

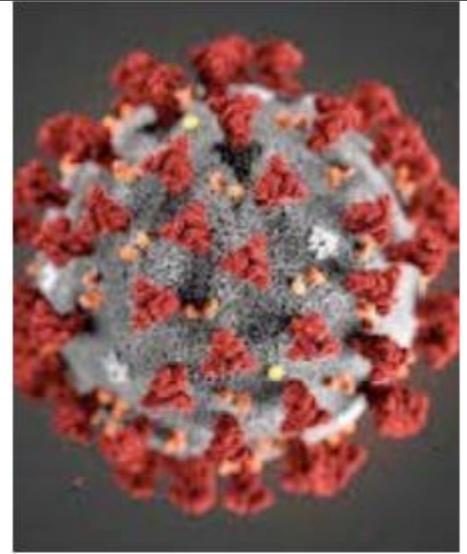
COVID 19

HISTORY, EPIDEMIOLOGY, VIROLOGY

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COVID 19 TRAINING OF TRAINER
Organized by: ORHB, Universities in Oromia, ORHB AC, OPA, IOHPA, EEHA,
EEA
25/4/20

Outline

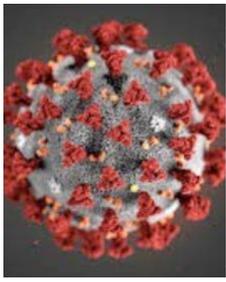
- HISTORY
- EPIDEMIOLOGY
- VIROLOGY





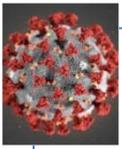
History of Pandemic in humankind

- 430 B.C : Peloponnesian war: Libya, Ethiopia and Egypt crossed the Athenians wall under the Spartans siege, 2/3 died, Athenians defeated by Spartans, ? Typhoid fever
- 165 A.D: Antoine Plaque; claimed Emperor Marcus Aurelius
- 1350: the Black Death: 1/3 of world population
- 1492; the Columbian Exchange
- 1665: the great Plaque of London
- 1817: First cholera pandemic
- 1855: the third plaque pandemic
- 1875: Fiji Measles pandemic
- 1889: Russian Flu
- 1918; Spanish Flu
- 1957: Asian Flu
- 1981: HIV/AIDS
- 2003: SARS
- 2012: MERS
- 2019; COVID-19

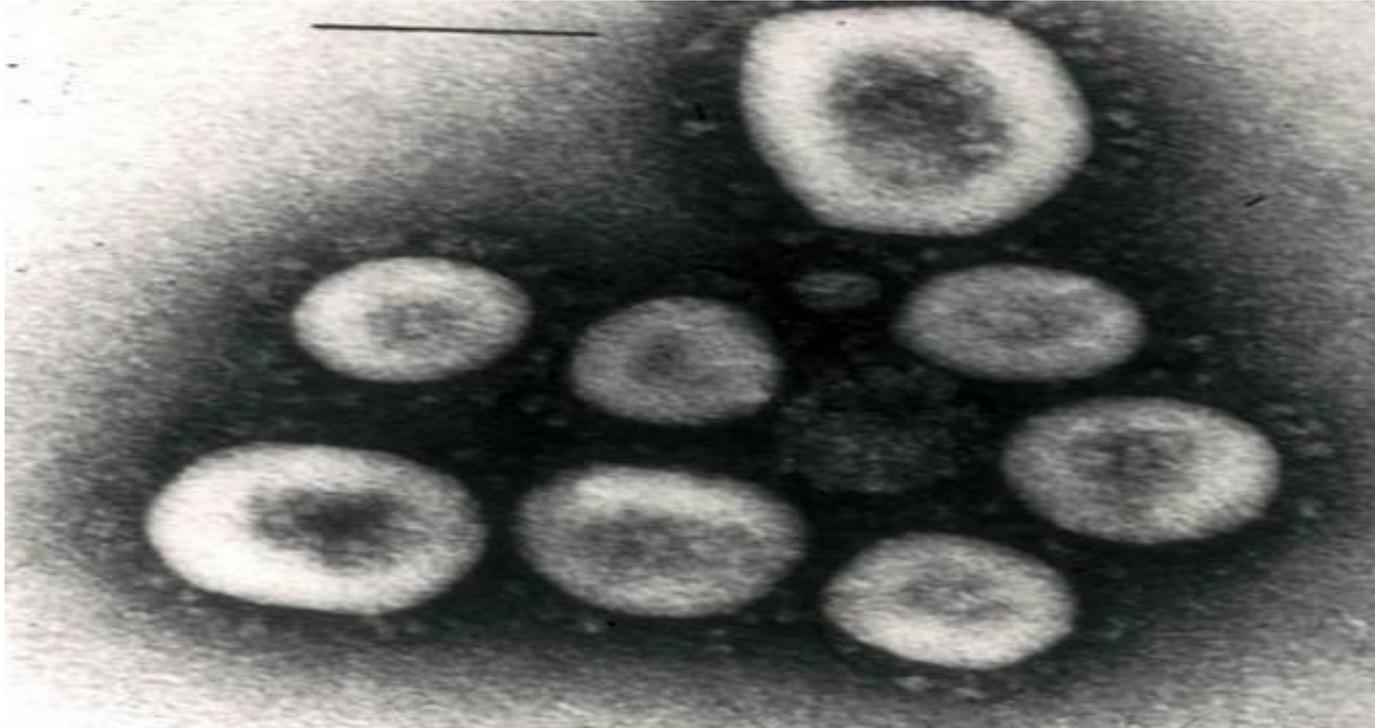


History of Corona Virus

- It was identified in animals
- Human coronaviruses, first characterized in the 1960s ⁽¹⁾
- Since 2003, at least 5 new human coronaviruses have been identified, including the SARS corona virus, which caused significant morbidity and mortality ⁽¹⁾
- MERS was another Corona virus epidemic that has caused significant mortality and morbidity in Middle east

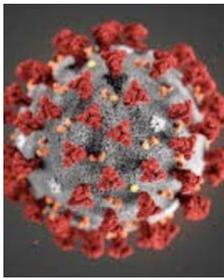


Coronavirus electron micrograph



Group of coronavirus particles, negatively stained with phosphotungstic acid (PTA). Some variation in size is seen, but shape is relatively uniform. Magnification 144,000x.

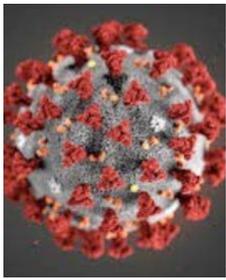
Reproduced with permission from: McIntosh, K, Dees, JH, Becker, WB, et al. Recovery in tracheal organ cultures of novel viruses from patients with respiratory disease. Proc Natl Acad Sci USA. 1967; 57(4):933. Copyright © 1967 Kenneth McIntosh, MD.



SARS

- During the 2002–2003 outbreak, SARS infection was reported in 29 countries in North America, South America, Europe and Asia.
- Overall 8098 infected individuals were identified, with 774 SARS-related fatalities
- Case fatality ratio 9.6%

1. Centers for Disease Control and Prevention. Available at <http://www.cdc.gov/ncidod/sars/index.htm>
2. WHO , Emergencies preparedness, response, SARS



MERS

- MERS: First reported in Saudi Arabia in 2012
- Since then spread to several Other countries including USA
- 2494 confirmed cases of MERS
- 858 MERS-Cov associated deaths since October 2012 (case fatality rate 34.4%)
- Majority from KSA (2102 Cases, 780 deaths with a case fatality rate of 37.1%)
- 27 countries reported MERS-Cov



World Map



NEW



U.S. Map



Critical Trends

Total Confirmed

2,719,522

Confirmed Cases by
Country/Region/Sovereignty

869,172 US

213,024 Spain

189,973 Italy

159,467 France

153,129 Germany

139,246 United Kingdom



Cumulative Confirmed Cases

Esri, FAO, NOAA

Total Deaths

191,228

25,549 deaths
Italy

22,157 deaths
Spain

21,856 deaths
France

18,738 deaths

Deaths

Recovered

Total Test Conducted in U.S.

4,684,300

695,920 tested
New York US

482,097 tested
California US

301,147 tested
Florida US

225,078 tested

US Tested



Confirmed

Logarithmic

Daily Cases

185

countries/regions

Lancet Inf Dis Article: [Here](#). Mobile Version: [Here](#).

Lead by JHU CSSE. Automation Support: [Esri Living Atlas team](#) and JHU

Last Updated at (MM/DD/YYYY)

4/24/2020, 12:31:37 PM

Confirmed
2.71M

Recovered
743K

Deaths
191K

Location	Confirmed	Recovered	Deaths
 United States	890K	82,843	50,372
 Spain	213K	89,250	22,157
 Italy	190K	57,776	25,549
 Germany	153K	95,817	5,575
 United Kingdom	138K	-	18,738
 France	121K	42,088	21,856
 Turkey	102K	18,491	2,491
 Iran	87,026	64,843	5,481
 China	84,302	77,257	4,642

COVID 19 AFRICA

Confirmed	HCW	Dead	Recovered
27397	491	1296	8179
confirmed covid-19 cases per country (52)			
SOUTH AFRICA	3953	EGYPT	3891
MOROCCO	3568	ALGERIA	3007
CAMEROON	1334	GHANA	1154
CIV	1004	DJIBOUTI	986
NIGERIA	981	TUNISIA	918
GUINEA	862	NIGER	671
BURKINA	616	SENEGAL	479
DRC	394	MAURITIUS	331
SOMALIA	328	KENYA	320
MALI	309	TANZANIA	284
CONGO	186	SUDAN	174
GABON	167	RWANDA	154
MADAGASCAR	121	ETHIOPIA	116
LIBERIA	101	TOGO	88
EQ. GUINEA	84	CAPE VERDE	82
ZAMBIA	76	UGANDA	74
SIERRA LEONE	64	LIBYA	60
BENIN	54	GUINEA-B.	52
MOZAMBIQUE	46	CHAD	40
ERITREA	39	ESWATINI	36
MALAWI	33	ZIMBABWE	29
ANGOLA	25	BOTSWANA	22
CAR	17	NAMIBIA	16
BURUNDI	12	SEYCHELLES	11
GAMBIA	10	MAURITANIA	7
SAO TOME	7	SOUTH SUDAN	4

Update: 24/04/2020 10:07





Cases

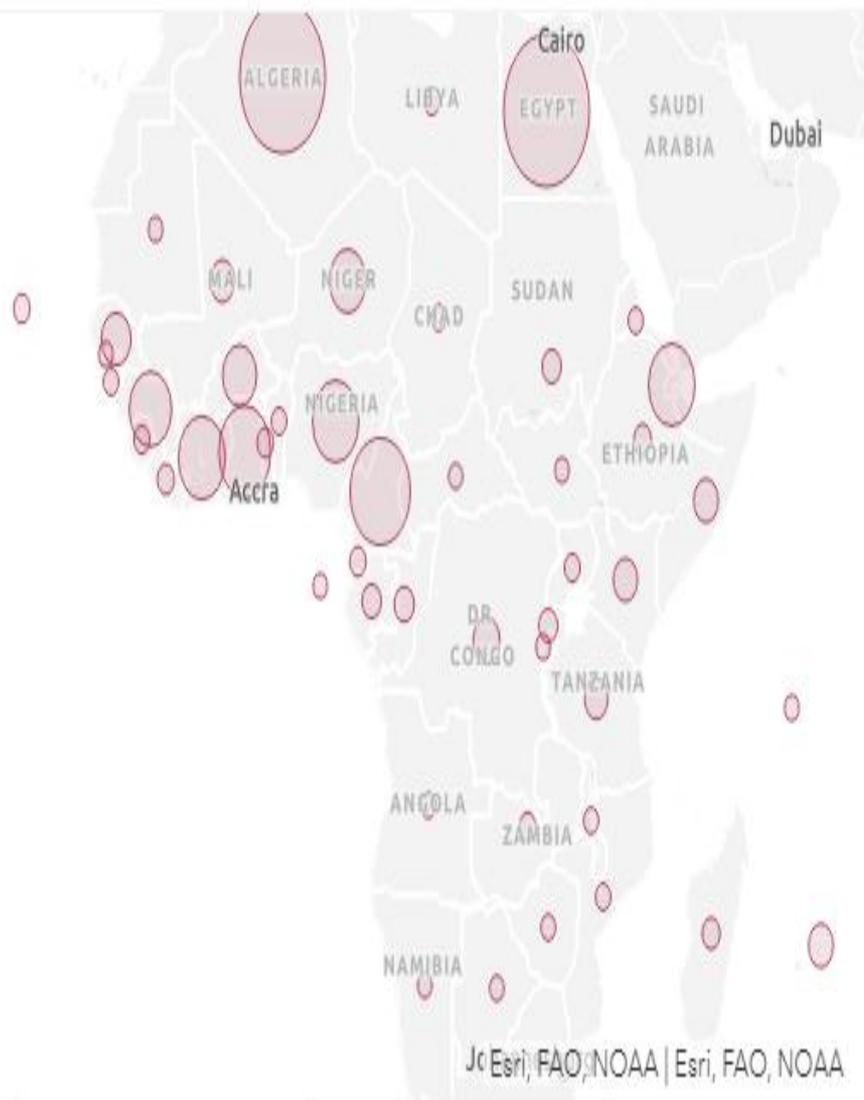
27,427

Deaths

1,298

Recoveries

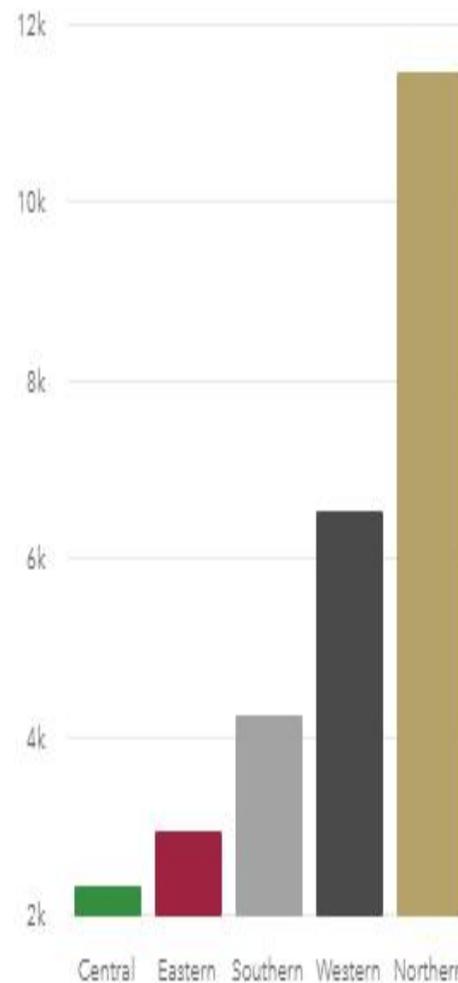
7,474



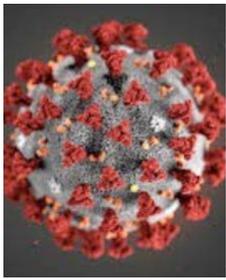
Map of Cumulative Cases

Map Legend

Citation



Cases by Region



COVID-19 Ethiopia



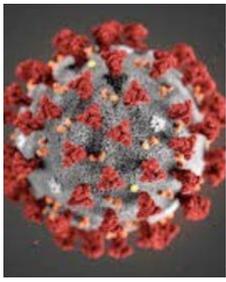
Ethiopia

- **Confirmed cases: 117**
- **Recovered: 25**
- **Death: 3**

World

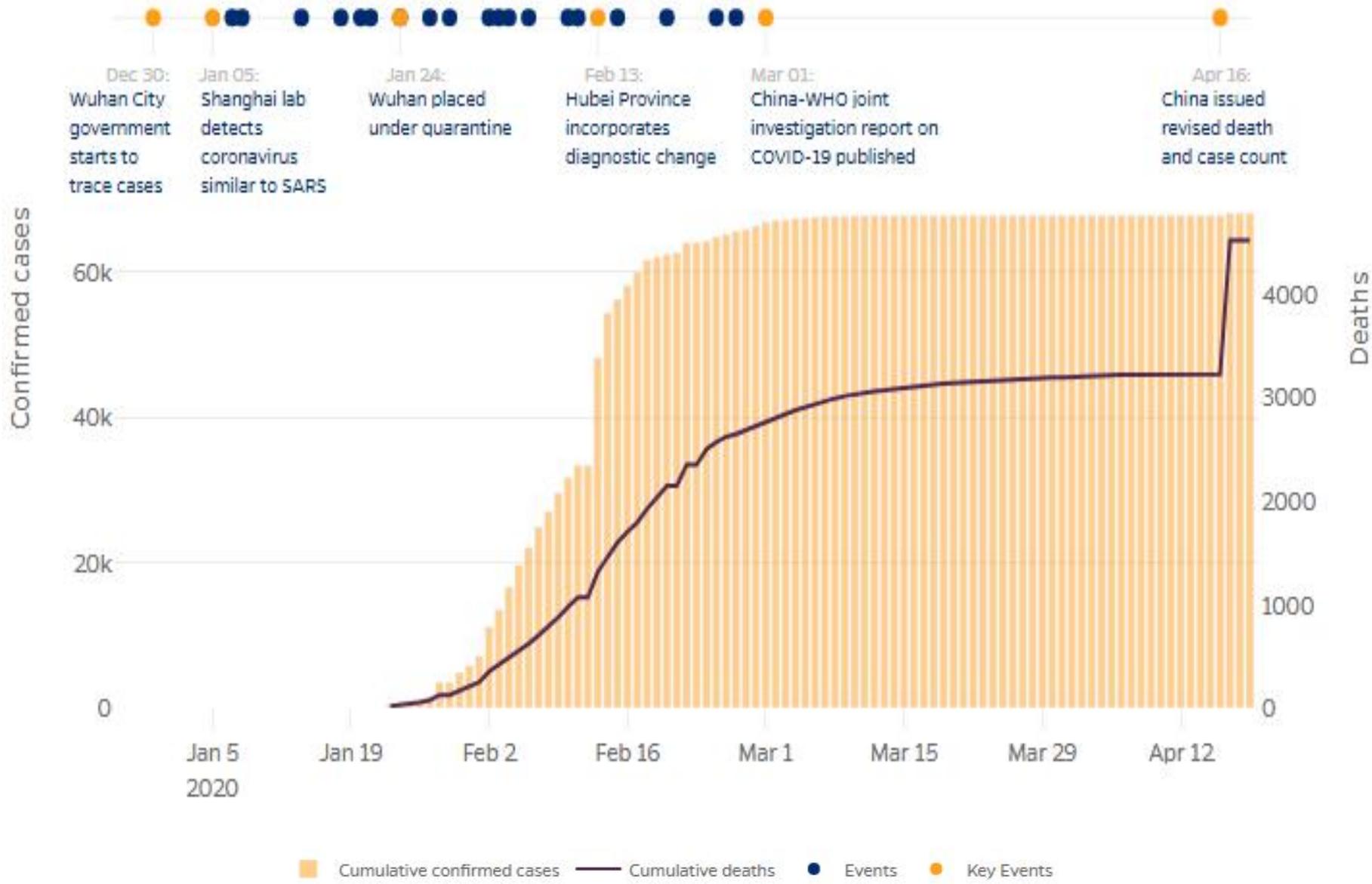


- **Confirmed: 2.71 M**
- **Recovered: 743 k**
- **Death: 191 k**



How It All Started

- In December 2019, an outbreak of COVID-19, caused by a novel coronavirus SARS-CoV-2, began in Wuhan, China
- The disease spread widely in China then to the rest of the world
- Severe cases of pneumonia, ARDS, and death reported
- Person-to-person transmission has been widely documented



Dec 30:
Wuhan City
government
starts to
trace cases

Jan 05:
Shanghai lab
detects
coronavirus
similar to SARS

Jan 24:
Wuhan placed
under quarantine

Feb 13:
Hubei Province
incorporates
diagnostic change

Mar 01:
China-WHO joint
investigation report on
COVID-19 published

Apr 16:
China issued
revised death
and case count

Confirmed cases

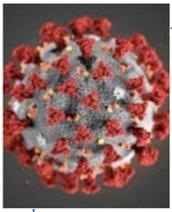
60k
40k
20k
0

Deaths

4000
3000
2000
1000
0

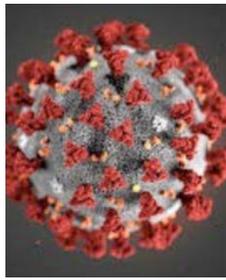
Jan 5 2020 Jan 19 Feb 2 Feb 16 Mar 1 Mar 15 Mar 29 Apr 12

Cumulative confirmed cases Cumulative deaths Events Key Events



Distribution of cases by severity

Symptoms	Percentage of patients	Death rate(%)
No symptoms	30	0
Mild/moderate	50	0
Severe symptoms	10	15
Critical symptoms	5	50

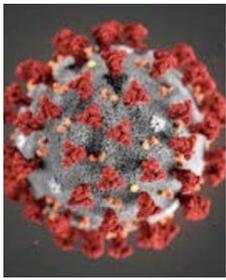


In critical care

- ICU: 5% of proven infections.
- critical care will be an integral component of the global response to this emerging infection
- Health systems can be challenged to provide adequate care: The rapid increase in the number of cases of COVID-19 in Wuhan
- Case-fatality : 7-fold higher in Hubei Province compared with those outside of the region, 2.9% vs 0.4%,
- emphasizing the importance of health system capacity

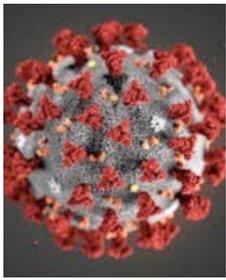
Who are at risk for severe Disease?

- **Older adults**
 - **Group at higher risk for severe illness**
 - **People with Asthma**
 - **People with HIV**
- **Group at Higher risk for severe illness**
 - Age >65
 - Nursing home or chronic care facility residents
 - Chronic lung diseases or moderate to severe asthma
 - Serious heart conditions
 - Conditions of immuno-compromized
 - Cancer, smoking, Bone marrow/ organ transplant, immunodeficiencies,, poorly controlled HIV/AIDS, Prolonged use of corticosteroids or other immune weakening drugs,
 - **Severe obesity BMI \geq 40**
 - **CKD and on dialysis**
 - **Liver diseases advanced**



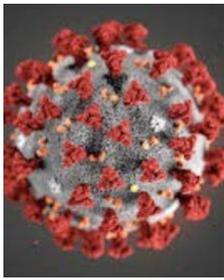
Virology of CORONA

- **VIRUS: SARS COV-2**
 - Part of corona virus 80% similarity with SARS-CoV 2002-2003
 - MERS 2012
- **DISEASE: COVID-19**



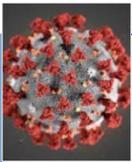
VIROLOGY ...CONT'D

- Class of Nidovirales order, replicate using mRNA
- Corona virus subfamily: alpha, beta, delta, gamma
- Human: alpha (Hcov-229E, HCoV-NL63)
Beta (HCoV-HKU1, HCoV-OC43,
MERS CoV, SARS-CoV)

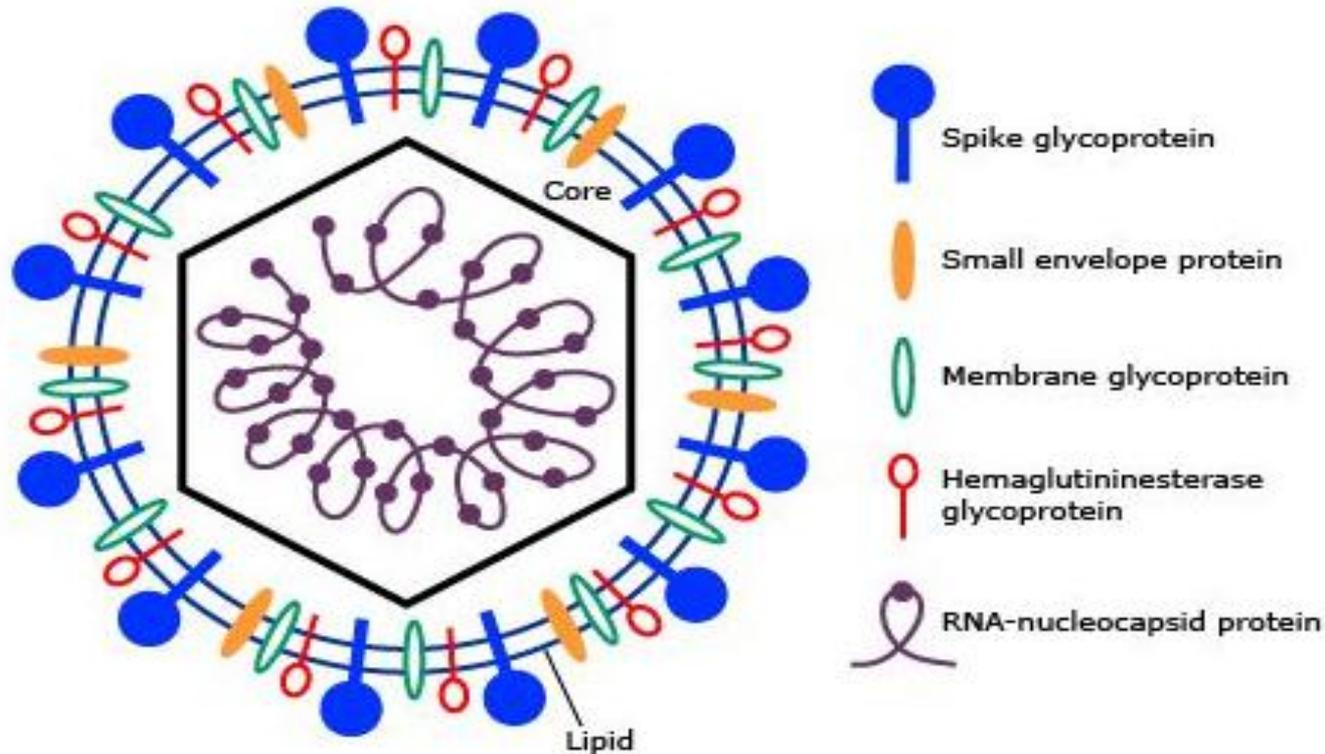


VIROLOGY...CONT'D

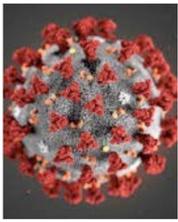
- RNA sequences resemble SARS-CoV(79%) and MERS-CoV(50%)
- SARS-CoV-2 had a similar receptor-binding domain structure to that of SARS-CoV, and can bind ACE-2 receptors in the lower respiratory tract of humans
- Epidemiologic information implicates a bat-origin virus infecting unidentified animal species sold in China's live animal market.
- This allowed direct access to crowds of humans, increasing opportunities for host switching
- Such live markets have also led to avian epizoonotics with fatal human spillover cases caused by Influenza H5N1 and H7N9
- In 2002-2003, bat-coronavirus-derived SARS infected palm civets and racoon dogs which in turn caused 8098 human infections and 774 deaths in 37 countries, costing the global economy \$30-\$100 billion
- In 2012, bat-coronavirus MERS-CoV infected dromedary camels and was responsible for 2494 lab- confirmed infections with 858 fatalities (the majority in Saudi Arabia) [case fatality rate of 36%], including 38 deaths following a single introduction into South Korea



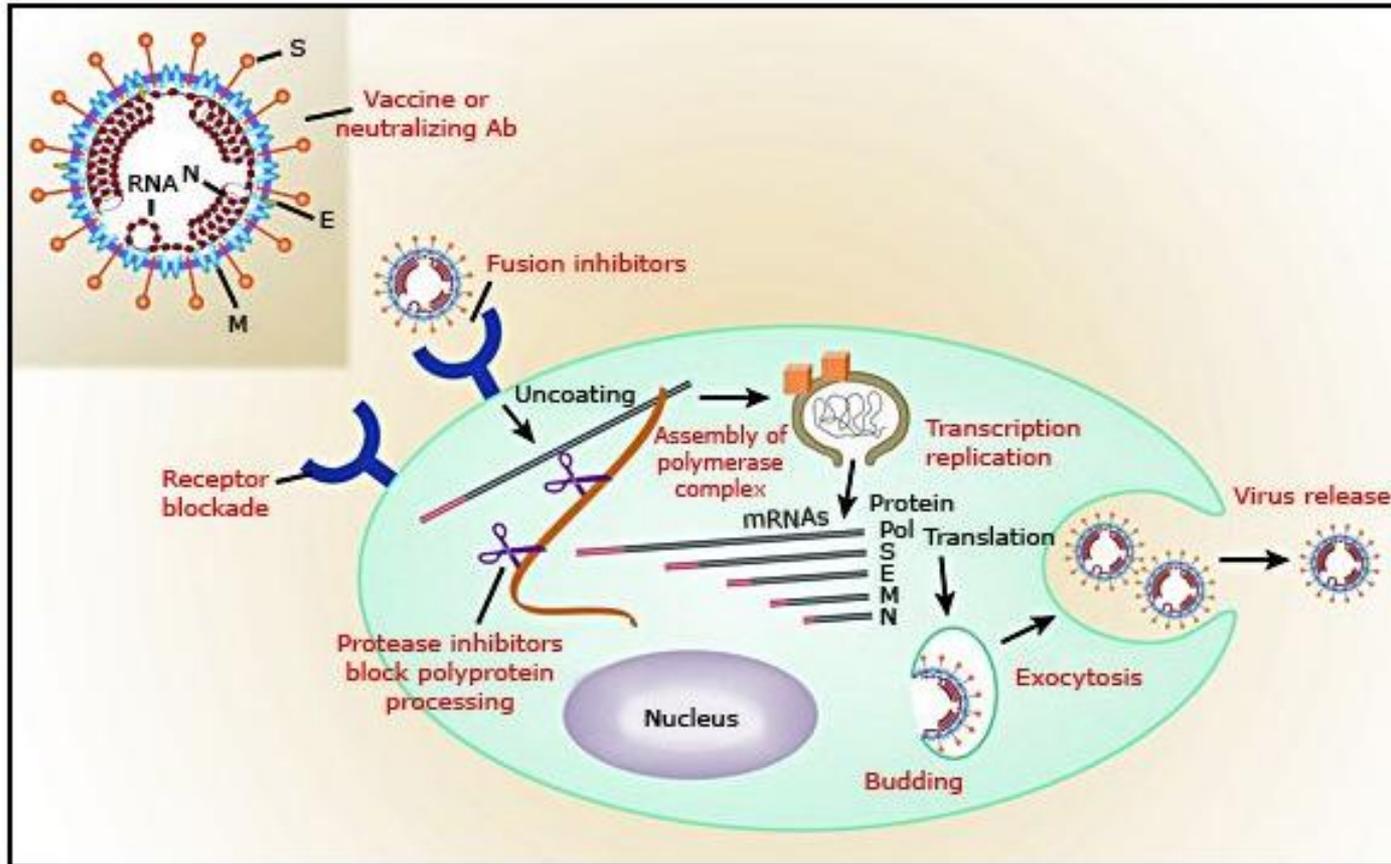
Model of coronavirus structure: A schematic diagram of virion structure



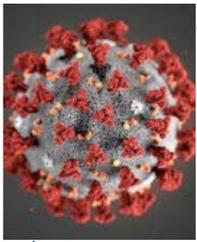
Reproduced with permission from: *Field's Virology*, 5th edition, Knipe DM, Howley PM, Griffin DE (Eds), Lippincott Williams & Wilkins, Philadelphia, 2007. Copyright © 2007 Lippincott Williams & Wilkins. Source: Uptodate



Coronavirus replication

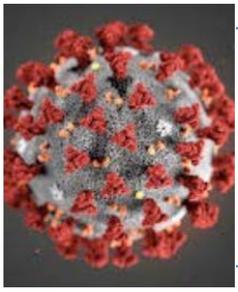


M: membrane protein required for virus budding; S: viral spike glycoprotein that has receptor binding and membrane fusion activities; E: small membrane protein that plays a role in coronavirus assembly; N: nucleocapsid phosphoprotein associated with viral RNA inside the virion.



Where does it come from?

- Bat Corona RaTG-13 : 96.2% genetic similarity , potentially it may come from bat to humans
- May have an intermediate host to get ability to infect, swabbing some genetic material leading to new virus formation. Homologous recombination.
- ??may be from lab



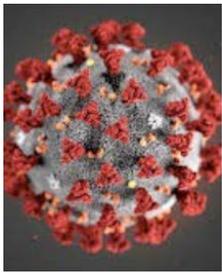
SARS-CoV-2 Types

S-type

- 30% infection
- Less severe smx
- Less aggressive
- Zoonotic connection

L-type

- 70 % infections
- Increased severity
- More aggressive
- Evolved from the s-type



Virus dynamics

- R_0 : Reproductive Ratio, ability to infect: 2-4 $R_0 = 3$
- SI = Series Interval, time to infect others = 4 days
 - In 12 days it can infect 40 individuals from one index case
 - $R_0 > 1$ there is exponential rise in the total number of cases.
- Route of Transmission:
 - Respiratory droplets
 - Aerosolized pressure procedures
 - ?? Airborne

Thank you