



اللجنة المركزية
للتعليم الإلكتروني

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م.م. عمر توفيق عبدالرحمن العبيدي
رئاسة الجامعة



يومياً
2:00 PM



Zoom cloud meeting
Meeting ID: 380 396 2676

عنوان المحاضرة:

Relationship ABO Blood group and Corona
virus (COVID19) infection



4 / 5 / 2020 الاثنين

2:00 PM



المحاضر



ا.م.د. صبا عبد السلام السلطان
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كلية طب نينوى



Relationship between **ABO** blood group and **Coronavirus** (COVID-19)

أ.م.د. صبا عبد السلام حامد السلطان
كلية الطب / جامعة نينوى



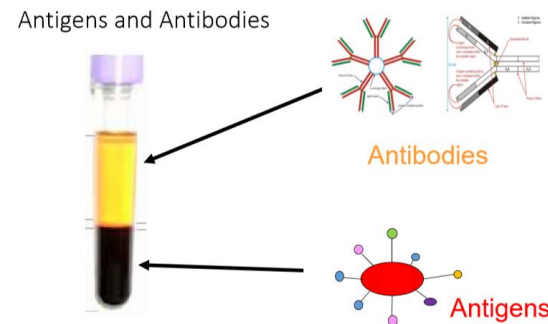
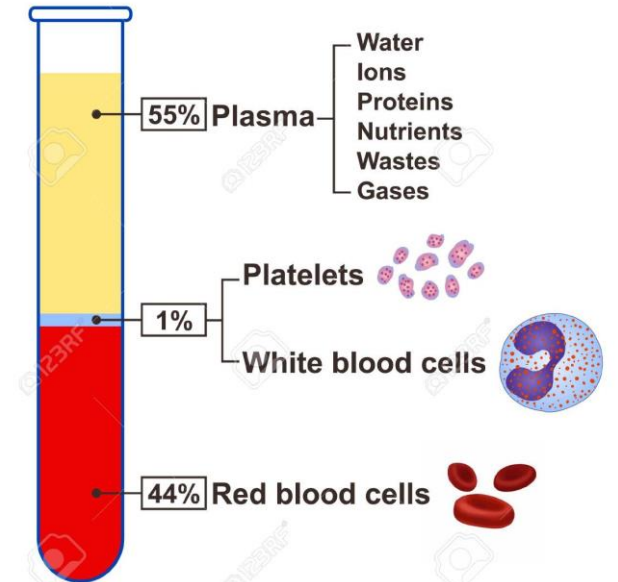
Blood and components



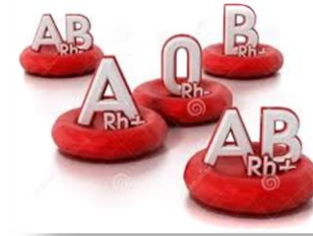
Liquid fluid consisting of the flowing components

- 1- Cell (45%)
- 2- plasma (55%)
- 3- Serum = Plasma - Fibrinogen

Components of Blood



ABO & Rh Blood Group Systems



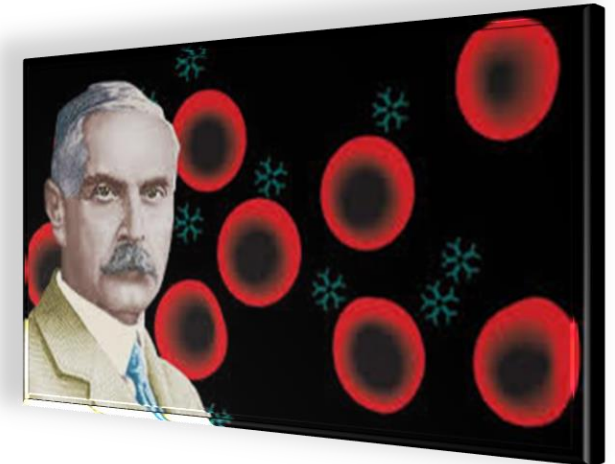
In 1901, Austrian immunologist Karl Landsteiner discovered ABO blood groups.

35 Blood group systems are recognized
Most important **ABO** blood group system and **Rh** system

M-N system also has **little importance**

Classification is based on inherited antigenic substances

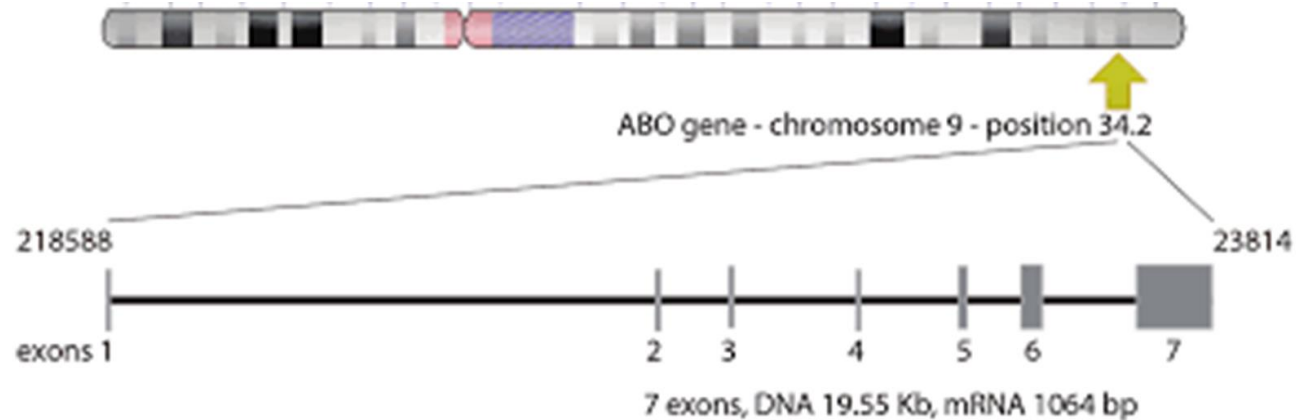
The most important and well studied blood group system is **ABO Blood group**



ABO Blood Group Systems

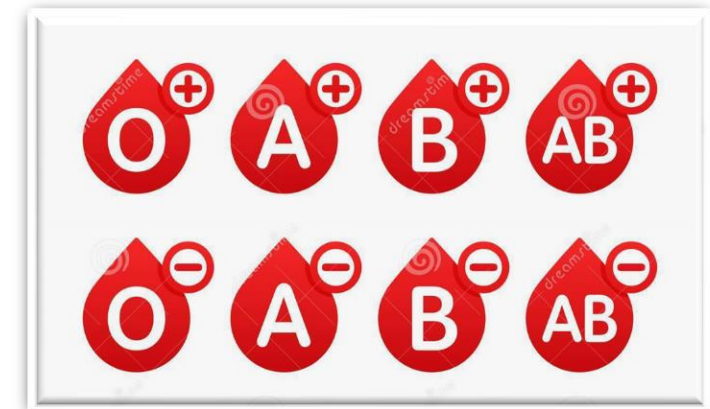


Determined by the ABO gene located on chromosome 9



The gene has three allelic form I^A , I^B and i
These determine four type of Blood group

Blood Type	Genotype		Can Receive Blood From:
A	$I^A I^A$ $I^A i$	AA AO	A or O
B	$I^B I^B$ $I^B i$	BB BO	B or O
AB	$I^A I^B$	AB	A, B, AB, O
O	ii	oo	O



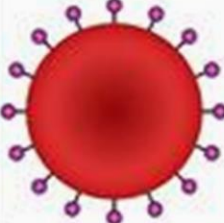
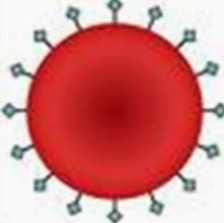
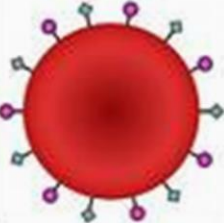







Antigens are part of the surface of cells - Red Cells have "Blood group antigens"

- White cells and platelets have HLA antigens (platelets also have HPA antigens)

Antibody : are Protein molecules - called immunoglobulins (Ig)

- Found in the plasma/serum - Produced by the immune system following exposure to a foreign antigen

Antibodies bind specifically to the corresponding antigen on the red cells

ABO Blood Group System				
Group	A	B	AB	O
Red Blood Cell Type				
Antigens Present	 Antigen A	 Antigen B	 Antigen A & B	None
Antibodies Present	 Anti-B	 Anti-A	None	 Anti-A & Anti-B

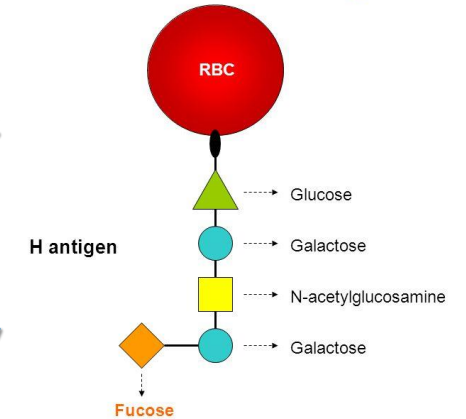


RBCs Antigens

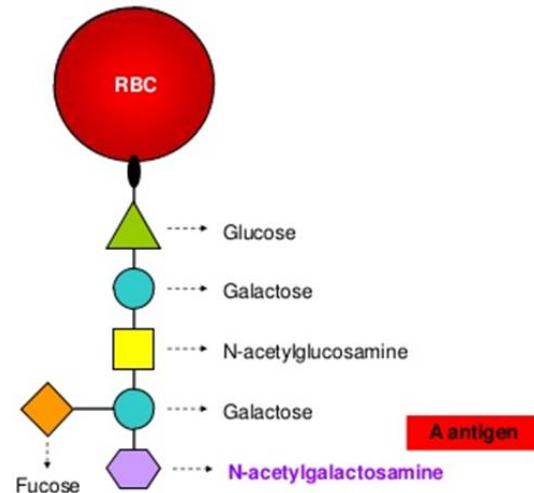
H antigen : the H gene is located on the 19th chromosome in humans and code for an enzyme that adds the sugar **fucose** to the terminal sugar of precursor substance (PS)

H antigen is a precursor to each of the ABO blood group antigens (A and B), apparently present in all people except those with the Bombay Blood phenotype

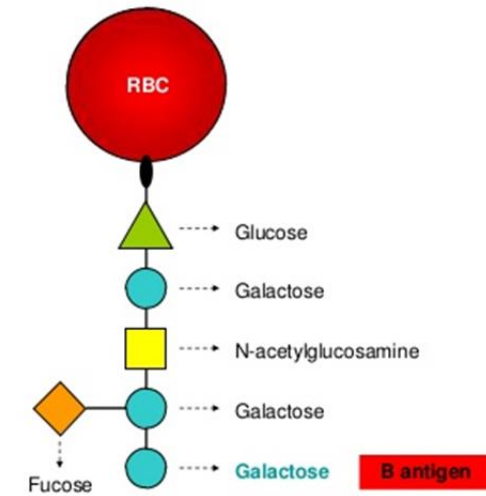
Formation of the H antigen



Formation of the A antigen

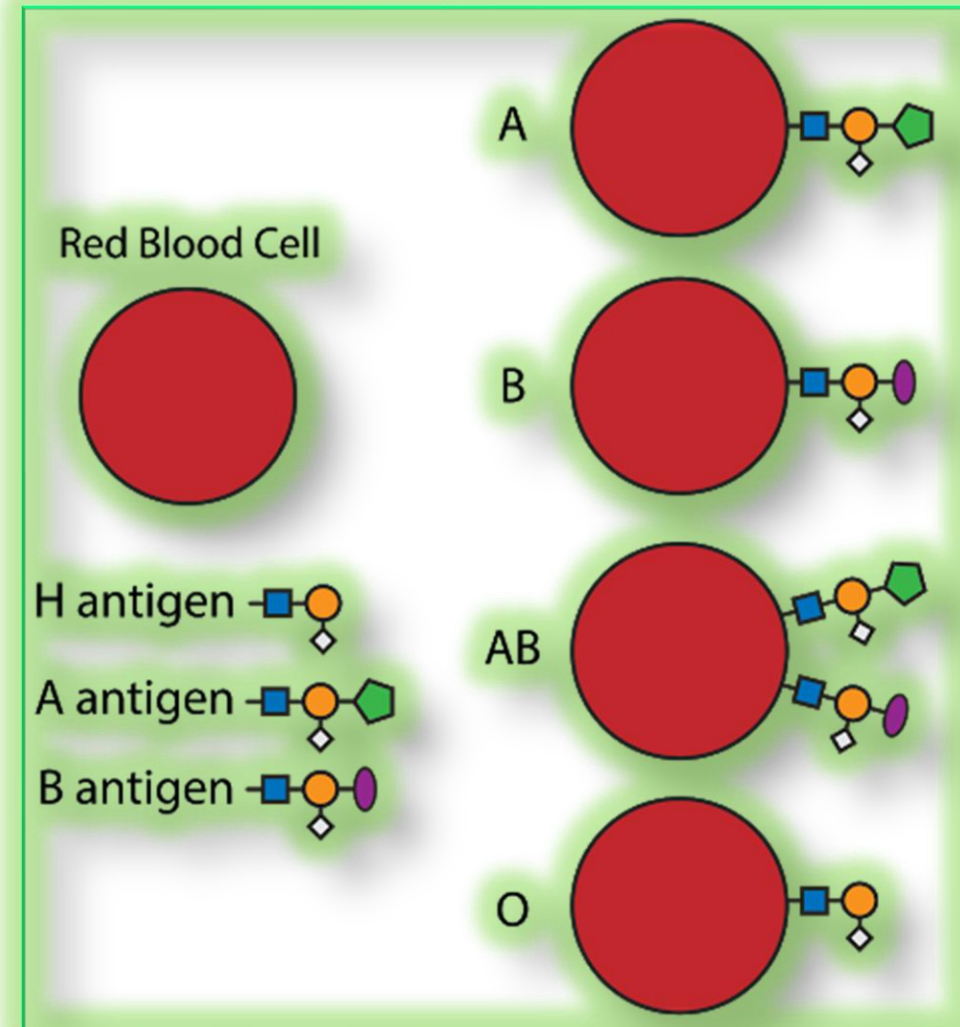


Formation of the B antigen



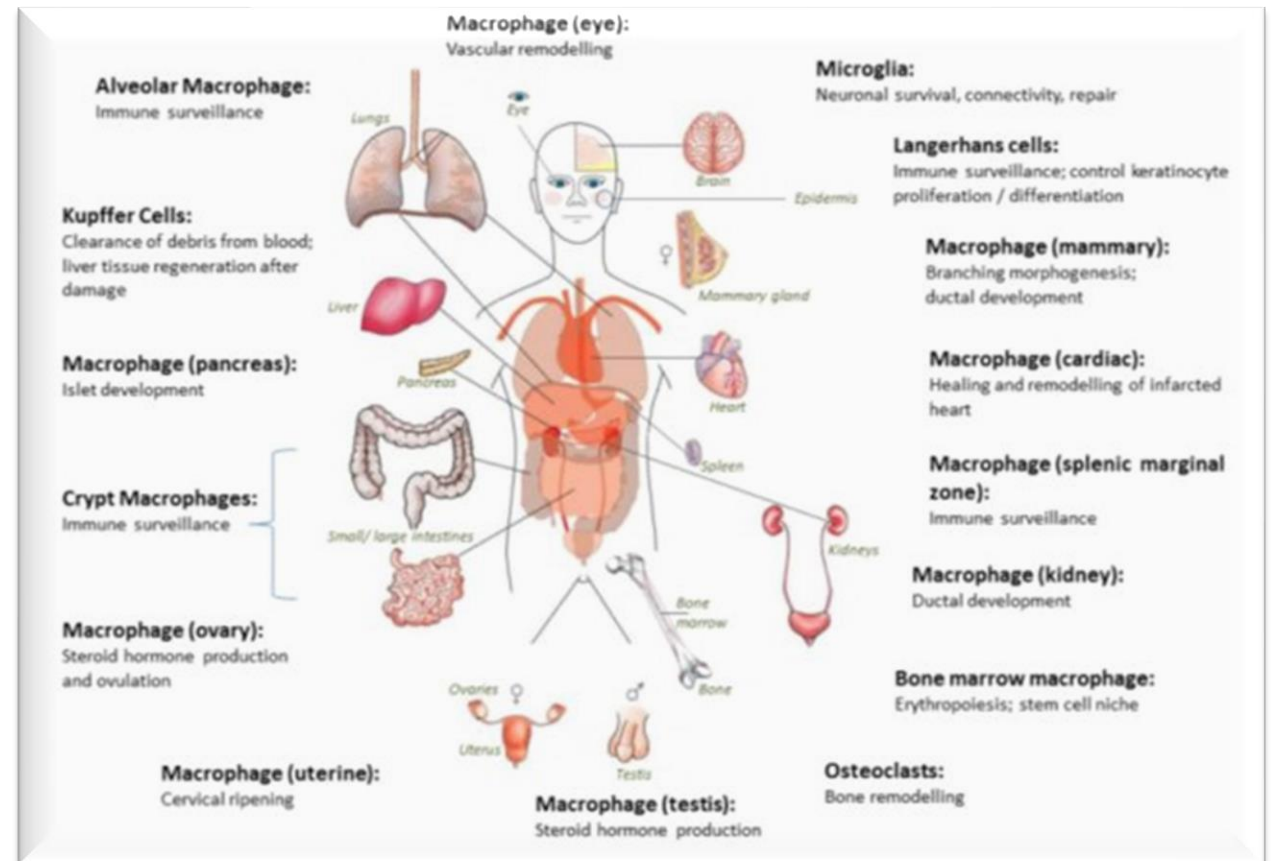
RBCs Antigens

- Why do Group O individuals have more H antigen than the other groups?
- Group O individuals have no A or B genes to convert the H antigen to A or B antigens....that means more H antigen sites



A & B antigen expression

Antigens A and B were initially identified on human RBCs. However, depending on the ABO phenotype of the individual, they can also be expressed on other types of cells, including the **epithelial cells** of the **gastrointestinal and respiratory tracts** and the **endothelial cells** that **line the blood vessels**, (and are therefore termed **histo-blood group antigen**) in addition to the RBCs.

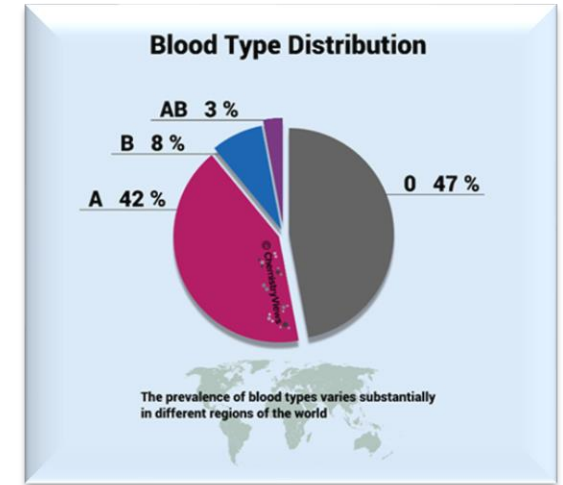


The prevalence of blood types varies substantially in different regions of the world

PEOPLE GROUP	O	A	B	AB
Aborigines	61	39	0	0
Abyssinians	43	27	25	5
Ainu (Japan)	17	32	32	18
Albanians	38	43	13	6
Grand Andamanese	9	60	23	9
Arabs	34	31	29	6
Armenians	31	50	13	6
Asian (in USA - General)	40	28	27	5
Austrians	36	44	13	6
Bantus	46	30	19	5
Basques	51	44	4	1
Belgians	47	42	8	3
Blackfoot (N. Am. Indian)	17	82	0	1
Bororo (Brazil)	100	0	0	0
Brazilians	47	41	9	3

A Contribution to the Physical Anthropology and Population Genetics

L. Beckman - *as revised by BloodBook.com 12/07/2000; 07/22/2001; 04/10/2002; 05/22/2004; 07/13/2008.



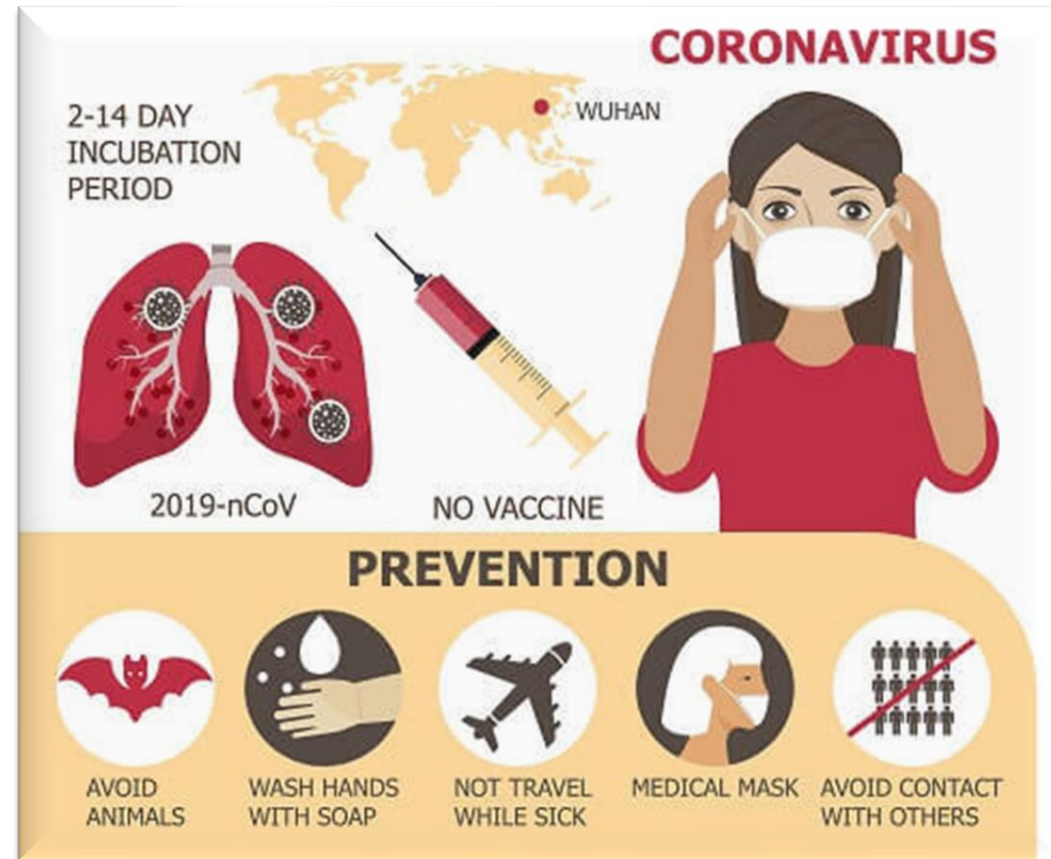
The frequencies of people with different ABO blood groups vary by ethnicity and location.

TYPES	DISTRIBUTION	RATIOS
O +	1 person in 3	38.4%
O -	1 person in 15	7.7%
A +	1 person in 3	32.3%
A -	1 person in 16	6.5%
B +	1 person in 12	9.4%
B -	1 person in 67	1.7%
AB +	1 person in 29	3.2%
AB -	1 person in 167	0.7%



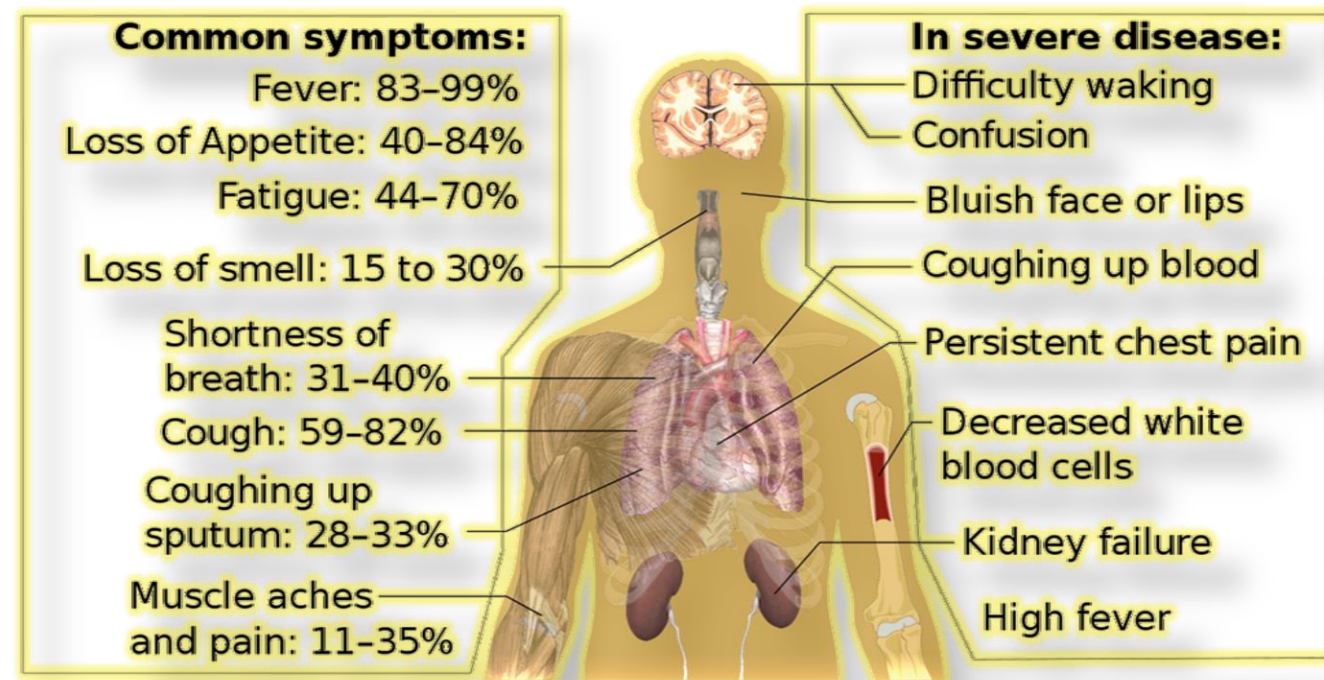
Coronavirus disease 2019 (COVID-19)

We all know about coronavirus disease 2019 because this ongoing (COVID-19) pandemic disease has been drastically affecting our daily routine, infecting and sacrificing many people



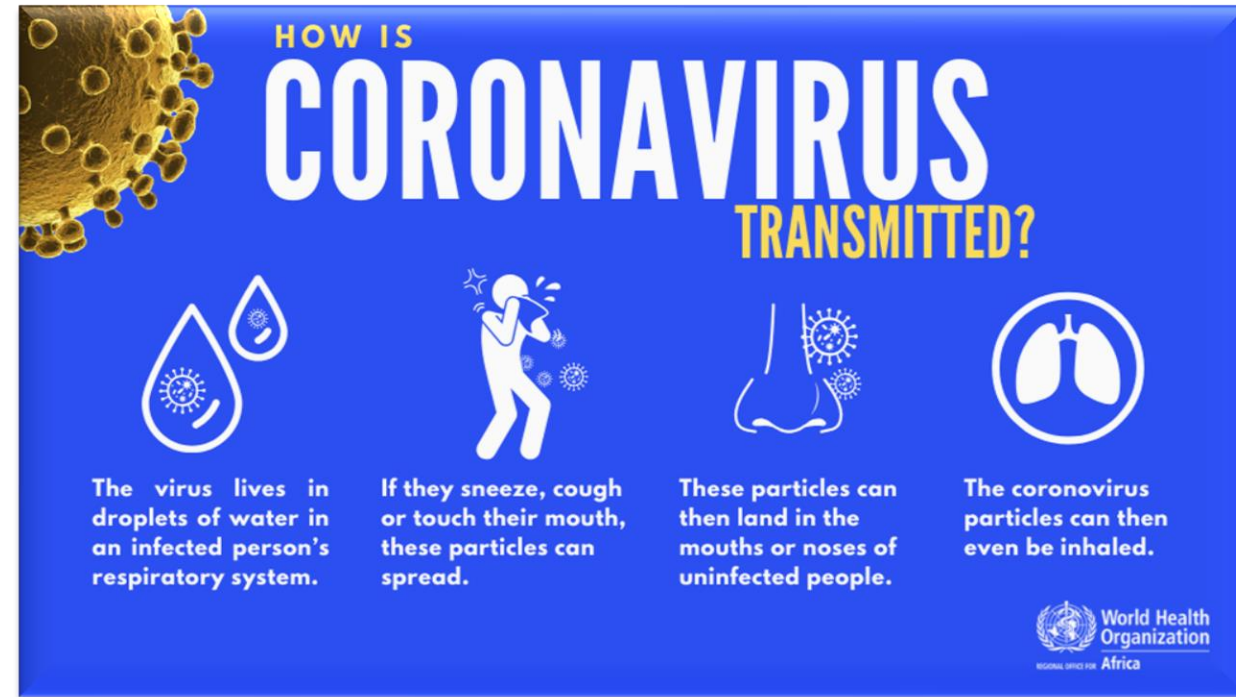
Coronavirus disease 2019 (COVID-19)

The disease is caused by the coronavirus called "severe acute respiratory syndrome coronavirus 2", in short, **SARS-CoV-2**. The disease was initially identified in Wuhan in China (2019-2020), but has since spread worldwide. Common symptoms include fever, cough, and shortness of breath. Although most infected people show mild symptoms, some progress to severe pneumonia, multiple organ failure, and even death.

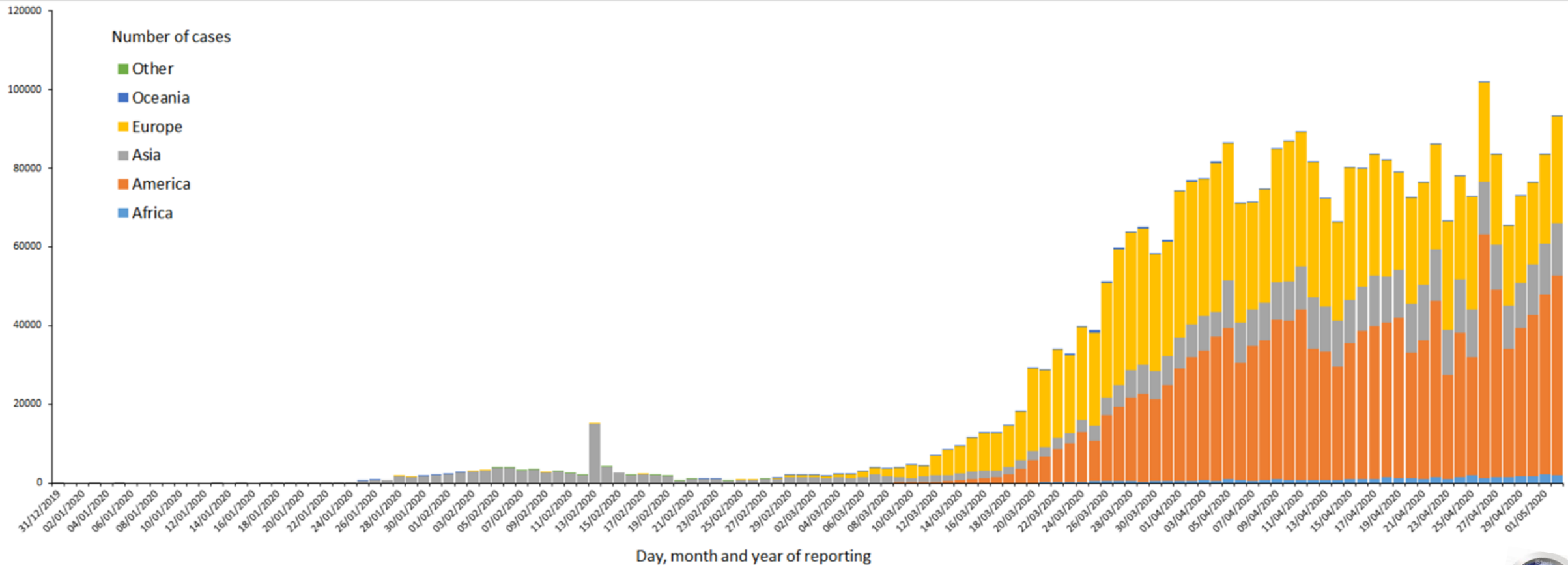


Coronavirus disease 2019 (COVID-19)

- The virus is transmitted primarily through respiratory droplets released by coughing and sneezing,
- although people can become infected through physical contact with contaminated materials.
- Time from exposure to onset of symptoms is generally between 2-14 days , with an average of 5 days
- Unfortunately, there are no licensed vaccines or specific antiviral medications available at this time (MAY, 4, 2020).



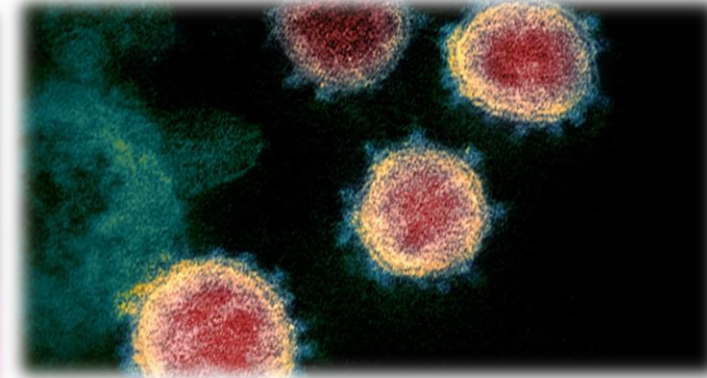
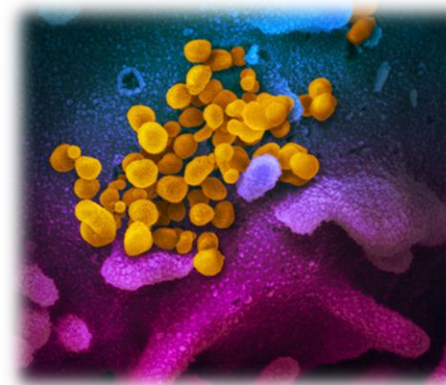
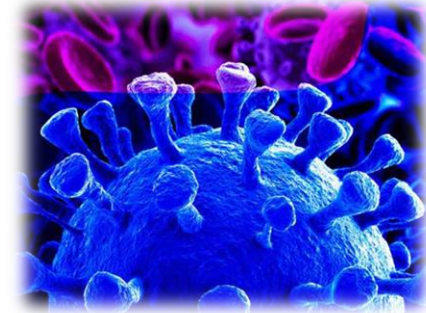
Distribution of COVID-19 cases world wide as of 1 MAY 2020



COVID-19

The name "**Coronavirus**" derives from its morphology reminiscent of the solar corona.

- Human corona virus have been involved in serious respiratory tract infections , including **SARS-COV** responsible to Severe Acute Respiratory Syndrome (SARS) in 2003
- **MERS-COV** responsible for Middle East Respiratory Syndrome (MERS) in 2012 and
- **SARS-COV-2** responsible for COVID-19 IN 2019-2020

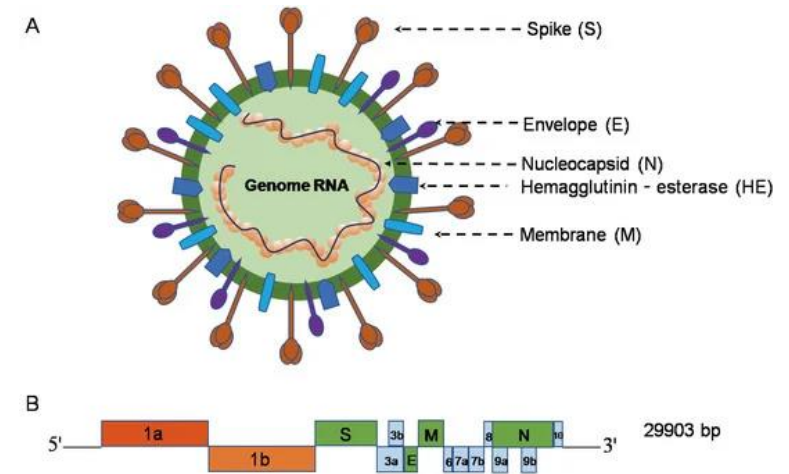


the virus that causes COVID-19-isolated from a patient in the U.S. Virus particles are shown emerging from the surface of cells cultured in the lab



COVID-19

The virus is a positive-sense single-stranded RNA virus. The size of the genome is approximately 30 kilobases long and contains approximately 10 genes. The genome sequence has been determined from dozens of isolates and has been found to be highly homologous to SARS-CoV and MERS-CoV and other human coronaviruses, as well as to coronaviruses in bats and pangolins.



SARS-COV-2 virus has membrane-encapsulated and has four structural proteins: S(spike), E(envelope), M(membrane), and N(nucleocapsid). The N protein holds the RNA genome, and the S, E, and M together create the viral envelope. Viral Spike (S) proteins are glycoproteins embedded in the membrane, and they are "coronas" of viral particles.



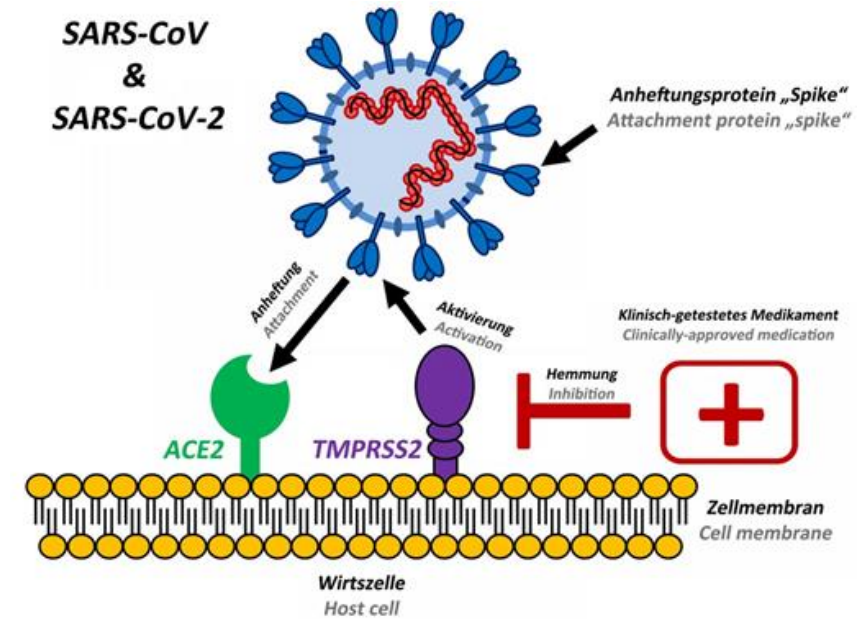
COVID-19 Spike (S-protein) & ACE2

S proteins mediate viral association with cells. Both the SARS-CoV and SARS-CoV-2 S proteins have been shown to physically interact with the cellular angiotensin-converting enzyme 2 (ACE2).

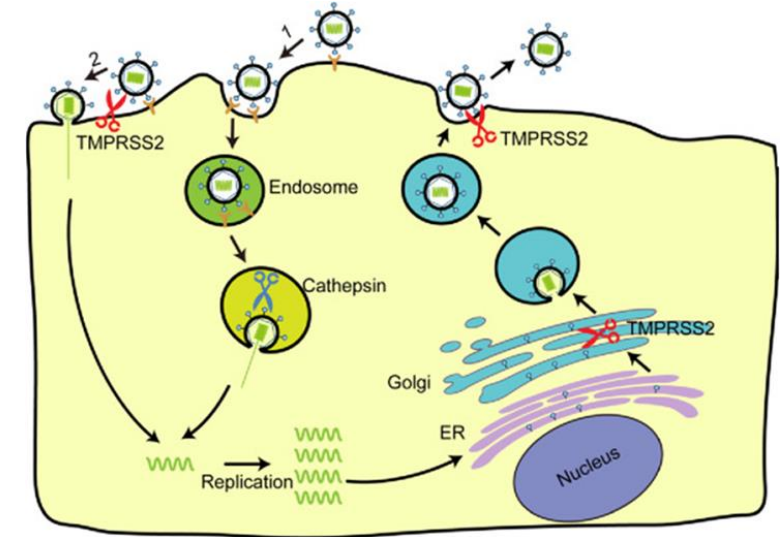
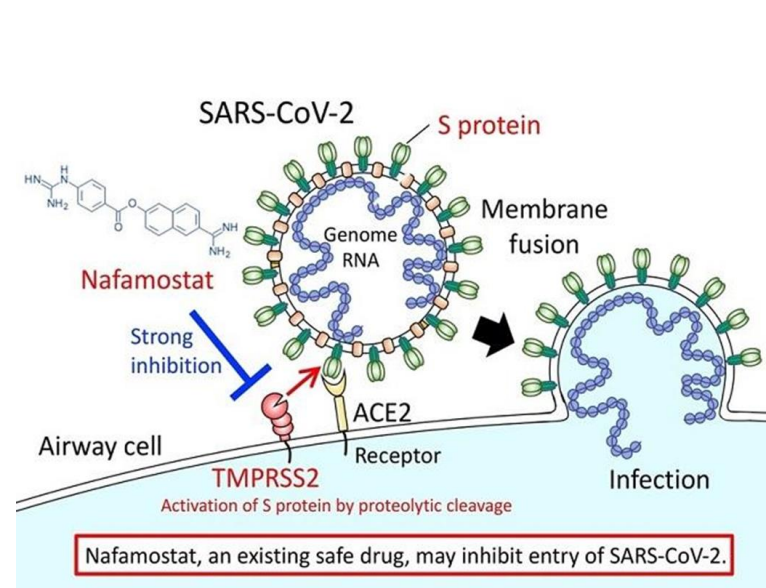
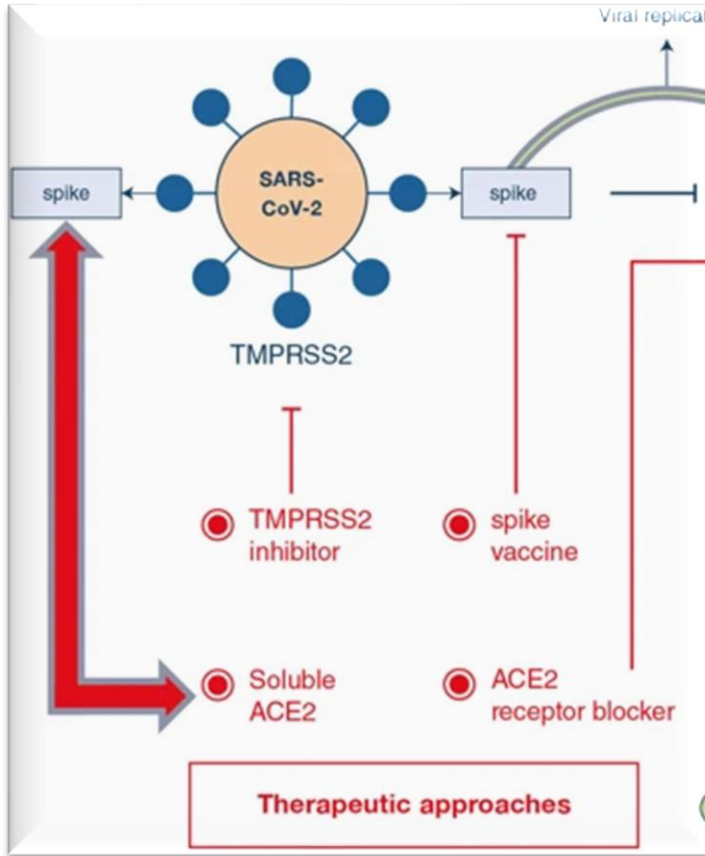
ACE2 also serves as the entry point into cells for some coronaviruses. The human version of the enzyme is often referred to as hACE2.

ACE2 is present in most organs: ACE2 is attached to the cell membrane of mainly lung type II alveolar cells, enterocytes of the small intestine, arterial and venous endothelial cells and arterial smooth muscle cells in most organs.

This entry process also requires priming of the S protein by the host transmembrane protease serine TMPRSS2, the inhibition of which is under current investigation as a potential therapeutic.



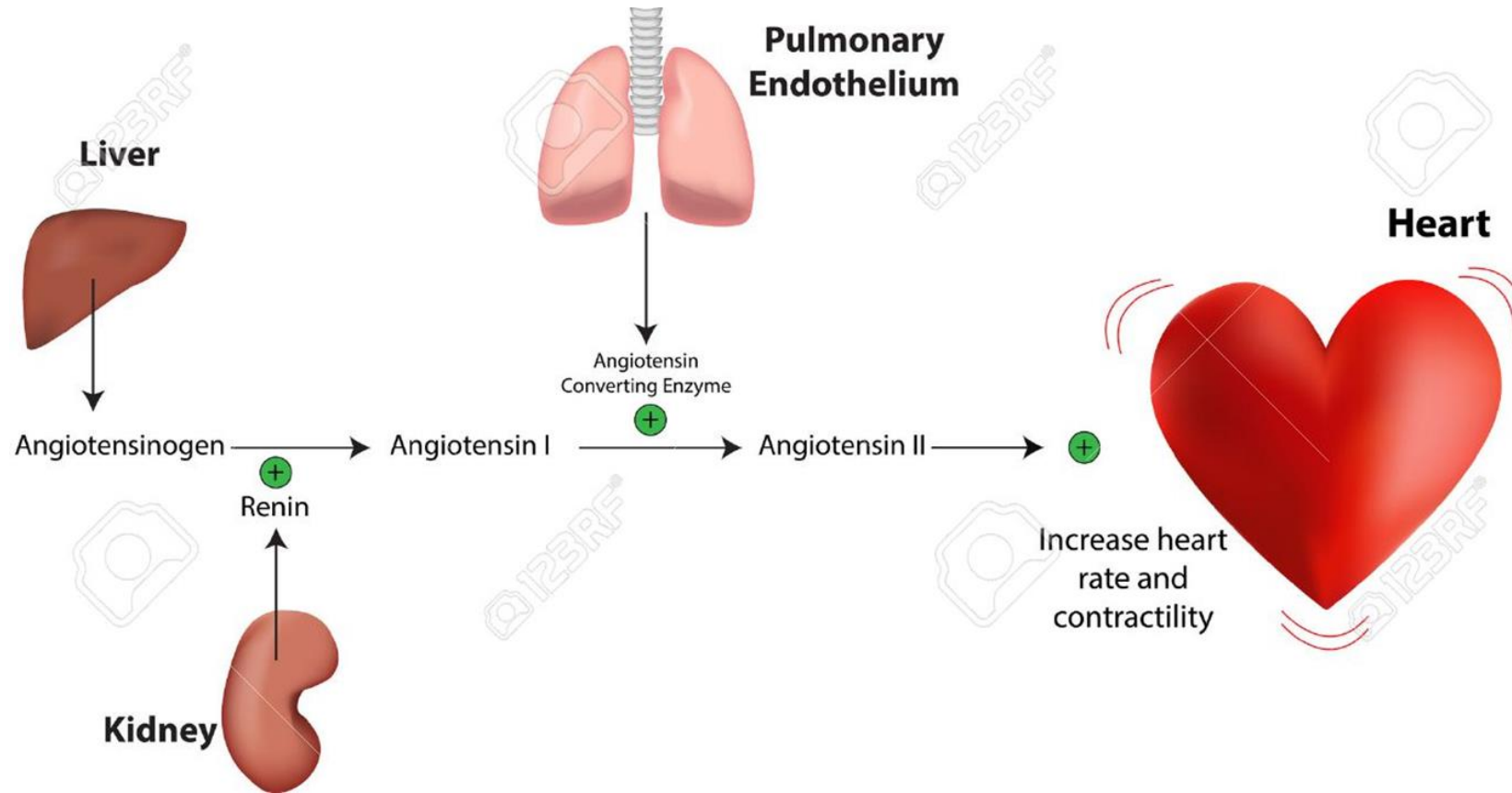
COVID-19 Spike (S-protein) @ ACE2



Japanese researchers suggest Nafamostat mesylate (Fusan), a drug used to treat acute pancreatitis, could be repurposed to inhibit SARS-CoV-2, the virus causing the COVID-19 pandemic, from entering human cells

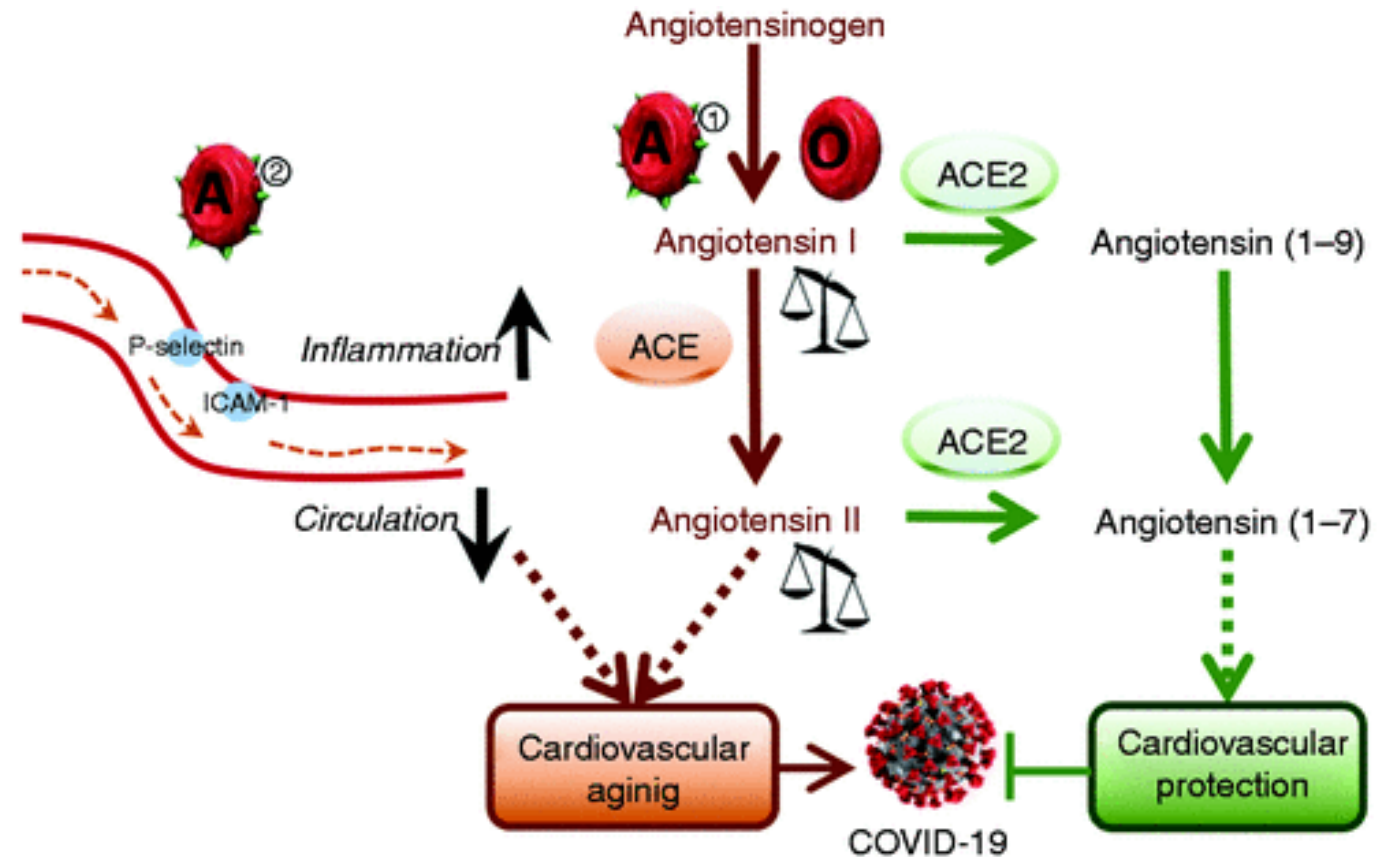


COVID-19 Spike (S-protein) & ACE2 Renin angiotensin aldosterone system



COVID-19 Spike (S-protein) & ACE2 Renin angiotensin aldosterone system

Conceptual Illustration on the predisposing role of ABO blood type to cardiovascular diseases and COVID-19 severity. Blood O type is protective against the development of cardiovascular diseases and severe COVID-19 as it is associated with lower angiotensin-converting enzyme (ACE) level and higher ACE2 activity. Blood A type is risky for the development of cardiovascular diseases and severe COVID-19 due to: (a) its positive association with ACE activity, and (b) the attachment of adhesion molecules on the vascular wall that increases inflammation and decreases blood circulation.



Some Facts

The **GATC** haplotype of the four polymorphisms of the ABO gene (**rs8176746**, **rs8176740**, **rs495828**, **rs12683493**), which is prevalent among non-O blood type patients, is positively associated with ACE activity. Thereby, O blood type carriers should have lower ACE levels and a higher probability of enjoying protection from ACE2-conveyed benefits.

Consistent with this, blood type O carriers have a higher interleukin 6 (IL-6) level than non-type O carriers. IL-6 is a proinflammatory cytokine triggering the production of acute-phase proteins such as C-reactive protein. As higher levels of C-reactive protein were detected among ACE-inhibitor-induced coughers than controls, we would expect a positive relationship between IL-6 secretion and ACE inhibitor and/or ACE2.

A genome-wide association study (GWAS) found that blood type O carriers have increased IL-6 levels than individuals carrying the other blood group types.

<https://journals.sagepub.com/doi/pdf/10.1177/2047487320922370>



COVID-19 & ABO Blood group

Fact:

*SARS-CoV replicates in epithelial cells of the respiratory and digestive tracts that have the ability to synthesize A and/or B glycan antigens, depending on individual's ABO phenotype.

Assumptions:

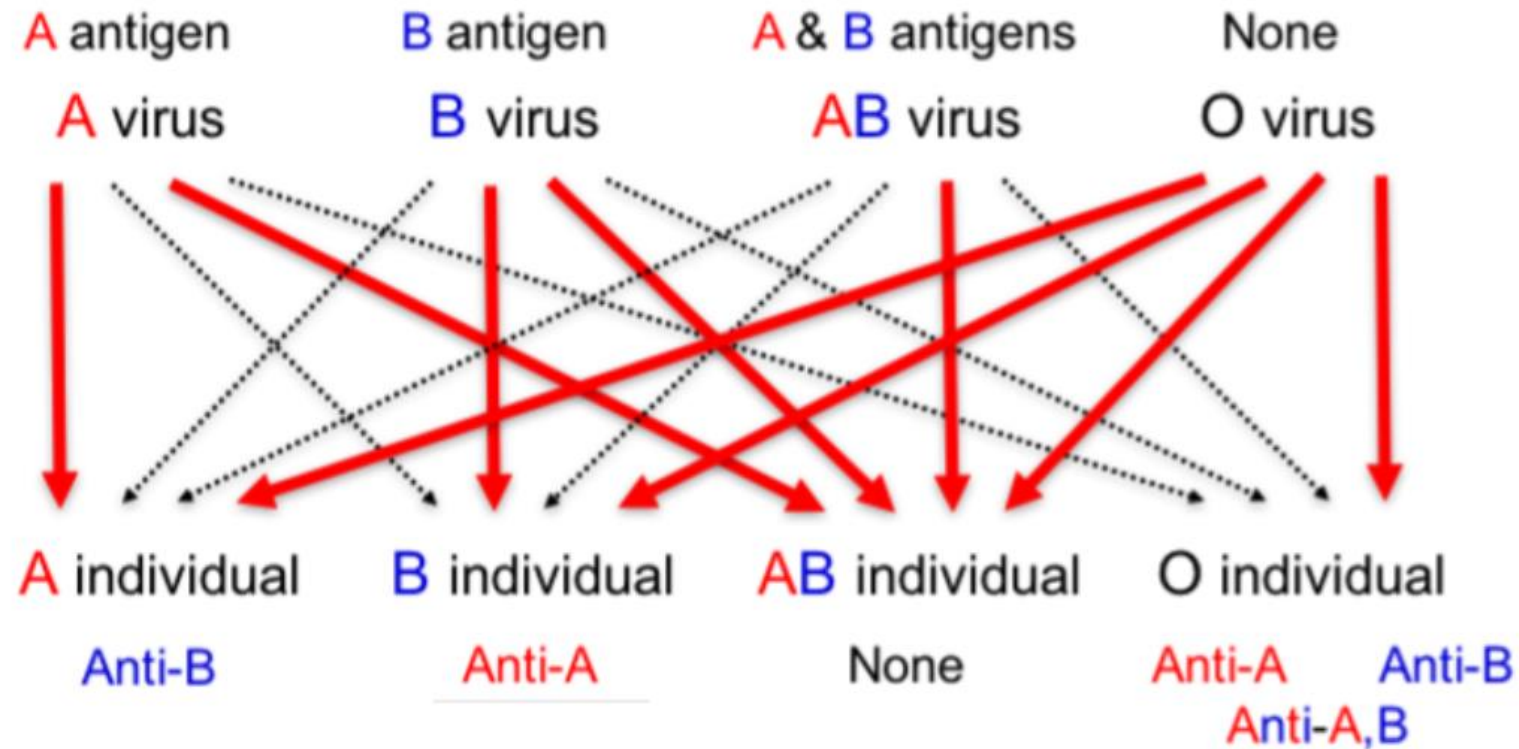
*The S proteins produced in A, B, or AB individuals could be decorated with A, B, or A/B glycan antigens, respectively.

*Anti-A, Anti-B, and Anti-A,B antibodies could bind to the A, B, and A/B antigens on the S proteins, respectively, and block the interaction between S and ACE2 proteins.



COVID-19 @ ABO Blood group

SARS-CoV-2 Infectivity



CONCLUSION:

*People with blood group A have a significantly higher risk for acquiring COVID-19 compared with non-A blood groups.

*People with blood group O have a significantly lower risk for the infection compared with non-O blood groups.



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لإصغائكم

