How can development of new vaccine platforms, such as mucosal vaccines, be encouraged?

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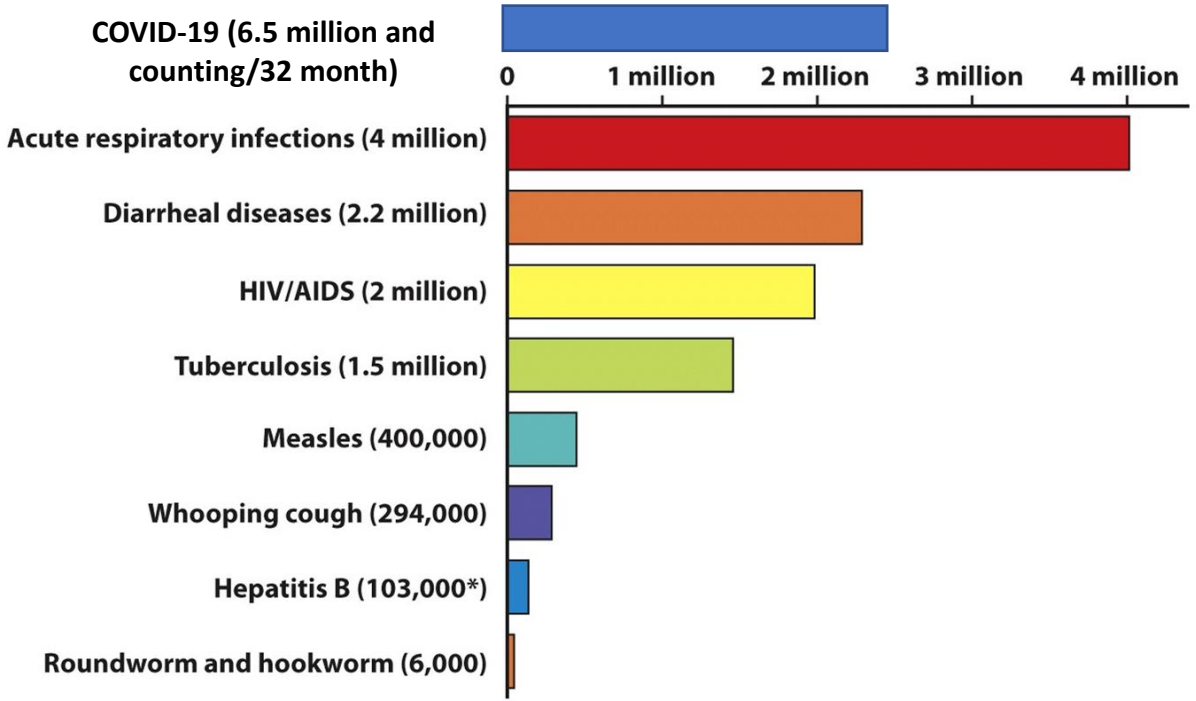
@VirusesImmunity

Worldwide Deaths Annually from Mucosal Infections

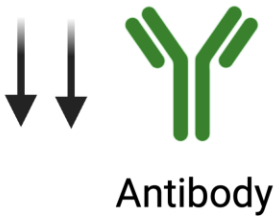


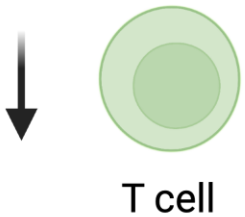
Adapted from Janeway's Immunology, 8ed. (© Garland Science 2012)

Why are mucosal vaccines better than intramuscular vaccines?

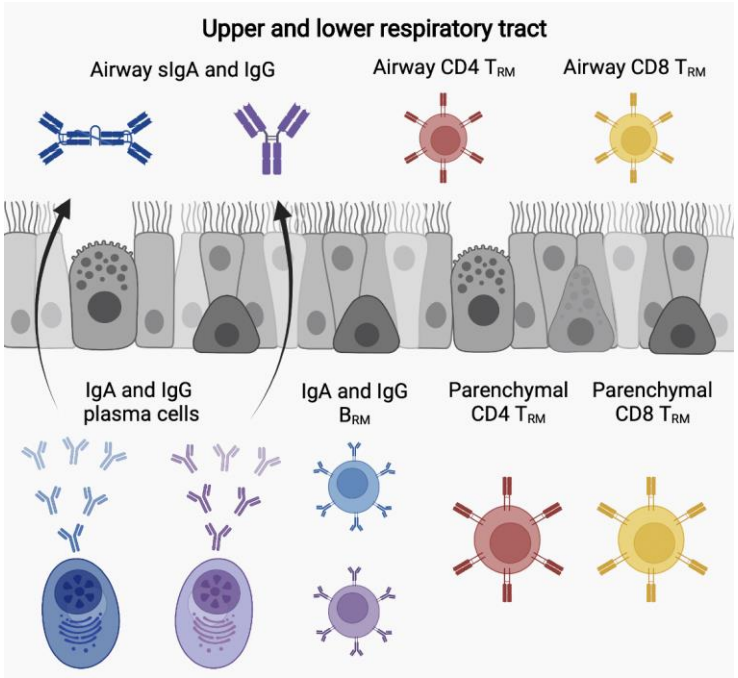
Host and virological factors contributing to breakthrough infection following vaccination

Waning immunity



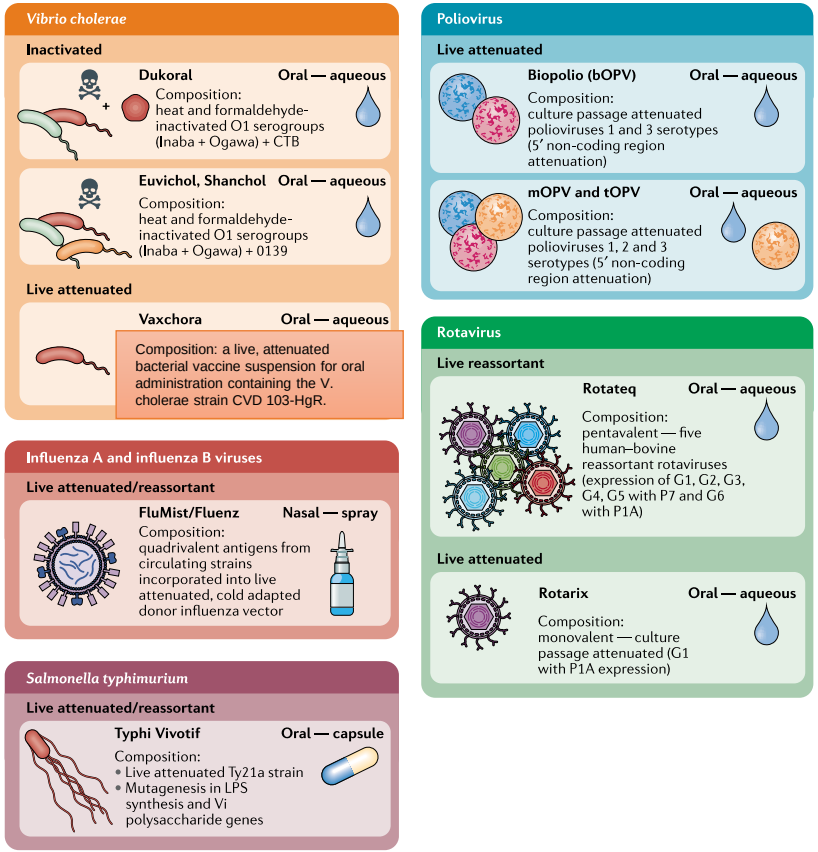


Mucosal immunity: sterilizing protection and rapid recall responses



Problems and solutions to nasal vaccines

- **Only a handful of licensed mucosal vaccines**
- **Live attenuated vaccines require significant R&D for safety and are not usable in immunocompromised**
- **Only one is available for respiratory pathogens (FluMist)**
- **Proximity of nasal cavity to the CNS via olfactory bulb requires extra safety precautions**

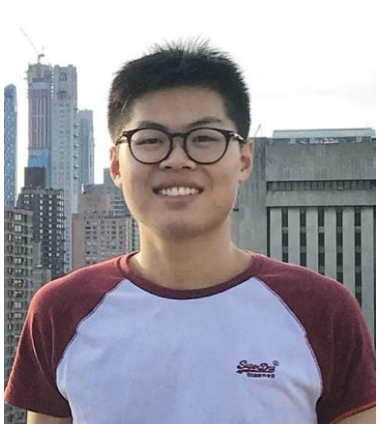


Modified from Nature Reviews Immunology volume 22, pages236–250 (2022)

Solution: Prime and Spike

We found a way to safely and robustly induce protective immunity in the respiratory mucosa with a nasal booster

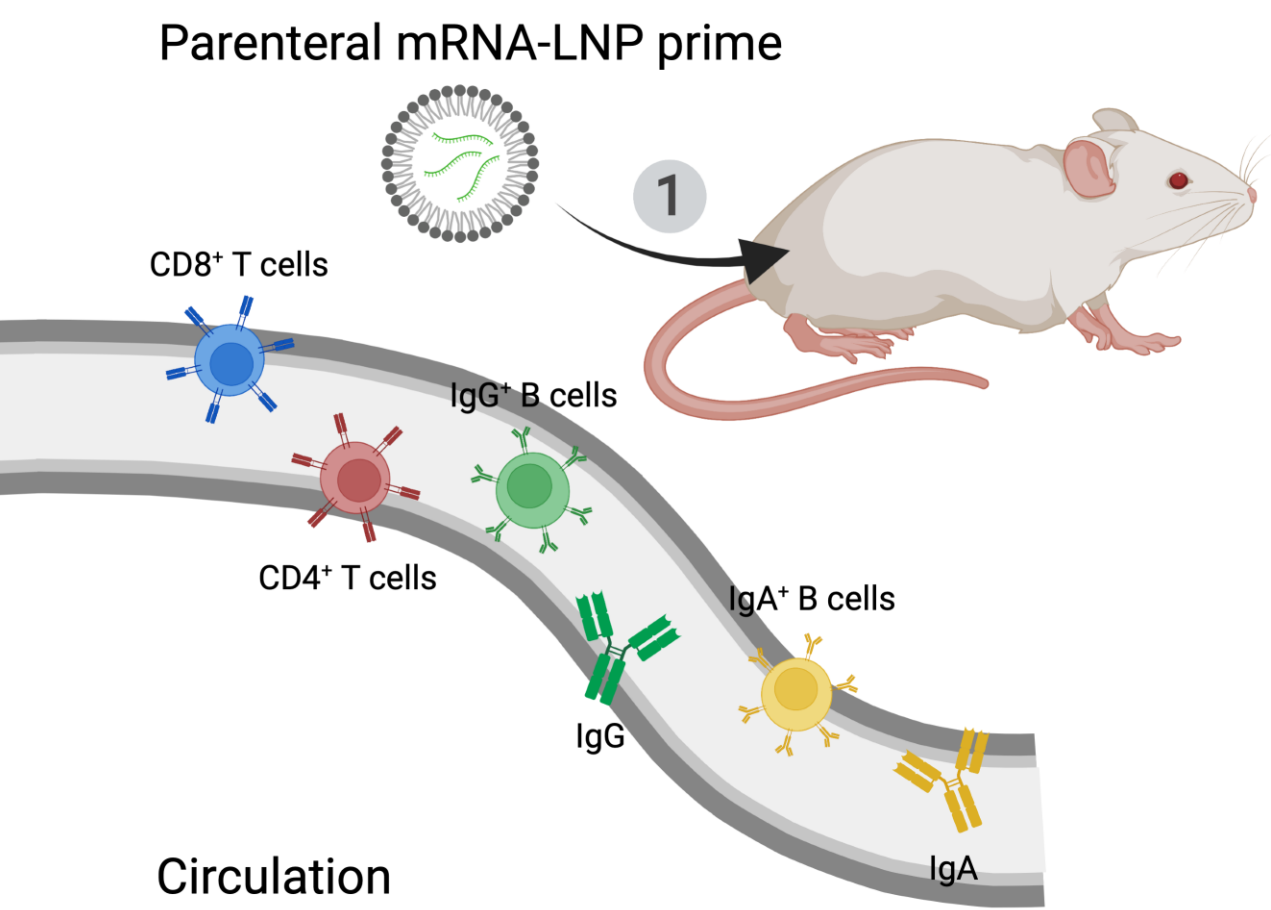
Ben Israelow



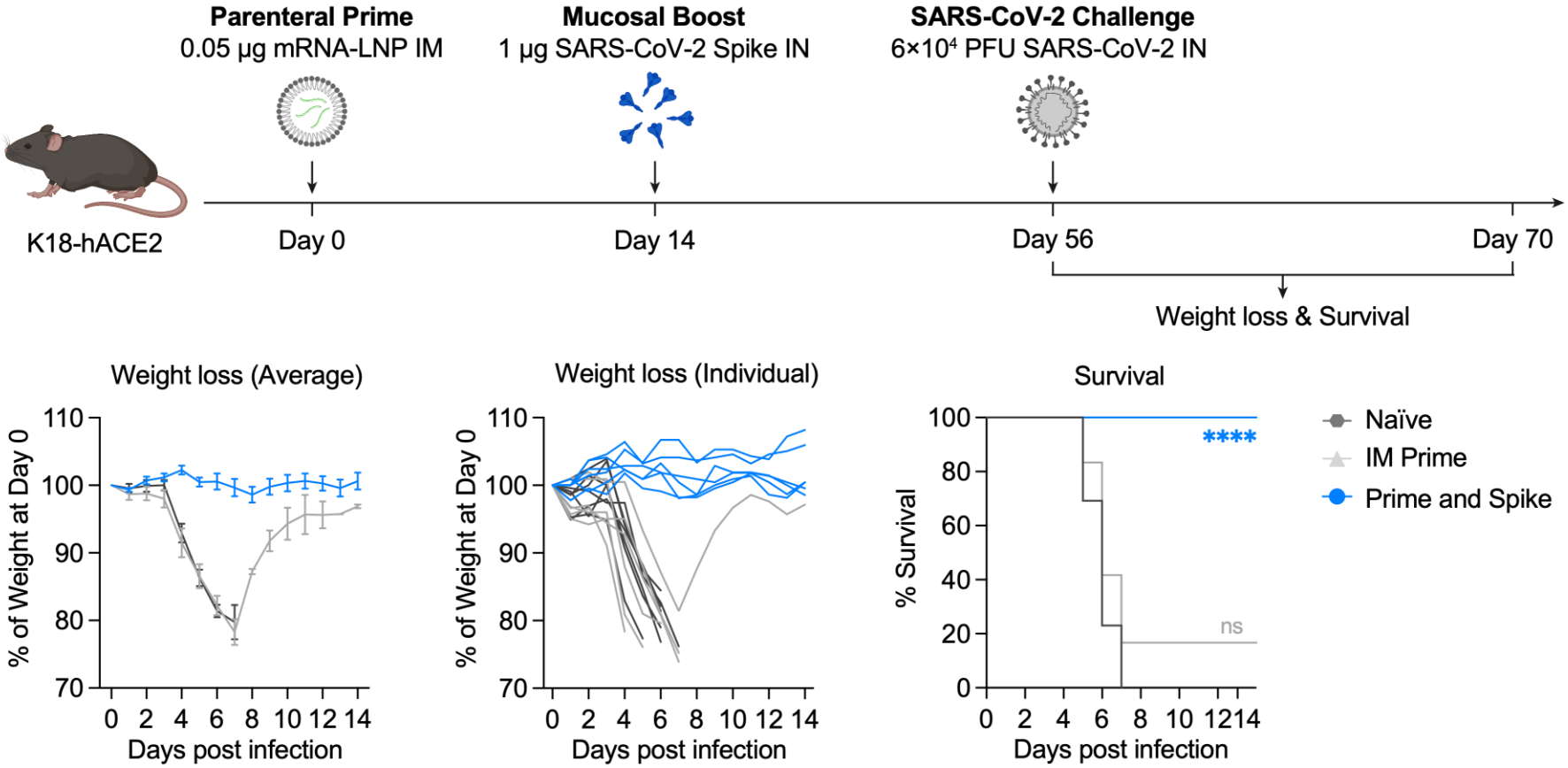
Tianyang Mao

Mao et al. BioRxiv (2022)

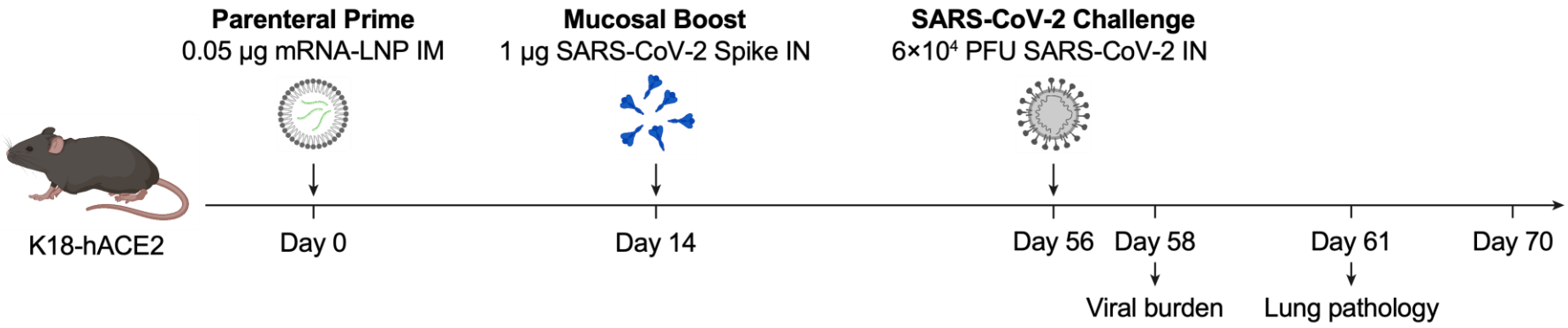
“Spiking” respiratory immunity via intranasal boosting of prime-induced systemic immunity

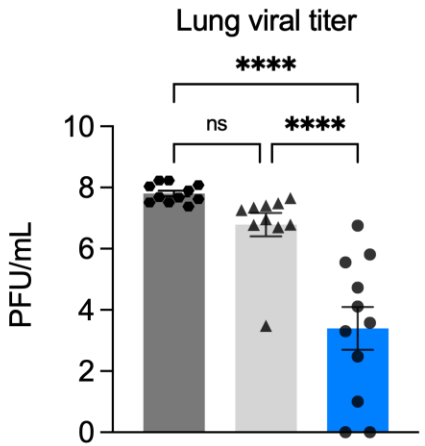


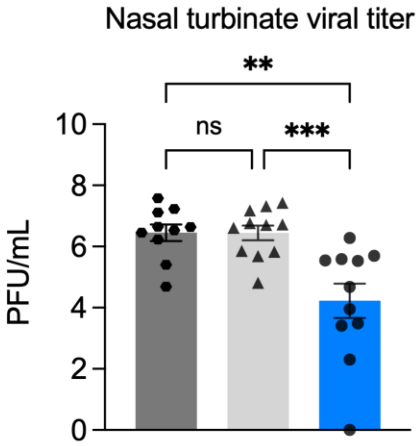
IN Spike boosting confers complete mucosal protection against lethal SARS-CoV-2 infection

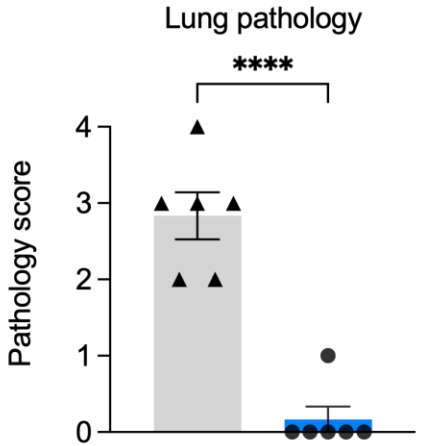


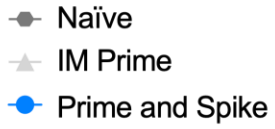
IN Spike boosting reduces viral titer and alleviates lung pathology in the respiratory tract



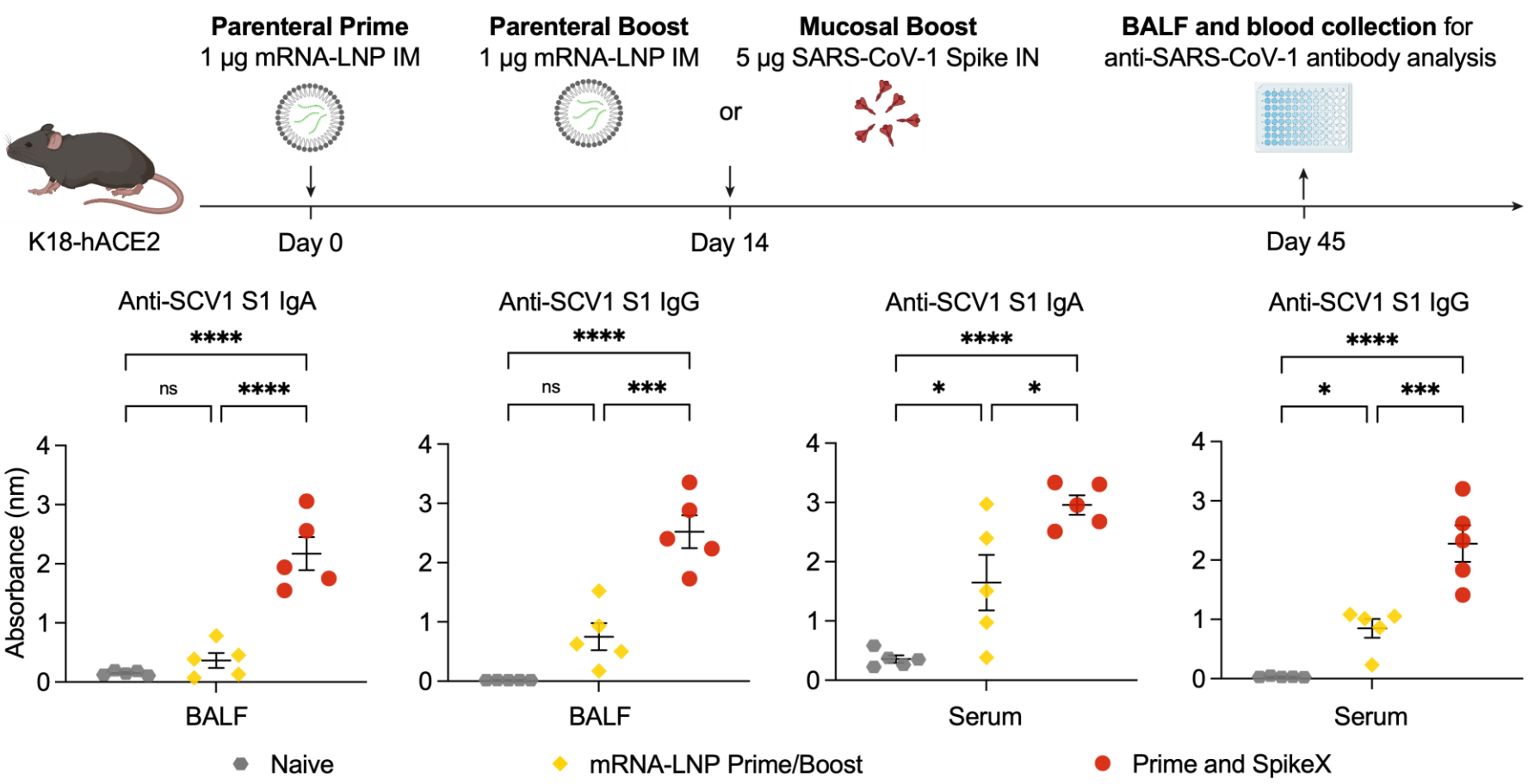




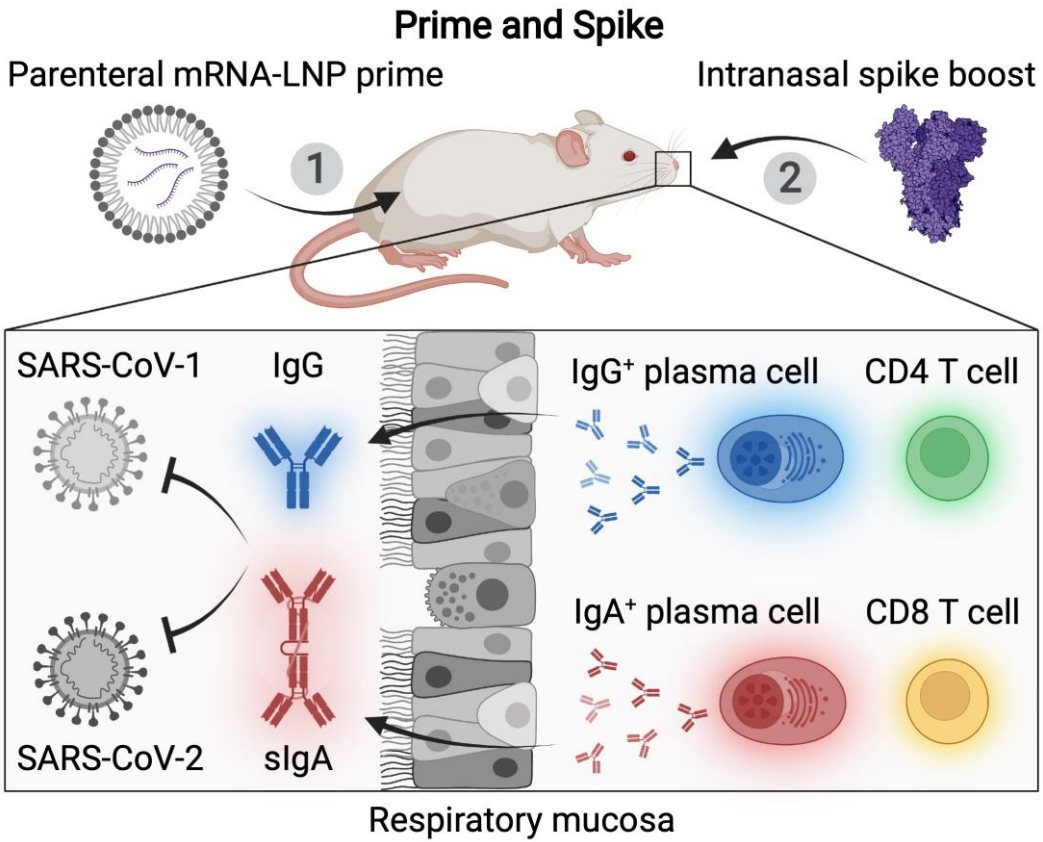




IN SARS-CoV-1 Spike boost induces mucosal and systemic antibody responses against SARS-CoV-1



Conclusions



- Prime and Spike leverages existing memory cells to stimulate robust mucosal immunity in the upper and lower respiratory tract.
- Prime and Spike induces robust local T and B cell immunity at the respiratory mucosa.
- Prime and Spike protects mice with partial immunity from lethal SARS-CoV-2 infection.
- Intranasal boosting with SARS-CoV-1 spike elicits pan-sarbecovirus immunity.
- Prime and Spike reduces mucosal viral replication and transmission.

How can development of new vaccine platforms, such as mucosal vaccines, be encouraged?

- More resources and government support are needed to develop and translate mucosal vaccines -> Operation nasal vaccines at lightning speed (Eric Topol)
- Develop correlates of protection that better reflect mucosal immunity. This may require new methods of collection and measurements.
- Make existing vaccines available for research purposes. We need to be able to compare new vaccine strategies to existing vaccines.

Acknowledgement

Unadjuvanted intranasal spike vaccine booster elicits robust protective mucosal immunity against sarbecoviruses

Tianyang Mao, Benjamin Israelow, Alexandra Suberi, Liqun Zhou, Melanie Reschke, Mario A Peña-Hernández, Huiping Dong, Robert J. Homer, W. Mark Saltzman, Akiko Iwasaki

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