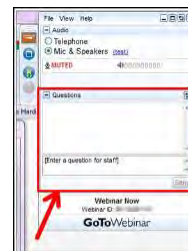




Have Questions?



Type them into questions box!

**“Why am I muted?”**

Don't worry. Everyone is muted except the presenter and host. Thank you and enjoy the show.

Contact ACS Webinars® at [acswebinars@acs.org](mailto:acswebinars@acs.org)

1



@AmericanChemicalSociety



@AmerChemSociety



@AmerChemSociety



<https://www.linkedin.com/company/american-chemical-society>

Contact ACS Webinars® at [acswebinars@acs.org](mailto:acswebinars@acs.org)

2

## Check out the ACS Webinar Library!

*An ACS member exclusive benefit*



Hundreds of presentations from the best and brightest minds that chemistry has to offer are available to you on-demand. The Library is divided into 6 different sections to help you more easily find what you are searching.

### Professional Development

▶ View the Collection

Learn how to write better abstracts, deliver more engaging presentations, and network to your next dream job. Brush up on your soft skills and set a new career path by mastering what can not be taught in the lab.

### Technology & Innovation

▶ View the Collection

From renewable fuels to creating the materials for the technology of tomorrow, chemistry plays a pivotal role in advancing our world. Meet the chemists that are building a better world and see how their science is making it happen.

### Drug Design and Delivery

▶ View the Collection

The Drug Design Delivery Series has built a collection of the top minds in the field to explain the mechanics of drug discovery. Discover the latest research, receive an overview on different fields of study, and gain insight on how to possibly overcome your own med chem roadblocks.

### Culinary Chemistry

▶ View the Collection

Why does food taste better when it is grilled or what molecular compounds make a great wine? Discover the delectable science of your favorite food and drink and don't forget to come back for a second helping.

### Popular Chemistry

▶ View the Collection

Feeling burdened by all that molecular weight? Listen to experts expound on the amazing side of current hot science topics. Discover the chemistry of rockets, how viruses have affected human history, or the molecular breakdown of a hangover.

### Business & Entrepreneurship

▶ View the Collection

How do ideas make it from the lab to the real world? Discover the ins and outs of the chemical industry whether you are looking to start a business or desire a priceless industry-wide perspective.

<https://www.acs.org/content/acs/en/acs-webinars/videos.html>

3



## ACS Webinars®

CLICK • WATCH • LEARN • DISCUSS



**Learn from the best and brightest minds in chemistry!** Hundreds of webinars on diverse topics presented by experts in the chemical sciences and enterprise.

**Edited Recordings** are an exclusive ACS member benefit and are made available once the recording has been edited and posted.

**Live Broadcasts** of ACS Webinars® continue to be available to the general public several times a week generally from 2-3pm ET!

A **collection of the best recordings** from the ACS Webinars Library will occasionally be rebroadcast to highlight the value of the content.

[www.acs.org/acswebinars](http://www.acs.org/acswebinars)

4

## ACS Holiday Store



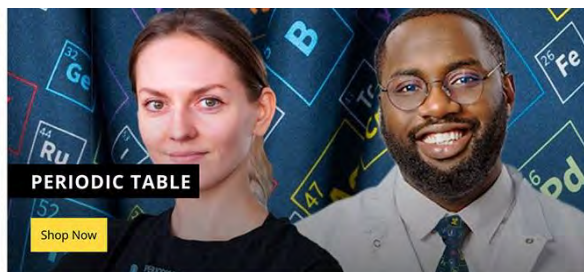
Get a positive reaction!  
Give a gift from the  
ACS Holiday Store

Shop Gifts!



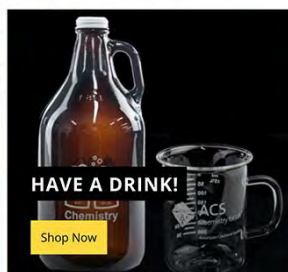
PERIODIC TABLE

Shop Now



HAVE A DRINK!

Shop Now



ELEMENT PINS

Shop Now



THE MOLES

Shop Now



<https://eventstore.acs.org>

5

## Advance YOUR CAREER

ChemIDP™



ChemIDP.org

## Discover ACS PUBLICATIONS

Publishing Resources



ACSaxial



ACS  
Authoring  
Services

publish.acs.org

## Connect WITH CHEMISTS AND OTHER SCIENCE PROFESSIONALS

CAS SciFinder Future Leaders



171 alumni, 35 countries  
and over 120 institutions

[acsoncampus.acs.org/resources](https://acsoncampus.acs.org/resources)





## From ACS Industry Member Programs

### ◆ Industry Matters Newsletter

ACS Member-only weekly newsletter with exclusive interviews with industry leaders and insights to advance your career.

Preview & Subscribe: [acs.org/indnews](https://acs.org/indnews)



Connect, collaborate, and stay informed about the trends leading chemical innovation

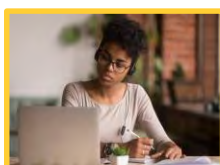
Join: [bit.ly/ACSinnovationhub](https://bit.ly/ACSinnovationhub)

## ACS Career Navigator: Your Home for Career Services



Whether you are just starting your journey, transitioning jobs, or looking to brush up or learn new skills, the **ACS Career Navigator** has the resources to point you in the right direction.

We have a collection of career resources to support you during this global pandemic:



Professional Education



Virtual Career Consultants



ACS Leadership Development System



Career Navigator LIVE!



ChemIDP



College to Career



ACS Webinars



Virtual Classrooms

Visit [www.ACS.org/COVID19-Network](https://www.ACS.org/COVID19-Network) to learn more!

8

## ACS Department of Diversity Programs

*Advancing ACS's Core Value of Diversity, Inclusion & Respect*



We believe in the strength of diversity in all its forms, because inclusion of and respect for diverse people, experiences, and ideas lead to superior solutions to world challenges and advances chemistry as a global, multidisciplinary science.

### Contact Us:

[https://app.suggestionox.com/r/DI\\_R](https://app.suggestionox.com/r/DI_R)

[Diversity@acs.org](mailto:Diversity@acs.org)



[acsvoices.podbean.com/](http://acsvoices.podbean.com/)



[www.acs.org/diversity](http://www.acs.org/diversity)

9

# Grateful for your chemistry career?

Pay it forward with a donation to the ACS Scholars Program today!

[www.donate.acs.org/scholars](http://www.donate.acs.org/scholars)




ACS Office of Philanthropy  
Chemistry for Life®



ACS Scholar Endowment Founder **Joe Vacca**, retired Vice President of Chemistry, Merck & Co., meets with his 2018 ACS Scholar **Johanna Masterson**, now a grad student at Princeton University.

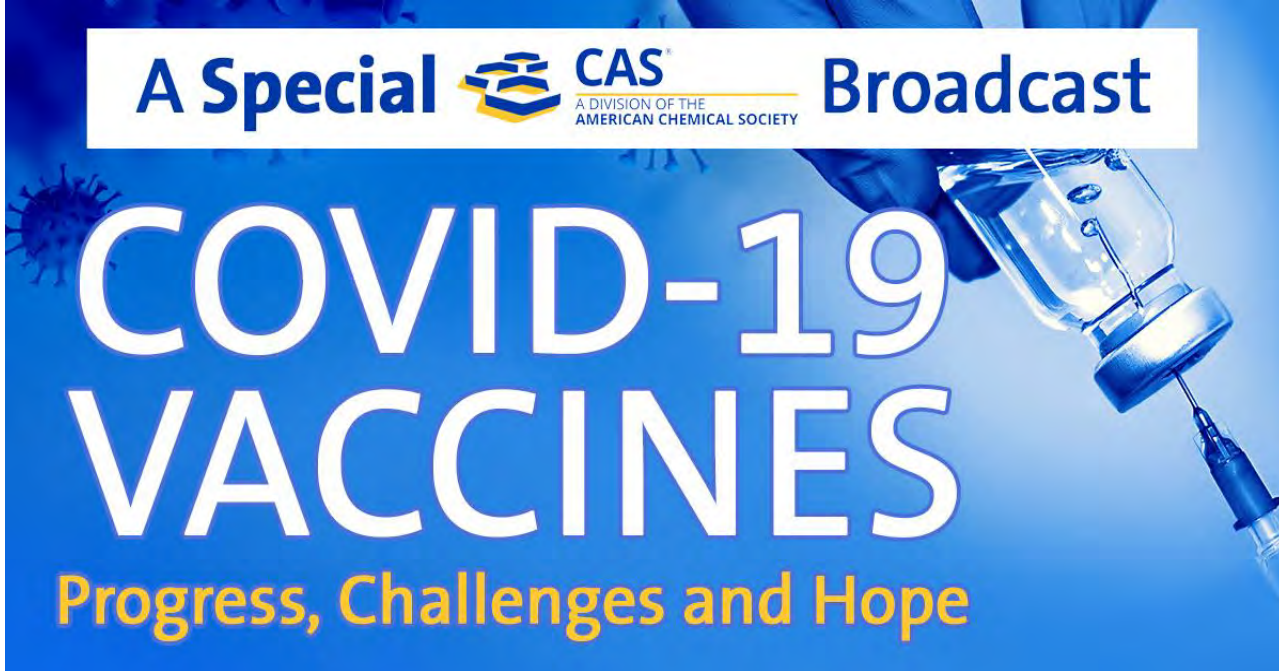
“Chemistry has been good to me...so I wanted to make a significant gift to provide that opportunity to others.”

10

A Special  CAS<sup>®</sup> Broadcast  
 A DIVISION OF THE AMERICAN CHEMICAL SOCIETY

# COVID-19 VACCINES

Progress, Challenges and Hope



THIS ACS WEBINAR WILL BEGIN SHORTLY...

11



## COVID-19 Vaccines: Progress, Challenges and Hope



**Gilles Georges**  
 Vice President, Content Operations  
 & Chief Scientific Officer, CAS



**Angela Zhou**  
 Information Scientist,  
 Content Operations, CAS



**Catherine Saveson**  
 Manager, Scientific Information,  
 Content Operations, CAS



**Cynthia Liu**  
 Manager, Scientific Information,  
 Content Operations, CAS

*Presentation slides are available now! The edited recording will be made available as soon as possible.*

[www.acs.org/acswebinars](http://www.acs.org/acswebinars)

*This ACS Webinar is co-produced with CAS.*

12



# COVID-19 Vaccines: Progress, Challenges and Hope

© Copyright 2020 American Chemical Society. All rights reserved.

## How do vaccines mimic pathogens to prepare our immune system for real invaders?

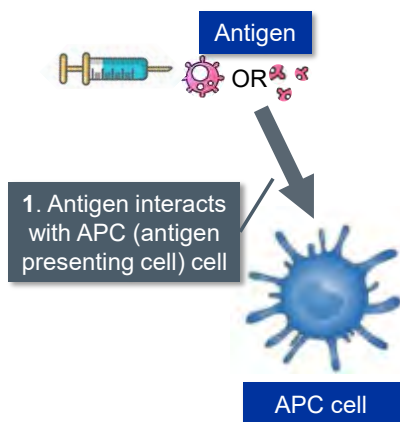


© Copyright 2020 American Chemical Society. All rights reserved.





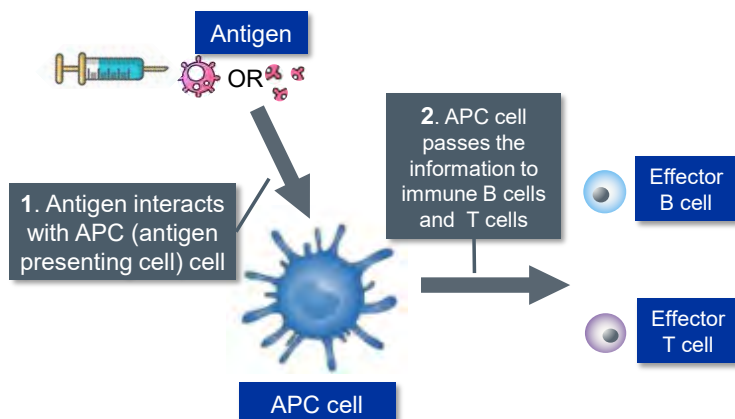
## How do vaccines mimic pathogens to prepare our immune system for real invaders?



© Copyright 2020 American Chemical Society. All rights reserved.



## How do vaccines mimic pathogens to prepare our immune system for real invaders?

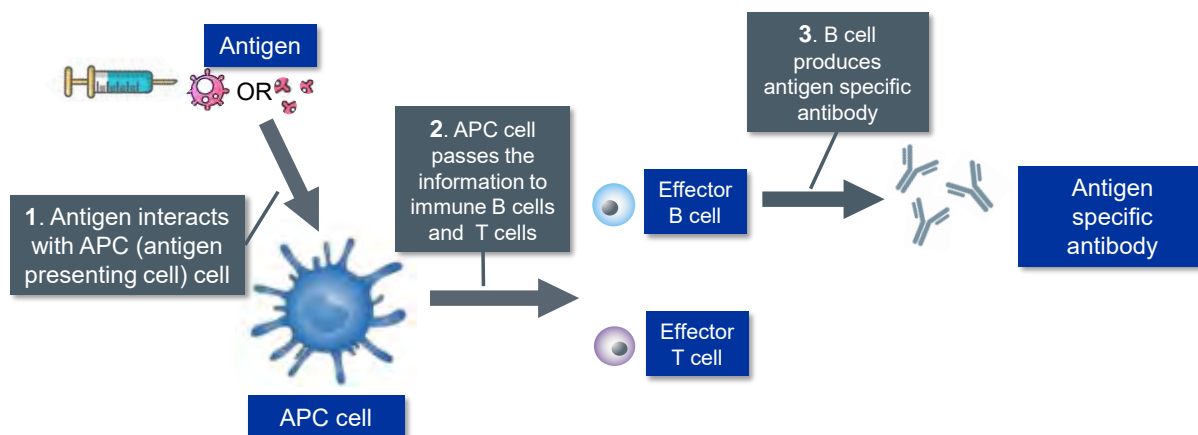


© Copyright 2020 American Chemical Society. All rights reserved.





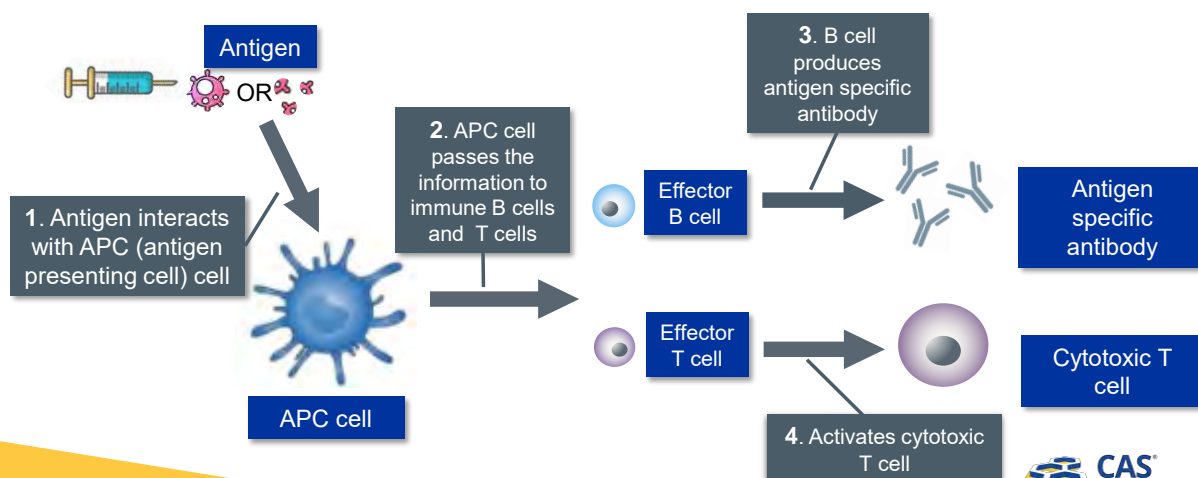
## How do vaccines mimic pathogens to prepare our immune system for real invaders?



© Copyright 2020 American Chemical Society. All rights reserved.



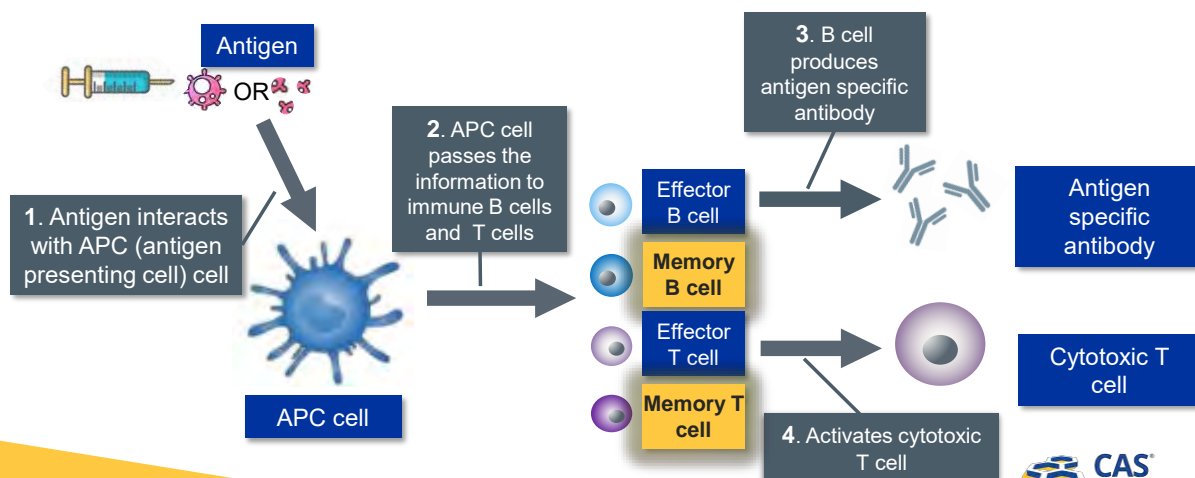
## How do vaccines mimic pathogens to prepare our immune system for real invaders?



© Copyright 2020 American Chemical Society. All rights reserved.



## How do vaccines mimic pathogens to prepare our immune system for real invaders?



© Copyright 2020 American Chemical Society. All rights reserved.




## Major vaccine development platforms

Live attenuated virus	Inactivated virus vaccine
Modified virus that can still replicate and produce immunity, but not cause disease	Whole virus killed by chemicals, heat or radiation
<ul style="list-style-type: none"> <li>Tuberculosis (BCG)</li> <li>Measles</li> </ul>	<ul style="list-style-type: none"> <li>Rabies</li> <li>Hepatitis A</li> </ul>
COVID-19 candidate vaccines	
Clinical trial: 1 Pre-clinical: 2	Clinical trial: 7 Pre-clinical: 15


© Copyright 2020 American Chemical Society. All rights reserved.

CAS<sup>®</sup>  
A DIVISION OF THE  
AMERICAN CHEMICAL SOCIETY







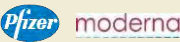
## Major vaccine development platforms

 Live attenuated virus	 Inactivated virus vaccine	 Viral protein vaccine
Modified virus that can still replicate and produce immunity, but not cause disease	Whole virus killed by chemicals, heat or radiation	Viral protein, or virus-like particles formed by proteins, without DNA/RNA
<ul style="list-style-type: none"> <li>• Tuberculosis (BCG)</li> <li>• Measles</li> </ul>	<ul style="list-style-type: none"> <li>• Rabies</li> <li>• Hepatitis A</li> </ul>	<ul style="list-style-type: none"> <li>• Hepatitis B (HBV)</li> <li>• Papillomavirus (HPV)</li> </ul>
<b>COVID-19 candidate vaccines</b>		
Clinical trial: 1 Pre-clinical: 2	Clinical trial: 7 Pre-clinical: 15	Clinical trial: 18 Pre-clinical: 71


© Copyright 2020 American Chemical Society. All rights reserved.



## Major vaccine development platforms

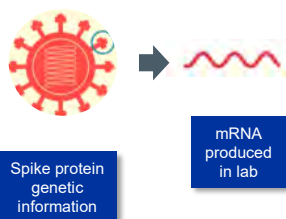
 Live attenuated virus	 Inactivated virus vaccine	 Viral protein vaccine	 Viral vector vaccine	 mRNA vaccine
Modified virus that can still replicate and produce immunity, but not cause disease	Whole virus killed by chemicals, heat or radiation	Viral protein, or virus-like particles formed by proteins, without DNA/RNA	Using another harmless virus to carry the genetic code that can give cells the instruction to make the antigenic protein	Using a lipid nanoparticle to deliver an mRNA strand that can give cells the instructions to make the antigenic protein
<ul style="list-style-type: none"> <li>• Tuberculosis (BCG)</li> <li>• Measles</li> </ul>	<ul style="list-style-type: none"> <li>• Rabies</li> <li>• Hepatitis A</li> </ul>	<ul style="list-style-type: none"> <li>• Hepatitis B (HBV)</li> <li>• Papillomavirus (HPV)</li> </ul>	<ul style="list-style-type: none"> <li>• Ebola vaccine</li> </ul>	<ul style="list-style-type: none"> <li>• COVID-19 vaccine (EUA)</li> </ul>
<b>COVID-19 candidate vaccines</b>				
Clinical trial: 1 Pre-clinical: 2	Clinical trial: 7 Pre-clinical: 15	Clinical trial: 18 Pre-clinical: 71	Clinical trial: 14 Pre-clinical: 36 	Clinical trial: 6 Pre-clinical: 22 

© Copyright 2020 American Chemical Society. All rights reserved.



## How do mRNA vaccines work?

1. Sequence info of the Spike protein is used to synthesize an mRNA sequence

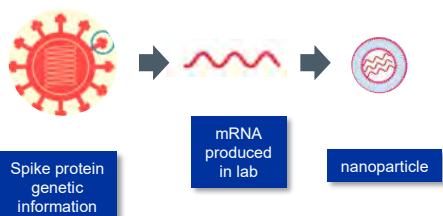


© Copyright 2020 American Chemical Society. All rights reserved.

## How do mRNA vaccines work?

1. Sequence info of the Spike protein is used to synthesize an mRNA sequence

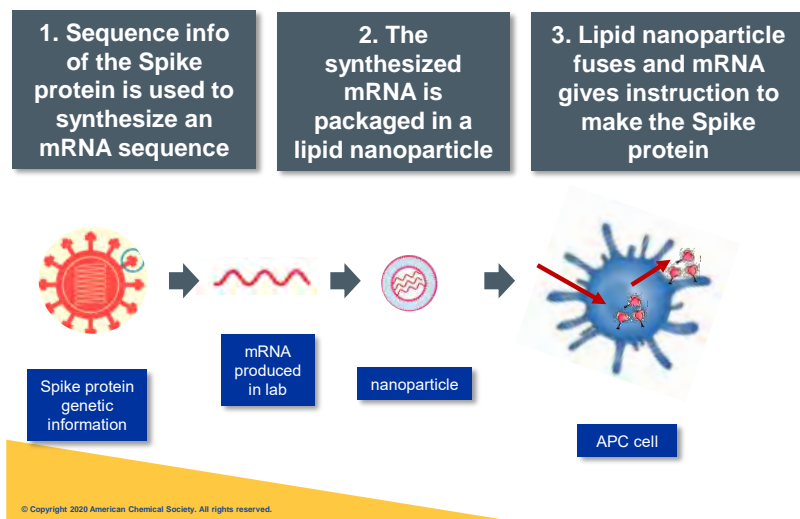
2. The synthesized mRNA is packaged in a lipid nanoparticle



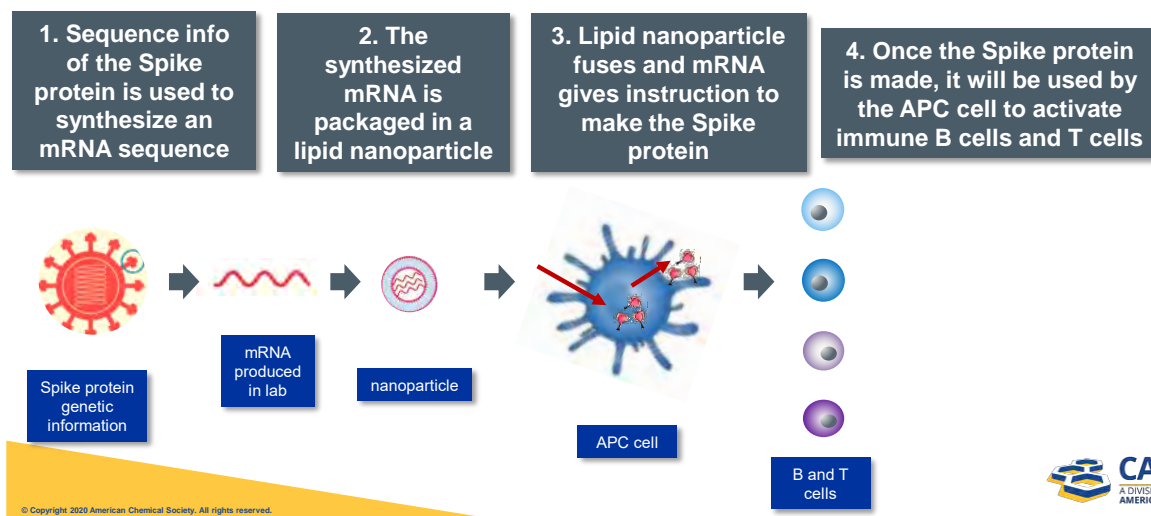
© Copyright 2020 American Chemical Society. All rights reserved.



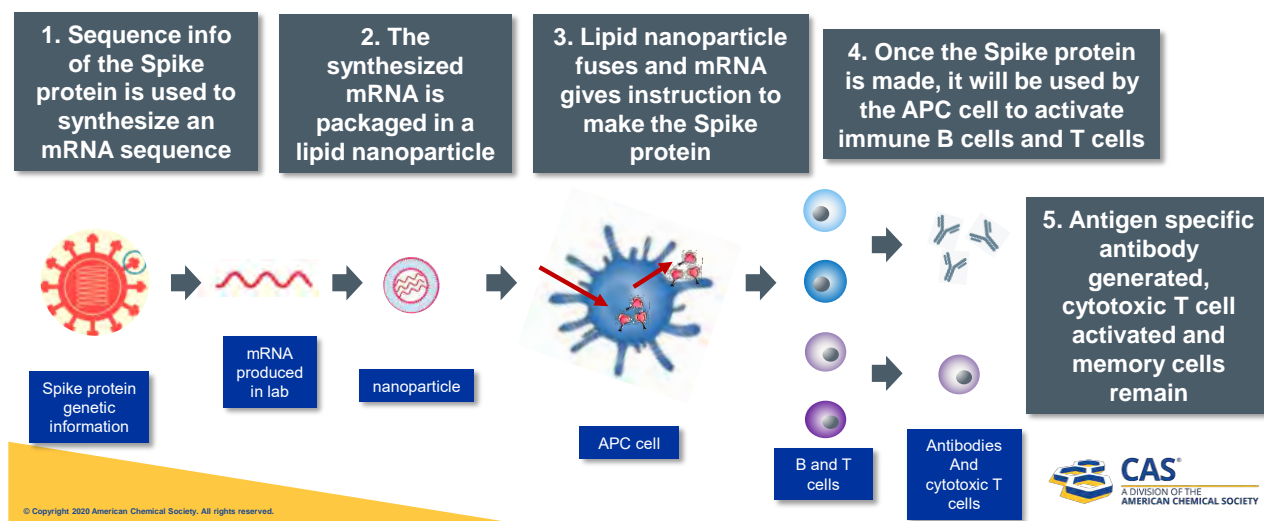
## How do mRNA vaccines work?



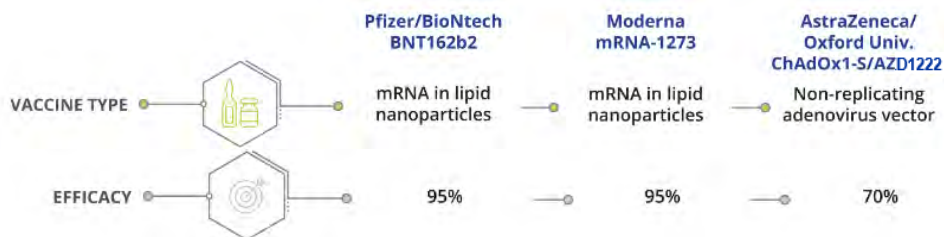
## How do mRNA vaccines work?



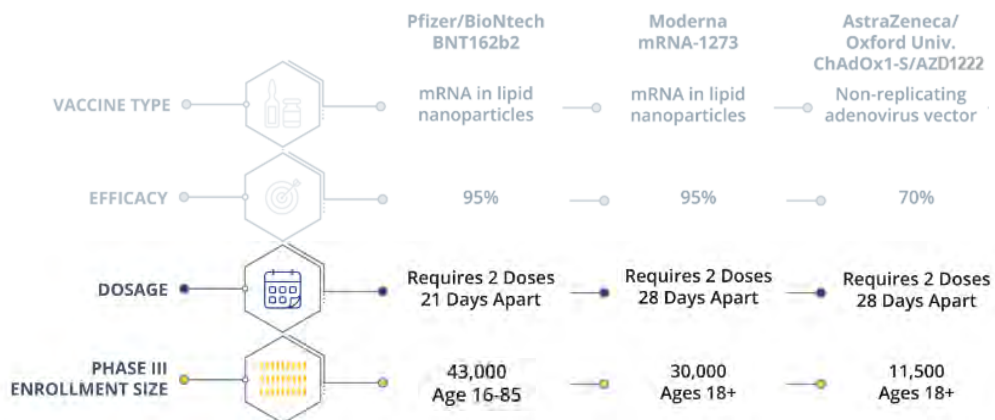
## How do mRNA vaccines work?



## How do the vaccine front-runners compare?



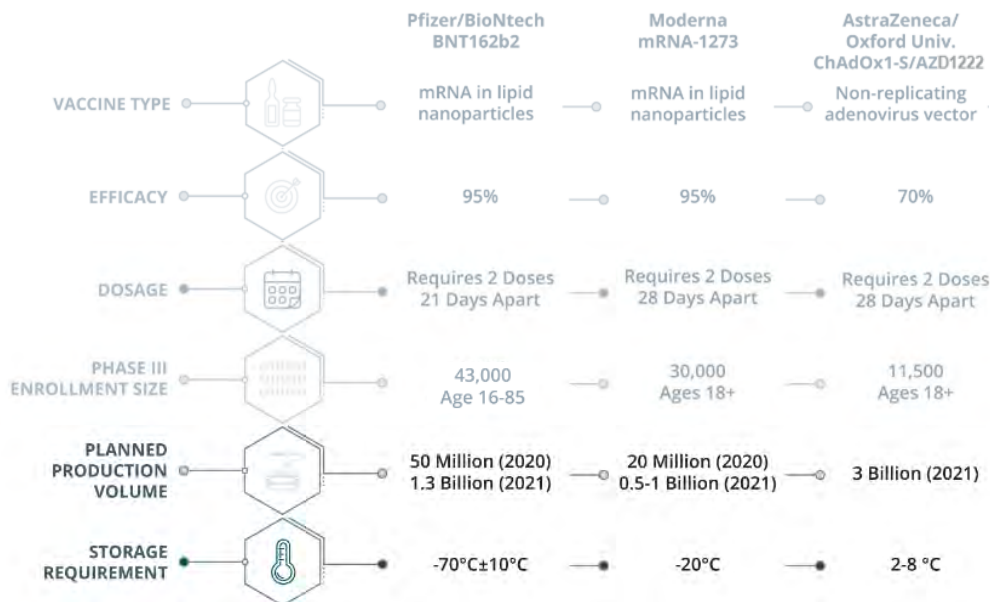
## How do the vaccine front-runners compare?



© Copyright 2020 American Chemical Society. All rights reserved.



## How do the vaccine front-runners compare?



## Audience Survey Question

ANSWER THE QUESTION ON BLUE SCREEN IN ONE MOMENT



### How many COVID-19 candidate vaccines are currently in clinical trials worldwide?

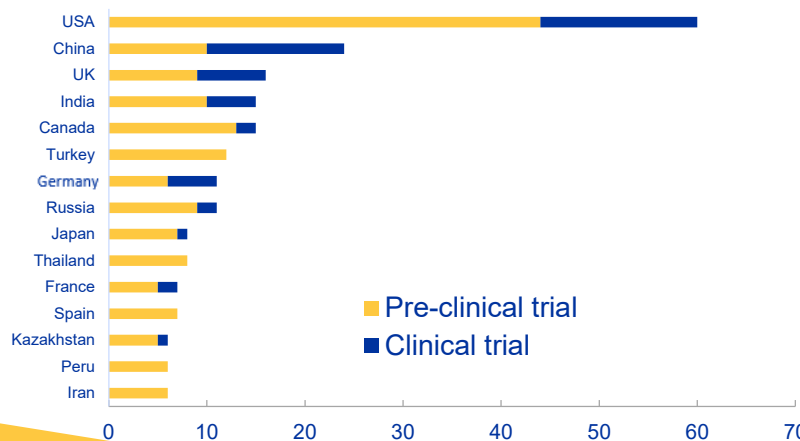
- Only a handful
- Around ten to fifteen
- Around fifty
- A hundred
- A few hundred

31

## Where are COVID-19 candidate vaccines currently being developed?

As of 12/8/2020, 214 in development and 52 in clinical trials worldwide

Top 15 countries



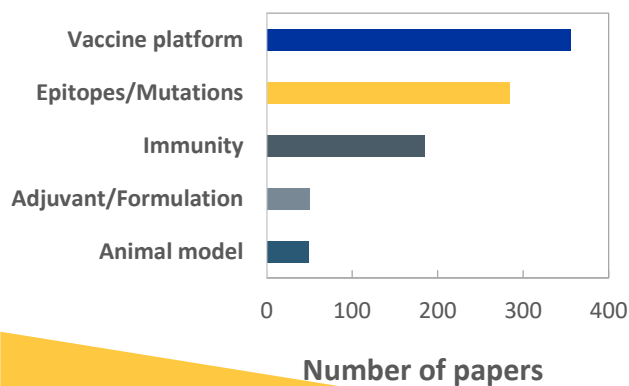
\*Derived from WHO data





## What has COVID-19 vaccine research focused on?

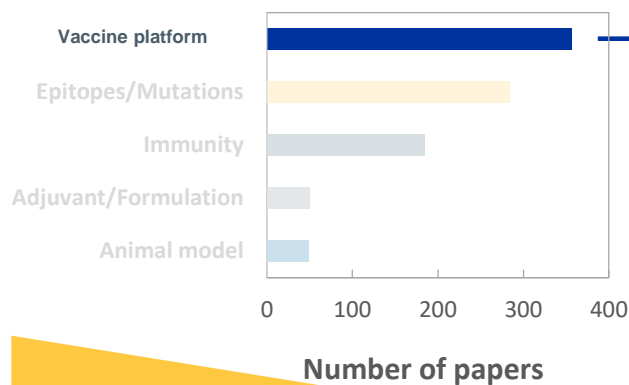
Number of COVID-19 vaccine related papers per topic



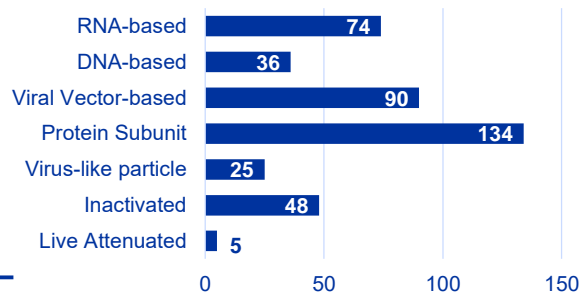
© Copyright 2020 American Chemical Society. All rights reserved.

## What has COVID-19 vaccine research focused on?

Number of COVID-19 vaccine related papers per topic



COVID-19 papers per vaccine development platform



© Copyright 2020 American Chemical Society. All rights reserved.

## What are the challenges and questions?

### How long will immunity last?

- Antibodies & memory cells
- Mutation is not as fast as that for influenza



### Are these vaccines safe?

- No compromise of safety standards in clinical trials
- Continue to assess in post-marketing surveillance



### What about herd immunity?

- Varies, but needs large % of population vaccinated
- Impact of public trust



### When to resume normal life?

- Effectiveness of the vaccines
- Vaccination process
- Social distance and masks



© Copyright 2020 American Chemical Society. All rights reserved.

Explore more at [cas.org/blog](https://cas.org/blog) or [cas.org/covid19](https://cas.org/covid19)

### Blogs

#### Top 5 COVID-19 vaccine questions answered



Angela Zhou  
Information Scientist, CAS  
Posted December 9, 2020

#### Meet the mRNA vaccine rookies aiming to take down COVID-19



Yingzhu Li  
Senior Information Scientist, CAS  
Posted December 2, 2020

#### Building on "flu shot" success to tackle COVID-19



Jeffrey Smart  
Information Scientist, CAS  
Posted October 29, 2020

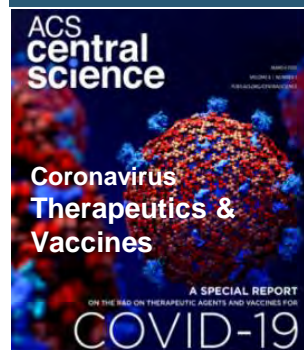
### Videos

#### How mRNA COVID-19 Vaccines Work to Fight COVID-19?




<https://youtu.be/LcTEmHlvY10>

### Paper Publications

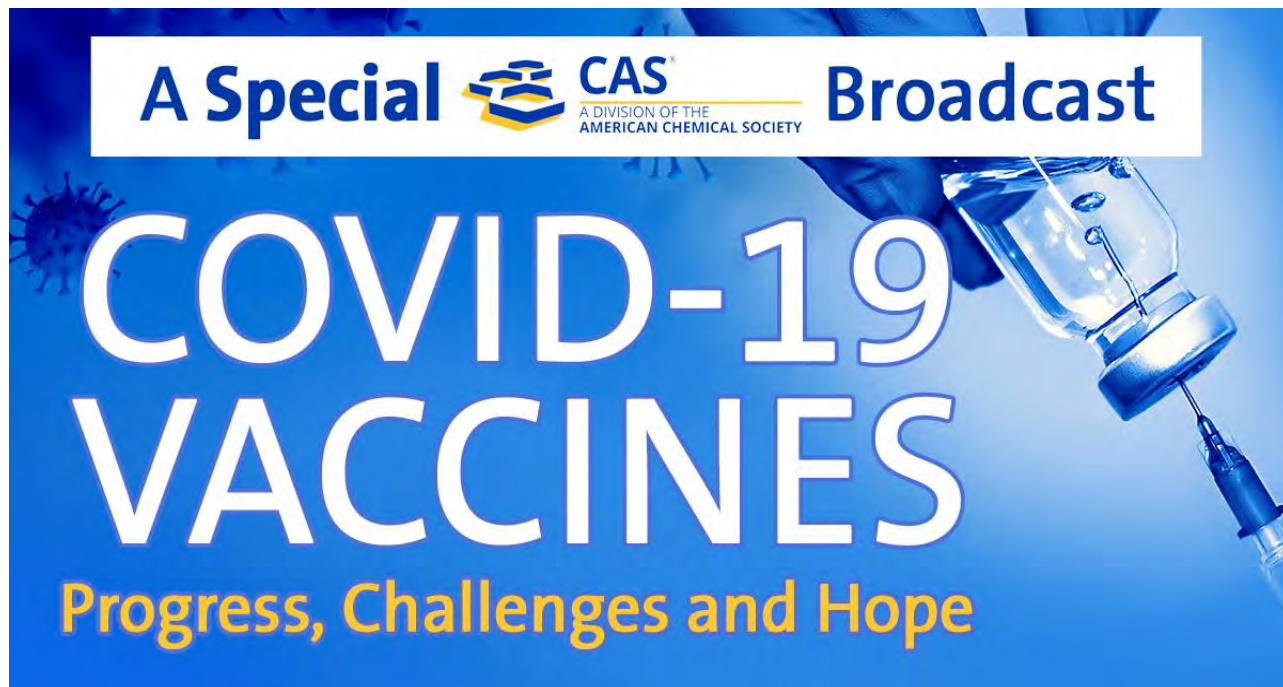


© Copyright 2020 American Chemical Society. All rights reserved.

A Special  CAS<sup>®</sup> **Broadcast**  
 A DIVISION OF THE AMERICAN CHEMICAL SOCIETY

# COVID-19 VACCINES

## Progress, Challenges and Hope



This ACS Webinar is co-produced with CAS.

37

## Check out the ACS Webinar Library!

*An ACS member exclusive benefit*



Hundreds of presentations from the best and brightest minds that chemistry has to offer are available to you on-demand. The Library is divided into 6 different sections to help you more easily find what you are searching.

### Professional Development

▶ View the Collection

Learn how to write better abstracts, deliver more engaging presentations, and network to your next dream job. Brush up on your soft skills and set a new career path by mastering what can not be taught in the lab.

### Technology & Innovation

▶ View the Collection

From renewable fuels to creating the materials for the technology of tomorrow, chemistry plays a pivotal role in advancing our world. Meet the chemists that are building a better world and see how their science is making it happen.

### Drug Design and Delivery

▶ View the Collection

The Drug Design Delivery Series has built a collection of the top minds in the field to explain the mechanics of drug discovery. Discover the latest research, receive an overview on different fields of study, and gain insight on how to possibly overcome your own med chem roadblocks.

### Culinary Chemistry

▶ View the Collection

Why does food taste better when it is grilled or what molecular compounds make a great wine? Discover the delectable science of your favorite food and drink and don't forget to come back for a second helping.

### Popular Chemistry

▶ View the Collection

Feeling burdened by all that molecular weight? Listen to experts expound on the amazing side of current hot science topics. Discover the chemistry of rockets, how viruses have affected human history, or the molecular breakdown of a hangover.

### Business & Entrepreneurship

▶ View the Collection

How do ideas make it from the lab to the real world? Discover the ins and outs of the chemical industry whether you are looking to start a business or desire a priceless industry-wide perspective.

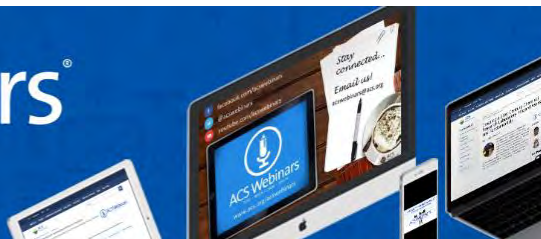
<https://www.acs.org/content/acs/en/acs-webinars/videos.html>

38



# ACS Webinars®

CLICK • WATCH • LEARN • DISCUSS



**Learn from the best and brightest minds in chemistry!** Hundreds of webinars on diverse topics presented by experts in the chemical sciences and enterprise.

**Edited Recordings** are an exclusive ACS member benefit and are made available once the recording has been edited and posted.

**Live Broadcasts** of ACS Webinars® continue to be available to the general public several times a week generally from 2-3pm ET!

A **collection of the best recordings** from the ACS Webinars Library will occasionally be rebroadcast to highlight the value of the content.

[www.acs.org/acswebinars](http://www.acs.org/acswebinars)

39



ACS Webinars®

CLICK • WATCH • LEARN • DISCUSS



ACS

Chemistry for Life®

ACS Webinars® does not endorse any products or services. The views expressed in this presentation are those of the presenter and do not necessarily reflect the views or policies of the American Chemical Society.



*Mike Russell Erik Katie*

Contact ACS Webinars® at [acswebinars@acs.org](mailto:acswebinars@acs.org)

40

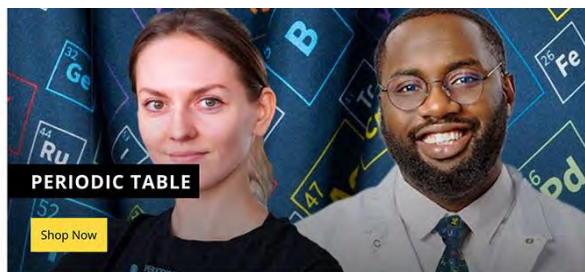


## ACS Holiday Store



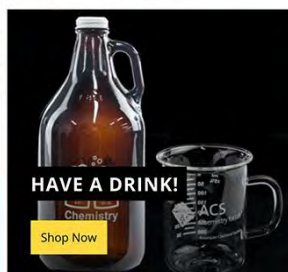
Get a positive reaction!  
Give a gift from the  
ACS Holiday Store

Shop Gifts!



PERIODIC TABLE

Shop Now



HAVE A DRINK!

Shop Now



ELEMENT PINS

Shop Now



THE MOLES

Shop Now

<https://eventstore.acs.org>

41