

SARS-CoV-2 and
COVID-19

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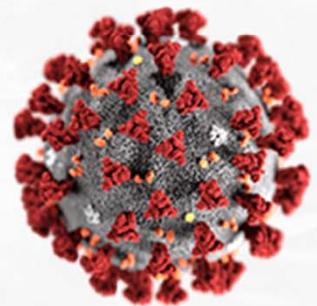
1. What is Virus?

2. Corona Virus

3. COVID-19

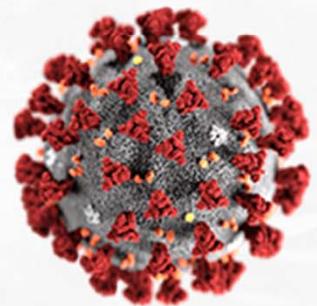
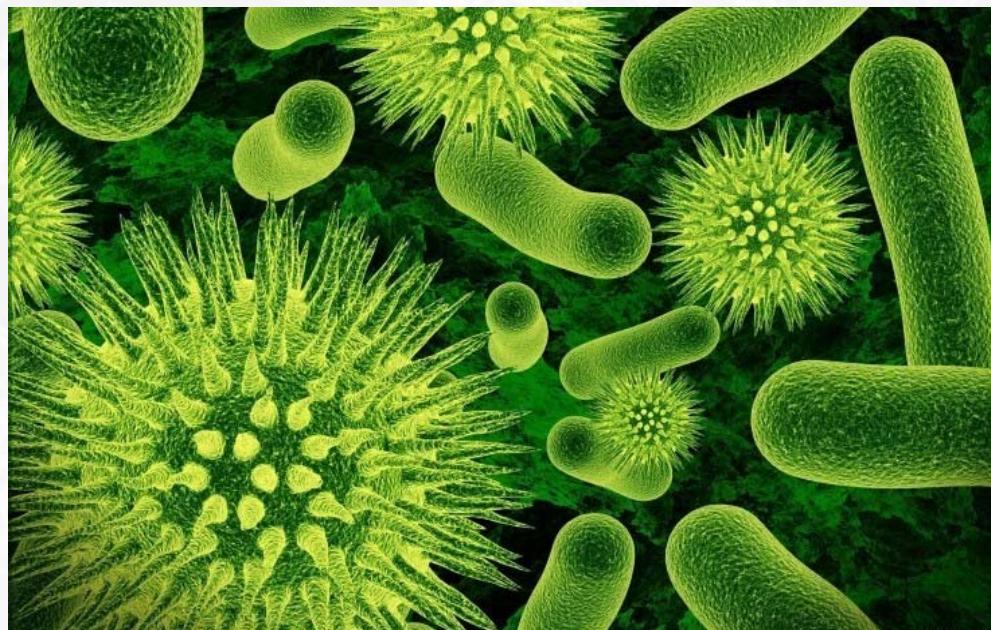
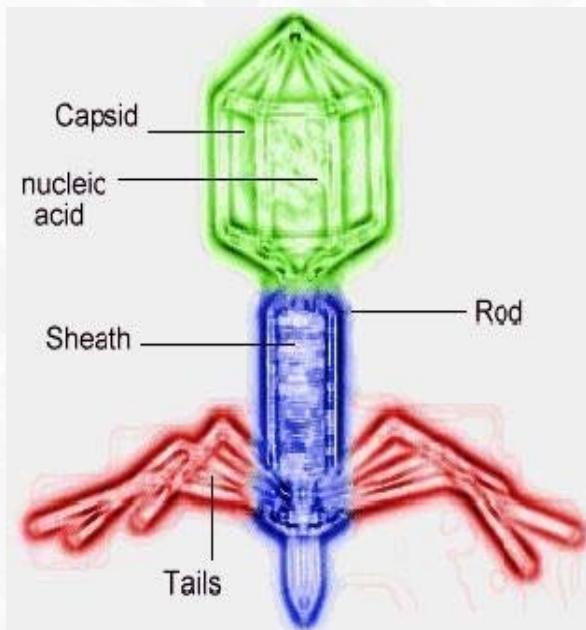
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What Is Virus?

- Infectious particle
- Have both animate and inanimate features



What Is Virus?

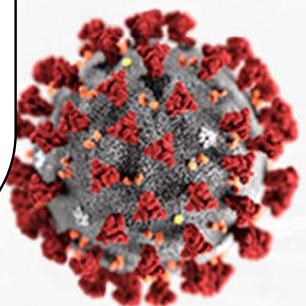
- Features of virus

- Animate features**

- Have genome
 - Self-organization process and reproduction (only in the host cells)
 - Mutagenic
 - evolvable

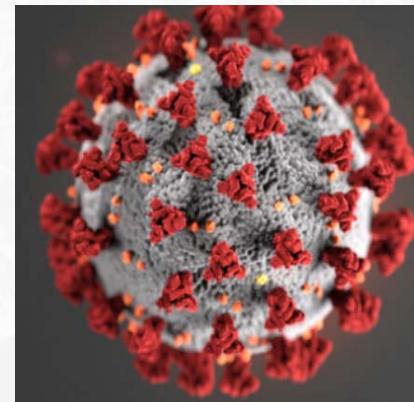
- Inanimate features**

- Don't have cellular organisms.
 - Unable to metabolize by oneself.

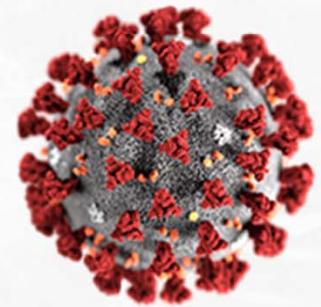
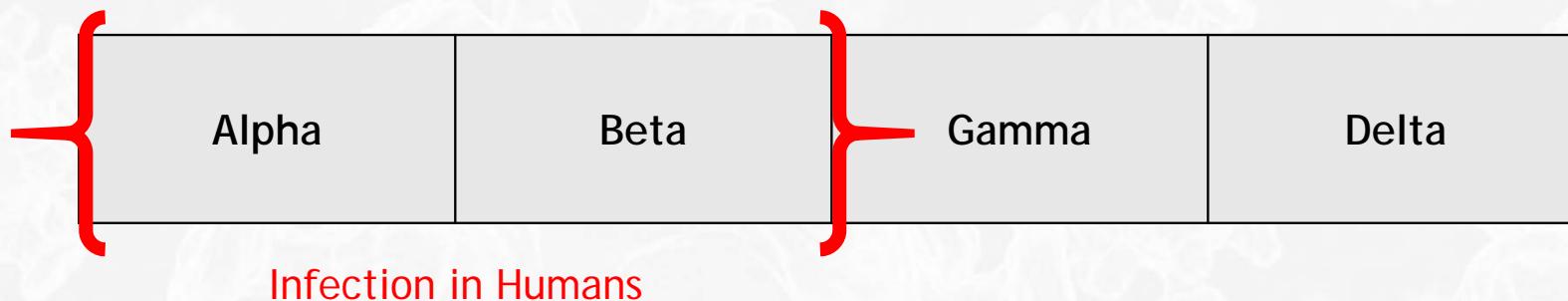


Corona Virus

- Named for its crown-shaped spike on its surface



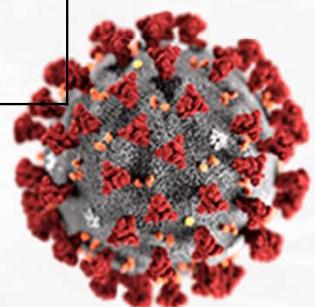
- There are four types of corona virus



Corona Virus

- There are seven types of viruses that can infect people

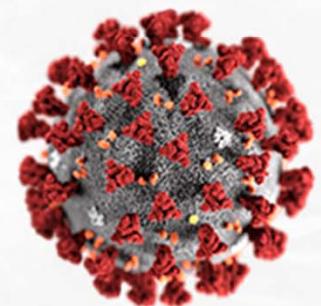
| | | | |
|----------------|----------------|---|-------------|
| 229E (alpha) | NL63 (alpha) | OC43 (beta) | HKU1 (beta) |
| MERs-CoV(beta) | SARS-CoV(beta) | SARS-CoV-2 (COVID-19) (beta) | |



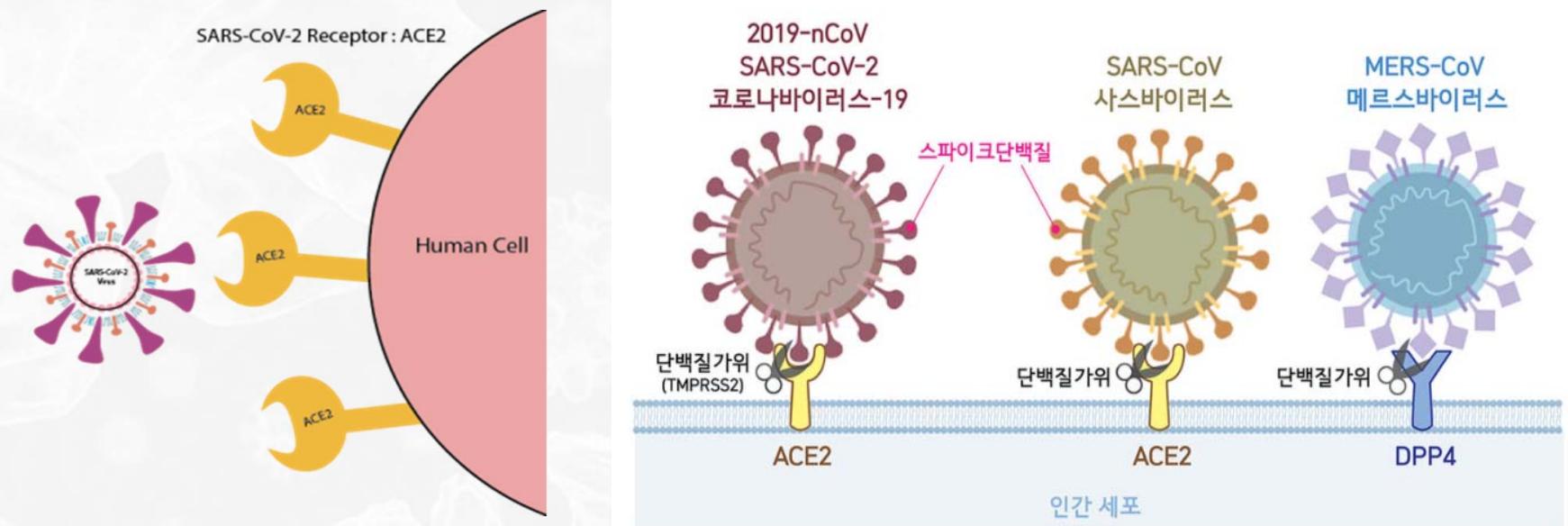
Corona Virus

▣ 코로나 바이러스 분류표

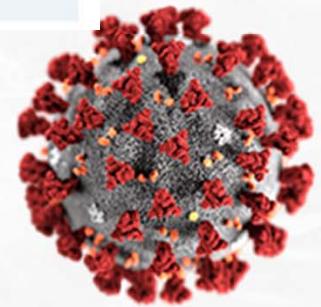
| 속(genus) | 사람-코로나 바이러스 | 사람 이외에 감염하는 코로나 바이러스 |
|-----------------------------------|--------------------------------|--|
| 알파-코로나 바이러스 (alphacoronavirus) | 229E, NL63, | 돼지 유행성 설사 바이러스(porcine epidemic diarrhea virus : PEDV), (돼지) 전염성 위장염 바이러스 (transmissible gastroenteritis virus : TGEV), 개코로나 바이러스(canine coronavirus : CCoV), 고양이 코로나 바이러스 (feline coronavirus : FCoV), Miniopterus bat(박쥐) coronavirus 1, Miniopterus bat(박쥐) coronavirus HKU8, Rhinolophus bat(박쥐) coronavirus HKU2, Scotophilus bat(박쥐) coronavirus 512 |
| 베타-코로나 바이러스 (betacoronavirus) | OC43, HKU1, SARS-CoV, MERS-CoV | 돼지 혈구 응집성뇌척수염 바이러스(porcine hemagglutinating encephalomyelitis virus : PHEV), 우코로나 바이러스(bovine coronavirus : BCoV), 말코로나 바이러스 (equine coronavirus : EqCoV), 쥐코로나 바이러스(murine coronavirus : MuCoV), Tylonycteris bat(박쥐) coronavirus HKU4, Pipistrellus bat(박쥐) coronavirus HKU5, Rousettus bat(박쥐) coronavirus HKU9 |
| 감마-코로나 바이러스 (gammacoronavirus) | 없음 | 새코로나 바이러스(Avian coronavirus), 흰색 돌고래(Beluga whale)-코로나 바이러스 SW1 |
| 델타-코로나 바이러스 (deltacoronavirus) | 없음 | 제주직박구리(Bulbul)-코로나 바이러스 HKU11, 개똥지빠귀 (Thrush)-코로나 바이러스 HKU12, 칸바라(Munia)-코로나 바이러스 HKU13 |



Corona Virus

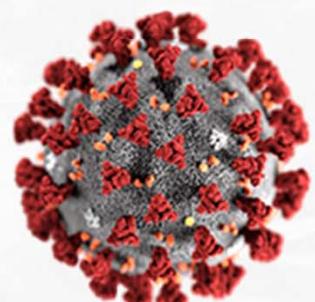


Receptor ACE2 (Human cell)
+ Spike protein (SARS-CoV-2 Virus)
= Get infected !

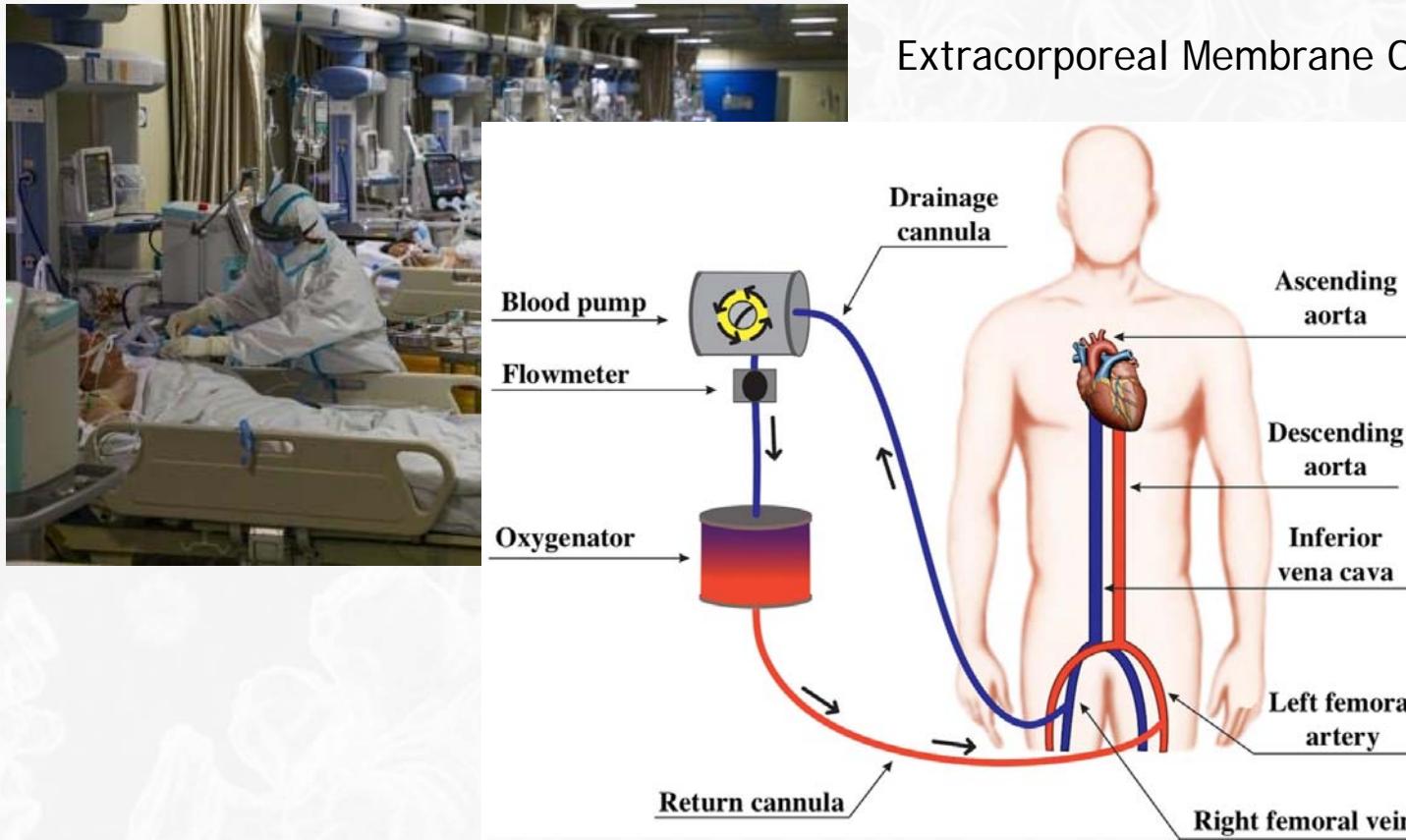


COVID-19

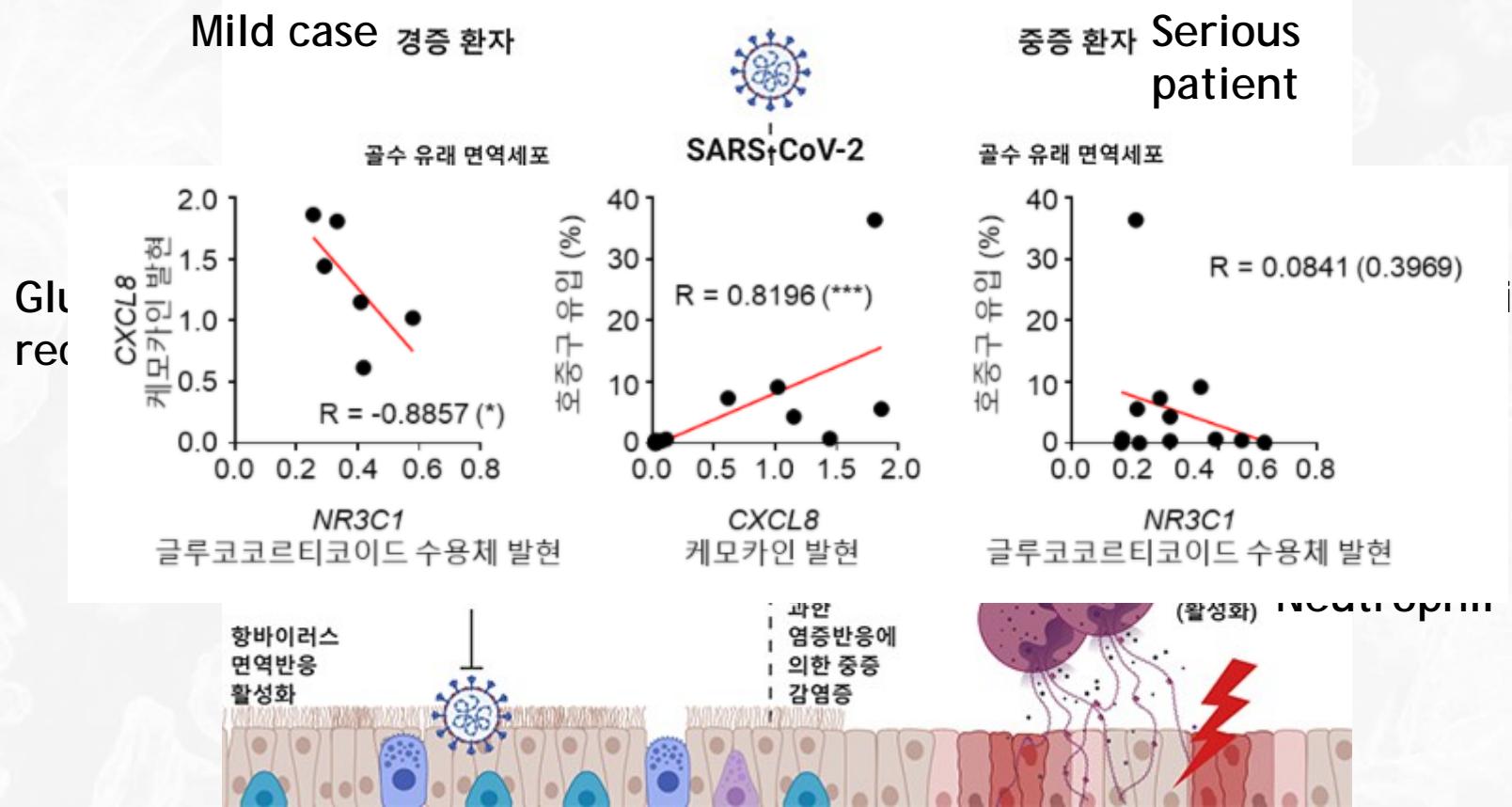
| | |
|-------------------|---|
| Pathogen | SARS-CoV-2 |
| Infectious source | Assuming it was an animal |
| Infection route | Animal -> People -> People |
| Infection symptom | Fever, respiratory symptoms, pneumonia, phlegm, sore throat, headache , etc. |
| Incubation period | 2 days ~ 14 days |
| Fatality rate | The global mortality rate is about 3.4% (Most of them are elderly, patients with impaired immune function, and patients with underlying diseases.) |
| Preventive method | Washing hands, disinfect and ventilate the surrounding environment |
| Treatment method | No antiviral drugs |



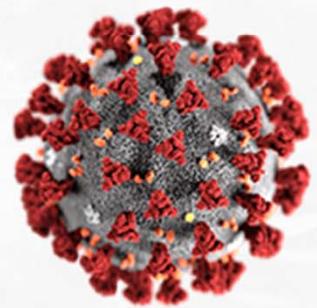
COVID-19



COVID-19

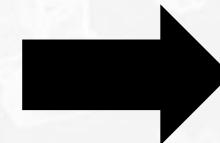
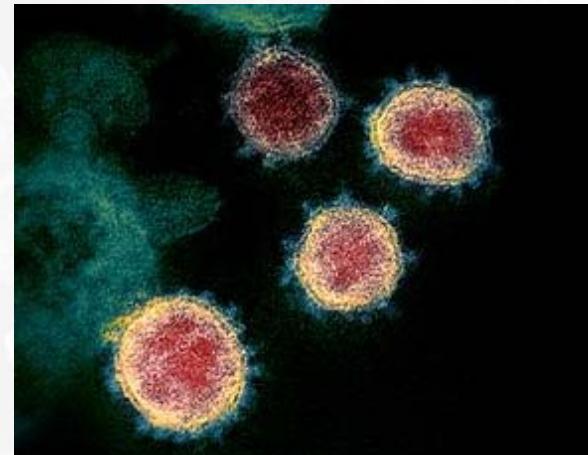
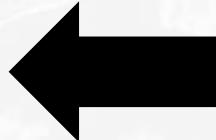


**How do people deal with
COVID-19?**



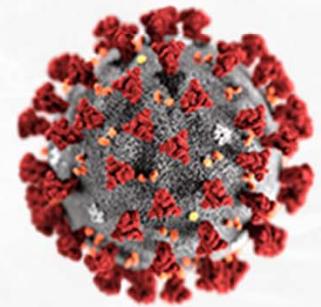
Countermeasure of COVID-19

Before
infection

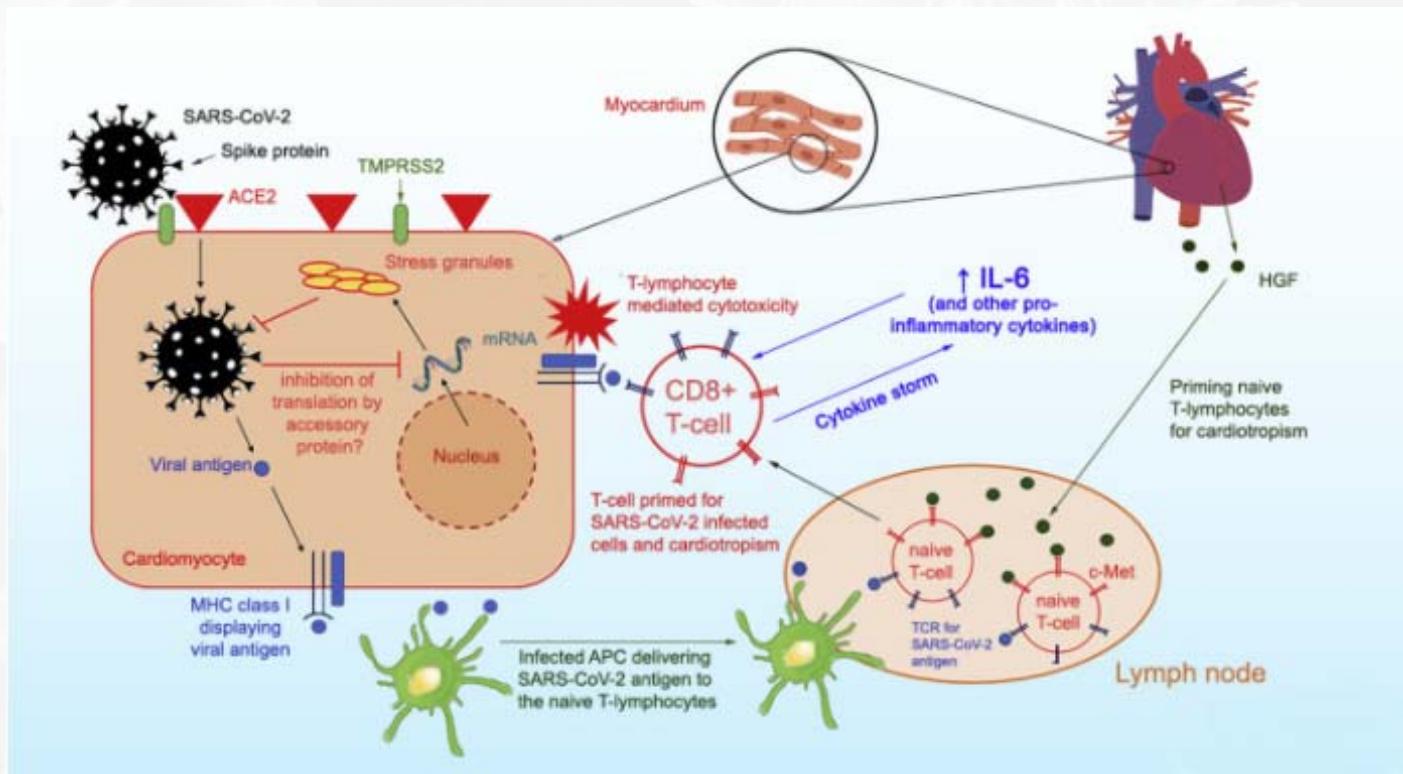


After
infection

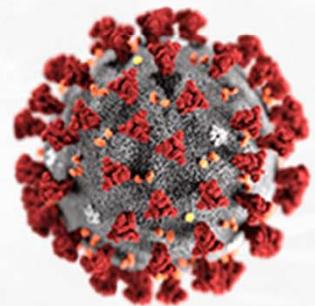
Both cases use our immune system



Immune Response to SARS-CoV-2



<[https://www.heartrhythmjournal.com/article/S1547-5271\(20\)30422-7/fulltext](https://www.heartrhythmjournal.com/article/S1547-5271(20)30422-7/fulltext)>



Treatment of COVID-19 After infection

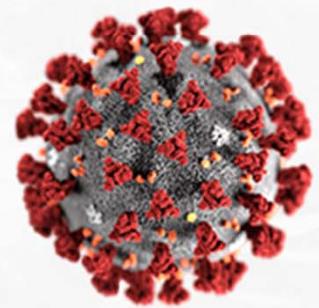
Currently, there is no obvious therapeutic agent

Drug Treatment

- Antiviral agents (e.g. Lopinavir, Remdesivir)
- Antibody

Symptomatic Therapy

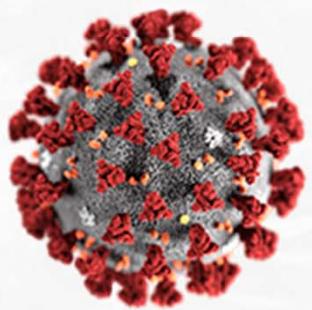
- ECMO
- Immune suppressant drug
(e.g. Dexamethasone, antibiotics)



Before COVID-19 Infection

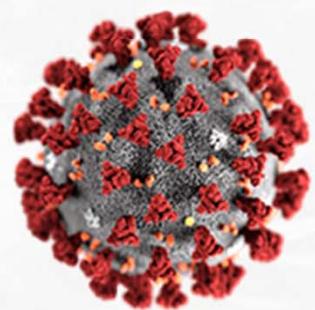


Vaccine !

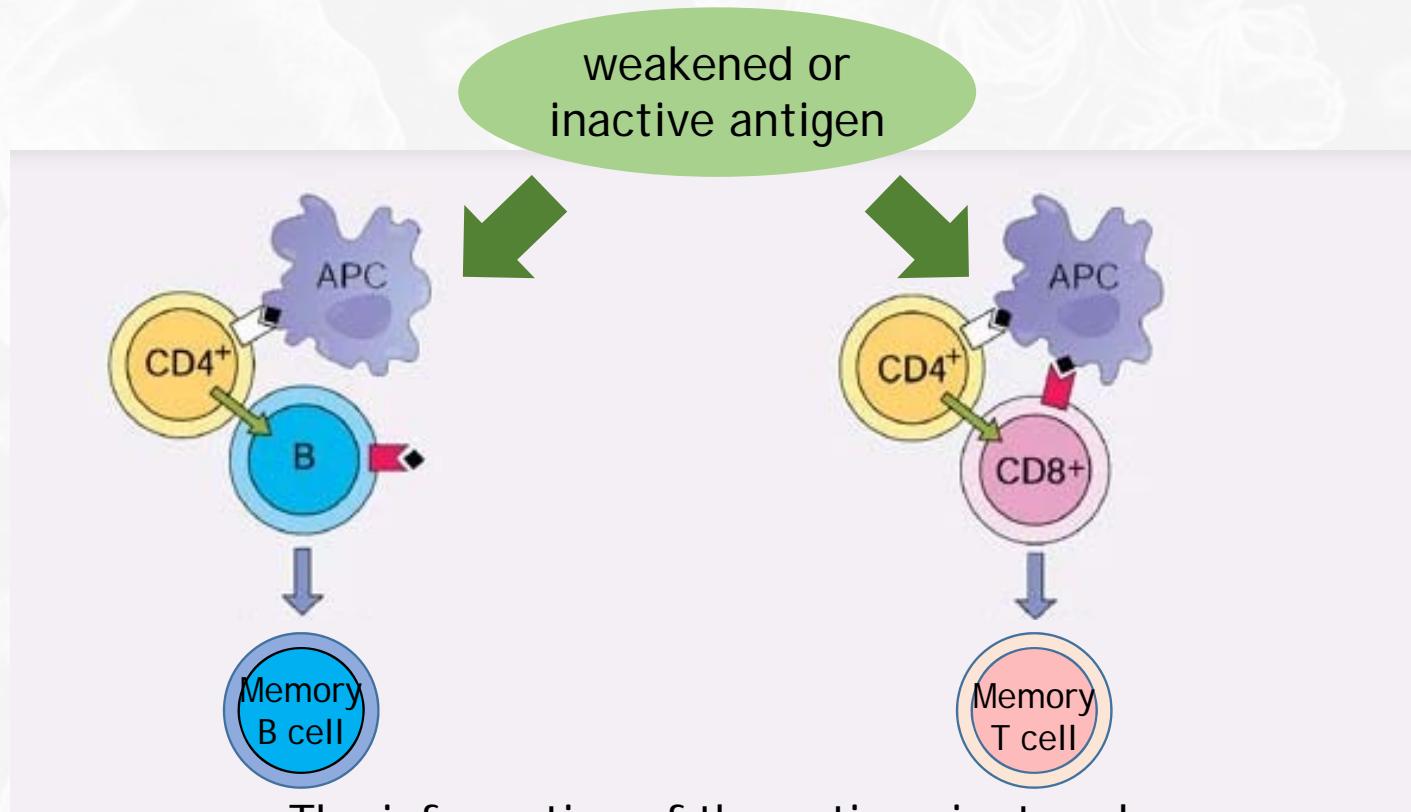


What is Vaccine?

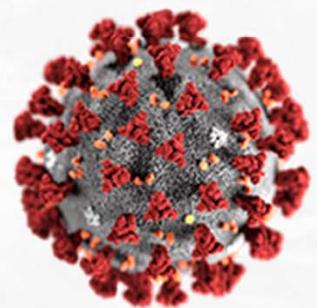
- Vaccine is related to our adaptive immunity
- Composed of weakened or inactive antigen



The Principle of Vaccine



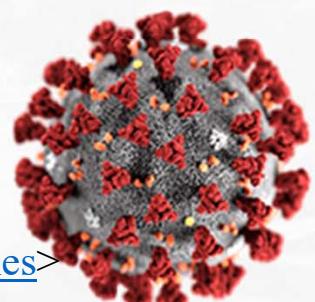
The information of the antigen is stored,
and Long-term immunity is formed



Candidate Vaccines for COVID-19

| 10 CANDIDATE VACCINES IN PHASE III CLINICAL EVALUATION | VACCINE PLATFORM | LOCATION OF PHASE III STUDIES |
|--|-------------------|--|
| Sinovac | Inactivated virus | Brazil |
| Wuhan Institute of Biological Products / Sinopharm | Inactivated virus | United Arab Emirates |
| Beijing Institute of Biological Products / Sinopharm | Inactivated virus | China |
| University of Oxford / AstraZeneca | Viral vector * | United States of America |
| CanSino Biological Inc. / Beijing Institute of Biotechnology | Viral vector * | Pakistan |
| Gamaleya Research Institute | Viral vector | Russia |
| Janssen Pharmaceutical Companies | Viral vector | USA, Brazil, Colombia, Peru, Mexico, Philippines, South Africa |
| Novavax | Protein subunit | The United Kingdom |
| Moderna / NIAID | RNA | USA |
| BioNTech / Fosun Pharma / Pfizer | RNA | USA, Argentina, Brazil |

<<https://www.who.int/publications/m/item/draft-landscape-of-covid-19-candidate-vaccines>>

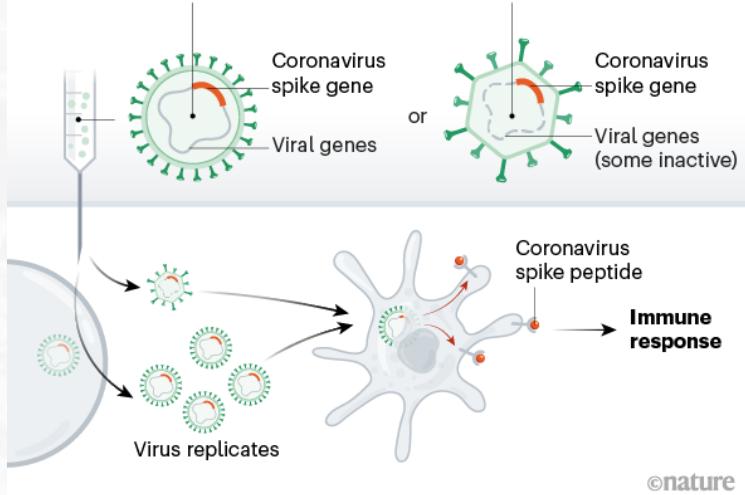


Viral Vector Vaccine

VIRAL-VECTOR VACCINES

Replicating viral vector (such as weakened measles)

The newly approved Ebola vaccine is an example of a viral-vector vaccine that replicates within cells. Such vaccines tend to be safe and provoke a strong immune response. Existing immunity to the vector could blunt the vaccine's effectiveness, however.



Non-replicating viral vector (such as adenovirus)

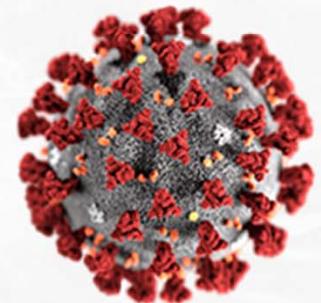
No licensed vaccines use this method, but they have a long history in gene therapy. Booster shots can be needed to induce long-lasting immunity. US-based drug giant Johnson & Johnson is working on this approach.

Advantage

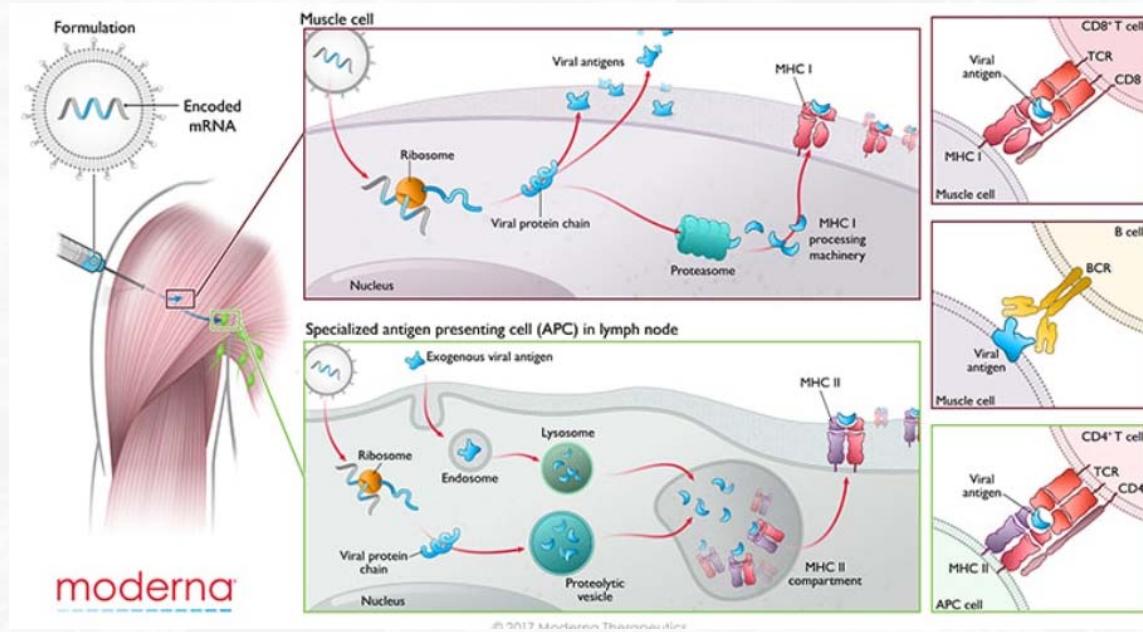
- High safety
- High stability

Disadvantage

- Immunity to the vector can be formed
- Need cells to manufacture



RNA(mRNA) Vaccine



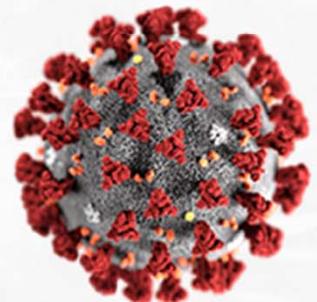
<<https://www.modernatx.com/moderna-blog/shedding-light-our-prophylactic-vaccines-moa>>

Advantage

- Don't require cell culture
- Short manufacturing time
- High safety

Disadvantage

- Low stability
- Inflammation
- Blood coagulation



Some COVID-19 Vaccine

- Modified RNA vaccine
→ use mRNA(BNT162b2)



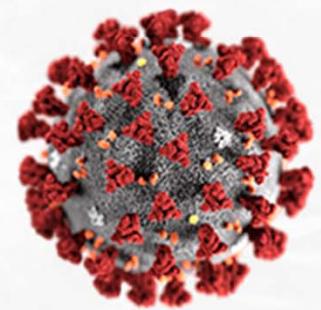
- Vaccine efficacy: 95% ($p<0.0001$)
→ 170 first confirmed cases
(Placebo: 162 vs Vaccine: 8)

- Modified RNA vaccine
→ use mRNA-1273



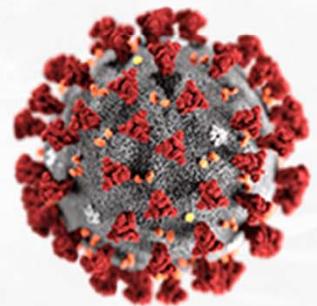
- Vaccine efficacy: 94.5% ($p<0.0001$)
→ 95 first confirmed cases (Placebo:
90 vs Vaccine: 5)

- No severe safety concerns
- Fever, Swelling rarely occurs



Reference

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Thank you !

