

Human B cell response to SARS-CoV-2

Ali Ellebedy, Ph.D.

Associate Professor of Pathology and
Immunology

LA City Health Commision

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Washington
University in St. Louis

SCHOOL OF MEDICINE

Disclosure

- **My laboratory has received funding support in sponsored research agreements from AbbVie and Emergent BioSolutions.**
- **Washington University has applied for patents related to some of our anti-influenza virus and anti-SARS-CoV-2 monoclonal antibodies.**

Outline

- **Impact of vaccination**
- **B cell response to SARS-CoV-2 infection**
- **B cell response to SARS-CoV-2 mRNA vaccination**

Vaccination works



<https://www.nzherald.co.nz/lifestyle/smallpox-and-the-photos-anti-vaxxers-dont-want-you-to-see/24MJGHWAIJRJD6LIPQ6ZTBKHI/>

Wild Poliovirus 1988



Wild Poliovirus 2008



Vaccines as the greatest triumph of medicine in the 20th century

Elimination of smallpox, control of polio, measles, mumps, rubella, influenza

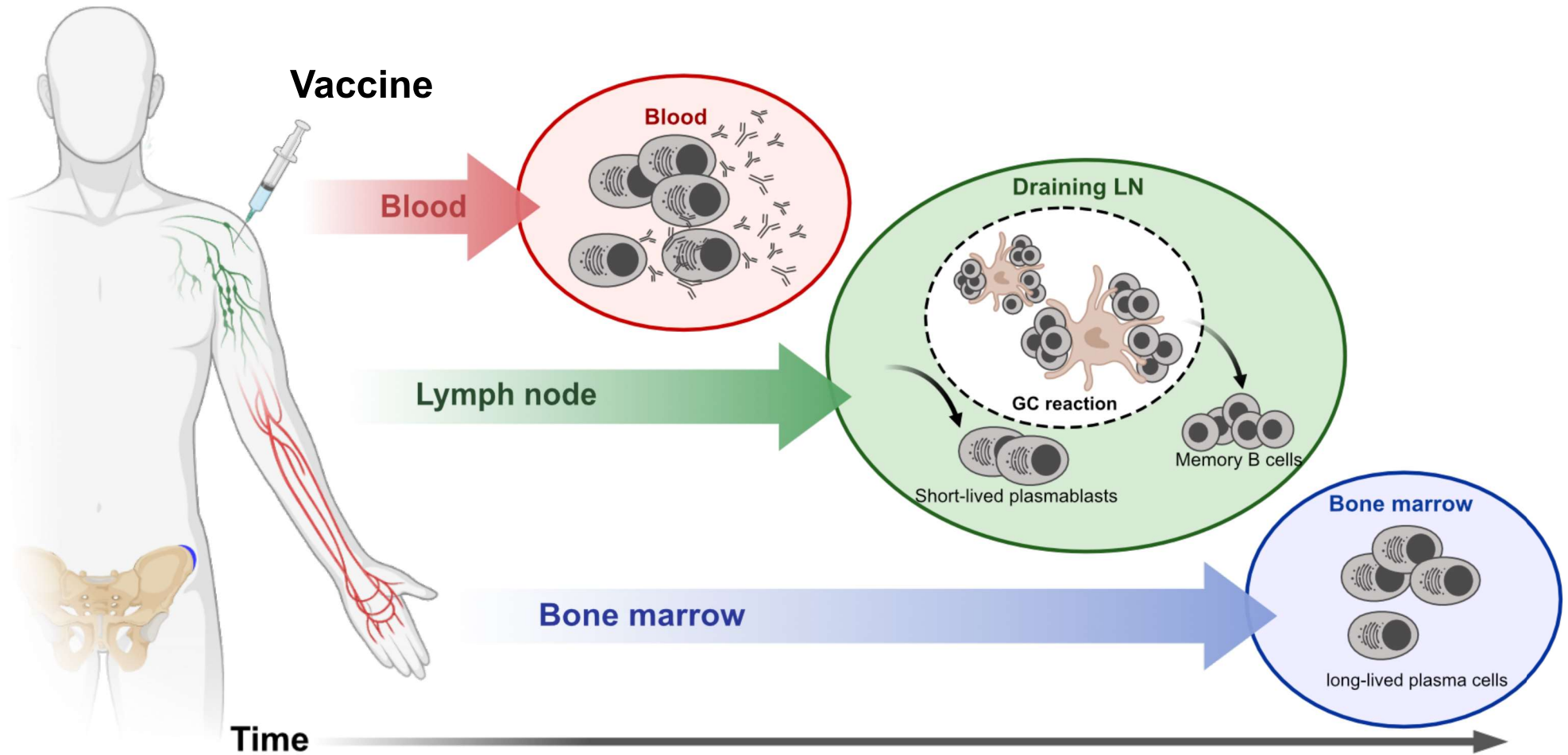
Potential control of hepatitis B, adenovirus, papillomavirus

Treatment of rabies

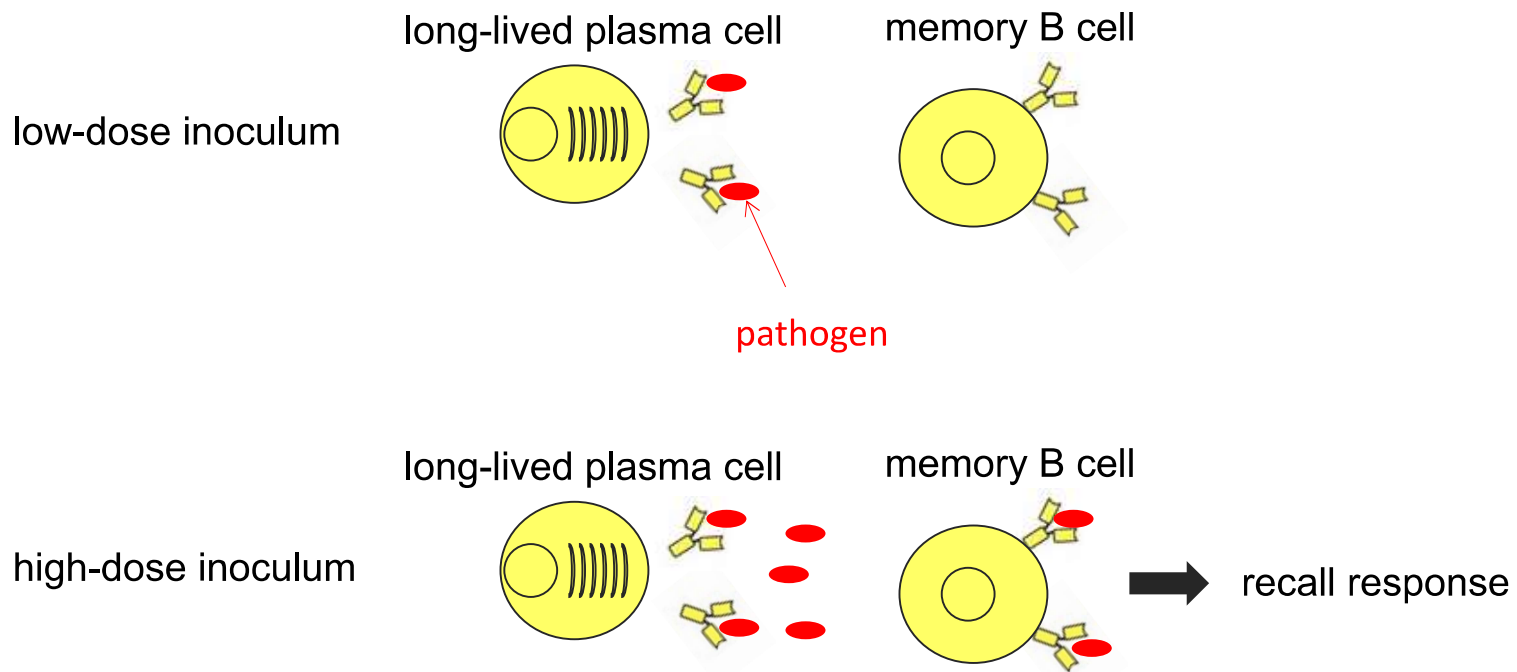
Most successful vaccines were the product of empiric trials of strategies developed prior to extensive knowledge of either viral molecular biology or immunology.

Vaccines	Vaccine type	Serum IgG	Mucosal IgG	Mucosal IgA	T cells
Diphtheria toxoid	toxoid	++	(+)		
Hepatitis A	killed	++			
Hepatitis B (HbsAg)	protein	++			
Hib PS	PS	++	(+)		
Hib glycoconjugates	PS-protein	++	++		
Influenza	killed, subunit	++	(+)		
Influenza intranasal	live attenuated	++	+	+	+ (CD8 ⁺)
Measles	live attenuated	++			+ (CD8 ⁺)
Meningococcal PS	PS	++	(+)		
Meningococcal conjugates	PS-protein	++	++		
Mumps	live attenuated	++			
Papillomavirus	VLPs	++	++		
Pertussis, whole cell	killed	++			
Pertussis, acellular	protein	++			+?(CD4 ⁺)
Pneumococcal PS	PS	++	(+)		
Pneumococcal conjugates	PS-protein	++	++		
Polio Sabin	live attenuated	++	++	++	
Polio Salk	killed	++	+		
Rabies	killed	++			
Rotavirus	live attenuated			++	
Rubella	live attenuated	++			
Tetanus toxoid	toxoid	++			
Tuberculosis (BCG)	live mycob				++(CD4 ⁺)
Typhoid PS	PS	+	(+)		
Varicella	live attenuated	++			+?(CD4 ⁺)
Yellow Fever	live attenuated	++			

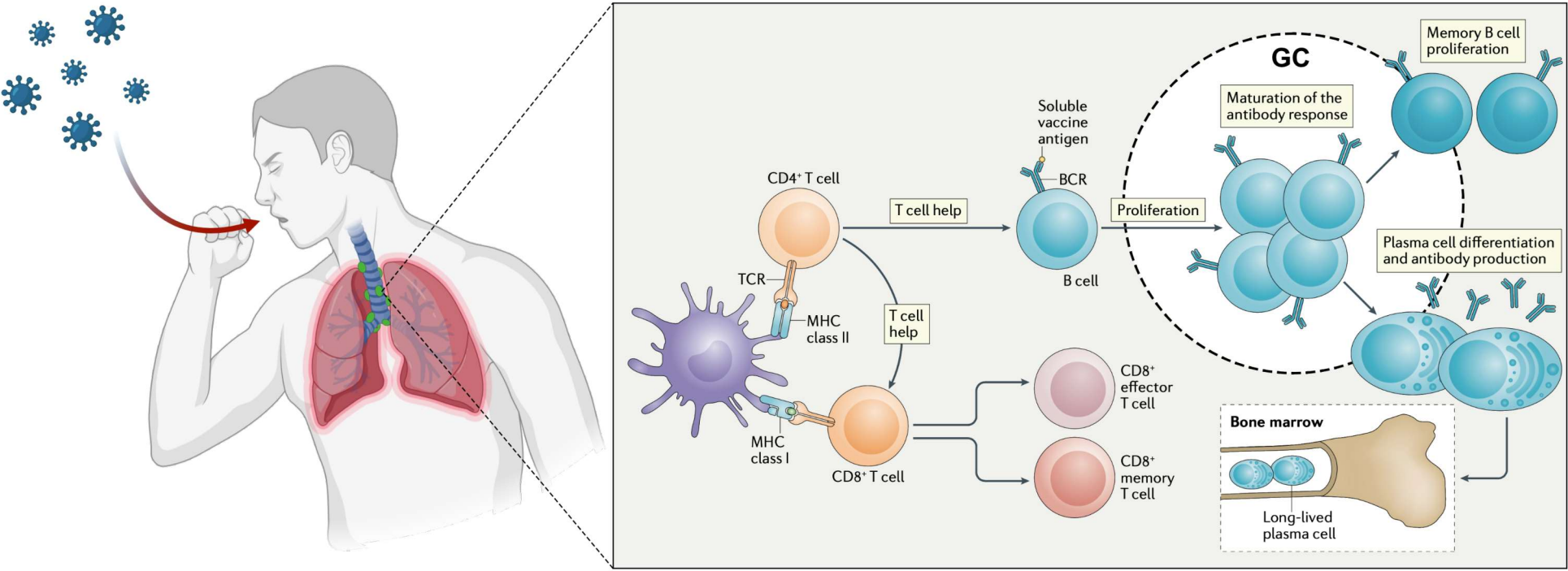
B cell response to vaccination



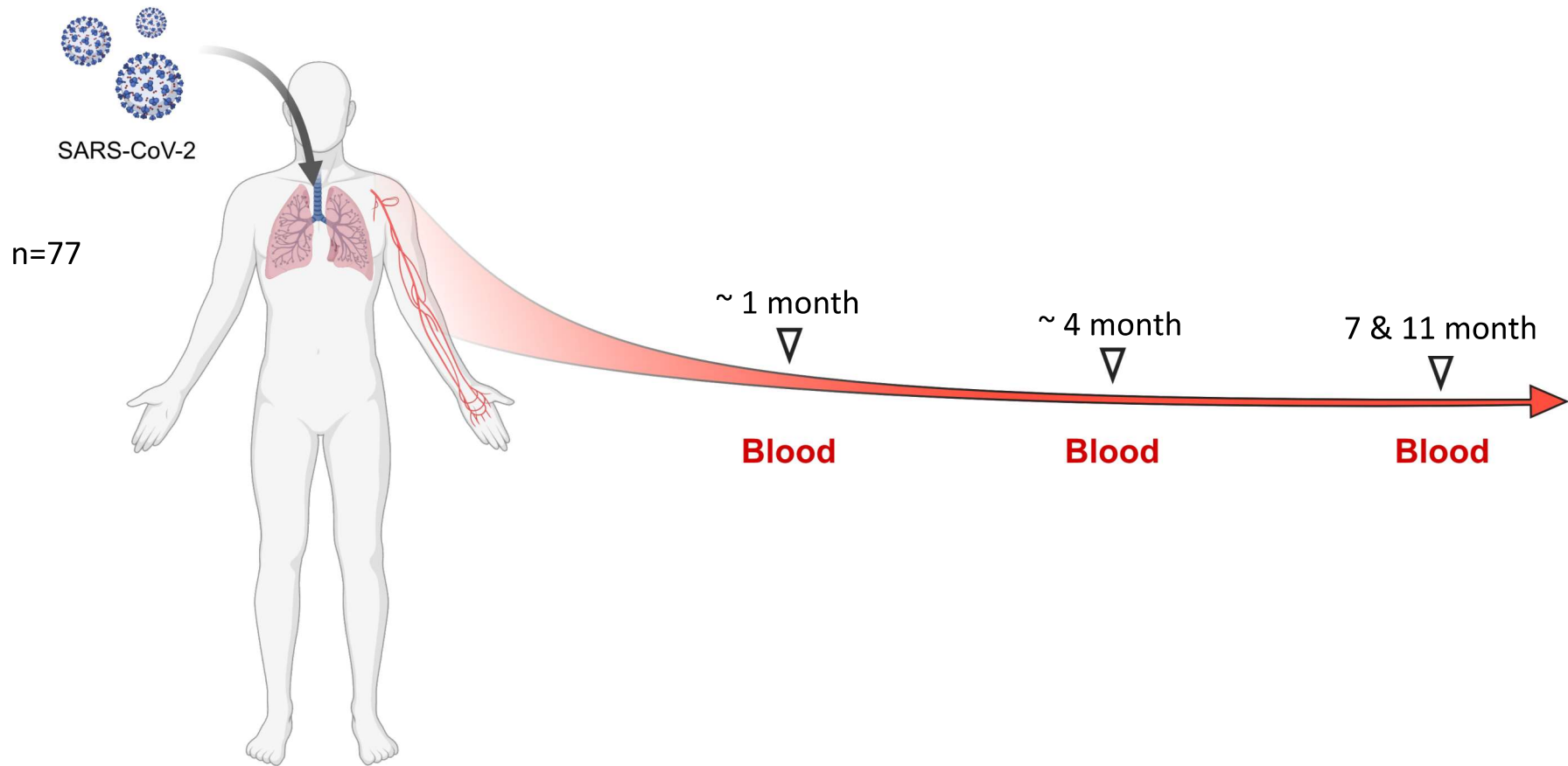
Long-lived plasma cells and memory B cells contribute to immunity in different ways



Immune response to SARS-CoV-2 infection

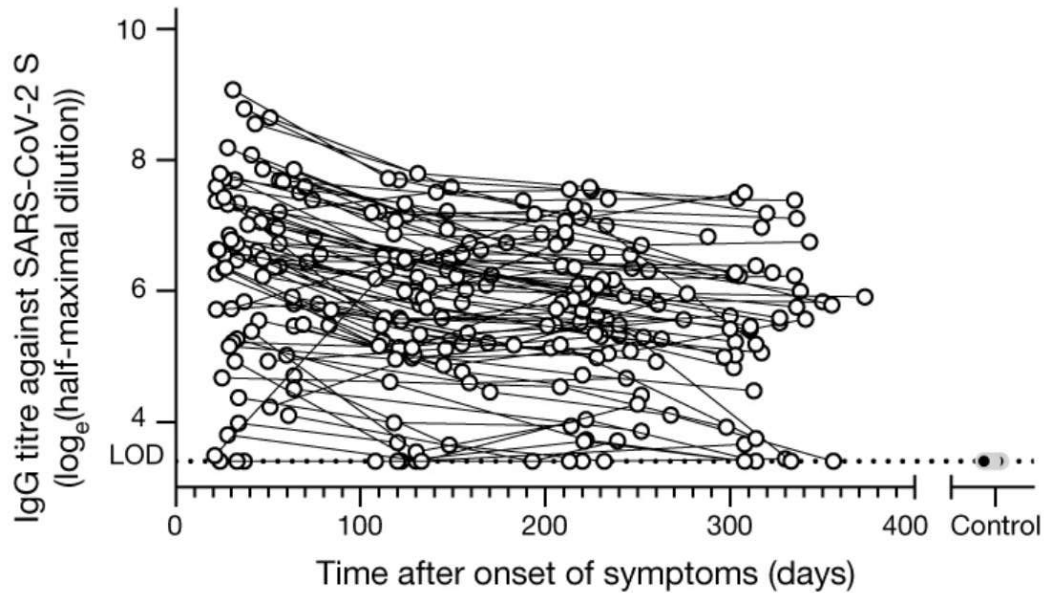


How durable the antibody response to SARS-CoV-2 infection in humans?

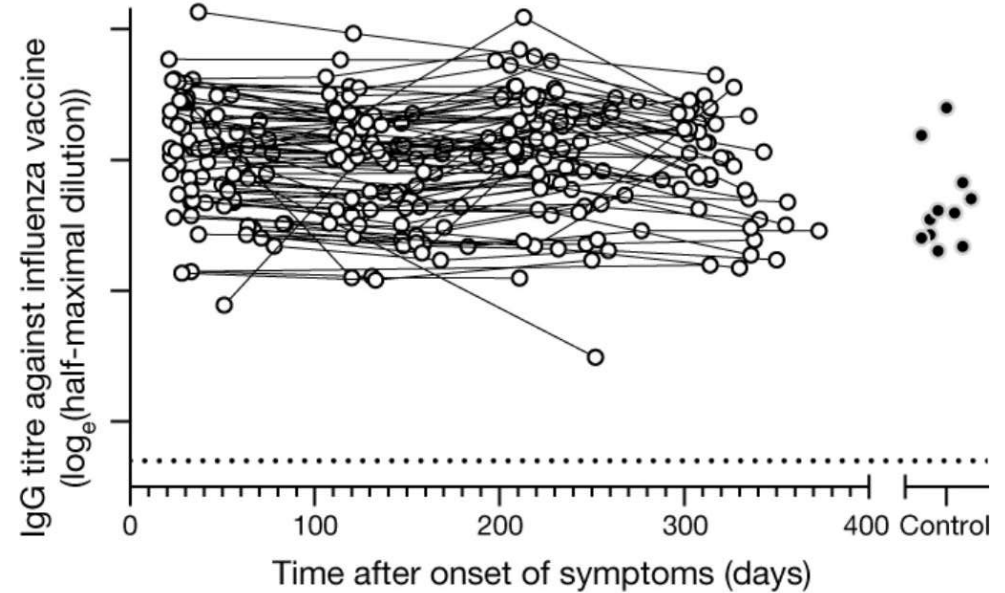


Biphasic decay of anti-Spike antibody titres

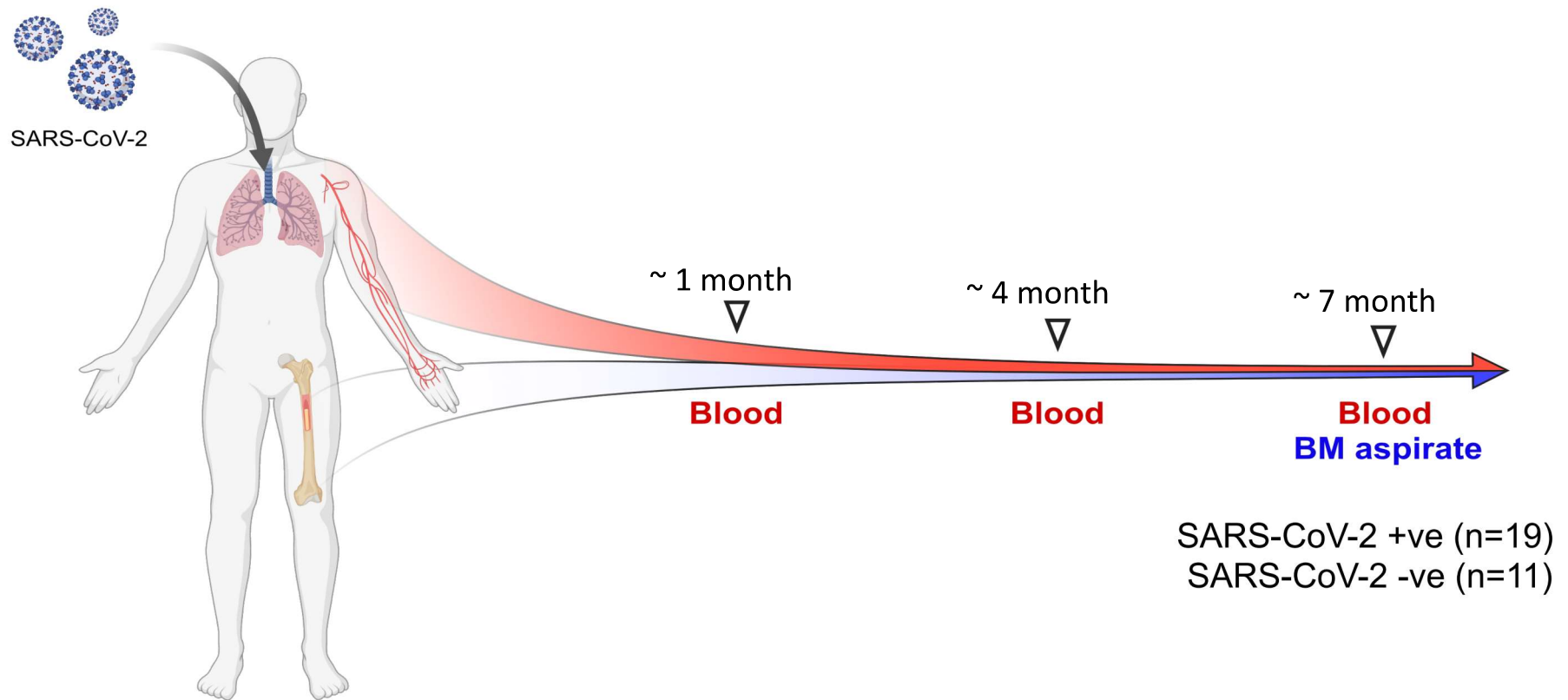
SARS-CoV-2



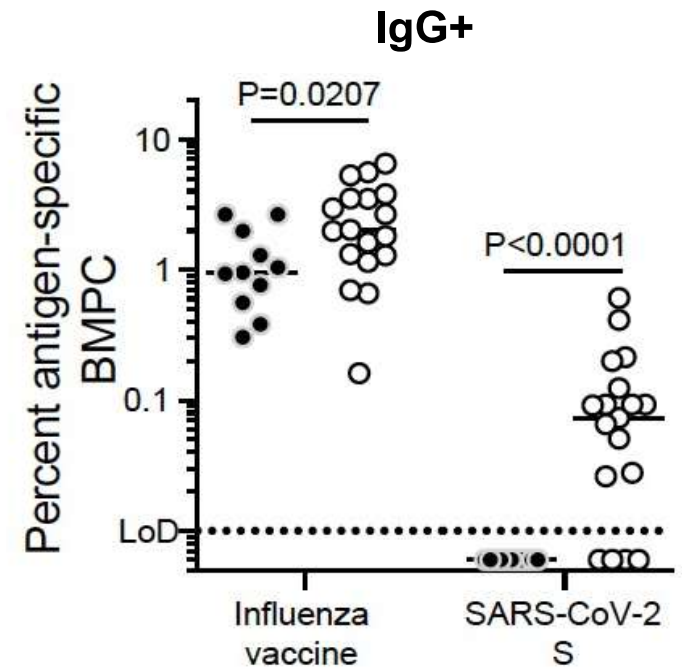
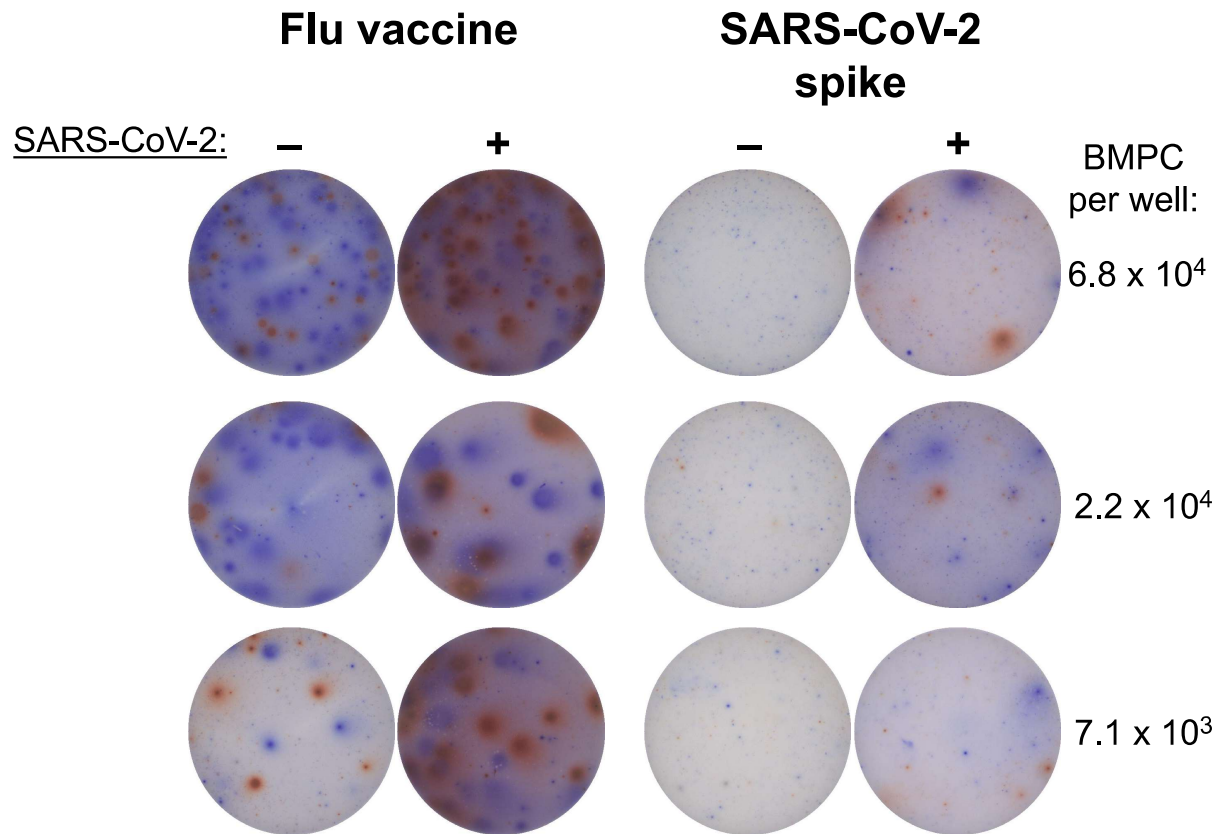
Influenza



Does SARS-CoV-2 infection induce long-lived bone marrow plasma cells?

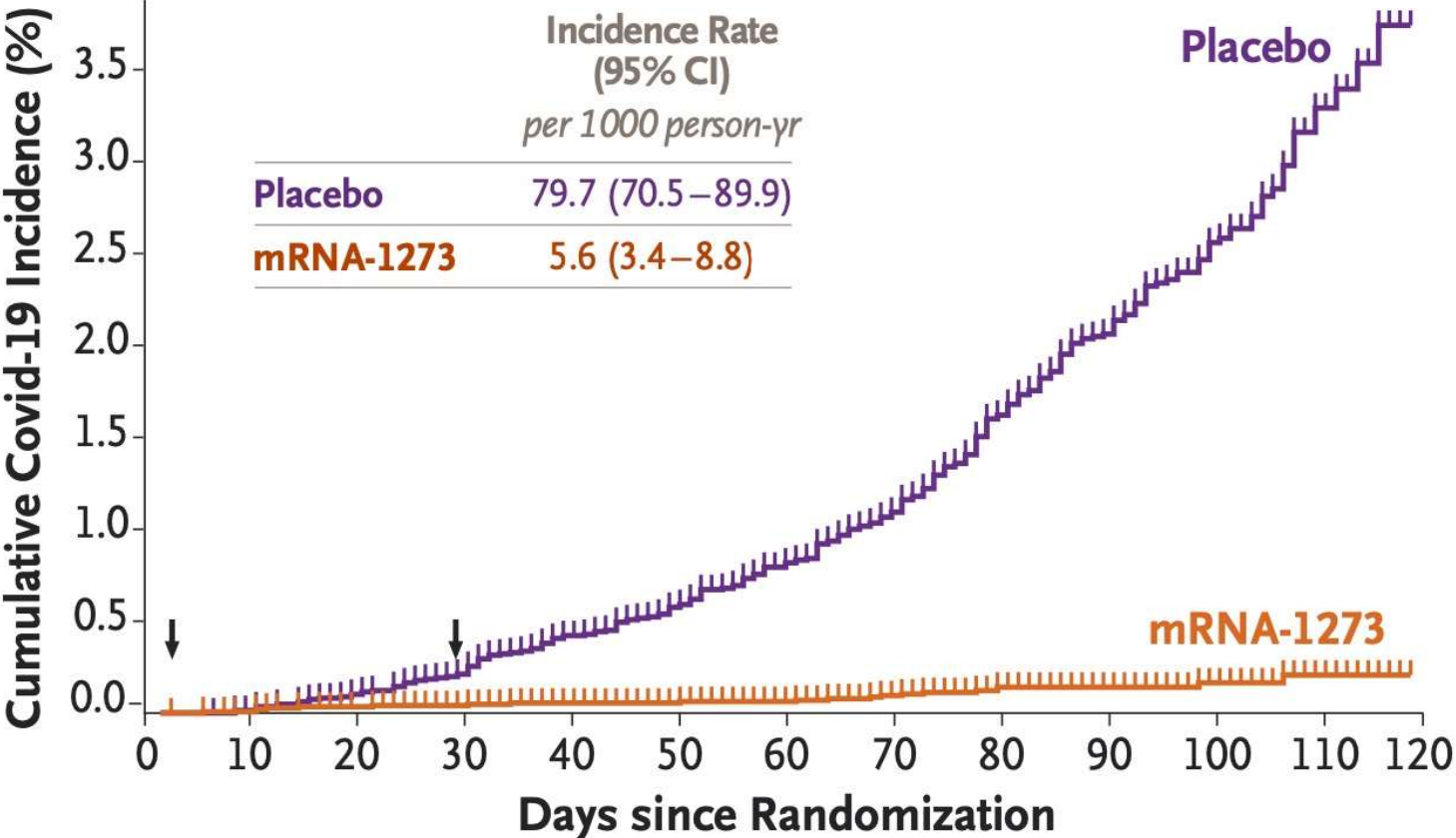


Induction of long-lived bone marrow plasma cells after mild SARS-CoV-2 infection



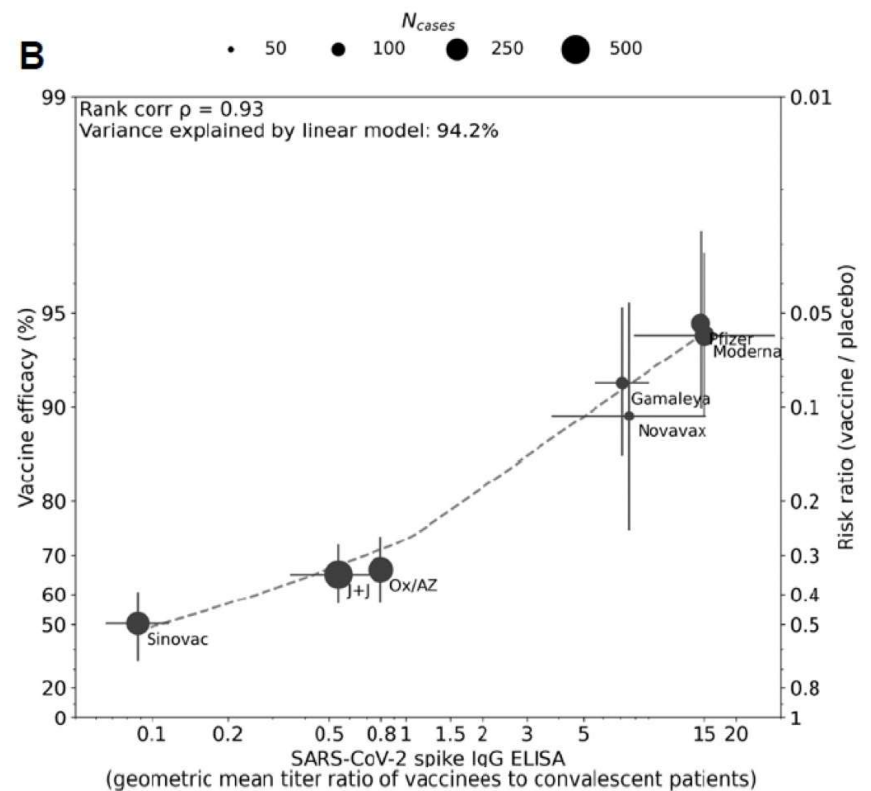
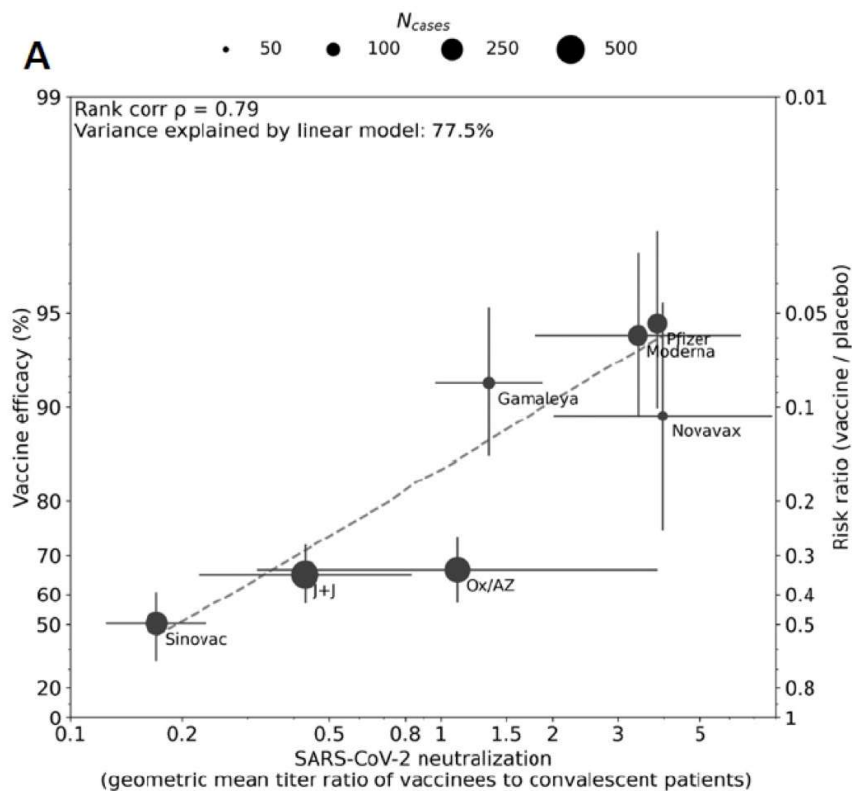
Turner et al. Nature. 2021 May 24.

SARS-CoV-2 vaccines: Game changer!

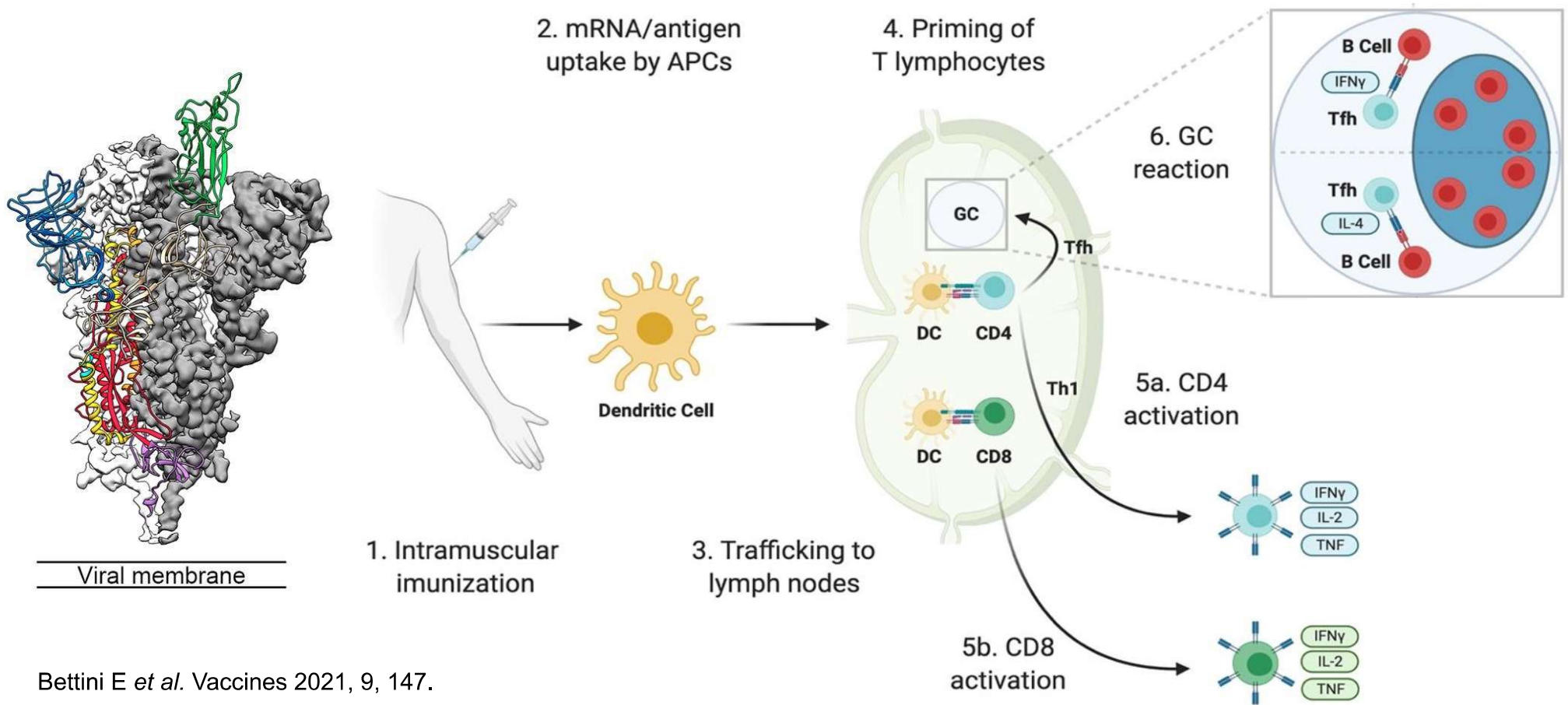


Correlation between antibody responses and efficacy rate of COVID-19 vaccines

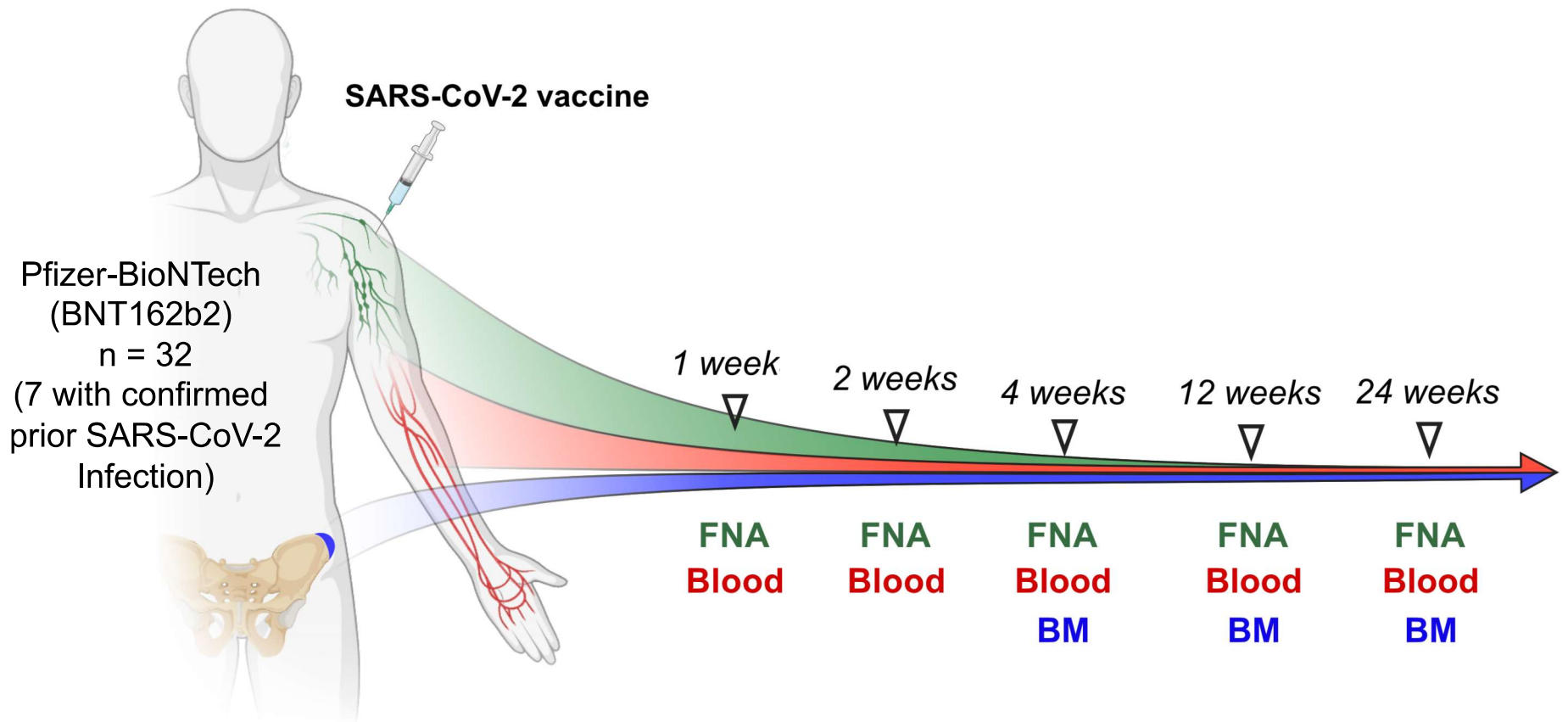
Stanley Plotkin et al. medRxiv preprint doi: <https://doi.org/10.1101/2021.03.17.20200246>



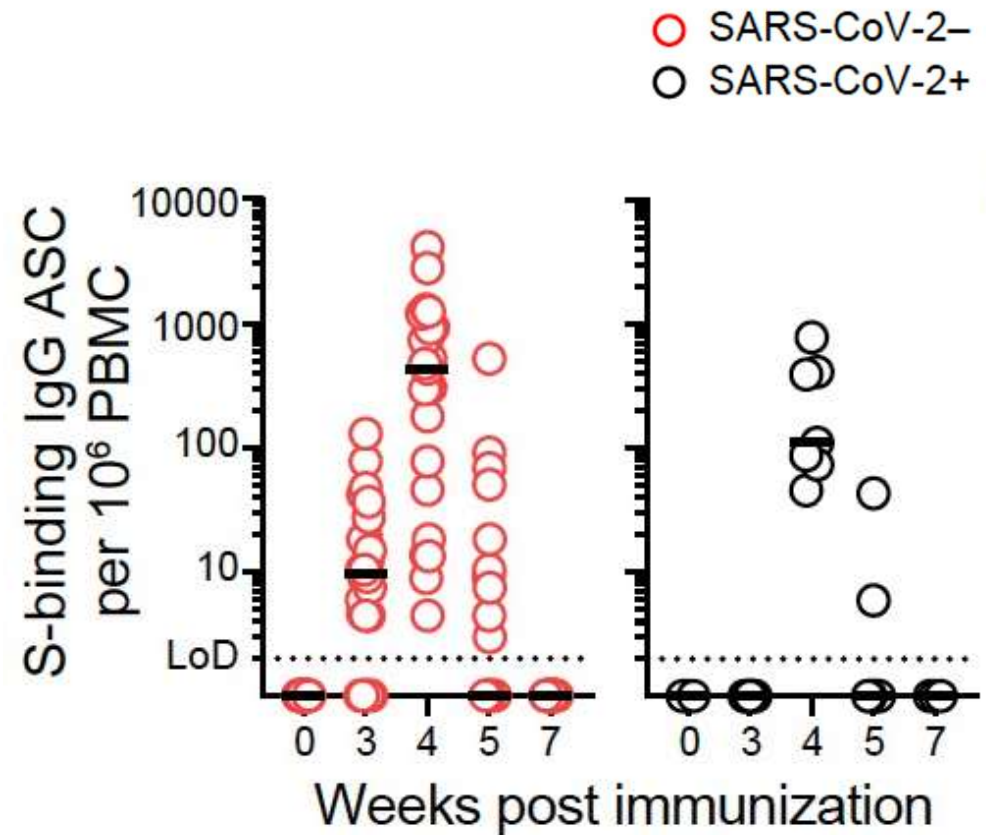
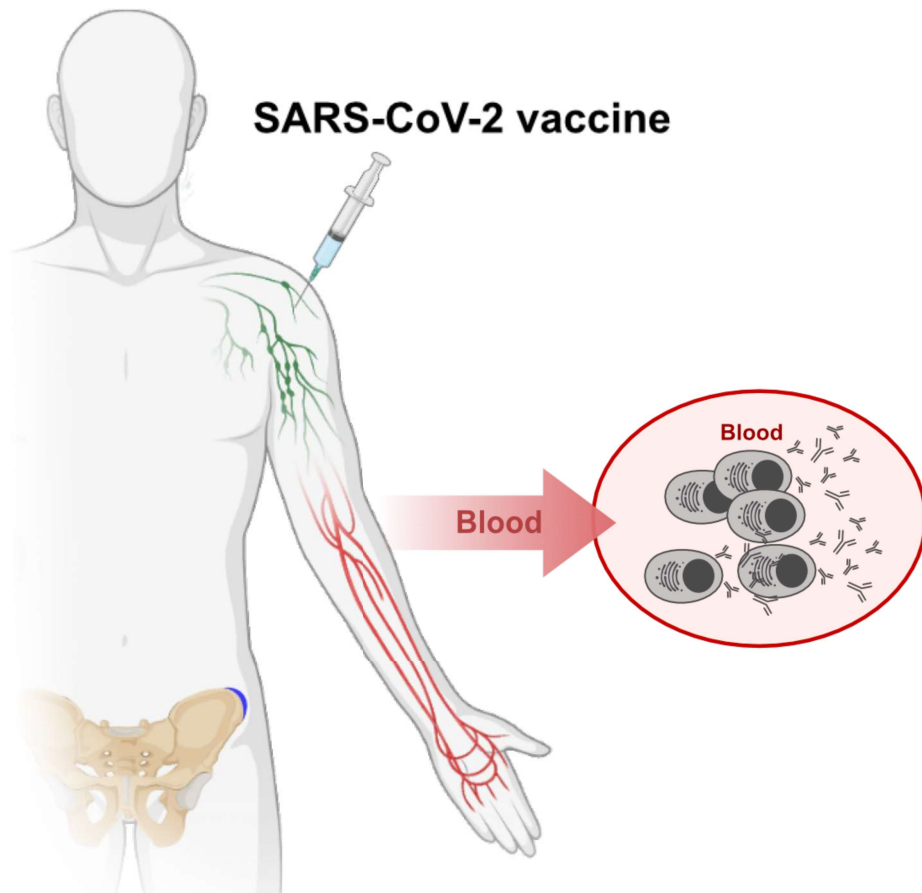
SARS-CoV-2 mRNA vaccination



Immune response to SARS-CoV-2 vaccines (Wash U 368 Study)

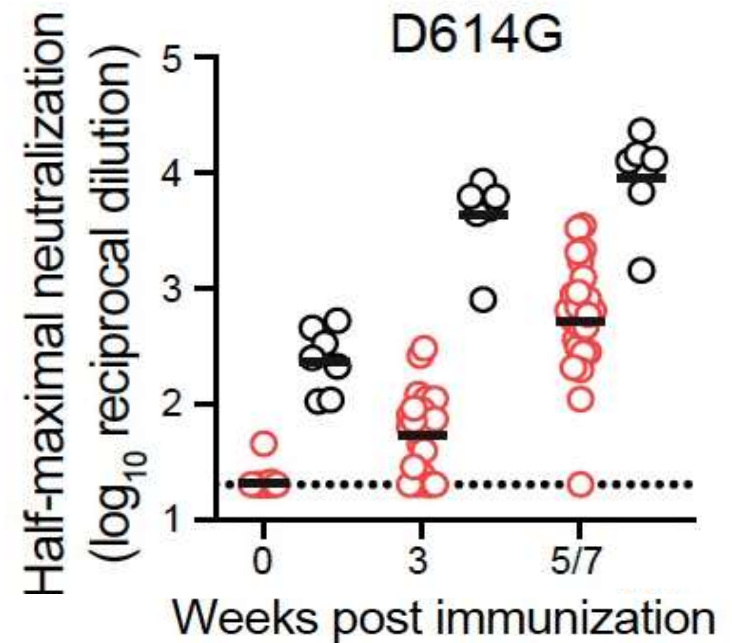
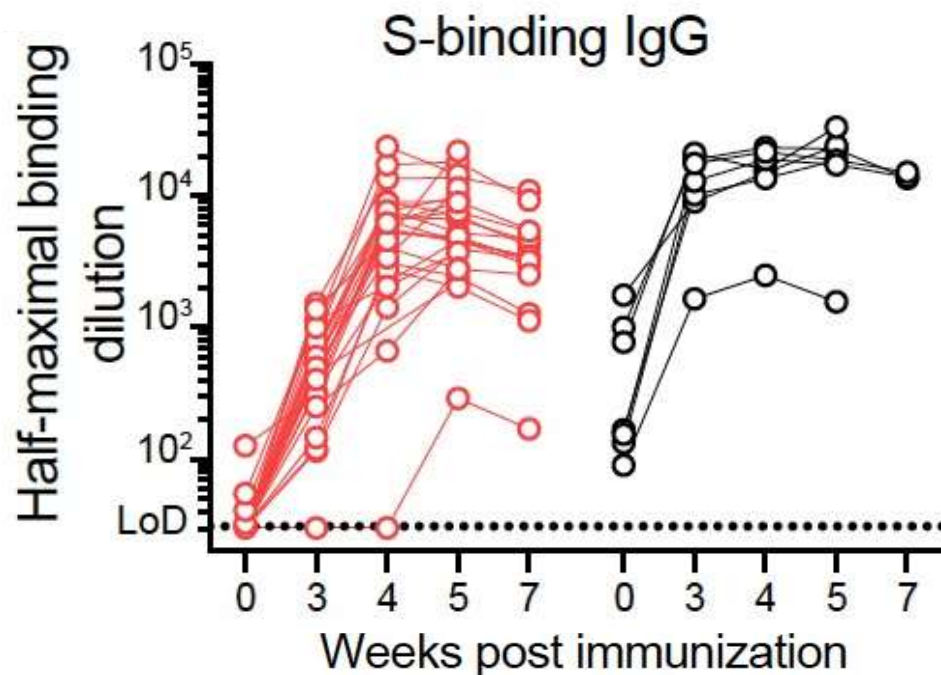


Strong plasmablast response to SARS-CoV-2 vaccination



Kinetics of serum antibody response to SARS-CoV-2 spike protein

- SARS-CoV-2-
- SARS-CoV-2+



Two years later: What did we learn?

- SARS-CoV-2 virus infection induces a robust and durable humoral immune response**
- SARS-CoV-2 mRNA vaccines are strongly immunogenic – elicit a potent antibody response**

Thank you!

Ellebedy Lab

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- * Previous lab members

Clinical partners

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- John DiPersio
- Rachel Presti
- Jane O'Halloran
- Sharlene Teefey
- Iskra Pusic
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Diamond lab

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 - Rita Chen
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- Sean Whelan
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Dynamics and Evolution of Immune Responses to Influenza Viruses
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