COVID-19 and Secondary Infection

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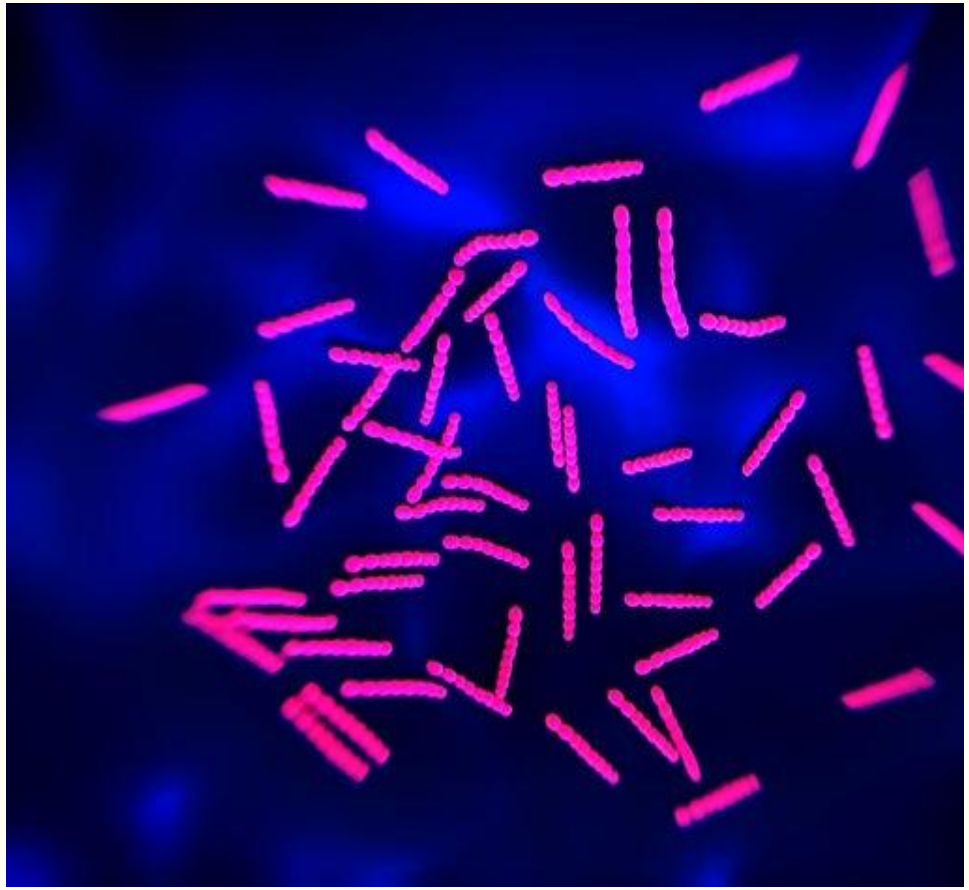
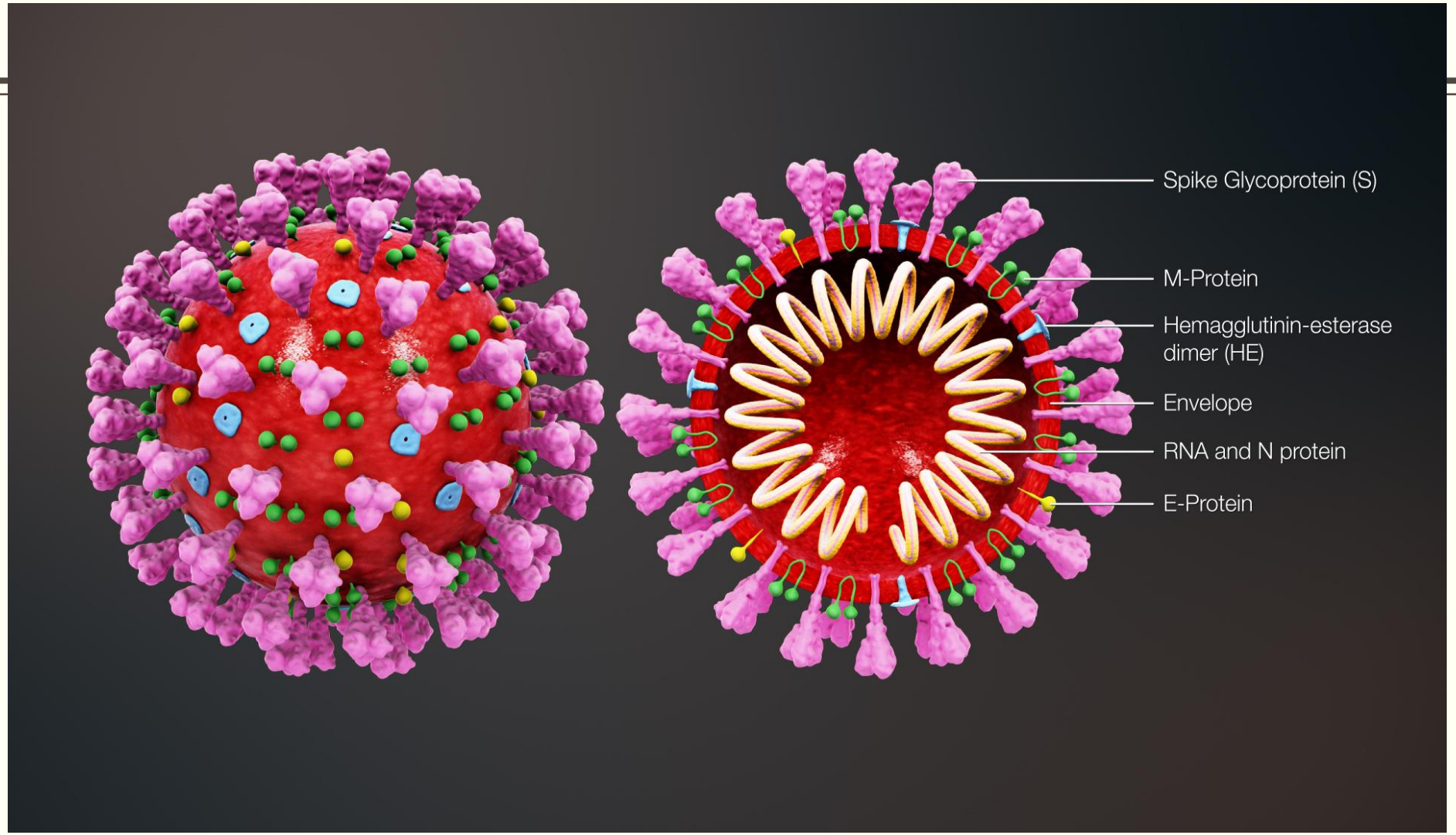
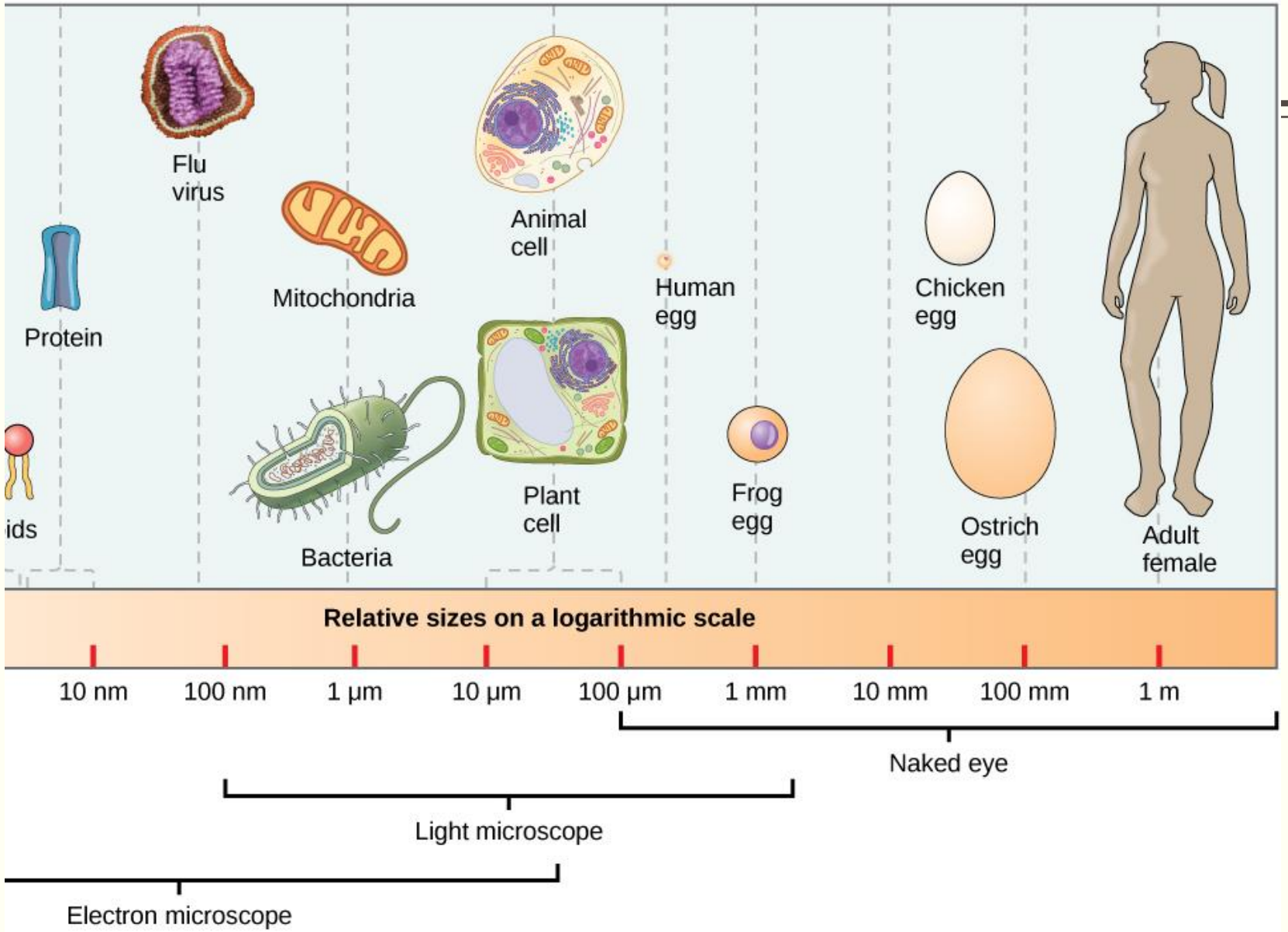


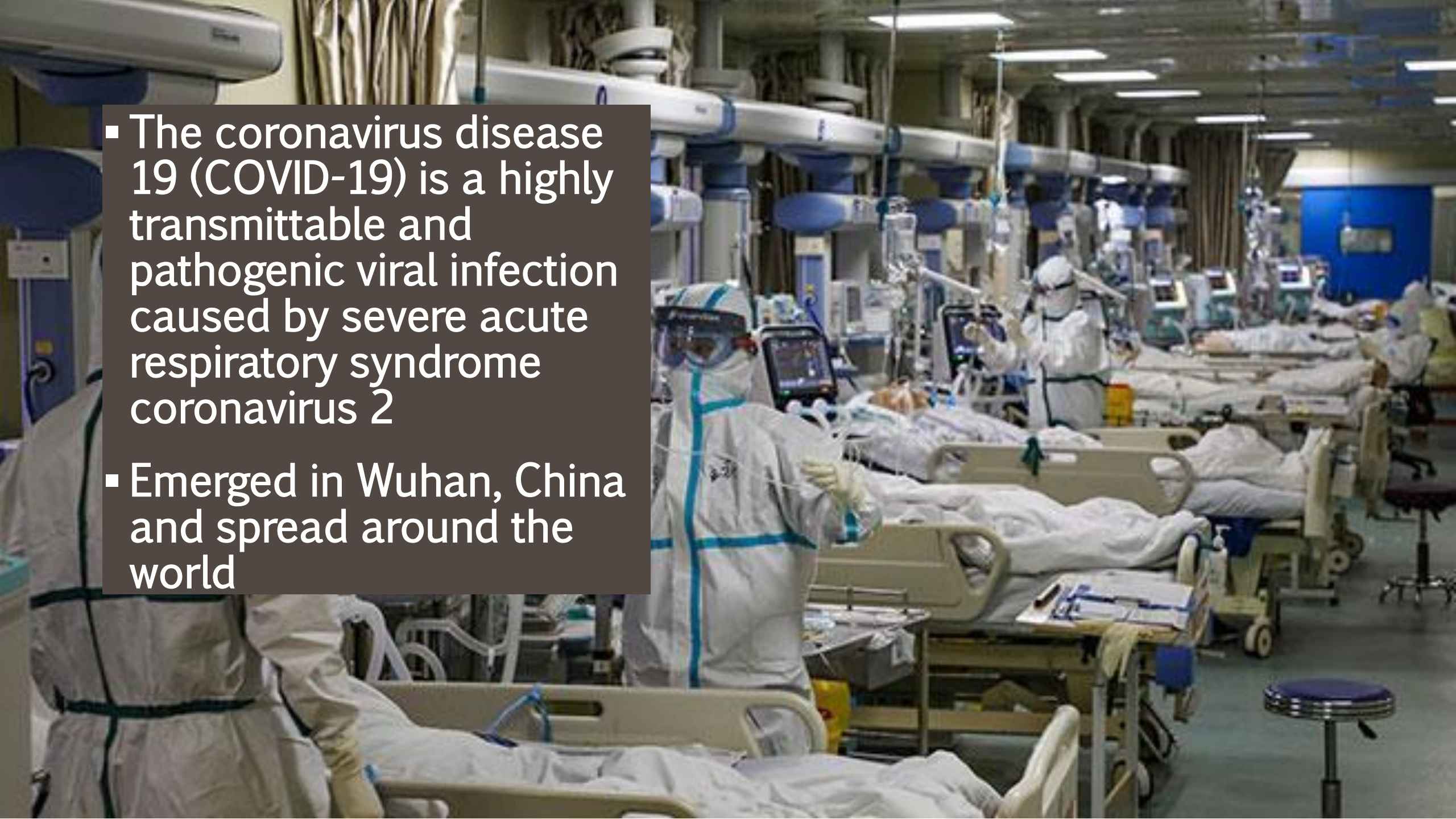


https://id.wikipedia.org/wiki/Berkas:3D_medical_animation_coronavirus_structure.jpg



https://opentextbc.ca/biology/chapter/3-2-comparing-prokaryotic-and-eukaryotic-cells/

Size comparison



- The coronavirus disease 19 (COVID-19) is a highly transmittable and pathogenic viral infection caused by severe acute respiratory syndrome coronavirus 2
- Emerged in Wuhan, China and spread around the world

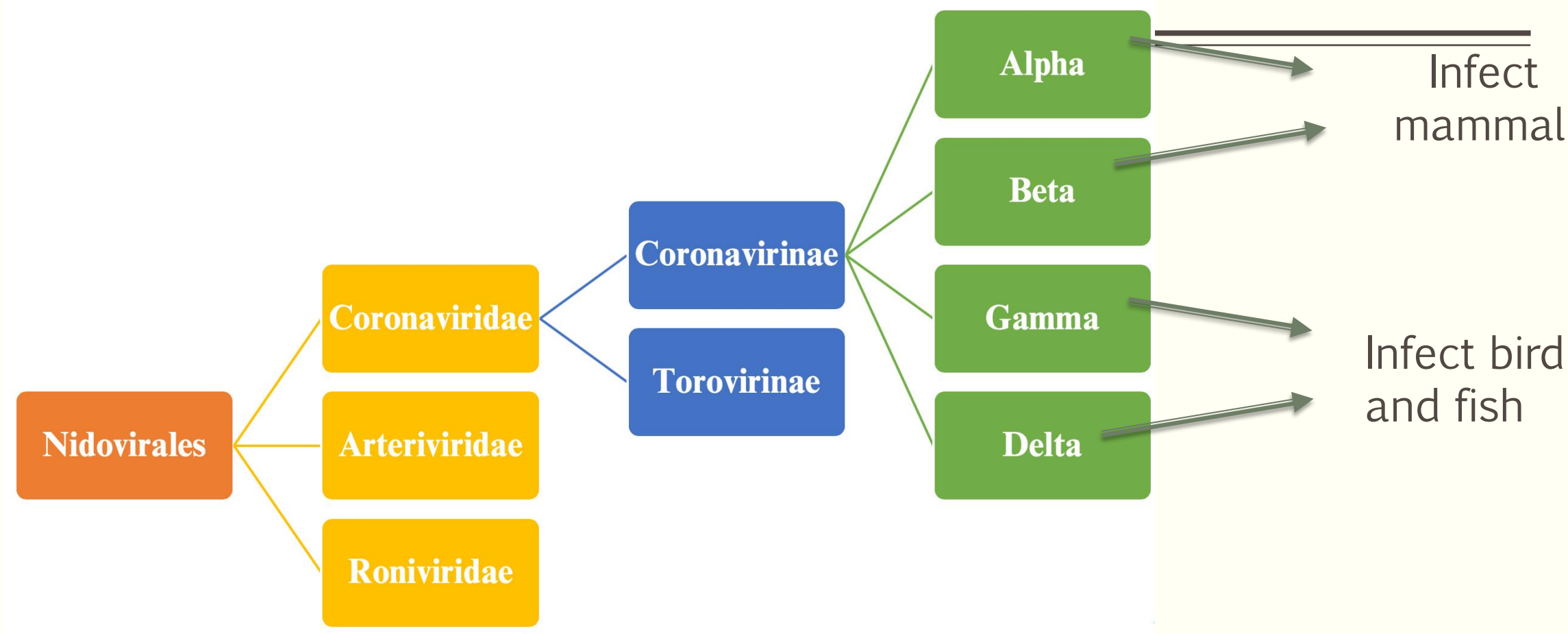

Nidovirales
Coronaviridae
Arteriviridae
Roniviridae
Coronavirinae
Torovirinae
Alpha
Beta
Gamma
Delta
Infect mammal
Infect bird and fish

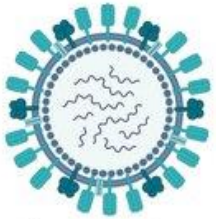
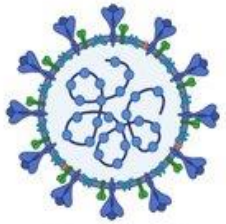
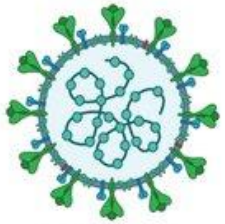
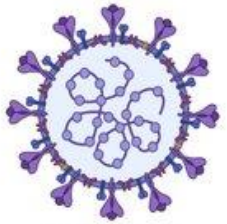
Table 1: Comparison between SARS, MERS, COVID-19

	SARS	MERS CoV	COVID-19
Year	2002-2003	2012-2013	2019-2020
Country of origin	China	Middle East	Wuhan, China
Animal Host	Himalayan palm civets and raccoon dog	Dromedary camels	Bat; Intermediate host ??
Receptor	ACE 2	DPP4	ACE 2
Incubation Period	2 – 10 days	2 – 14 days	2-7 days
Mortality	10%	35 %	2-3%

ACE: Angiotensin converting enzyme, DDP4: Dipeptidyl peptidase-4

https://japi.org/march_2020/23.html

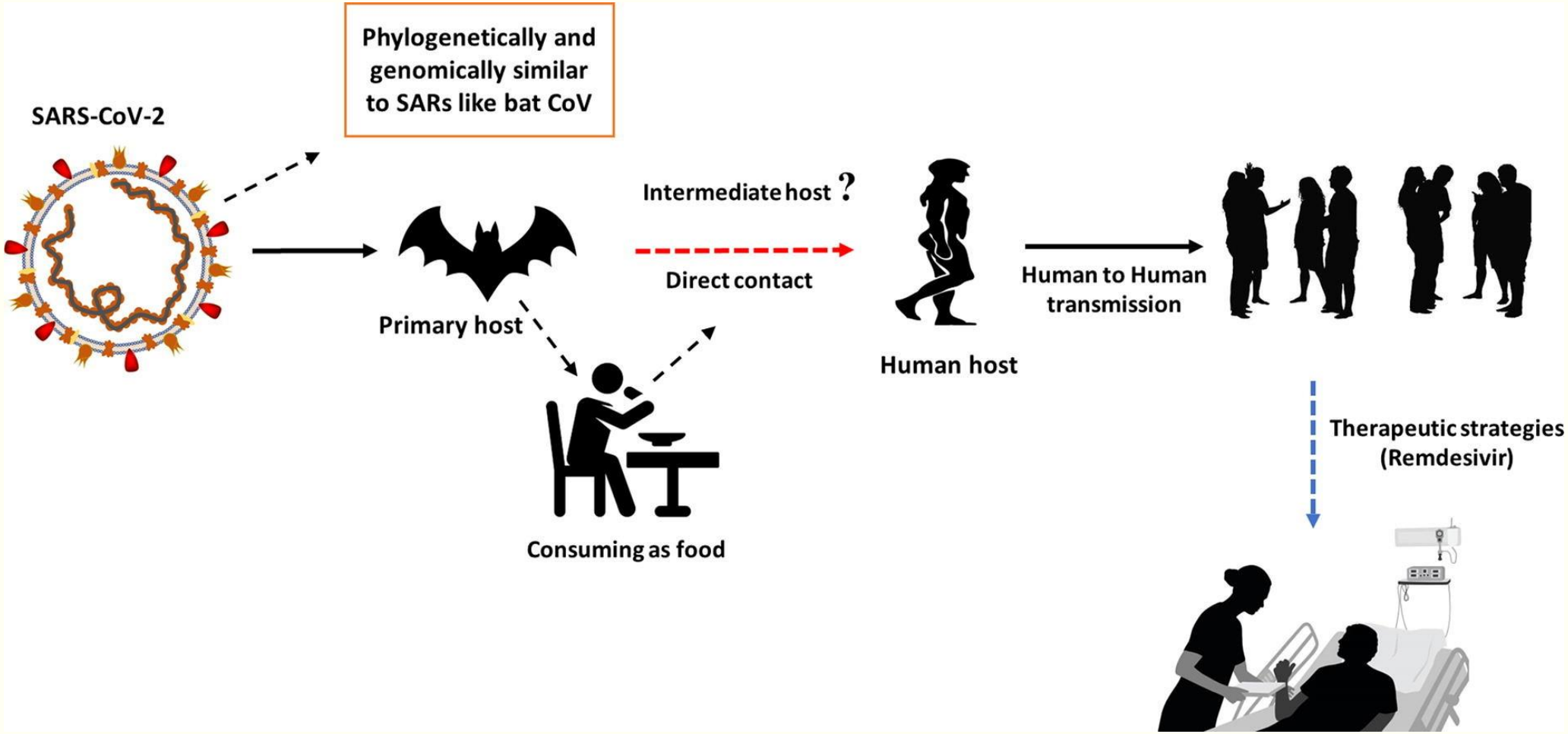
Epidemiological Comparison of Respiratory Viral Infections

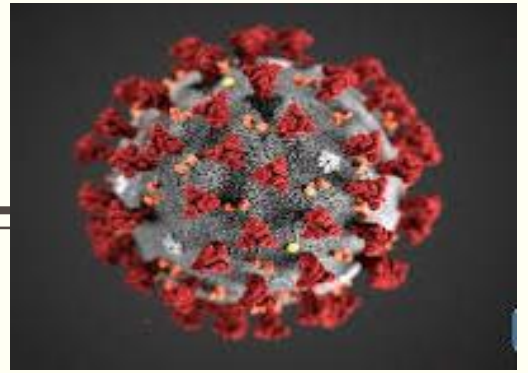
Disease	Flu	COVID-19	SARS	MERS
Disease Causing Pathogen	 Influenza virus	 SARS-CoV-2	 SARS-CoV	 MERS-CoV
R_0 Basic Reproductive Number	**1.3**	**2.0 - 2.5** *	**3**	**0.3 - 0.8**
CFR Case Fatality Rate	0.05 - 0.1%	~3.4% *	9.6 - 11%	34.4%
Incubation Time	1 - 4 days	4 - 14 days *	2 - 7 days	6 days
Hospitalization Rate	2%	~19% *	Most cases	Most cases
Community Attack Rate	10 - 20%	30 - 40% *	10 - 60%	4 - 13%
Annual Infected (global)	~ 1 billion	N/A (ongoing)	8098 (in 2003)	420
Annual Infected (US)	10 - 45 million	N/A (ongoing)	8 (in 2003)	2 (in 2014)
Annual Deaths (US)	10,000 - 61,000	N/A (ongoing)	None (since 2003)	None (since 2014)

* COVID-19 data as of March 2020.

https://www.mytwintiers.com/news-cat/regional-news/comparing-coronavirus-to-the-flu-and-other-respiratory-illnesses/

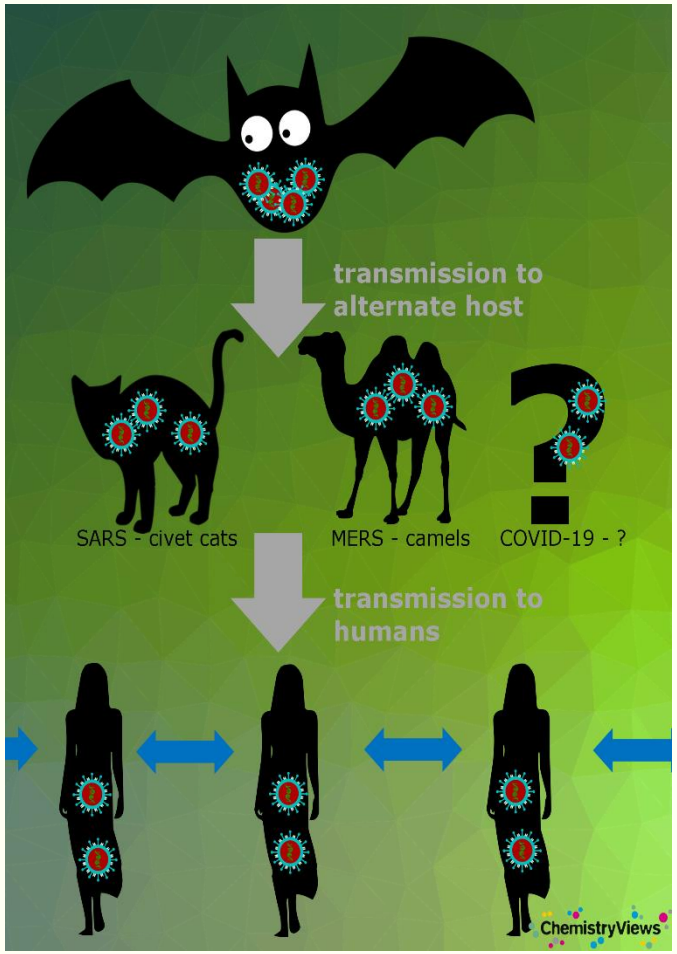
Transmission





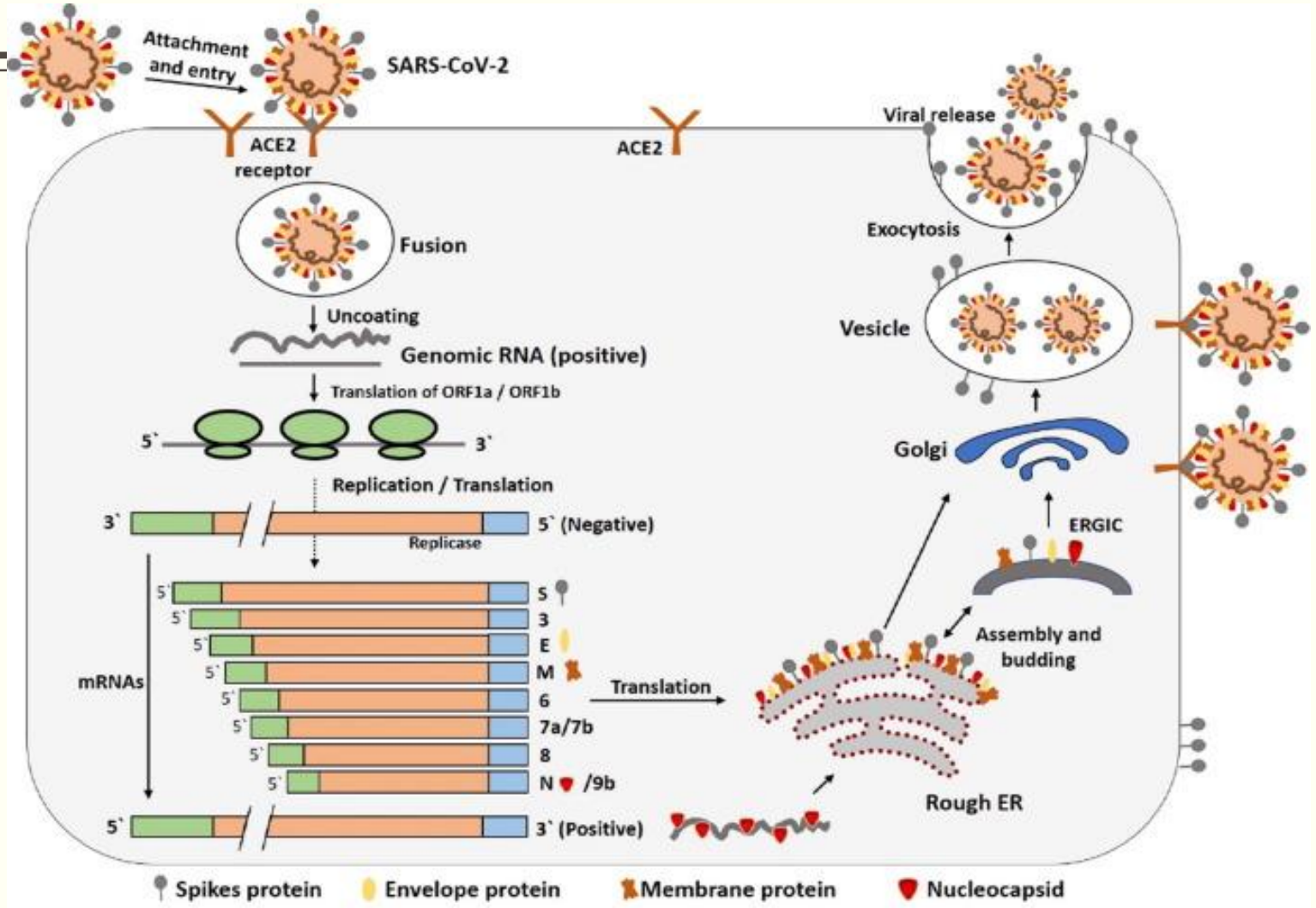
- 2019-nCoV revealed that homologous recombination may occurred between Clade A strains (bat-coronaviruses) and the origin-unknown isolates, located within the spike glycoprotein that recognizes cell surface receptor
- 2019-nCoV has most similar genetic information with bat coronovirus and has most similar codon usage bias with snake.

- The recombination of SARS in the spike glycoprotein genes might have mediated the initial cross-species transmission event from bats to other mammals



https://www.chemistryviews.org/details/ezine/11225161/Coronavirus_Entering_and_Replicating_in_a_Host_Cell.html

Life cycle of coronavirus



https://www.sciencedirect.com/science/article/pii/S2090123220300540

Covid-19 : what happen inside the body?

Phase1: Cell invasion and viral replication in the nose

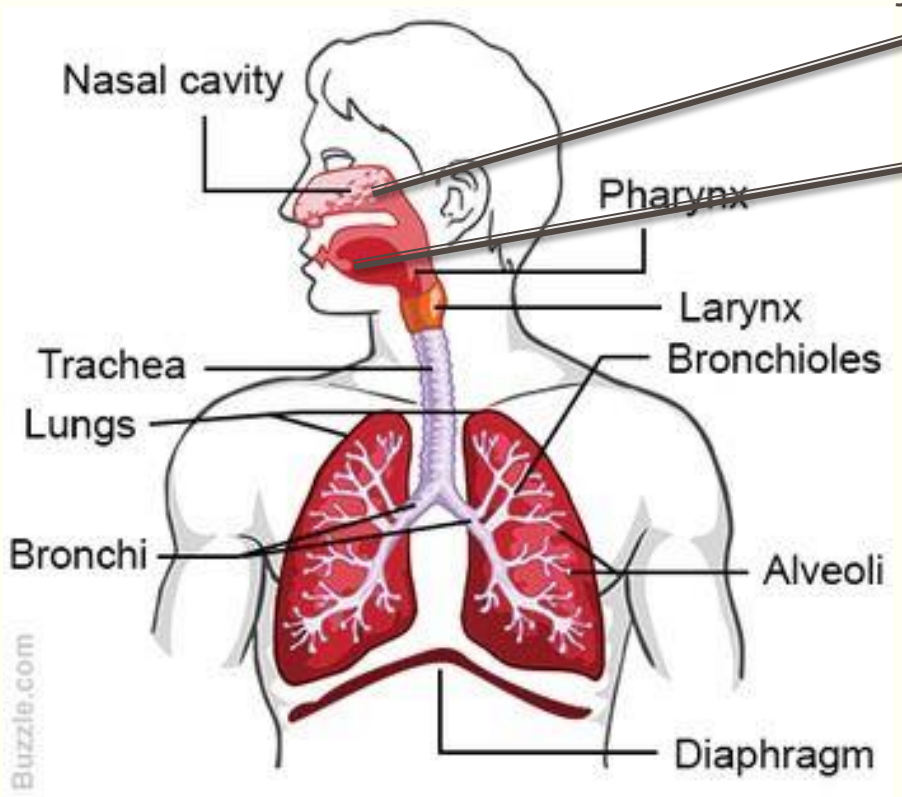
Phase 2: Replication in the lung and immune system alter

Phase 3: Pneumoniae

Phase 4: Acute respiratory distress syndrome, cytokine storm and multiple organ failure

Phase 1
Presymptomatic

ACE2 receptors and the protease TMPRSS2



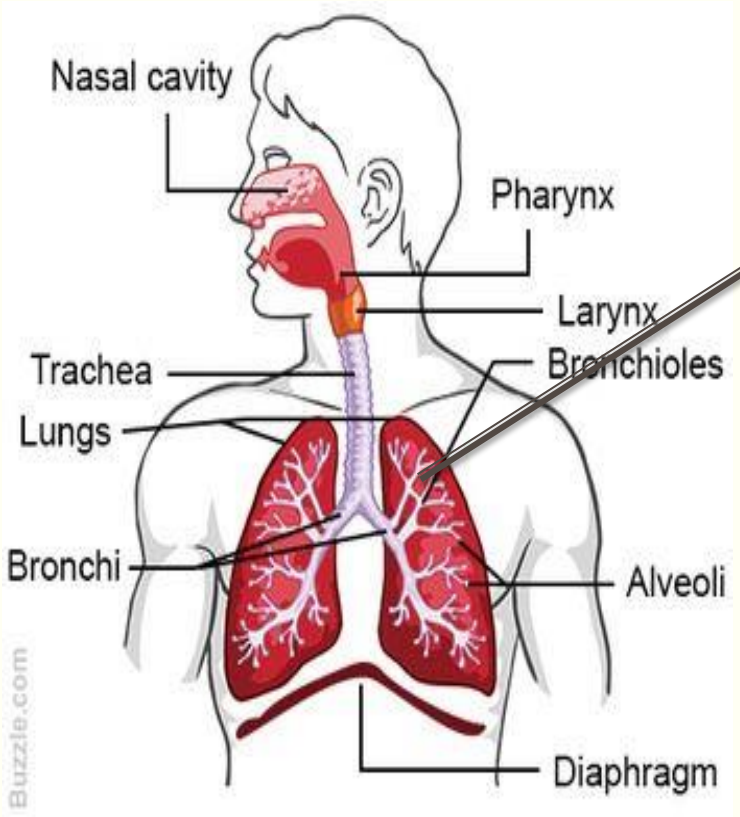
Controlling blood pressure and electrolyte

Nasal goblet (Hoffman et al., 2020)

Mouth and tounge (Xu et al.,2020)

Phase 2

In the lung, the ACE2 receptor sits on top of lung cells called pneumocytes



In the German viral study, 50% of the participants had IgM or IgG antibodies by day 7,

They all had these antibodies by day 14. The amount of antibodies did not predict the clinical course of the disease.

Covid-19 : what happen inside the body?

Phase1: Cell invasion and viral replication in the nose

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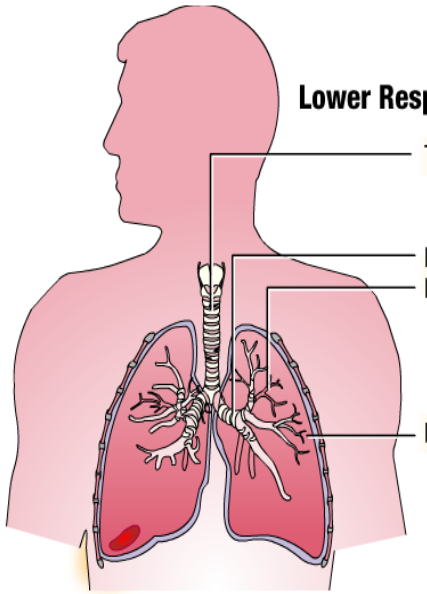
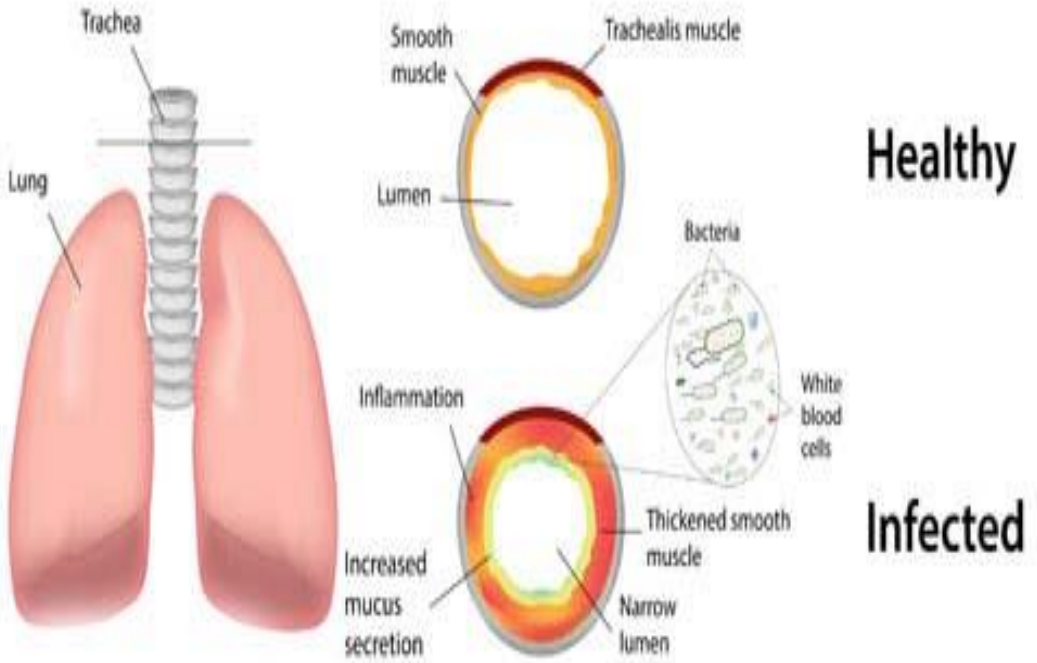
Phase 4: Acute respiratory distress syndrome, cytokine storm and multiple organ failure



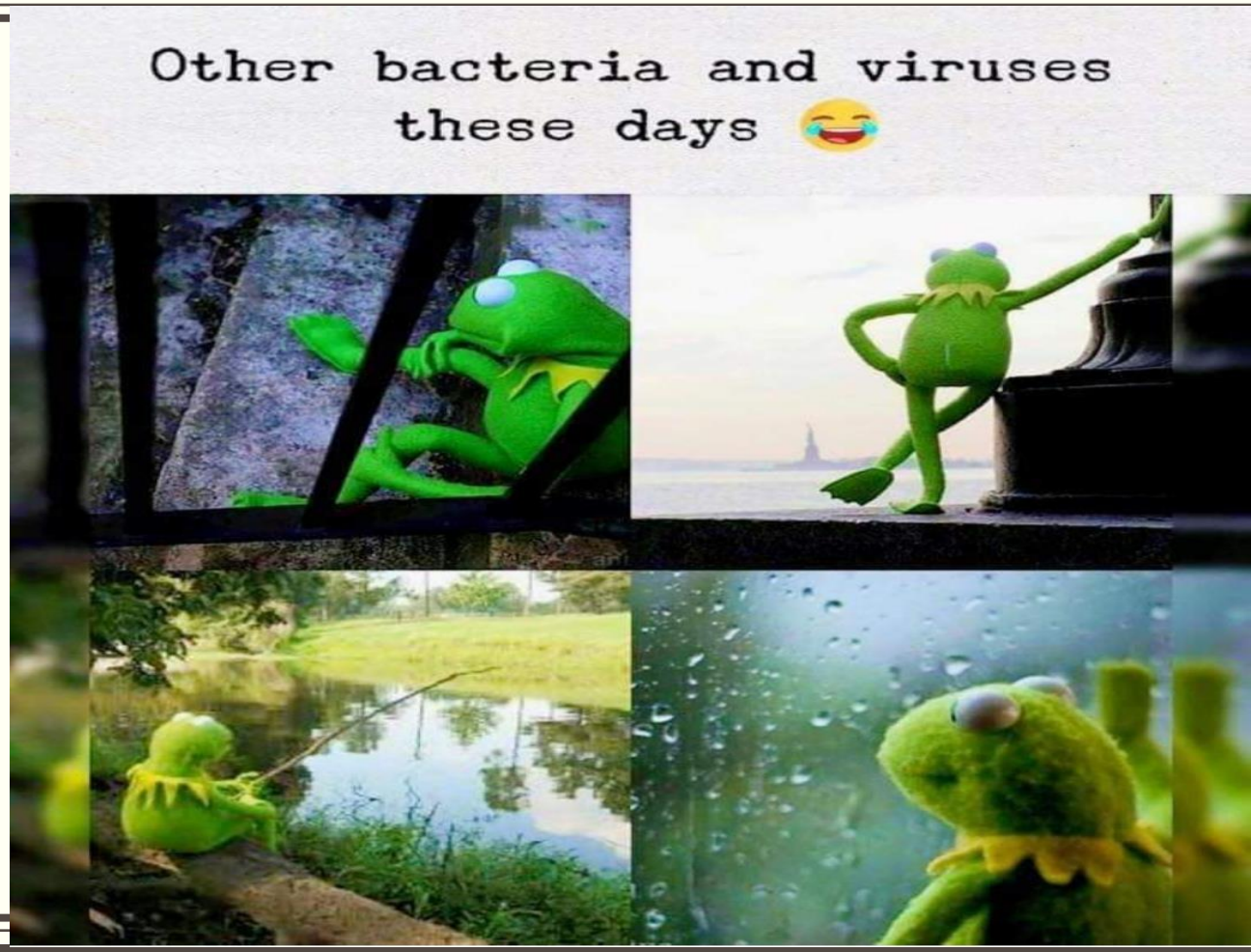
Lower Respiratory Tract Infections

		Examples
Trachea:	**Tracheitis**	*S. aureus*
Bronchus: Bronchioles:	**Bronchitis**	*M. pneumoniae* *M. catarrhalis* *S. pneumoniae* *H. influenzae*
Lung:	**Pneumonia**	*S. pneumoniae* *H. influenzae* *K. pneumoniae* *M. pneumoniae* *P. aeruginosa* *S. aureus*
Lung:	Abscesses	Anaerobic bacteria: • *Bacteroides* • *Fusobacterium*

Respiratory Tract Infection



SECONDARY INFECTION ???



MANY HOSPITALIZED VICTIMS ARE DEVELOPING POTENTIALLY LETHAL SECONDARY COINFECTIONS SUCH AS BACTERIAL PNEUMONIA AND SEPSIS

COVID-19 Patients Need to Be Tested for Bacteria and Fungi, Not Just the Coronavirus

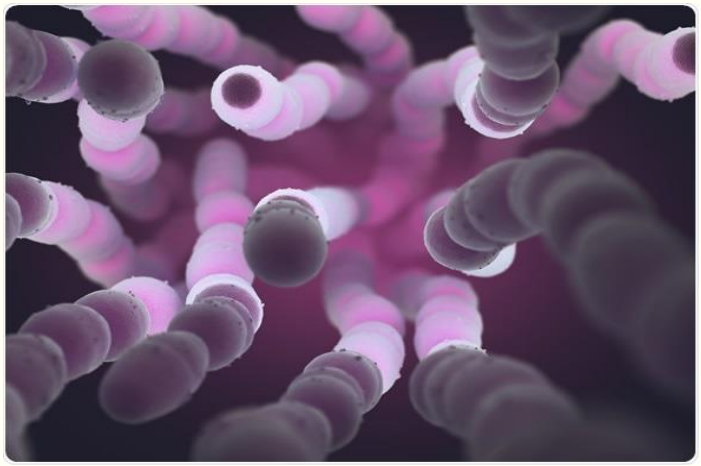
Respiratory viral infections predispose patients to co-infections and these lead to increased disease severity and mortality.

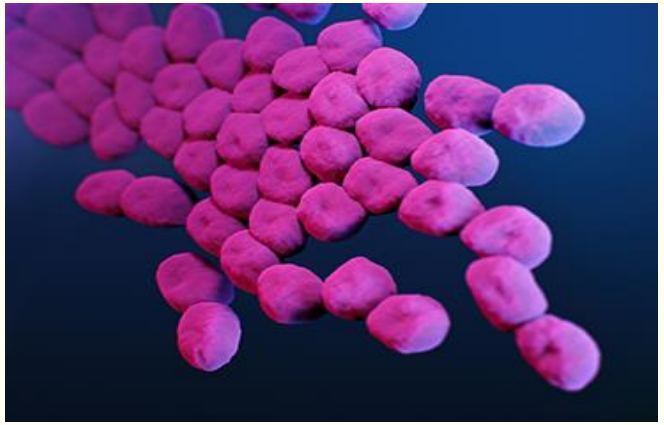
Most fatalities in the 1918 influenza outbreak were due to subsequent bacterial infection (Morens et al, 2008), including SARS and MERS.

Data regarding superinfections/coinfections in COVID-19 pneumonia are limited and still emerging

Diagnosing co-infections is complex. The organism itself might be carried by the patient before the viral infection, might be part of an underlying chronic infection, or might be picked up nosocomially

BACTERIAL CO-INFECTION





Mycoplasma pneumoniae (23%)
Legionella pneumophila (20%)
(Xing et al., 2020).
Acinetobacter baumannii
Klebsiella pneumoniae and
Streptococcus pneumoniae

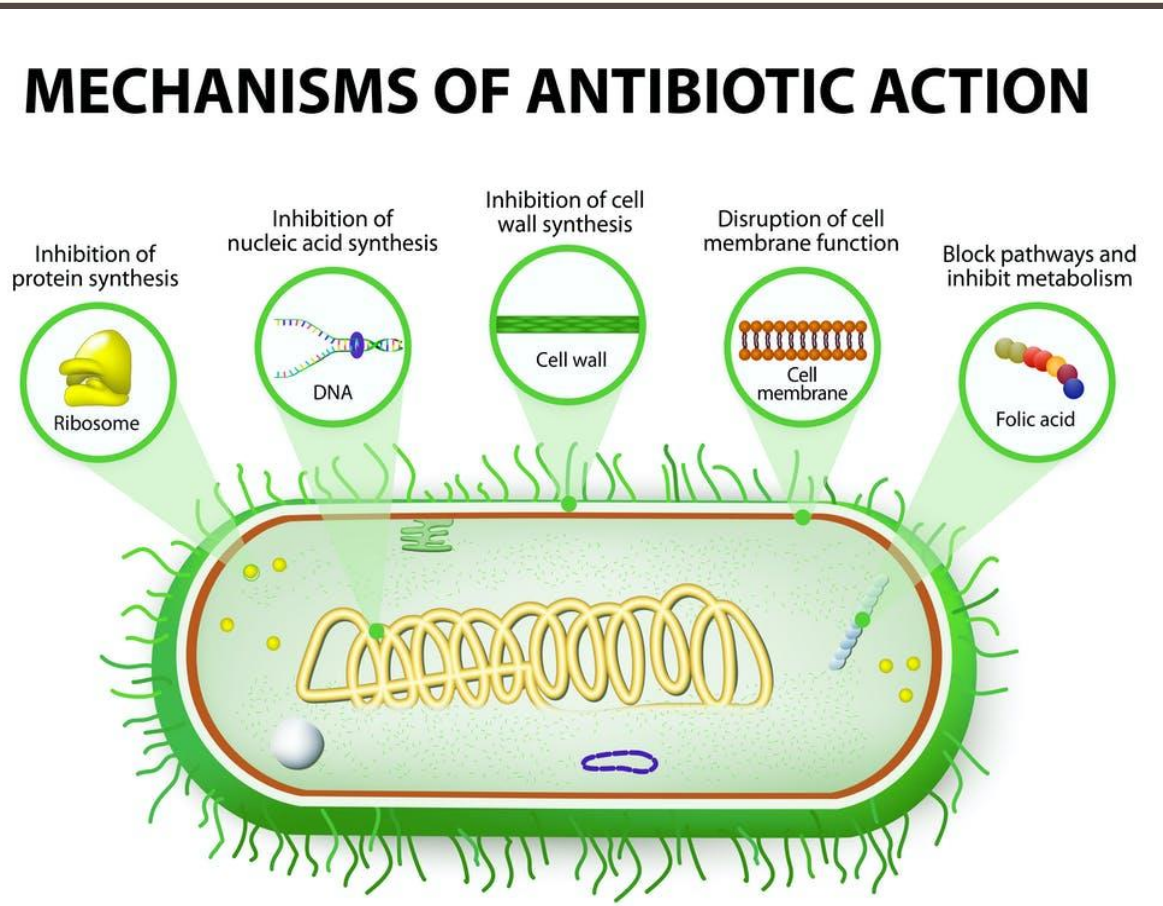
https://www.rheumatologyadvisor.com/home/rheumatoid-arthritis-advisor/mycoplasma-pneumonia-increases-risk-for-rheumatoid-arthritis/

https://thenativeantigencompany.com/products/legiotag-legionella-pneumophila-specific-label/

https://www.cdc.gov/hai/organisms/acinetobacter.html

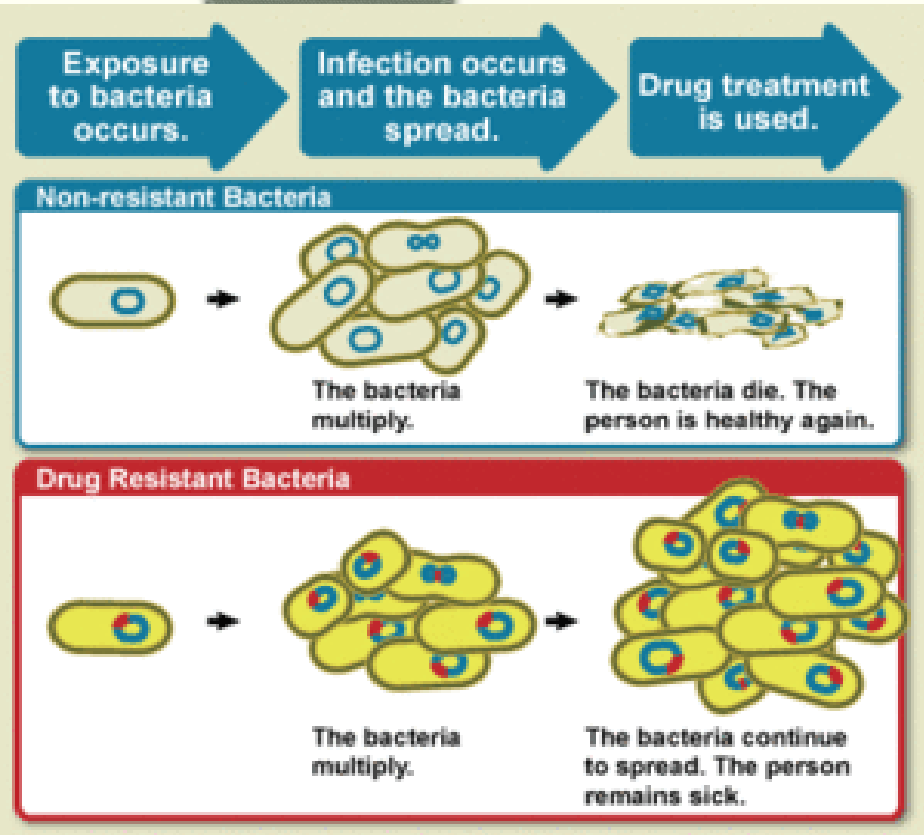
- Antibiotics do not treat viruses such as COVID-19, but they are absolutely essential for treating bacterial infections.

- Patients with COVID-19, are very susceptible to secondary bacterial infections which can only be treated with antibiotics.

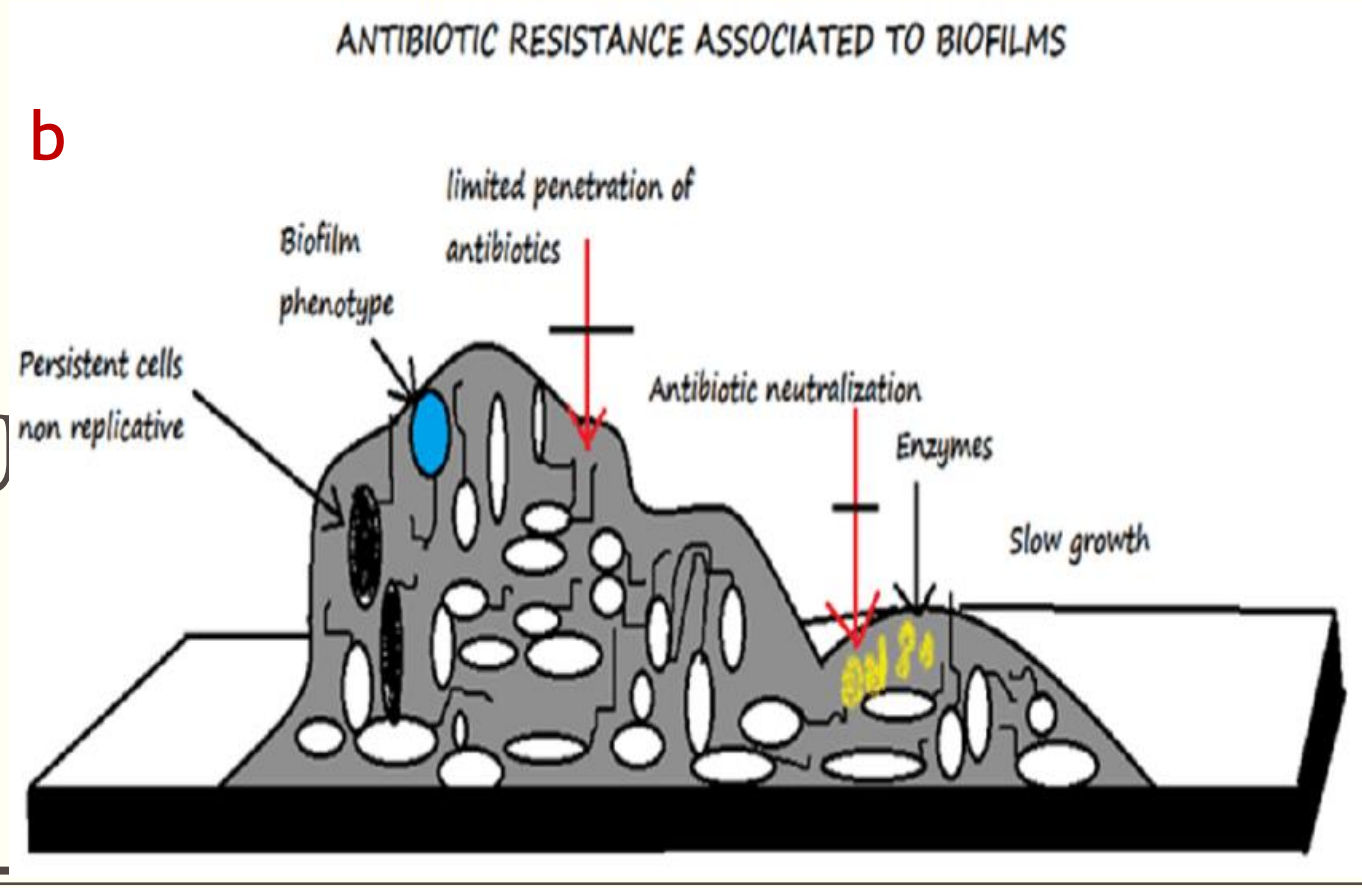


ANTIBIOTIC RESISTANCE

a



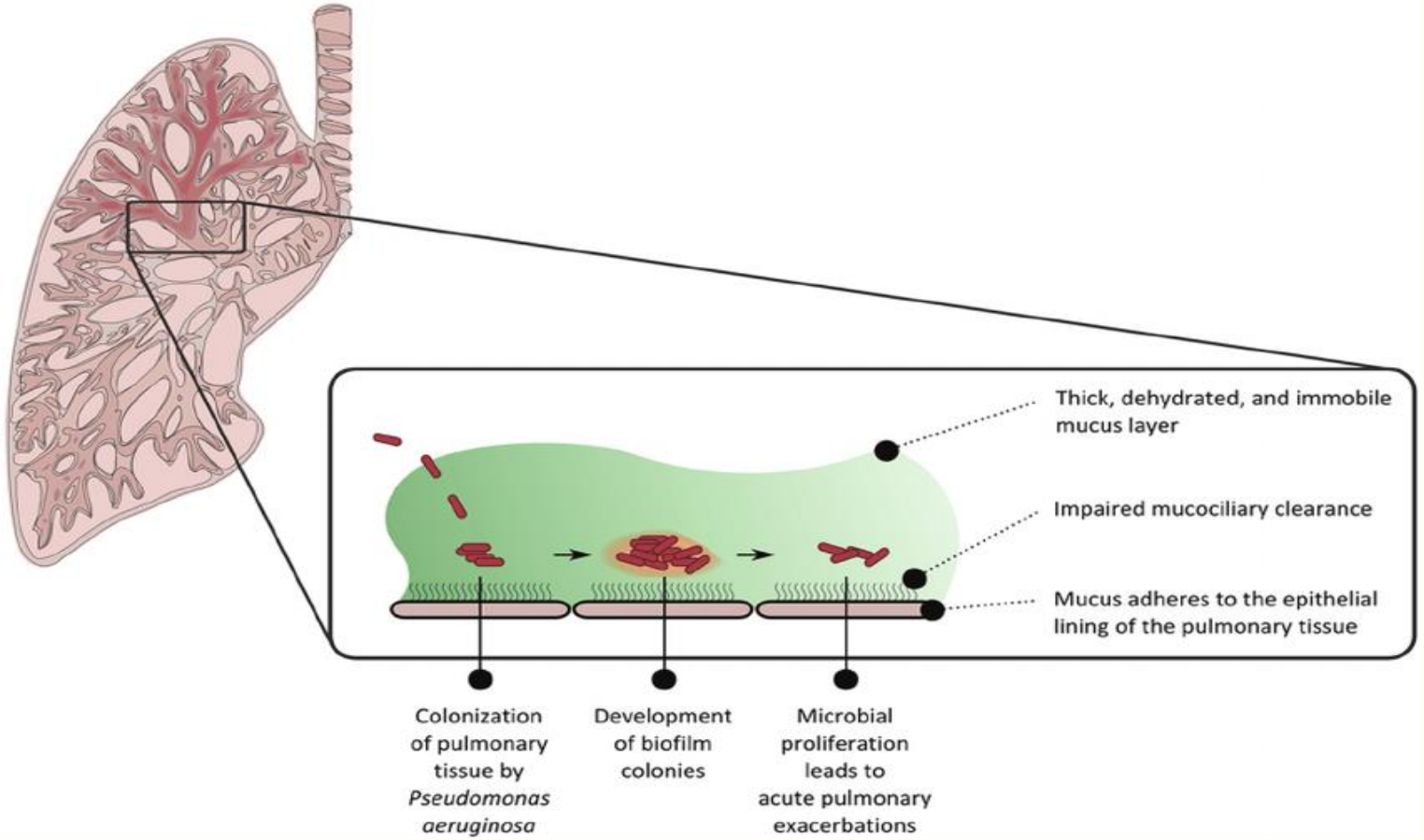
b



https://en.wikipedia.org/wiki/Antimicrobial_resistance

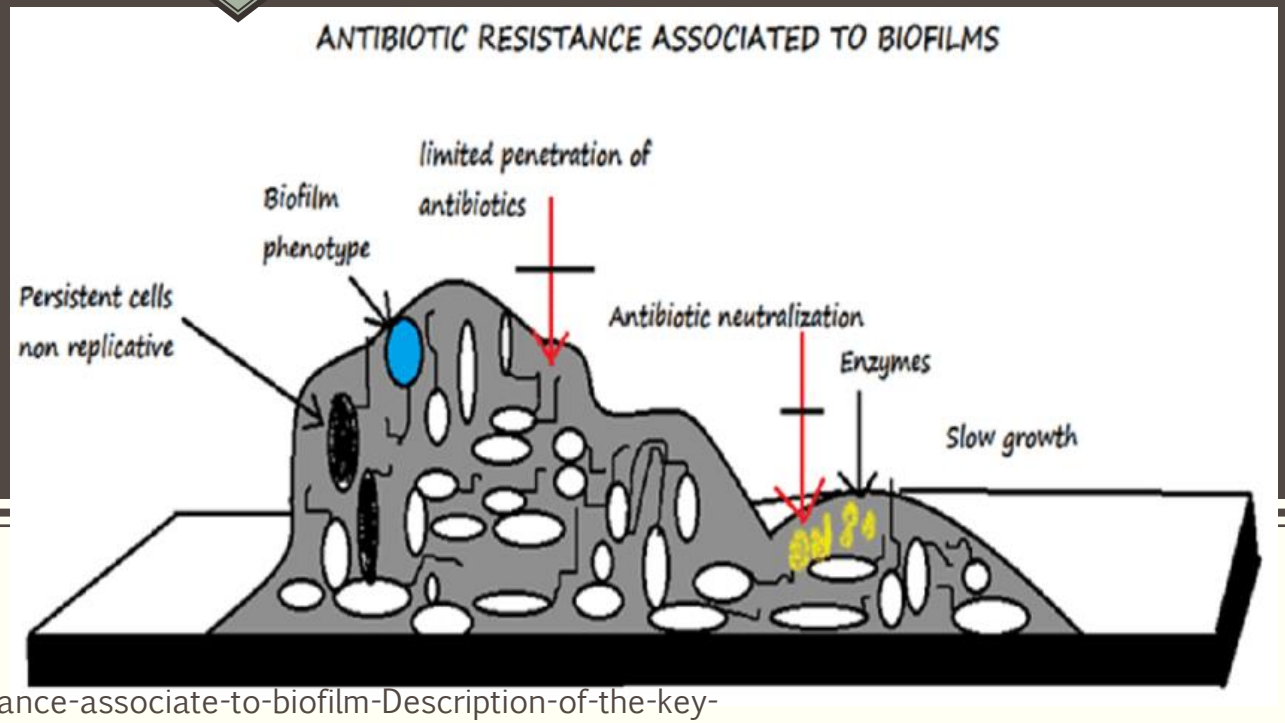
Antibiotic-resistance-associate-to-biofilm-Description-of-the-key-mechanisms-involved-in_fig2_285228261

BIOFILM FORMATION IN LUNG

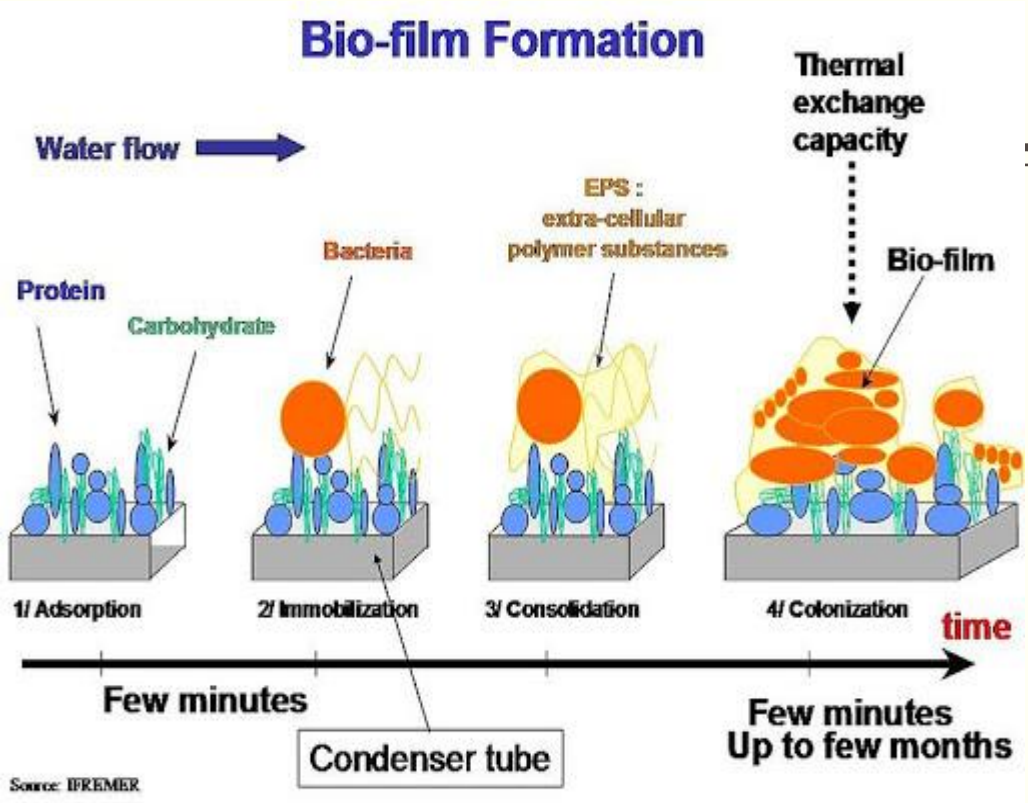


https://www.researchgate.net/figure/Pseudomonas-aeruginosa-biofilm-formation-and-growth-in-the-lungs-of-patients-with-cystic_fig1_259319415

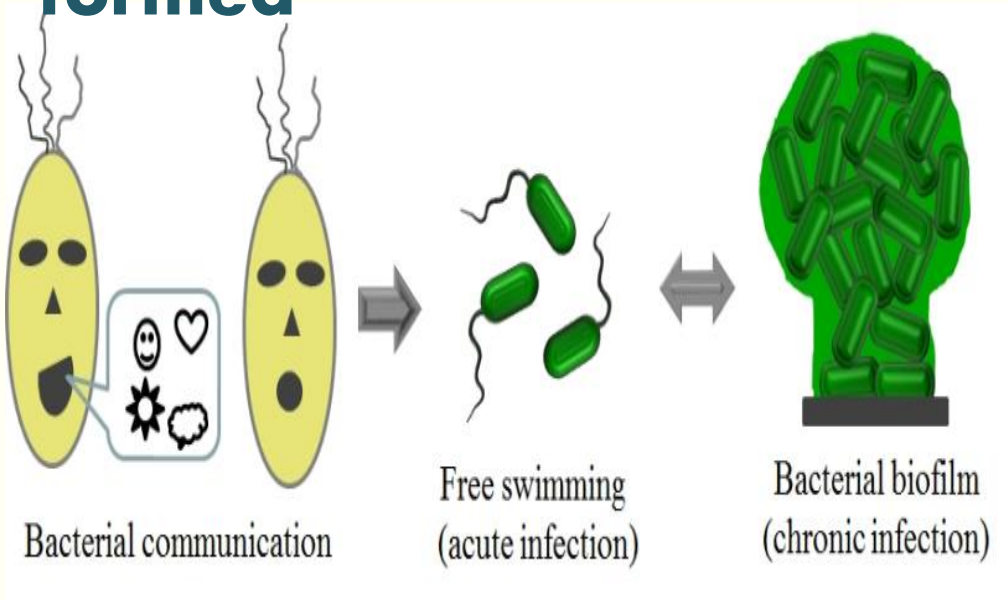
DEVELOP ANTIBIOFILM
Destruct or Inhibit Biofilm
Alternative way to combat antibiotic resistance



researchgate.net/figure/Antibiotic-resistance-associate-to-biofilm-Description-of-the-key-mechanisms-involved-in_fig2_285228261



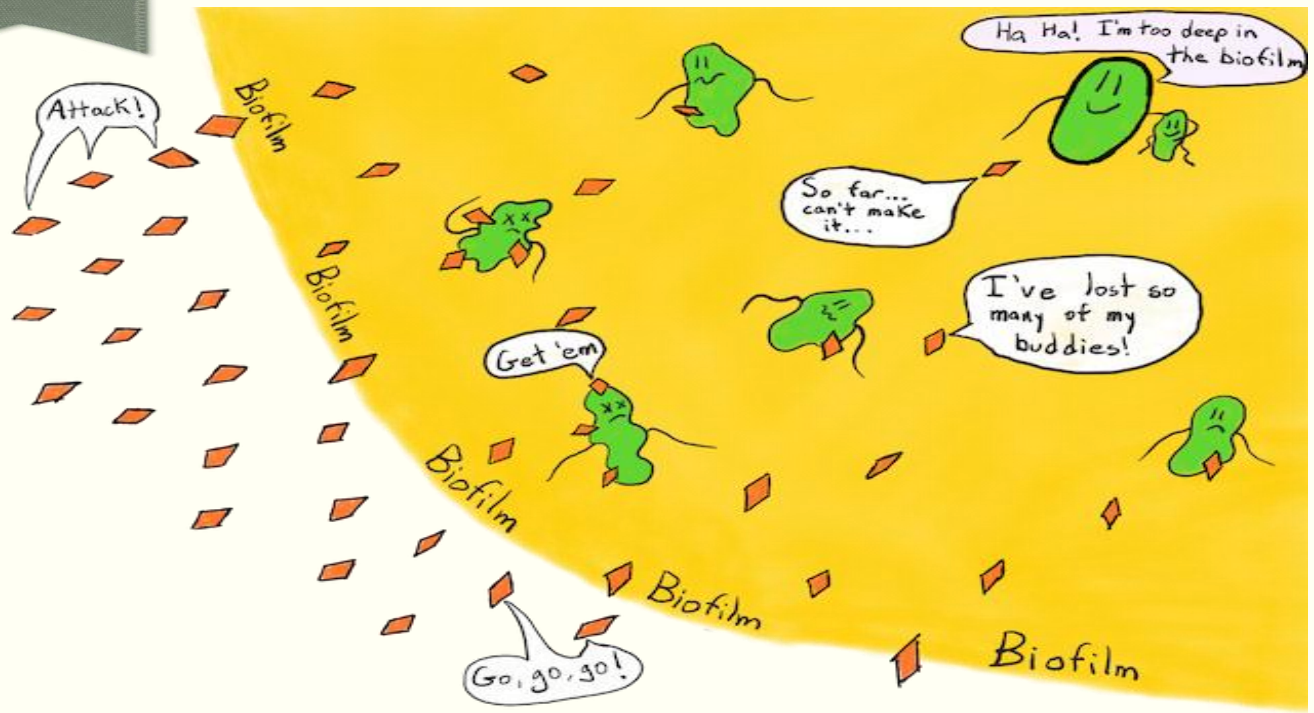
1. Inhibition of communication between bacteria before biofilm is formed



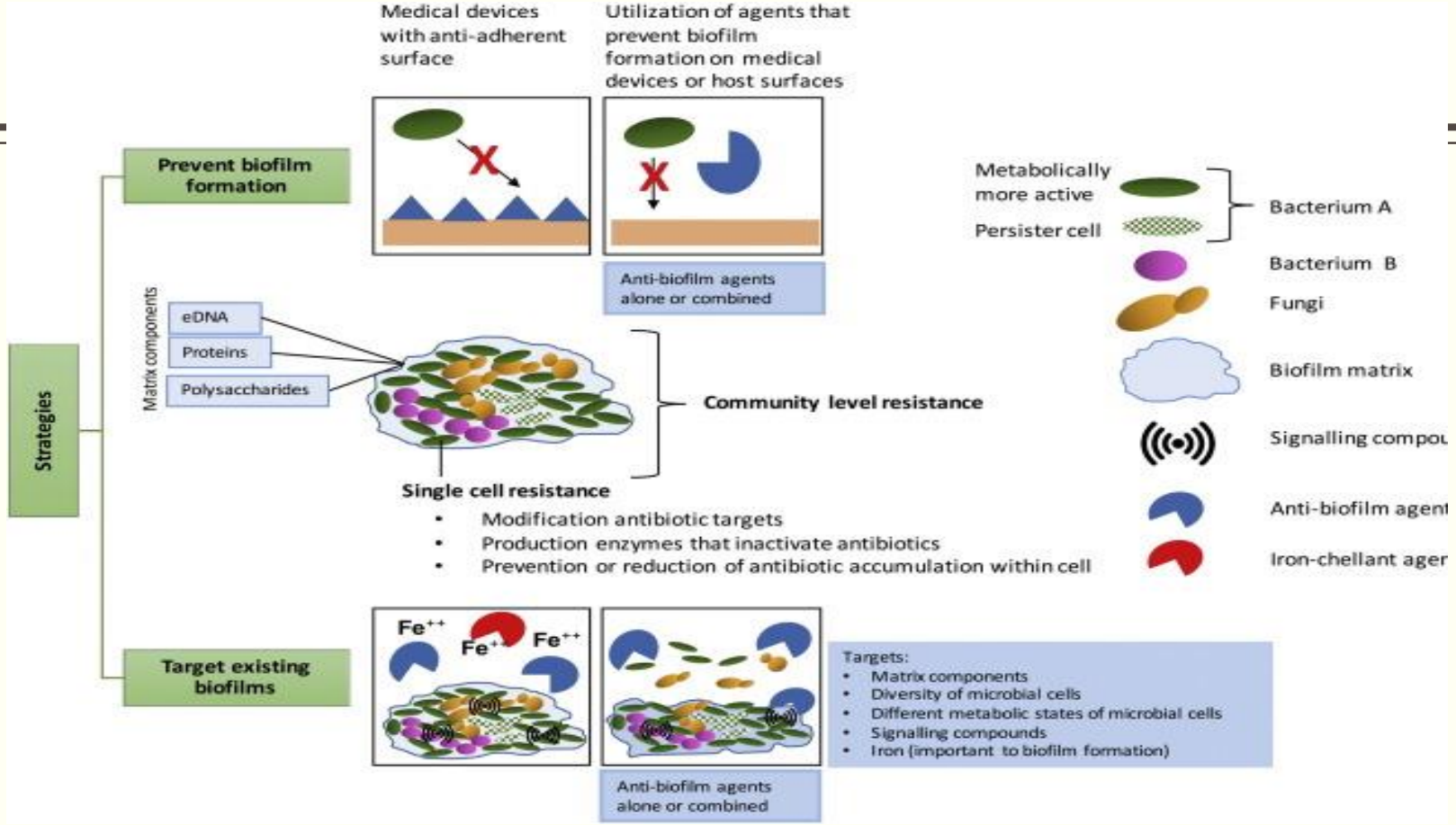
http://jonlieffmd.com/blog/bacteria-work-together-to-build-a-biofilm-civilization

https://thebiochemistblog.com/2017/06/30/the-rise-and-demise-of-antibiotics/

2. Biofilm destruction



https://www.khanacademy.org/science/health-and-medicine/current-issues-in-health-and-medicine/antibiotics-and-antibiotic-resistance/a/what-is-antibiotic-resistance



Antibiofilm application
Drug or supplement development

https://www.sciencedirect.com/science/article/abs/pii/S0163725816000358

Ocimum sanctum

Lactuca sativa L

Vigna radiata L

Pilea glaberrima blume

Brassica juncea

Exploration of antibiofilm from various bacteria

Malaysian Journal of Microbiology, Vol 12(4) 2016, pp. 291-299
http://dx.doi.org/10.21161/mjm.80915

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Characterization of bioactive compound from actinomycetes for antibiofilm activity against Gram-negative and Gram-positive bacteria

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Screening of Antibiofilm Activity from Marine Bacteria against Pathogenic Bacteria

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https://doi.org/10.1186/s13104-019-4775-1

BMC Research Notes

RESEARCH NOTE Open Access

Screening and quantification of anti-quorum sensing and antibiofilm activities of phyllosphere bacteria against biofilm forming bacteria

Nadine Amabel Theodora, Vania Dominika and Diana Elizabeth Waturangi*

Abstract

Objective: The objectives of this research were to screen anti-quorum sensing activity of phyllosphere bacteria and quantify their antibiofilm activity against biofilm forming bacteria (*Bacillus cereus, Staphylococcus aureus, Enterococcus faecalis, Salmonella typhimurium, Vibrio cholerae, Pseudomonas aeruginosa*).

Results: We found 11 phyllosphere bacteria isolates with potential anti-quorum sensing activity. Most of the crude extracts from phyllosphere bacteria isolates had anti-quorum sensing activity against *Chromobacterium violaceum* at certain concentration (20 and 10 mg/mL), but not crude extract from isolate JB 7F. Crude extract showed the largest turbid zone (1.27 cm) using isolate JB 14B with concentration of 10 mg/mL and the narrowest turbid zone isolate (1 cm) using JB 18B with concentration of 10 mg/mL. Crude extracts showed various antibiofilm activities against all tested pathogenic bacteria, it showed the highest biofilm inhibition (90%) and destruction activities (76%) against *S. aureus*.

Exploration of antibiofilm from various bacteria

THANK YOU