobre 2018

EVIDENZE IMMUNOLOGICHE

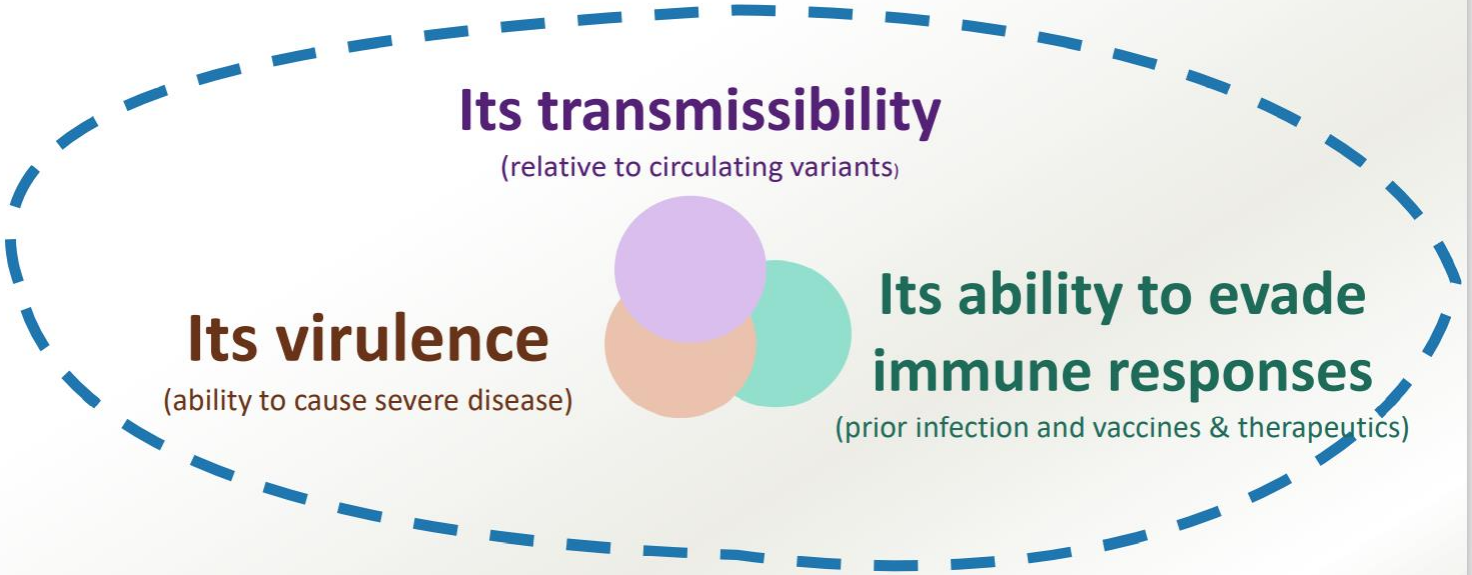
- **Vaccini di nuova concezione a RNA** : vaccini che evocano immunità innata con stimolazione di cellule dendritiche o vaccini basati su vettori virali nel cui genoma viene inserito il gene che codifica per la proteina verso cui si vuole evocare risposta immune (es. produzione di anticorpi anti- virus influenza di recente produzione)

Figure 1



Trends in Microbiology 2021 29871-873DOI: (10.1016/j.tim.2021.07.002)

Three key properties of a variant are likely to influence the overall threat from it



Received: 13 May 2020 | Accepted: 28 May 2020
DOI: 10.1002/jmv.26104

SHORT COMMUNICATION

JOURNAL OF MEDICAL VIROLOGY WILEY

Evidence for mutations in SARS-CoV-2 Italian isolates potentially affecting virus transmission

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[4]Department of Biochemical Sciences "A. Rossi Fanelli", University of Rome "La Sapienza", Rome, Italy
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Email: domenicobenvenuto95@gmail.com

Abstract

Italy is the first western country suffering heavy severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) transmission and disease impact after coronavirus disease-2019 pandemia started in China. Even though the presence of mutations on spike glycoprotein and nucleocapsid in Italian isolates has been reported, the potential impact of these mutations on viral transmission has not been evaluated. We have compared SARS-CoV-2 genome sequences from Italian patients with virus sequences from Chinese patients. We focussed upon three nonsynonymous mutations of genes coding for S(one) and N (two) viral proteins present in Italian isolates and absent in Chinese ones, using various bioinformatics tools. Amino acid analysis and changes in three-dimensional protein structure suggests the mutations reduce protein stability and, particularly for S1 mutation, the enhanced torsional ability of the molecule could favor virus binding to cell receptor(s). This theoretical interpretation awaits experimental and clinical confirmation.

KEYWORDS
bioinformatics, COVID-19, molecular evolution, mutation, SARS coronavirus

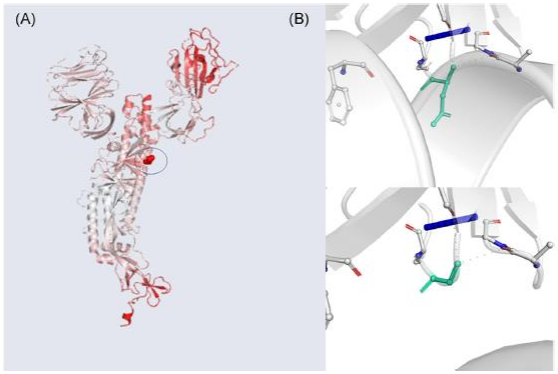


FIGURE 1 A, A model of spike glycoprotein monomer displaying the amino acids colored according to the vibrational entropy change upon mutation, red regions are those gaining in flexibility, The amino acidic mutation is blue circled; (B) the top image shows the molecular interaction between the side chain of the wild-type amino acid and the side chains of the surrounding amino acid; the bottom image shows the molecular interaction between the side chain of the mutated amino acid and the side chains of the surrounding amino acid

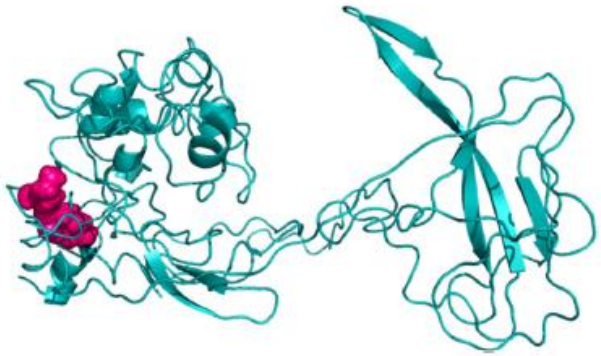
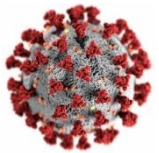
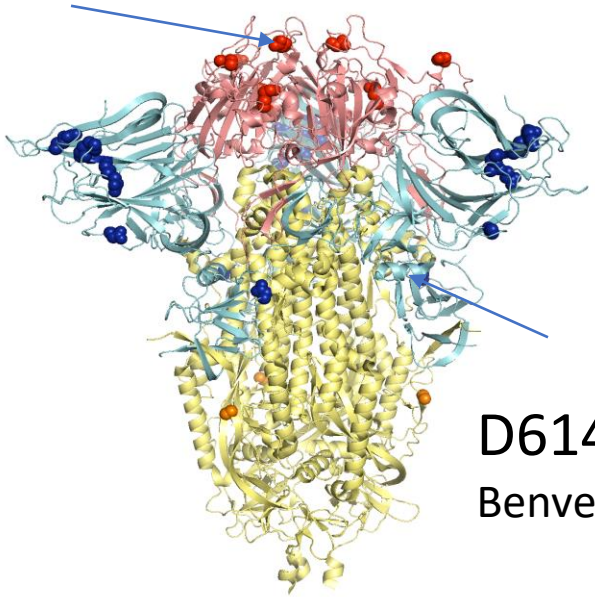


FIGURE 2 Cartoon model of the nucleocapsid of the SARS-CoV-2 where the mutated amino acids have been shown in purple

Mutazioni in RBD, S1 ed S2 della proteina Spike di SARS-CoV-2



Variante inglese N501T



D614G Italiana

Benvenuto et al. J.Infect.2020

Garcia-Beltra, et al.
MedRxiv.
https://doi.org/10.1101/2021.02.14.21251704

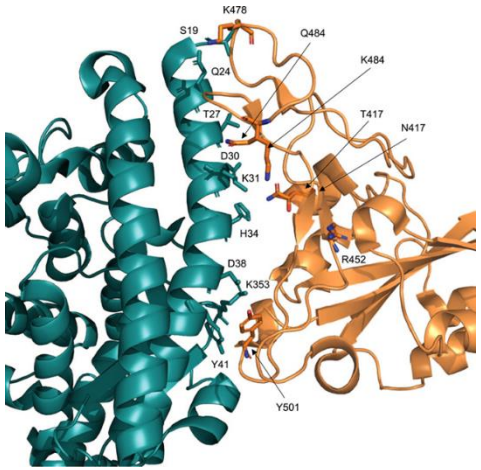
Received: 21 May 2021 | Revised: 11 June 2021 | Accepted: 8 July 2021
DOI: 10.1002/jmv.27210

RESEARCH ARTICLE

JOURNAL OF MEDICAL VIROLOGY WILEY

SARS-CoV-2 B.1.617 Indian variants: Are electrostatic potential changes responsible for a higher transmission rate?

Stefano Pascarella[1] | Massimo Ciccozzi[2] | Davide Zella[3] | Martina Bianchi[1] | Francesca Benedetti[3] | Domenico Benvenuto[2] | Francesco Broccolo[4] | Roberto Cauda[5] | Arnaldo Caruso[6] | Silvia Angeletti[7] | Marta Giovanetti[8] | Antonio Cassone[9]



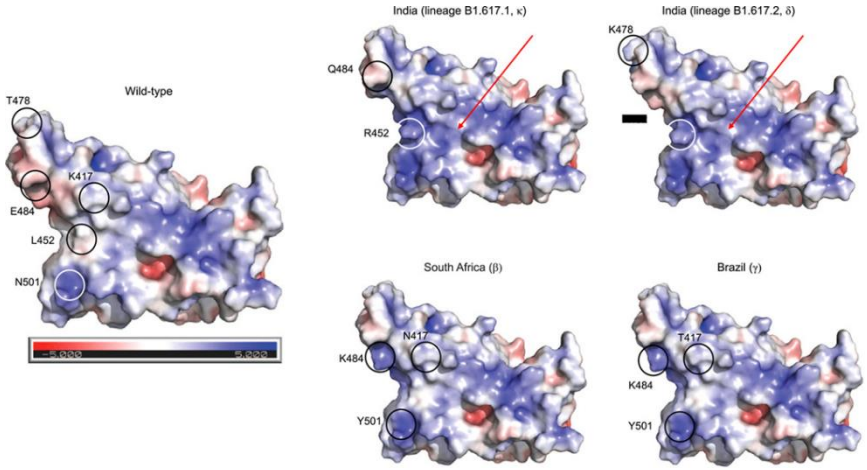


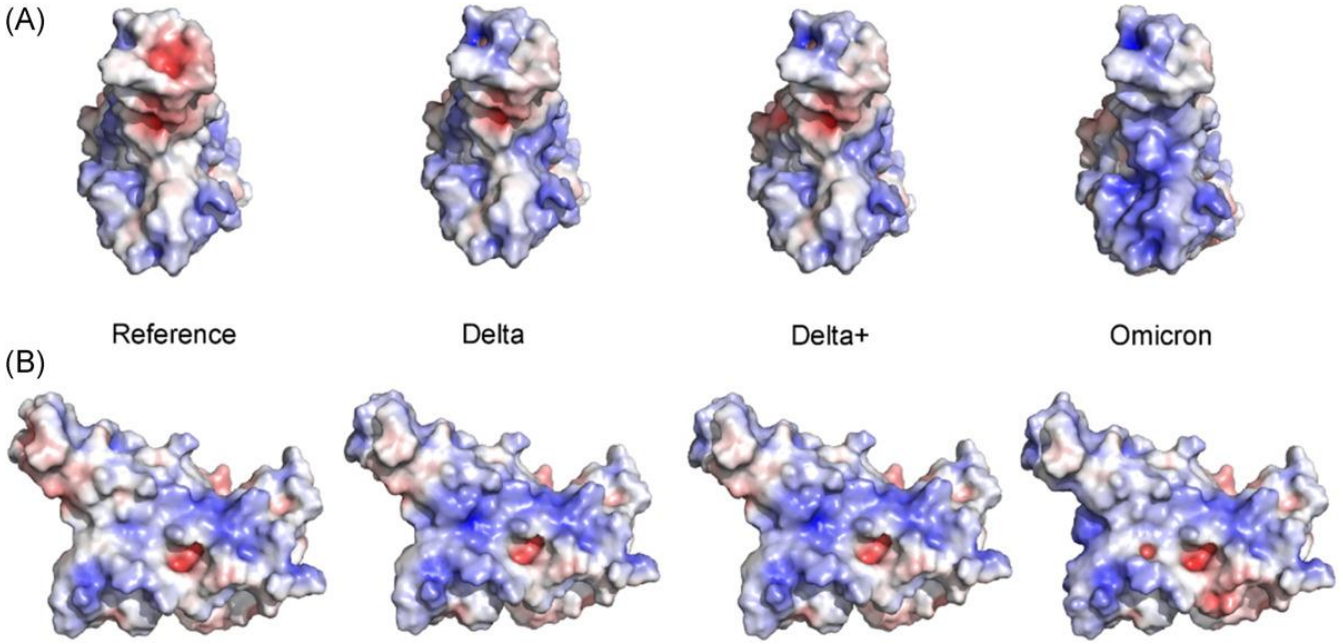
TABLE 1 Omicron mutations occurring in the Spike RBD

Mutationsa	Structural contextb	Interactions
G339D	α-helix	Possible H-bond to NAG
S371L	α-helix	VdW interaction with ACE2 V367 e F374
S373P	Loop	
S375F	N-terminal side of a β-strand	
K417N	C-terminal side of an α-helix	Removes the salt bridge with ACE2 D30
N440K	α-helix	
G446S	Loop within the RBM	
S477N	Loop within the RBM	
T478K	Loop within the RBM	
E484A	Loop	Removes the salt bridge between E484 and ACE2 K31
Q493R	short β-strand	Forms a salt bridge with ACE2 E35
G496S	Loop	H-bond with ACE2 D38
Q498R	Loop	Forms a salt bridge with ACE2 D38
N501Y		H-bond with ACE K353; Aromatic interaction with ACE2 Y41
Y505H	α-helix	Removes the H-bond with ACE2 E37

Note: Structural context and interaction changes (added or removed) compared to those found in the reference Spike. Boldfaced mutations are in the RBD.

Abbreviation: RBM, receptor-binding motif.

The electrostatic potential of the Omicron variant spike is higher than in Delta and Delta-plus variants: A hint to higher transmissibility?



Stefano Pascarella[1]
Massimo Ciccozzi[2]
Martina Bianchi[1]
Domenico Benvenuto[2]
Roberto Cauda[3]
Antonio Cassone[4]

Journal of Medical Virology, First published: 16 December 2021, DOI: (10.1002/jmv.27528)

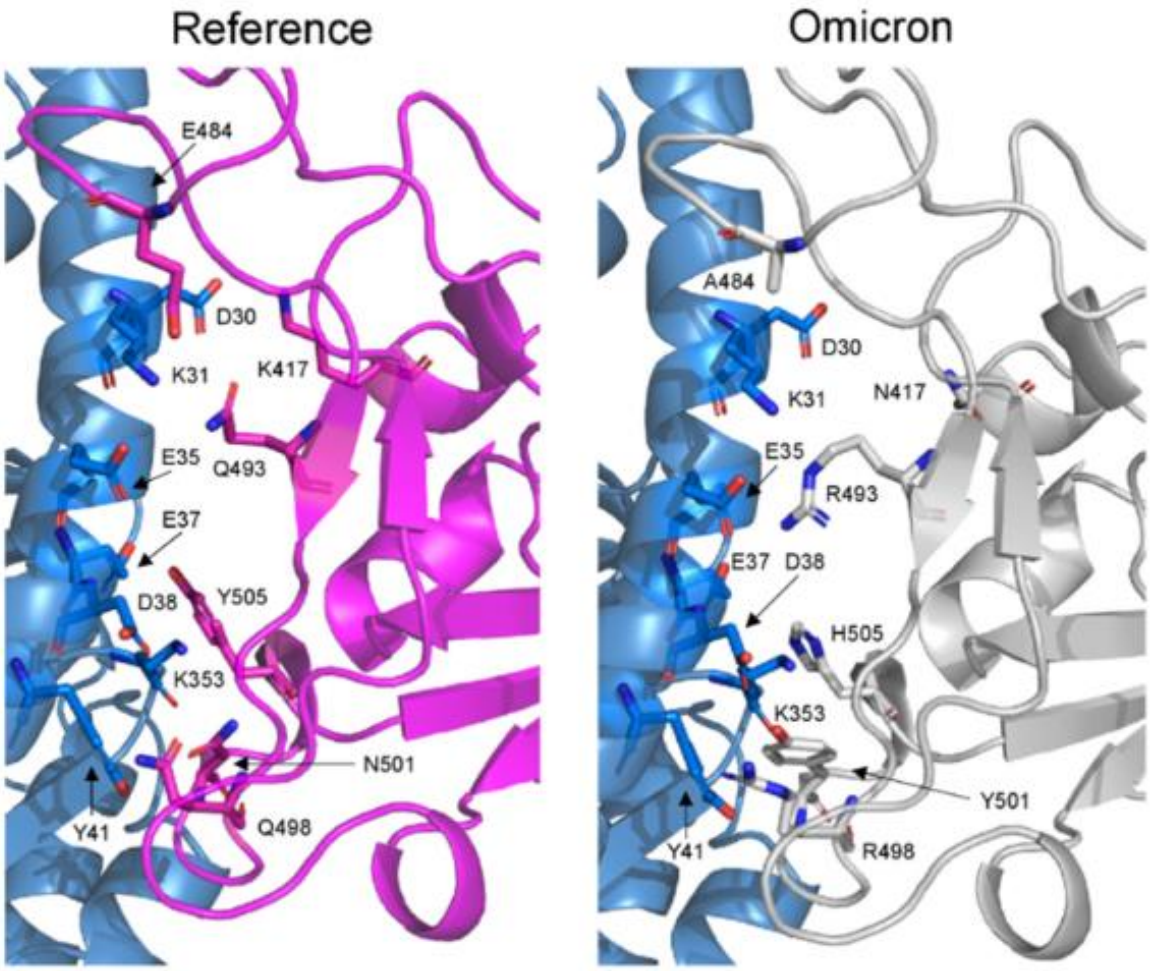
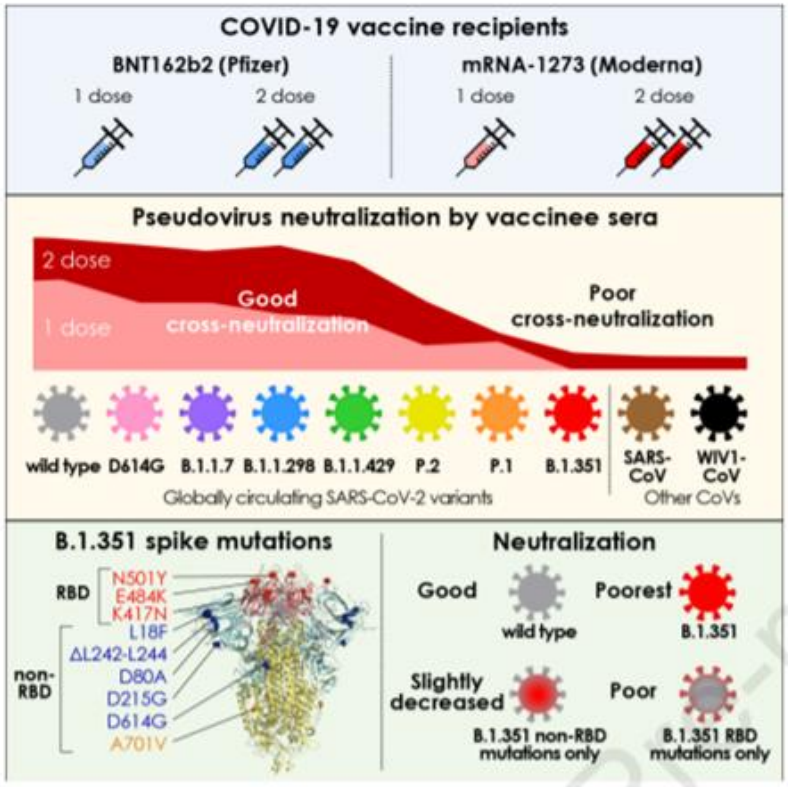


FIGURE 1 Comparison between the observed and predicted interactions at the interface between ACE2 and the Reference and Omicron RBDs, respectively. Spike Reference RBD ad Spike Omicron RBD are displayed as magenta and light gray ribbons, respectively. Blue cartoons indicate ACE2. Relevant Reference and Omicron side chains are displayed as sticks and labeled

Garcia-Beltram WF et al Cell 2020 https://www.cell.com/cell/fulltext/S0092-8674(21)00298-1	Multiple SARS-CoV-2 variants escape neutralization by vaccine-induced humoral immunity	Il siero di 99 individui vaccinati con vaccino a mRNA Pfizer o MODERNA contro SARS-CoV-2 neutralizza il virus wildtype e alcune varianti, ma non la B.1.351 ("sudafricana") e la P.2 ("brasiliana"), per cui andrebbe supportata secondo gli autori la sintesi di ulteriori dosi di vaccino adeguate alle mutazioni della proteina Spike.



ARTICLE

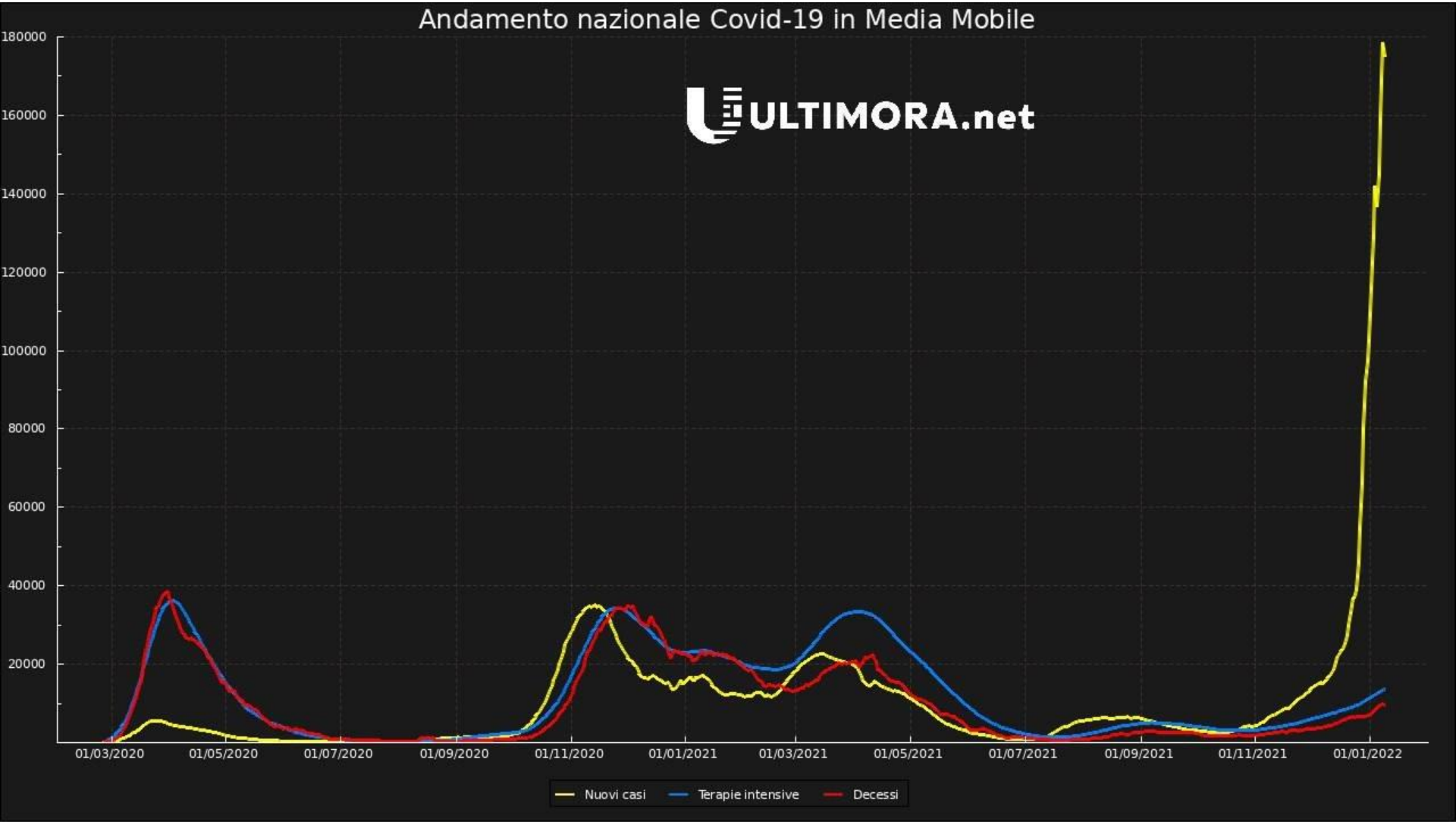
https://doi.org/10.1038/s41467-021-27649-y OPEN

Dynamics of spike-and nucleocapsid specific immunity during long-term follow-up and vaccination of SARS-CoV-2 convalescents

Nina Koerber[1,12], Alina Priller[2,12], Sarah Yazici[2,12], Tanja Bauer[1,3,12], Cho-Chin Cheng[1], Hrvoje Mijočević[1], Hannah Wintersteller[2], Samuel Jeske[1], Emanuel Vogel[1], Martin Feuerherd[1], Kathrin Tinnefeld[1], Christof Winter[4], Jürgen Ruland[4], Markus Gerhard[5], Bernhard Haller[6], Catharina Christa[1], Otto Zelger[7], Hedwig Roggendorf[2], Martin Halle[7], Johanna Erber[8], Paul Lingor[9], Oliver Keppler[10,3], Dietmar Zehn[11], Ulrike Protzer[1,3,12]✉ & Percy A. Knolle[2,3,12]✉

Anti-viral immunity continuously declines over time after SARS-CoV-2 infection. Here, we characterize the dynamics of anti-viral immunity during long-term follow-up and after BNT162b2 mRNA-vaccination in convalescents after asymptomatic or mild SARS-CoV-2 infection. Virus-specific and virus-neutralizing antibody titers rapidly declined in convalescents over 9 months after infection, whereas virus-specific cytokine-producing polyfunctional T cells persisted, among which IL-2-producing T cells correlated with virus-neutralizing antibody titers. Among convalescents, 5% of individuals failed to mount long-lasting immunity after infection and showed a delayed response to vaccination compared to 1% of naïve vaccinees, but successfully responded to prime/boost vaccination. During the follow-up period, 8% of convalescents showed a selective increase in virus-neutralizing antibody titers without accompanying increased frequencies of circulating SARS-CoV-2-specific T cells. The same convalescents, however, responded to vaccination with simultaneous increase in antibody and T cell immunity revealing the strength of mRNA-vaccination to increase virus-specific immunity in convalescents.

	IFNγ	IL-2	TNF	GzmB
convalescents 11 months	23 (±116)	85 (±116)	30 (±748)	0 (±10)
naive 11 months	0 (±5)	15 (±78)	290 (±1906)	0 (±13)
convalescents vacc	255 (±285)	625 (±353)	260 (±418)	0 (±8)
naive vacc	38 (±285)	328 (±266)	228 (±974)	0 (±10)
convalescents boost	225 (±299)	415 (±213)	165 (±305)	0 (±13)
naive boost	165 (±228)	435 (±376)	275 (±894)	0 (±22)


Andamento nazionale Covid-19 in Media Mobile
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01/05/2021
01/07/2021
01/09/2021
01/11/2021
01/01/2022
Nuovi casi
Terapie intensive
Decessi

Effectiveness of mRNA-1273 against SARS-CoV-2 omicron and delta variants

Authors: Hung Fu Tseng, PhD,[1,2,*] Bradley K. Ackerson, MD,[1] Yi Luo, PhD,[1] Lina S. Sy, MPH,[1] Carla A. Talarico, PhD,[3] Yun Tian, MS,[1] Katia J. Bruxvoort, PhD,[4] Julia E. Tubert, MPH,[1] Ana Florea, PhD,[1] Jennifer H. Ku, PhD,[1] Gina S. Lee, MPH,[1] Soon Kyu Choi, MPH,[1] Harpreet S. Takhar, MPH,[1] Michael Aragones, MD,[1] Lei Qian, PhD[1]

Figure 1. Vaccine effectiveness of 2-dose mRNA-1273 against omicron and delta variants by time since vaccination

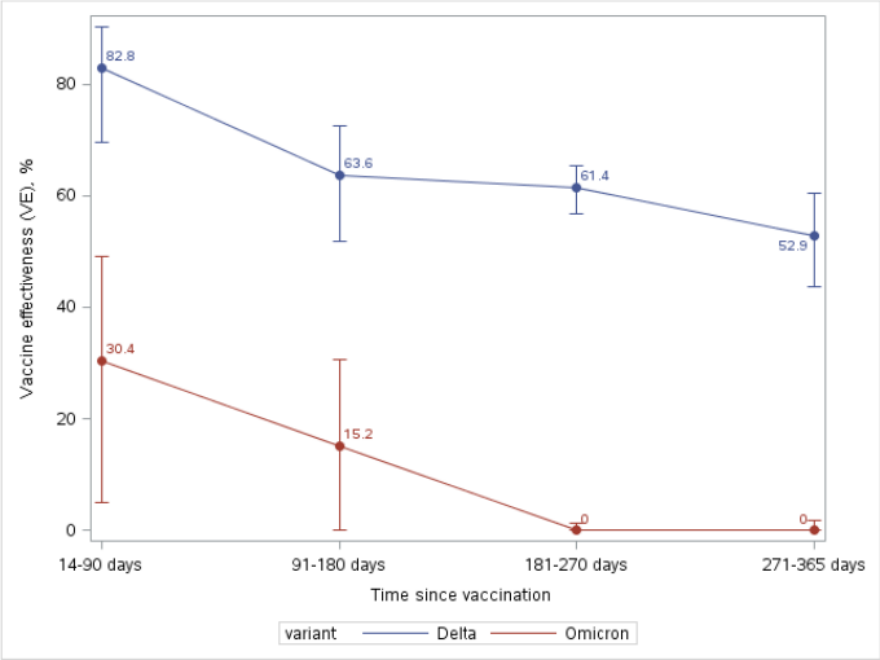
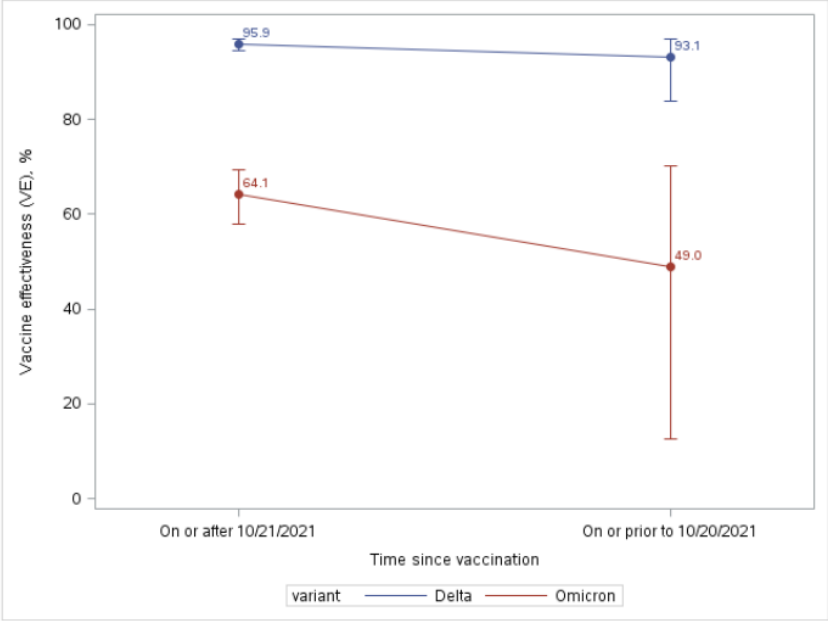
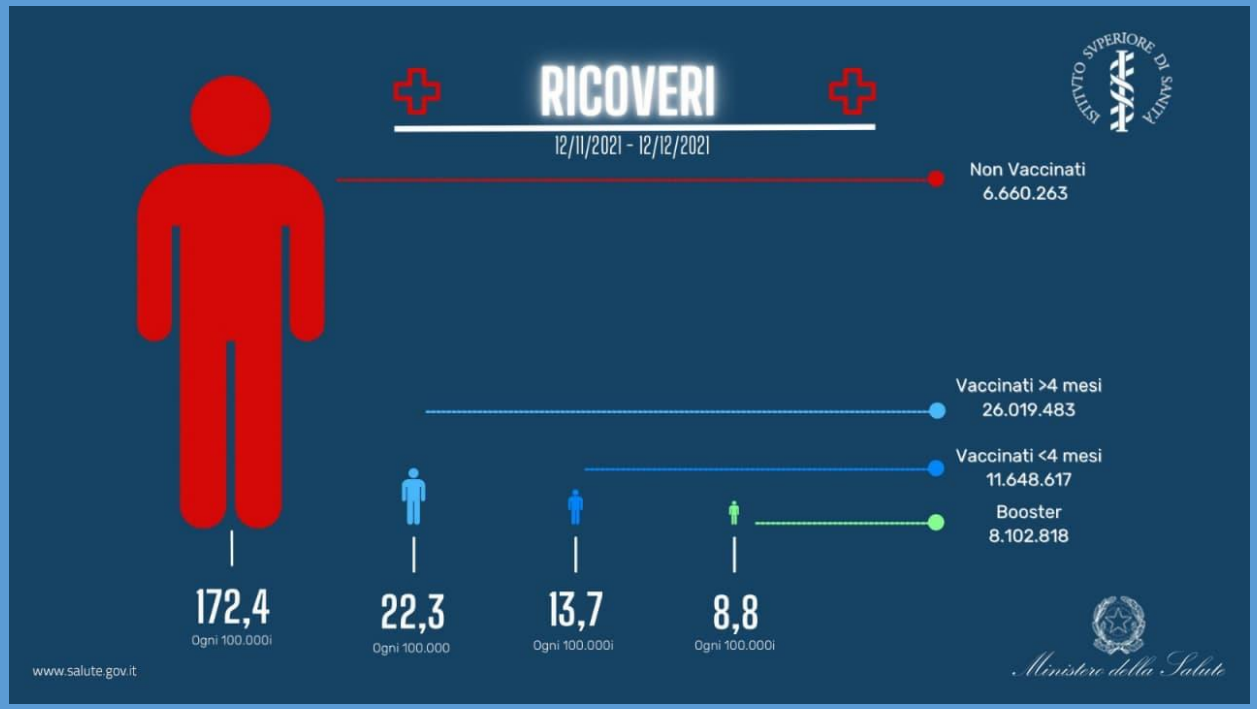


Figure 2. Vaccine effectiveness of 3-dose mRNA-1273 against omicron and delta variants by time since vaccination among immunocompetent population




RICOVERI
12/11/2021 - 12/12/2021
ISTITUTO SUPERIORE DI SANITÀ
Non Vaccinati
6.660.263
Vaccinati >4 mesi
26.019.483
Vaccinati <4 mesi
11.648.617
Booster
8.102.818
172,4
Ogni 100.000i
22,3
Ogni 100.000
13,7
Ogni 100.000i
8,8
Ogni 100.000i
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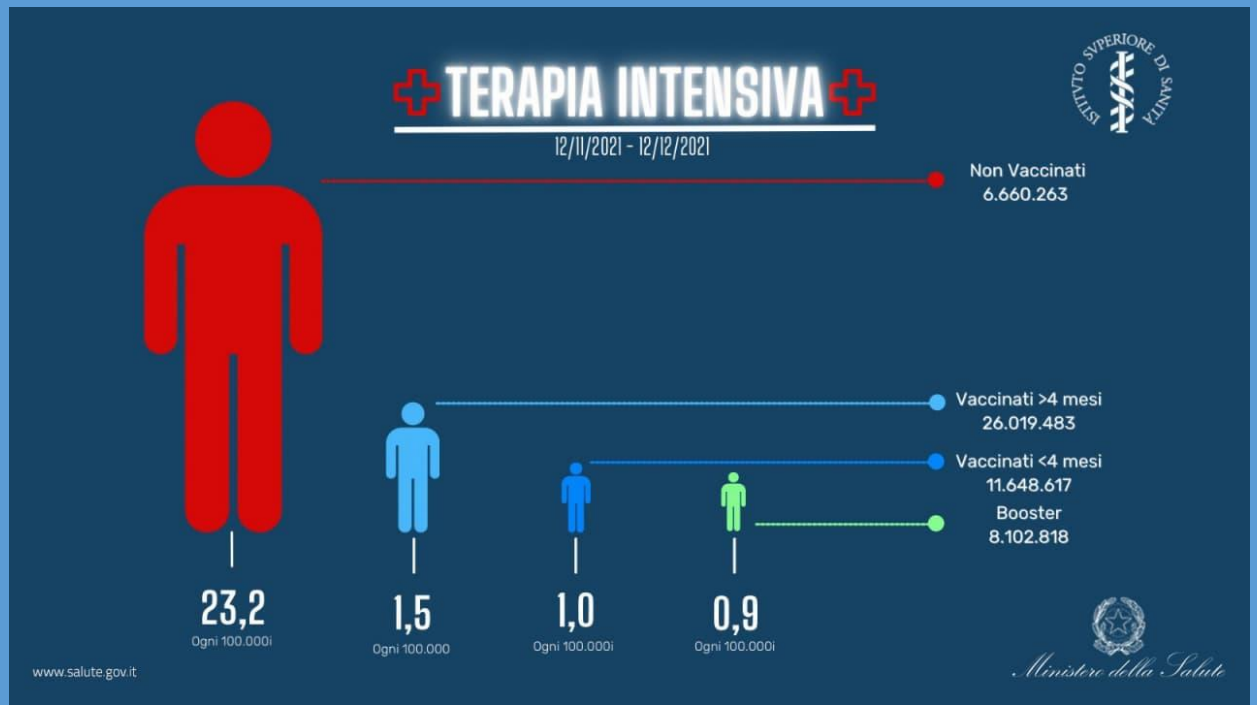
TERAPIA INTENSIVA
12/11/2021 - 12/12/2021
ISTITUTO SUPERIORE DI SANITÀ
Non Vaccinati
6.660.263
Vaccinati >4 mesi
26.019.483
Vaccinati <4 mesi
11.648.617
Booster
8.102.818
23,2
Ogni 100.000i
1,5
Ogni 100.000
1,0
Ogni 100.000i
0,9
Ogni 100.000i
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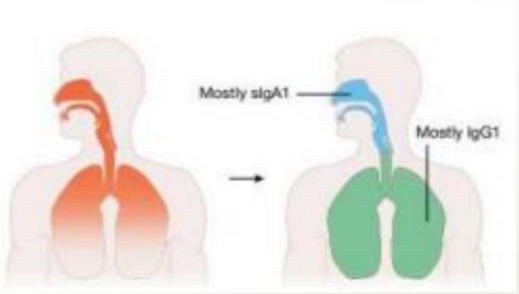
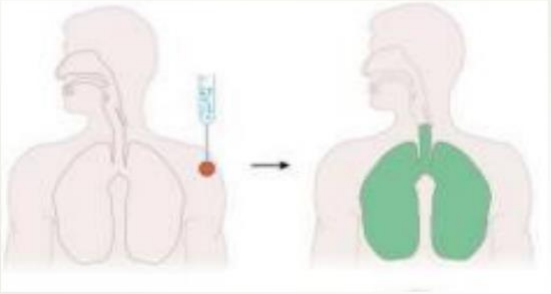
Mucosal immunity may work as a barrier to infection

- Current intramuscular COVID-19 vaccines do not induce mucosal immunity. They do not induce the same multifaceted immune response as a natural infection but do protect from severe disease
- Nasal COVID-19 vaccines are being investigated to protect from infection as well as from severe disease



Infection-induced immunity induces systemic immunity but also mucosal immunity because SARS-CoV-2 infection starts in the upper respiratory tract



Vaccine-induced immunity induces systemic immunity only and no mucosal immunity

Contents lists available at ScienceDirect

Vaccine

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Commentary

Multicomponent vaccines to fight SARS-CoV-2 variants of concern

Antonio Cassone [a,*], Roberto Cauda [b,1]

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[b] Dipartimento di Sicurezza e Bioetica, Università Cattolica del Sacro Cuore, Rome, Italy

interacts with the host cell membrane and allows the viral fusion with, and entry, the cell so initiating infection [1]. The choice of nucleic acid technology and S protein as antigen for vaccine formulation was pathogenically logical and allowed generation of safe and highly efficacious vaccines at an unprecedented speed (around 1 year). These vaccines elicit the production of specific antibodies that inhibit S protein binding to ACE2 receptor and neutralize virus infection. They also activate cell-mediated, B and T memory immunity, and are highly effective in protecting against severe disease, hence abating COVID-19 mortality [2].

2. Vaccines challenged by SARS-CoV-2 variants

Unfortunately, though expected, viral mutations have soon appeared among spreading SARS-CoV-2 lineages, the so-called Variants of Interest (VOI) or Concern (VOC), which seriously threaten vaccine effectiveness. The most threatening mutations are those leading to amino acid substitutions or deletions in the S protein, particularly in its RBD sequence. Some of them make SARS-CoV-2 more contagious because they confer to the S protein increased affinity for ACE2 receptor but do not appear to markedly undermine vaccine effectiveness. Some others, however, appear to substantially lower antibody protection as shown by in vitro

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3. Proposal

Scientists, public health administrators and stakeholders appear to be well aware of the above threatening situation, and some vaccine manufacturers have started production and validation of a second generation vaccines for VOC better fighting. To do this, the high efficiency and flexibility of nucleic acid-based technologies, as witnessed by the success of current vaccines, is being rightly advocated, and a logical option would seem to be just replacing, or adding to, the present nucleic acid sequences with those of coronavirus variants [1,2].

We believe there is time to consider an integrative option. We posit the necessity of broadening antigen composition of the second generation, SARS-CoV-2 vaccines by including sequences of genes encoding non RBD, non S constituents of the coronavirus genome. We invite vaccine companies to seriously consider the potential of a multicomponent vaccine to generate protective antibodies and cell-mediated immunity to which SARS-CoV-2 could much less likely escape by mutations than with the current, single component vaccines. A number of structural and non-structural viral proteins of critical importance for the reproduction cycle and architecture of the beta-coronaviruses, as well as for their interaction with human cells, could in principle be considered. Past studies have indeed documented that SARS-CoV-2 -infected subjects raise strong immune responses to antigenic components other than S protein, some of which are likely to contribute to the immune protection against the virus, as discussed below. Most of these immune responses are targeted to the nucleoprotein (N) constituent of the viral particle.

ARTICLE

https://doi.org/10.1038/s41467-021-27674-x OPEN

Cross-reactive memory T cells associate with protection against SARS-CoV-2 infection in COVID-19 contacts

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Cross-reactive immune responses to SARS-CoV-2 have been observed in pre-pandemic cohorts and proposed to contribute to host protection. Here we assess 52 COVID-19 household contacts to capture immune responses at the earliest timepoints after SARS-CoV-2 exposure. Using a dual cytokine FLISpot assay on peripheral blood mononuclear cells, we enumerate the frequency of T cells specific for spike, nucleocapsid, membrane, envelope and ORF1 SARS-CoV-2 epitopes that cross-react with human endemic coronaviruses. We observe higher frequencies of cross-reactive ($p = 0.0139$), and nucleocapsid-specific ($p = 0.0355$) IL-2-secreting memory T cells in contacts who remained PCR-negative despite exposure ($n = 26$), when compared with those who convert to PCR-positive ($n = 26$); no significant difference in the frequency of responses to spike is observed, hinting at a limited protective function of spike-cross-reactive T cells. Our results are thus consistent with pre-existing non-spike cross-reactive memory T cells protecting SARS-CoV-2-naïve contacts from infection, thereby supporting the inclusion of non-spike antigens in second-generation vaccines.

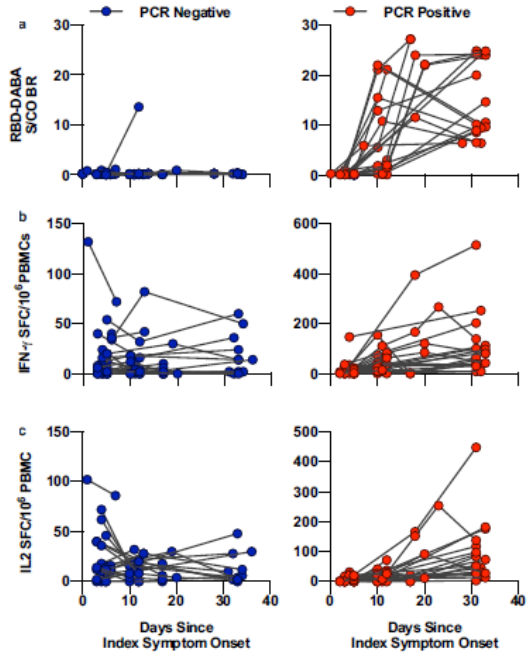

Fig. 3 Dynamics of cross-reactive T cells and RBD-specific antibody in PCR-positive and negative contacts. Serum sampled from COVID-19 contacts at the baseline, D7 and D28 visit were assayed for RBD-specific antibody, represented as sample/control ratios (**a**). PBMCs from these visits were rested overnight at high density prior to stimulation with 1 µg/ml cross-reactive peptide pool cultured for 20 h in a FLISpot assay to detect IL-2- (**b**) and IFNγ (**c**) secreting T cells. Serum from these visits were assayed for RBD-specific antibody, represented as sample/control ratios (**c**). Left-hand panels and blue circles represent PCR-negative contacts whilst right-hand panels and red circle represent PCR-positive contacts.

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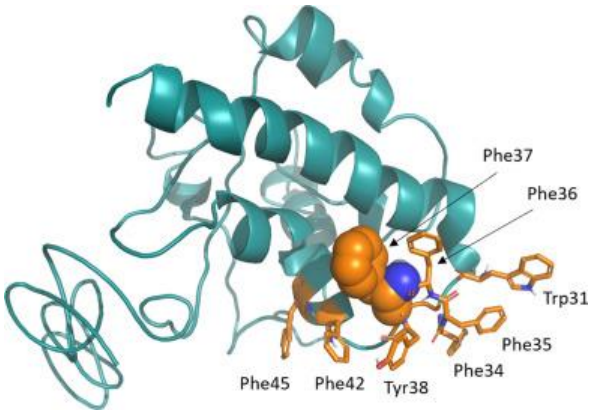
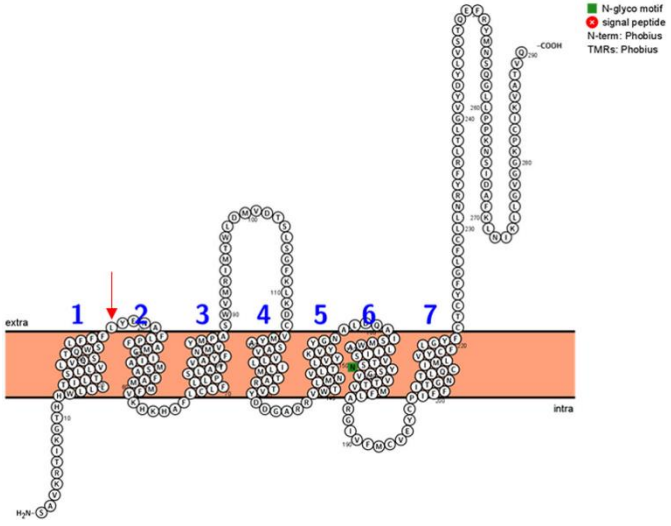
Volume 81, Issue 1, July 2020, Pages e24-e27

Evolutionary analysis of SARS-CoV-2: how mutation of Non-Structural Protein 6 (NSP6) could affect viral autophagy

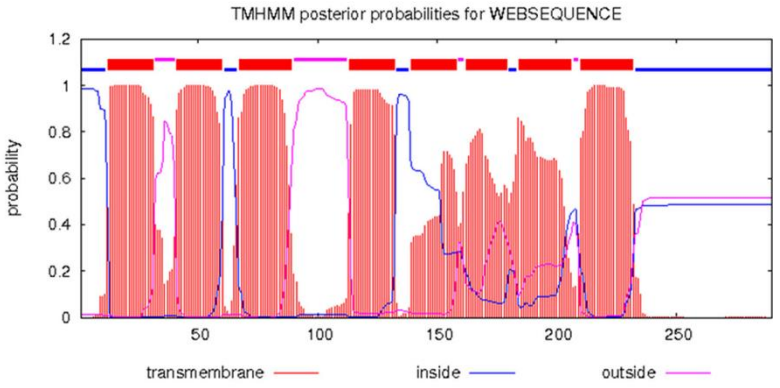
Domenico Benvenuto [a], Silvia Angeletti [b], Marta Giovanetti [c], Martina Bianchi [d], Stefano Pascarella [d], Roberto Cauda [e, f], Massimo Ciccozzi [a], Antonio Cassone [g]



A



B



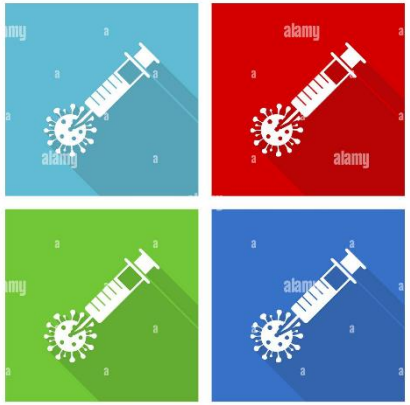
1) Il Sars-Cov2 muta molto in fretta e alcune mutazioni conferiscono vantaggi al virus

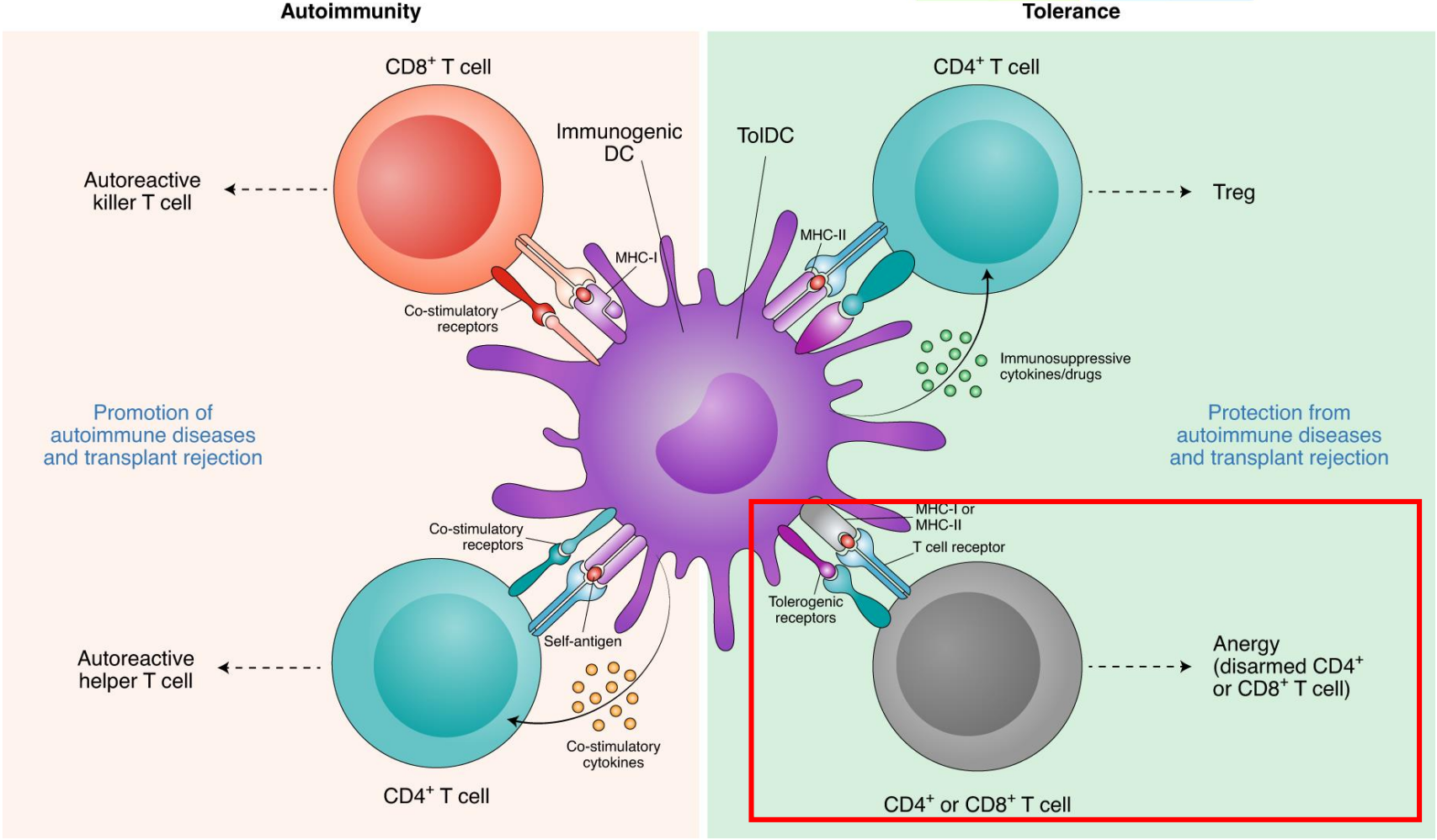
2) I vaccini attuali nonostante non siano aggiornati sulle varianti forniscono un'ottima protezione dalla malattia

3) I ricercatori del centro Walter Reed hanno messo a punto un vaccino pan-coronavirus

4) Il vaccino pan-coronavirus dovrebbe proteggere dalle varianti attuali e dalle future

5) Il vaccino pan-coronavirus accoppiato al vaccino spray potrebbe segnare una svolta nella pandemia




Autoimmunity
Tolerance
CD8+ T cell
Immunogenic DC
Autoreactive killer T cell
MHC-I
Co-stimulatory receptors
Promotion of autoimmune diseases and transplant rejection
Co-stimulatory receptors
Self-antigen
Autoreactive helper T cell
Co-stimulatory cytokines
CD4+ T cell
CD4+ T cell
TolDC
MHC-II
Treg
Immunosuppressive cytokines/drugs
Protection from autoimmune diseases and transplant rejection
MHC-I or MHC-II
T cell receptor
Tolerogenic receptors
Anergy (disarmed CD4+ or CD8+ T cell)
CD4+ or CD8+ T cell

IDEAL+ Student Training Course - Paris 2021

	Monday 8 March	Tuesday 9 March	Wednesday 10 March	Thursday 11 March	Friday 12 March
Rooms	200 / 206 / 208 / 210 Pavillon 1	Online	200 / 202 / 206 / 210 Pavillon 3	200 / 206 / 208 / 210	200 / 206 / 208 / 210 Pavillon 3
Zoom link	Click here	Click here	Click here	Click here	Click here
08:30	**Welcome & introduction**				
09:00	09:00 - 10:50 **Sepsis & Infectious Diseases Emergencies** (Antwerp)	09:00 - 10:50 **Lung infections** (Rome)	09:00 - 10:50 **Meningitis & Encephalitis** (Rome)	09:00 - 10:50 **Bloodstream infections** (Antwerp & Hamburg)	
09:30					
10:00					09:00 - 11:50 **Vaccination** (Antwerp & Athens)
10:30					
11:00	11:00 - 12:50 **UTI** (Paris)	11:00 - 12:20 **Tuberculosis** (Rome)	11:00 - 11:50 **Animal bites & scratches** (Paris)	11:00 - 11:50 **Malaria** (Edinburgh)	
11:30					
12:00			12:00 - 12:50 **HIV infection** (Rome)	12:00 - 12:50 **Other tropical diseases** (Edinburgh)	**Lunch break**
12:30		**Lunch break**			
13:00	**Lunch break**		**Lunch break**	**Lunch break**	13:00 - 14:10 **Congenital infections** (Athens & Paris)
13:30		13:30 - 14:50 **ENT** (Paris)			
14:00	14:00 - 14:50 **Key rules in management of Infectious Diseases** (Antwerp)		14:00 - 14:50 **HIV infection** (Rome)	14:00 - 14:50 **Roundtable on COVID-19** (Rome & Edinburgh)	
14:30					14:20 - 15:40 **Infection control** (Antwerp)
15:00	15:00 - 15:50 **Hepatitis** (Hamburg)	15:00 - 16:20 **Skin rash** (Edinburgh)	15:00 - 16:50 **Skin and soft tissue infections & Arthritis** (Hamburg & Paris)	15:00 - 16:50 **Bronchiolitis, whooping cough and other miscellaneous** (Athens)	
15:30					15:40 - 16:30 **Lymphadenopathy** (Edinburgh)
16:00	16:00 - 16:50 **STI** (Paris)				
16:30		16:30 - 17:20 **Diarrhea** (Edinburgh)			**Wrap-up session**
17:00					
17:30