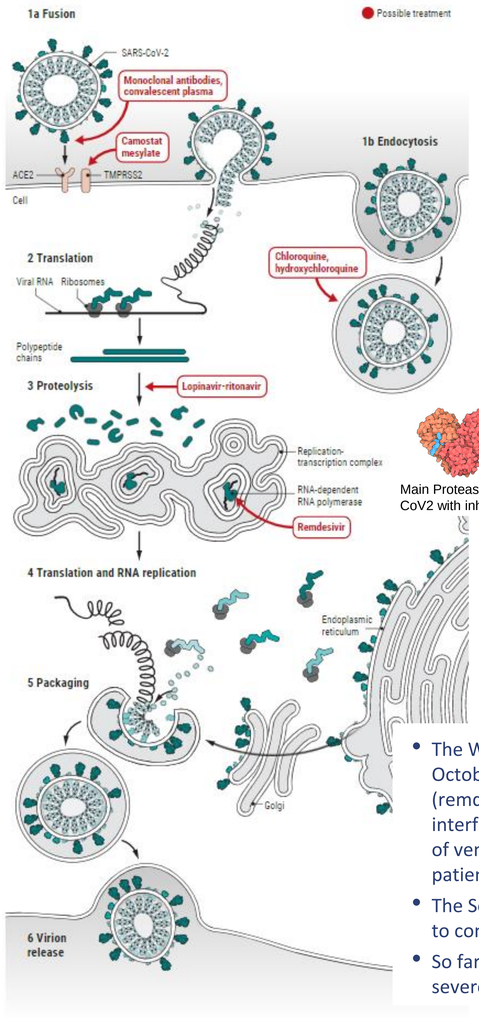
Coronavirus Explainer 2021: Testing and Vaccination

Amy B. Sprenkle, PhD Salem State University, Salem, MA, 01970 USA asprenkle@salemstate.edu

SARS-CoV2 Life Cycle and Therapeutic Targets

Lines of attack

Experimental treatment strategies being tested by a large WHO study and other clinical trials attempt to interfere with different steps (numbered) in the coronavirus replication cycle.



V. ALTOUNIAN/*SCIENCE* [1]

Main Protease from SARS-CoV2 with inhibitor (blue). [2]

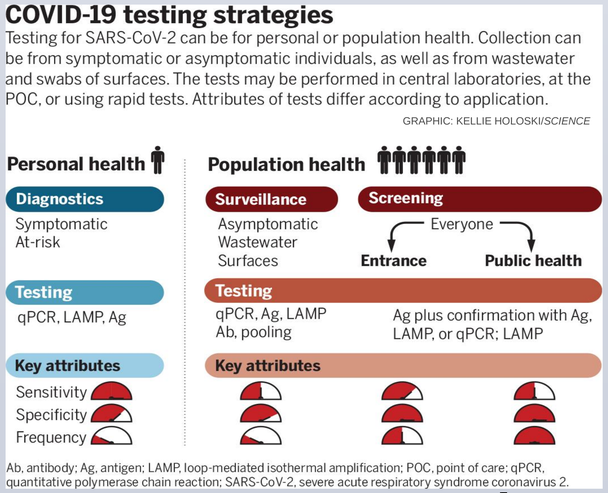
- The WHO Solidarity Trial[3] published interim results on 15 October 2020. It found that all 4 treatments evaluated (remdesivir, hydroxychloroquine, lopinavir/ritonavir and interferon) had little or no effect on overall mortality, initiation of ventilation and duration of hospital stay in hospitalized patients.
- The Solidarity Trial is considering evaluating other treatments, to continue the search for effective COVID-19 therapeutics.
- So far, only corticosteroids have been proven effective against severe and critical COVID-19.

Coronavirus Vaccines

Type of Vaccine	How it's made	Example [4]
Killed/Inactivated	Virus treated with heat or chemicals.	Salk polio, injected Flu, Sinovac SARS-CoV2
Live attenuated	Live cell/virus, but won't make you sick; missing virulence factors.	Sabin oral polio vaccine, flu mist, NO SARS-CoV2?
Subunit	Only subset of proteins or toxins from pathogen is used as immunogen.	Acellular pertussis, tetanus toxoid, Novavax spike protein in recombinant nanoparticle
Recombinant	Express antigenic protein in different virus: Adenovirus.	Gardasil (HPV), SARS CoV2: Johnson & Johnson/Jannsen, AstraZeneca, Sputnik V
mRNA	Modified RNA in lipid nanoparticle injected into muscle, your own cells transcribe and translate the antigenic protein and present to your immune system.	Pfizer/BioNTech Moderna

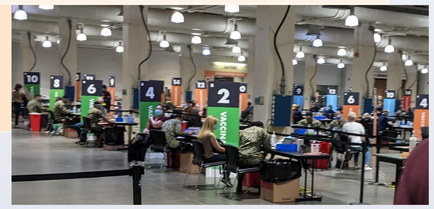
Testing for SARS-CoV2

Type of Test	How it's Done
Nucleic Acid Testing: looking for the genome of the virus	qPCR, LAMP
Viral Antigen Testing: looking for the actual virus particle	*In vitro* antibody testing, ELISA/EIA, Western Blotting
Serology: looking for antibodies generated by exposure to the virus in a patient	Test patient serum *in vitro* for presence of Antibodies that bind to coronavirus



From COVID-19 testing: One size does not fit all.[5]

Salem State's testing strategy: Use of the CoVerified App and extensive testing of on campus personnel with samples sent for nucleic acid testing at the Broad Institute.



GET YOUR SHOT!

Top: Mass Vaccination Center at the Hynes Convention Center.

Bottom: The author with HHMI swag and Vaccination Button from CIC Health at Hynes

Photo credit: ASprenkle

References

1. Life Cycle https://www.sciencemag.org/news/2020/03/who-launches-global-megatrial-four-most-promising-coronavirus-treatments
2. PDB Molecule of the Month: http://pdb101.rcsb.org/motm/242
3. WHO Solidarity Trial https://www.who.int/emergencies/diseases/novel-coronavirus-2019/global-research-on-novel-coronavirus-2019-ncov/solidarity-clinical-trial-for-covid-19-treatments
4. STAT Vaccine Tracker https://www.statnews.com/2020/04/27/drugs-vaccines-tracker//
5. COVID-19 testing: One size does not fit all Michael J. Mina, Kristian G. Andersen Science 08 Jan 2021 : 126-127

Acknowledgements

Thank you to:

- Gail Gasparich, outgoing Dean of the College of Arts and Sciences, Salem State University for mentoring and support.
- Graham Hatfull and the HHMI SEA for valuable mentoring and assistance. https://seaphages.org/
- The Tiny Earth Program, Jo Handelsman, Nicole Broderick and TEPIs worldwide! https://tinyearth.wisc.edu/