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Nursing Home Leadership COVID-19 Roundtable and Office Hours

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DEPARTMENT OF LABORATORY MEDICINE AND PATHOLOGY

Update on COVID-19: Testing and Variants

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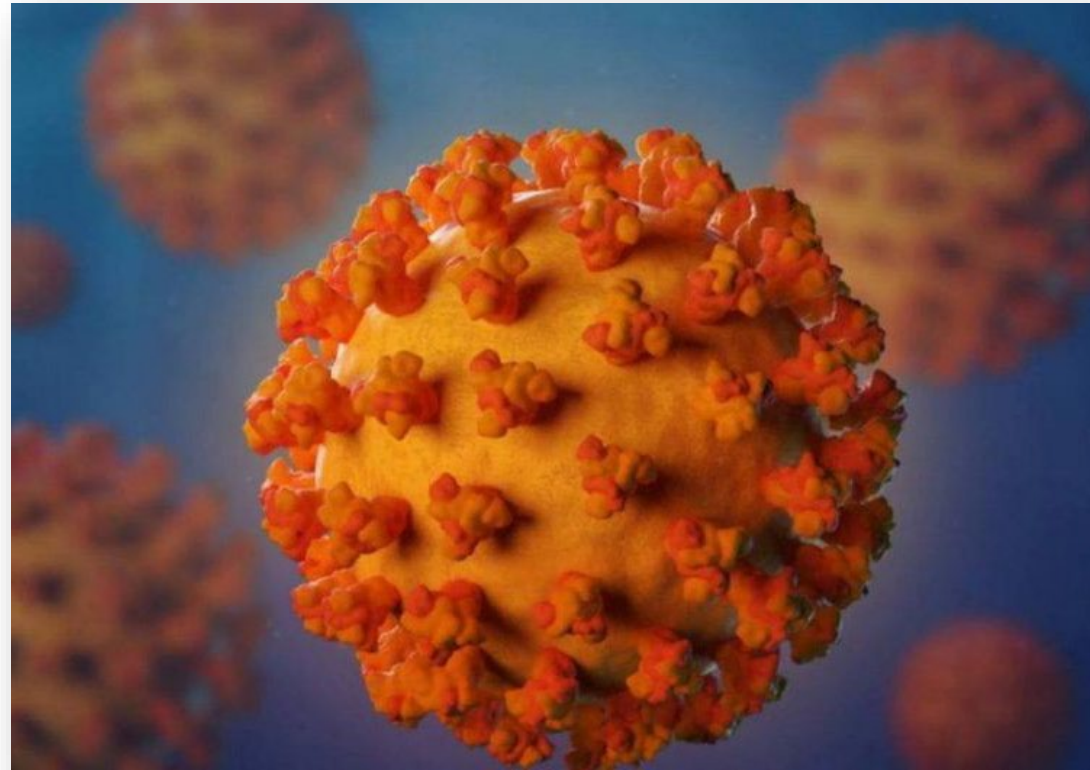
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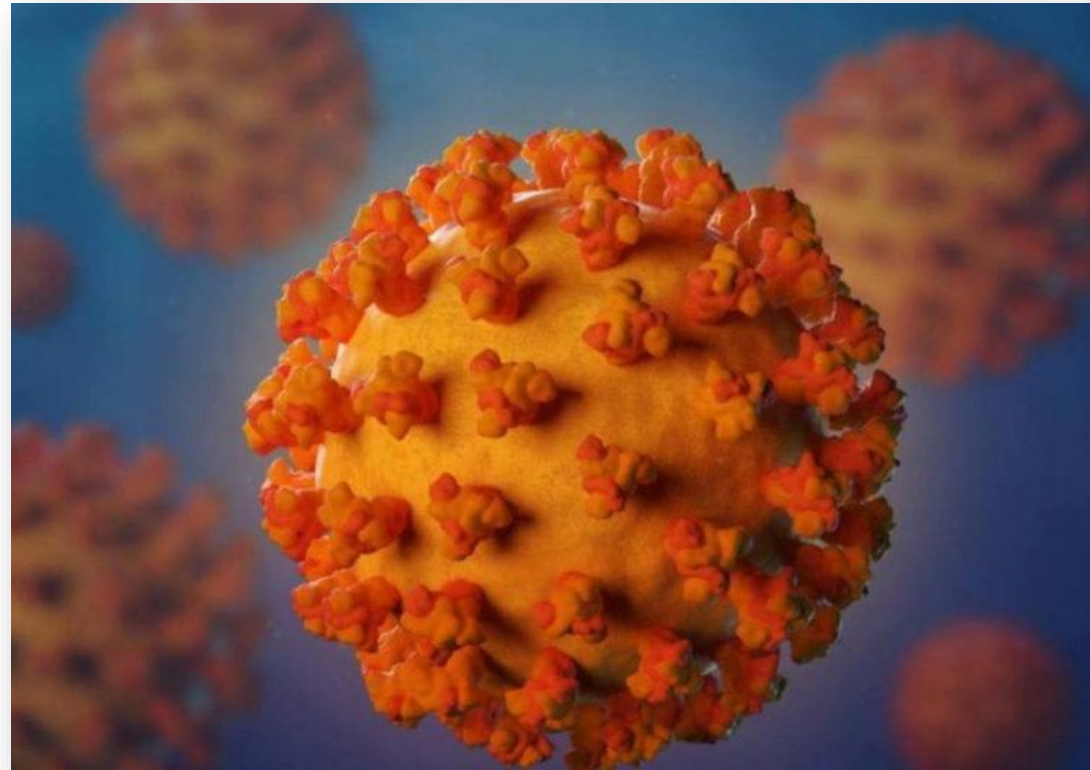
Disclosures

- Advisory Board Member
 - DiaSorin Molecular
 - Mammoth Biosciences



Objectives

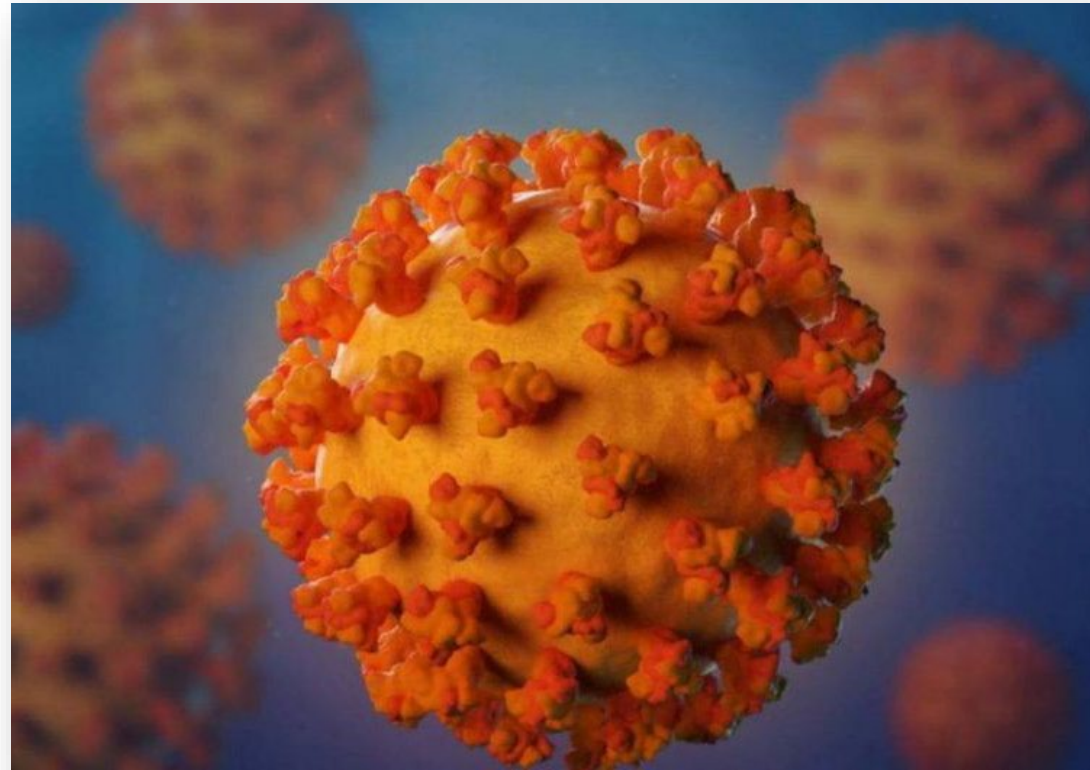
- Describe the evolution of testing methods for the diagnosis of COVID-19
- Discuss the potential impact of SARS-CoV-2 variants on transmission, vaccines and testing
- Review new advancements in testing that may improve the detection of SARS-CoV-2 in the future



Coronaviruses: From the Common Cold to Global Contagion

Common human coronaviruses:

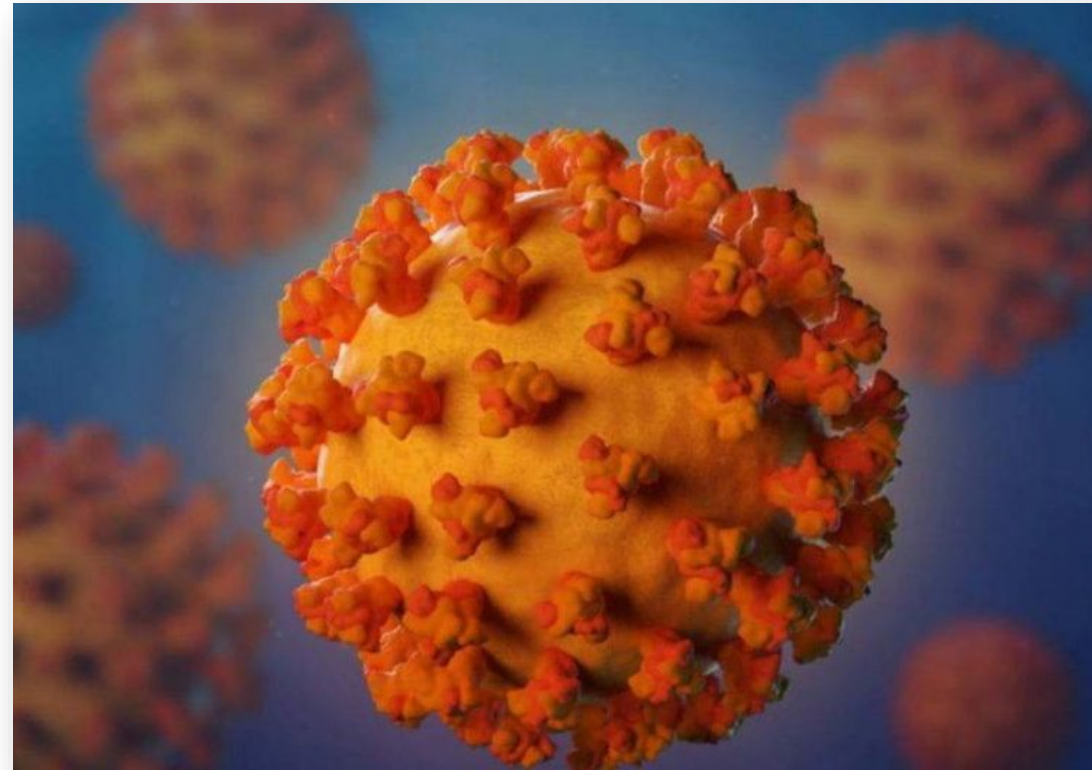
- HCoV-OC43
- HCoV-NL63
- HCoV-229E
- HCoV-HKU1



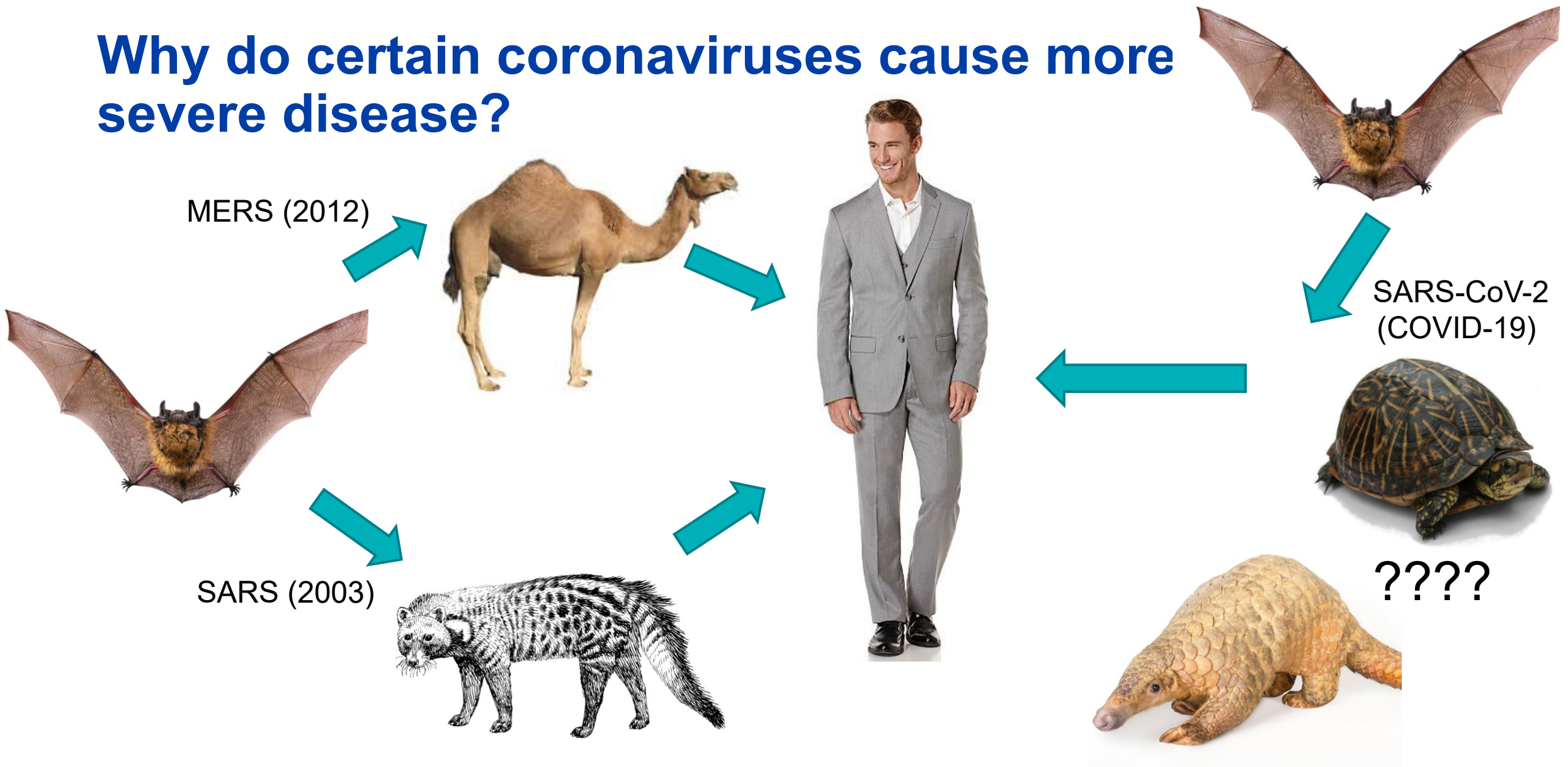
Coronaviruses: From the Common Cold to Global Contagion

Coronaviruses associated with severe disease:

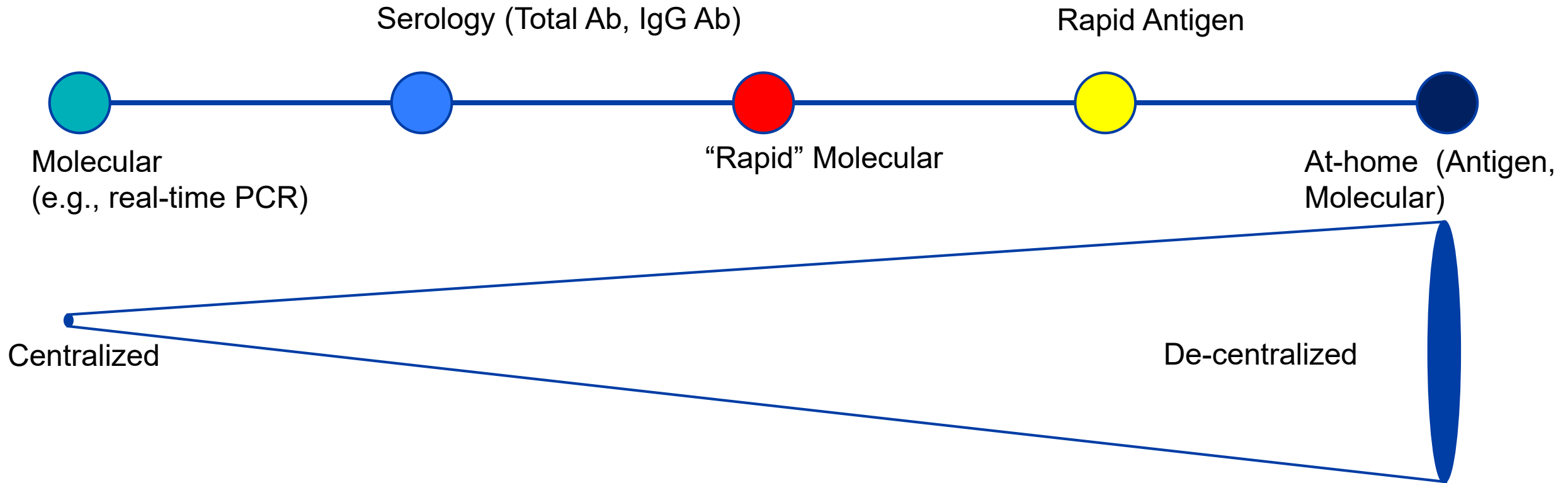
- SARS (2002-2003)
- MERS (2012)
- SARS-CoV-2 (2019-2022)



Why do certain coronaviruses cause more severe disease?



Evolution of testing for COVID-19



Molecular (e.g., Real-time PCR)

- >240 commercial molecular assays have received emergency use authorization from the FDA¹
- Lessons learned:
 - Sensitivity highest around time of symptom onset (i.e., 3-5 days post exposure)²
 - Sensitivity dependent on timing of sample collection, specimen type, quality of sample, test
 - Patients may test positive for weeks/months³; Molecular should not be used to discontinue isolation, with exception of those who are severely immunosuppressed⁴

COVID-19: At-home molecular testing



Used with permission from LuciraDx

Serology

- >75 commercial serology assays have received emergency use authorization from the FDA¹
- Lessons learned:
 - Sensitivity of detecting antibodies <40% during first 7 days post onset of symptoms⁵
 - By day 15 post onset, total antibodies detected in 100% of patients⁵
 - Asymptomatic patients *may* not develop a robust antibody response, and serology has limited-to-no role as acute diagnostic test

Rapid antigen

- >20 commercial antigen assays have received emergency use authorization from the FDA¹
- Still learning...but early data suggest:
 - Sensitivity varies among studies.
 - MA: As high as 96.5% in adults with <7 days of symptoms⁶.
 - AZ: 64.2% among symptomatic persons⁷

Rapid antigen

- Still learning...but early data suggest:
 - MA: Among asymptomatic adults, sensitivity was **70.2%**
 - AZ: Among asymptomatic persons, sensitivity was **35.8%**;
***Virus cultured from 11 samples with negative antigen result
 - Specificity of most antigen tests appears to be high, but false-positives can occur, especially among those without symptoms

Sequencing

- 7 commercial sequencing-based assays have received emergency use authorization from the FDA¹
- Due to prolonged turnaround time, limited role in acute diagnostic testing
- Important tool in epidemiologic investigations
 - Outbreak investigation
 - Investigation of potential reinfection
 - Identification of new variants

COVID-19 testing: Use and Interpretation

	Molecular	Antigen	Serology	Sequencing
Turnaround time (TAT)	<24 hours (Several options with <30 min TAT)	15-30 min	<24 hours	2-5 days
Acute diagnostic?	Yes	Yes ^a	No	No
Identify prior infection?	No	No	Yes	No
Broadly available?	Yes	Yes	Yes	No
Asymptomatic screening?	Yes ^b	No (?)	No	No

^a A negative result may not rule out COVID-19 infection, especially in asymptomatic patients

^b Most EUA assays **not** authorized for asymptomatic screening

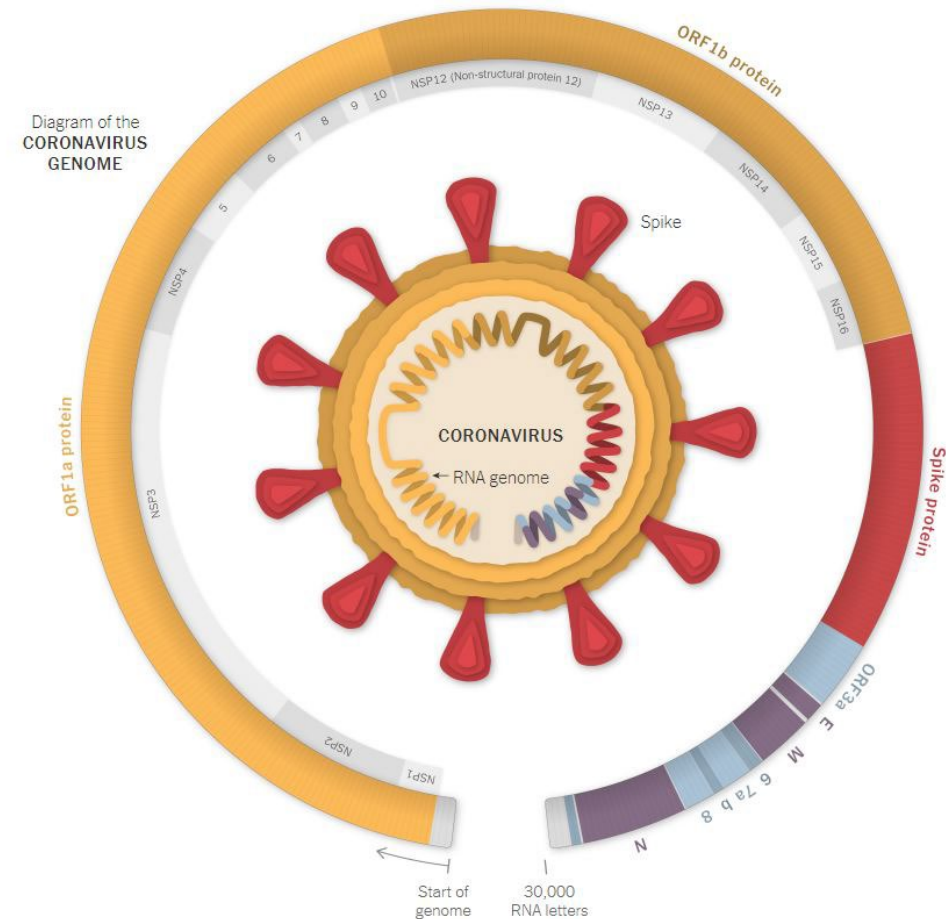
Emergence of SARS-CoV-2 Variants

- SARS-CoV-2 has an RNA genome
- RNA viruses are more likely to have errors occur when their genome is being replicated inside a host cell
 - For example, an influenza vaccine is needed yearly due to natural changes in the virus over time
- Most of the time, these errors don't result in the virus “behaving” any differently



Emergence of SARS-CoV-2 Variants

- However, in some cases, a variation (or mutation) in the genome can result in:
 - Increased transmission of the virus (e.g., SARS-CoV-2 mutations in Spike protein)
 - Change in disease severity caused by the virus
 - Reduced efficacy of vaccine or therapeutics



Could laboratory tests be impacted?

- Mutations in the SARS-CoV-2 genome *could* impact the ability of molecular or antigen tests to detect new variants
- Fortunately, labs and diagnostic test manufacturers plan for mutations to occur when designing tests
 - Target more conserved regions of the viral genome
 - Build in redundancy into the test (i.e., most molecular tests incorporate 2 or 3 gene targets)



What about testing throat swabs?

- Currently not recommended
- Rapid antigen tests were only studied using nasal swabs
- The pH level in the throat can be lower (more acidic) compared to nasal swabs, especially after eating or drinking. Low pH has been associated with higher rates of false-positive rapid antigen results



Why you should #SwabYourThroat... Negative via nose... Positive via the throat. #Omicron is very different from all other variants. We need to adapt to changing testing strategies.

P.s. This story made my day! 🙌

MommaT @tweetmommybop · Jan 1
If you haven't been following @DrEricDing you need to. My husband(ER, RN) started with a cough. He tested using rapid nasal swab & came up negative. After reading Eric's tweet, he added a throat swab and came up positive. We're vaccinated and will be ok. Add throat swab to rapid!

HEALTH
Should you swab your throat with an at-home COVID test amid omicron? Why experts say no.

Adrianna Rodriguez
USA TODAY
Published 6:02 a.m. ET Jan. 8, 2022 | Updated 10:35 a.m. ET Jan. 10, 2022

FDA warns against using throat swabs for home Covid-19 tests

By **Jamie Gumbrecht**, **Naomi Thomas** and **Jen Christensen**, CNN
Updated 6:32 PM ET, Fri January 7, 2022



Future Diagnostic Considerations

- Likely to see continued expansion of at-home testing
- Advantages:
 - Rapid (results in 15-20 minutes)
 - Ease-of-use
- Limitations/Considerations:
 - Limited sensitivity (symptomatic [\sim 80%]; asymptomatic [\sim 40%])

Pray IW et al. 2021 MMWR 69(5152):1642-16477

Future Considerations

- Limitations/Considerations:
 - Negative at-home (antigen) tests do NOT rule-out Covid-19
 - Positive at-home results should either be confirmed by lab-based test or uploaded to EMR in order to:
 - Track positive cases
 - Connect patients with healthcare team for appropriate management and follow-up

COVID-19: Future testing/screening options?

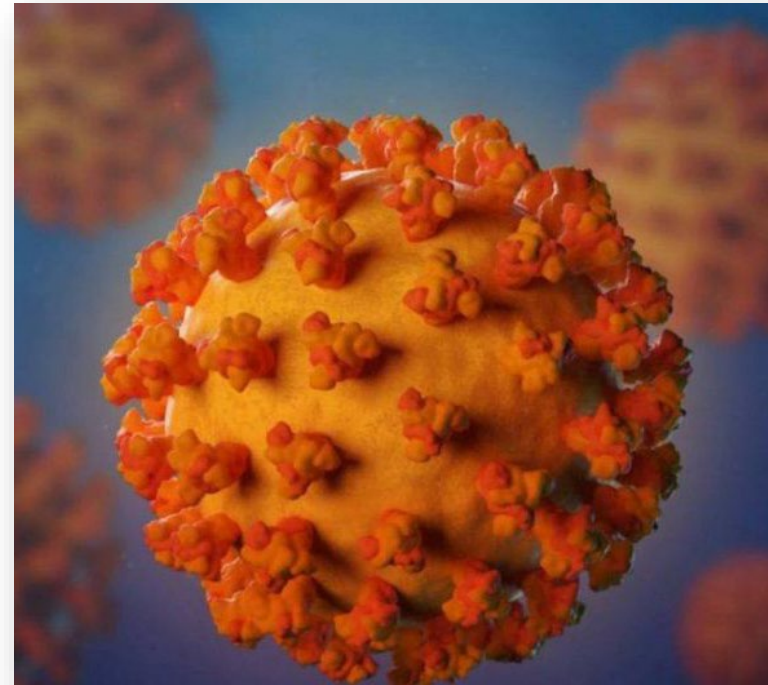
- Breath analyzer⁸
 - Rapid screening test
 - 1-minute, spectroscopy-based
- CRISPR-based rapid diagnostics^{9,10}
 - Isothermal
 - Point-of-care / Smartphone applications
- COVID sniffing dogs¹¹
 - 82.6% sensitivity
 - 96.4% specificity



Used with permission: Gabby Sarusi (Flanimus)

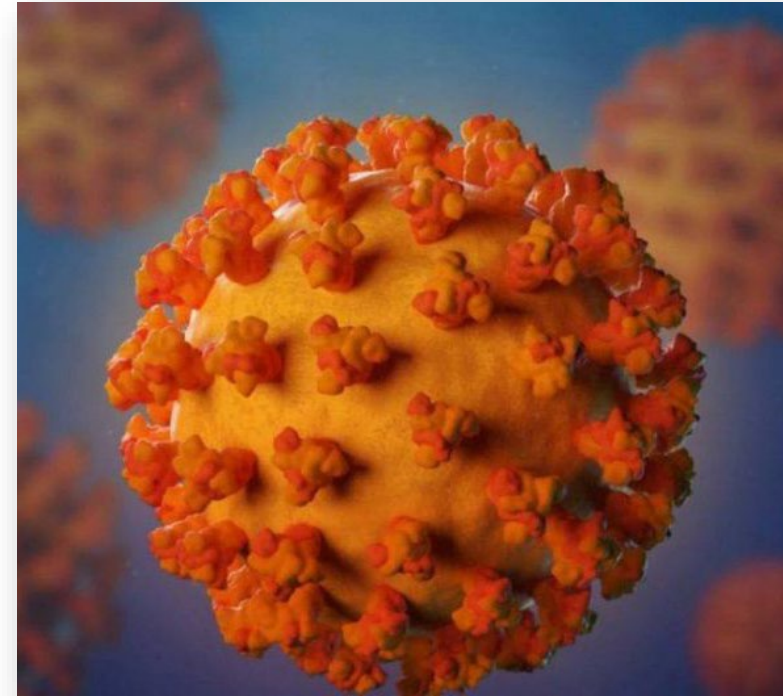
Summary

- COVID-19 is caused by an RNA virus, SARS-CoV-2
- Diagnostic testing has mainly been accomplished by molecular assays (e.g., PCR) but at-home testing is now common
- As >525M cases have occurred worldwide, the virus has evolved to carry certain mutations
- Some variants have increased transmission (delta) and/or may evade the immune response (omicron)



Summary

- Most tests can detect emerging variants, but updates to these tests will likely be needed
- Variants may impact ability of at-home tests to be positive, especially early on during disease
- Likely that boosters will be needed over next 1-2 years to maintain high levels of immunity



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QUESTIONS & DISCUSSION



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Quality Alliance

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