**MATRIC NO;16/MHS06/067**

 **COURSE CODE;MLS 406**

 **COURSE TITLE; VIROLOGY**

 **ASSIGNMENT.**

**Discuss the etiology, origin ,structure , and pathophysiology of Covid-19.**

 **ETHIOLOGY OF COVID -19**

 **The coronavirus disease 19 (COVID-19) is a highly transmittable and pathogenic viral infection caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), which emerged in Wuhan, China and spread around the world. Genomic analysis revealed that SARS-CoV-2 is phylogenetically related to severe acute respiratory syndrome-like (SARS-like) bat viruses, therefore bats could be the possible primary reservoir. The virus is**[**spread**](https://en.wikipedia.org/wiki/Transmission_%28medicine%29)**mainly through close contact and via**[**respiratory droplets**](https://en.wikipedia.org/wiki/Respiratory_droplets)**produced when people cough or sneeze. Respiratory droplets may be produced during breathing but the virus is not generally**[**airborne**](https://en.wikipedia.org/wiki/Airborne_disease)**. However, a recent study by the**[**National Institute of Health**](https://en.wikipedia.org/wiki/National_Institute_of_Health)**and the**[**New England Journal of Medicine**](https://en.wikipedia.org/wiki/New_England_Journal_of_Medicine)**indicates that the virus remains viable in aerosoles for up to 3 hours For healthcare professionals caring for patients with confirmed Covid-19 infection or suspected Covid-19 infection, the**[**CDC**](https://en.wikipedia.org/wiki/Centers_for_Disease_Control_and_Prevention)**recommends placing the patient in a Airborne Infection Isolation Room (AIIR) in addition to using standard precautions, contact precautions, and airborne precautions. People may also contract COVID-19 by touching a contaminated surface and then their face. It is most contagious when people are symptomatic, although spread may be possible before symptoms appear The virus can survive on surfaces up to 72 hours.**[**[22]**](https://en.wikipedia.org/wiki/Coronavirus_disease_2019#cite_note-22)**Time from exposure to onset of symptoms is generally between two and fourteen days, with an average of five days. The standard method of**[**diagnosis**](https://en.wikipedia.org/wiki/Diagnosis)**is by**[**reverse transcription polymerase chain reaction**](https://en.wikipedia.org/wiki/Reverse_transcription_polymerase_chain_reaction)**(rRT-PCR) from a**[**nasopharyngeal swab**](https://en.wikipedia.org/wiki/Nasopharyngeal_swab)**. The infection can also be diagnosed from a combination of symptoms,**[**risk factors**](https://en.wikipedia.org/wiki/Risk_factor)**and a chest**[**CT scan**](https://en.wikipedia.org/wiki/CT_scan)**showing features of pneumonia.**[**[25]**](https://en.wikipedia.org/wiki/Coronavirus_disease_2019#cite_note-:3-25)[**[26]**](https://en.wikipedia.org/wiki/Coronavirus_disease_2019#cite_note-:4-26)

**The life cycle of SARS-CoV-2 in host cells; begins its life cycle when S protein binds to the cellular receptor ACE2. After receptor binding, the conformation change in the S protein facilitates viral envelope fusion with the cell membrane through the endosomal pathway. Then SARS-CoV-2 releases RNA into the host cell. Genome RNA is translated into viral replicase polyproteins pp1a and 1ab, which are then cleaved into small products by viral proteinases. The polymerase produces a series of subgenomic mRNAs by discontinuous transcription and finally translated into relevant viral proteins. Viral proteins and genome RNA are subsequently assembled into virions in the ER and Golgi and then transported via vesicles and released out of the cell. ACE2, angiotensin-converting enzyme 2; ER, endoplasmic reticulum; ERGIC, ER–Golgi intermediate compartment.**

 **ORIGIN OF C0VID-19**

**Corona viruses belong to the Corona viridae family in the Nidovirales order. Corona represents crown-like spikes on the outer surface of the virus; thus, it was named as a coronavirus. Corona viruses are minute in size (65–125 nm in diameter) and contain a single-stranded RNA as a nucleic material, size ranging from 26 to 32kbs in length . The subgroups of coronaviruses family are alpha (α), beta (β), gamma (γ) and delta (δ) corona virus. The severe acute respiratory syndrome corona virus (SARS-CoV), H5N1 influenza A, H1N1 2009 and Middle East respiratory syndrome corona virus (MERS-CoV) cause acute lung injury (ALI) and acute respiratory distress syndrome (ARDS) which leads to pulmonary failure and result in fatality. These viruses were thought to infect only animals until the world witnessed a severe acute respiratory syndrome (SARS) outbreak caused by SARS-CoV, 2002 in Guangdong, China. Only a decade later, another pathogenic coronavirus, known as Middle East respiratory syndrome coronavirus (MERS-CoV) caused an endemic in Middle Eastern countries**

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 **PATHOPHYSIOLOGY OF COVID 19**

**The lungs are the organs most affected by COVID-19 because the virus accesses host cells via the enzyme**[**ACE2**](https://en.wikipedia.org/wiki/Angiotensin-converting_enzyme_2)**, which is most abundant in the**[**type II alveolar cells**](https://en.wikipedia.org/wiki/Type_II_cell)**of the lungs. The virus uses a special surface glycoprotein called a "spike" ([peplomer](https://en.wikipedia.org/wiki/Peplomer%22%20%5Co%20%22Peplomer)) to connect to ACE2 and enter the host cell. The density of ACE2 in each tissue correlates with the severity of the disease in that tissue and some have suggested that decreasing ACE2 activity might be protective,**[**[64]**](https://en.wikipedia.org/wiki/Coronavirus_disease_2019#cite_note-Zhang_Penninger_Li_Zhong_p.-64)[**[65]**](https://en.wikipedia.org/wiki/Coronavirus_disease_2019#cite_note-Xu_Zhong_Deng_Peng_p.-65)**though another view is that increasing ACE2 using [angiotensin II receptor blocker](https://en.wikipedia.org/wiki/Angiotensin_II_receptor_blocker%22%20%5Co%20%22Angiotensin%20II%20receptor%20blocker) medications could be protective and that these hypotheses need to be tested.**[**[66]**](https://en.wikipedia.org/wiki/Coronavirus_disease_2019#cite_note-66)**As the alveolar disease progresses, respiratory failure might develop and death may follow.**

**The virus also affects gastrointestinal organs as ACE2 is abundantly expressed in the**[**glandular**](https://en.wikipedia.org/wiki/Gland)**cells of**[**gastric**](https://en.wikipedia.org/wiki/Stomach)**,**[**duodenal**](https://en.wikipedia.org/wiki/Duodenum)**and**[**rectal**](https://en.wikipedia.org/wiki/Rectum)[**epithelium**](https://en.wikipedia.org/wiki/Epithelium)**as well as**[**endothelial**](https://en.wikipedia.org/wiki/Endothelium)**cells and [enterocytes](https://en.wikipedia.org/wiki/Enterocyte%22%20%5Co%20%22Enterocyte) of the**[**small intestine**](https://en.wikipedia.org/wiki/Small_intestine)**.**

 **REFERENCES.**

**1. J. Cui, F. Li, Z.-L. Shi**

**Origin and evolution of pathogenic coronaviruses**

**Nat Rev Microbiol, 17 (3) (2019), pp. 181-192**

 **2. N. Wang, X. Shi, L. Jiang, S. Zhang, D. Wang, P. Tong, *et al.***

**Structure of MERS-CoV spike receptor-binding domain complexed with human receptor DPP4**

**Cell Res, 23 (8) (2013), p. 986**

**3.**[***"Q&A on coronaviruses"***](https://www.who.int/news-room/q-a-detail/q-a-coronaviruses)***.***[***World Health Organization***](https://en.wikipedia.org/wiki/World_Health_Organization)***. 11 February 2020.***

[***Archived***](https://web.archive.org/web/20200120174649/https%3A/www.who.int/news-room/q-a-detail/q-a-coronaviruses)***from the original on 20 January 2020. Retrieved 24 February 2020.***

**4.**[***b***](https://en.wikipedia.org/wiki/Coronavirus_disease_2019#cite_ref-CDCTrans_17-1)[***c***](https://en.wikipedia.org/wiki/Coronavirus_disease_2019#cite_ref-CDCTrans_17-2)[***"Coronavirus Disease 2019 (COVID-19)—Transmission"***](https://www.cdc.gov/coronavirus/2019-ncov/prepare/transmission.html)***.***

***Centers for Disease Control and Prevention. 17 March 2020.***[***Archived***](https://web.archive.org/web/20200323055631/https%3A/www.cdc.gov/coronavirus/2019-ncov/prepare/transmission.html)***from the original on 23 March 2020. Retrieved 23 March 2020.***

**5.[^](https://en.wikipedia.org/wiki/Coronavirus_disease_2019%22%20%5Cl%20%22cite_ref-ECDCQA_18-0%22%20%5Co%20%22Jump%20up)**[***"Q & A on COVID-19"***](https://www.ecdc.europa.eu/en/novel-coronavirus-china/questions-answers)***. European Centre for Disease Prevention and Control.***

[***Archived***](https://web.archive.org/web/20200205054338/https%3A/www.ecdc.europa.eu/en/novel-coronavirus-china/questions-answers)***from the original on 5 February 2020. Retrieved 23 March 2020.***

**6.^ *van Doremalen, Neeltje (17 March 2020).***

[***"Aerosol and Surface Stability of SARS-CoV-2 as Compared with SARS-CoV-1"***](https://www.nejm.org/doi/10.1056/NEJMc2004973)***. New England Journal of Medicine.***[***doi***](https://en.wikipedia.org/wiki/Digital_object_identifier)***:***[***10.1056/NEJMc2004973***](https://doi.org/10.1056/NEJMc2004973)***.***

**7.^ *van Doremalen, Neeltje (17 March 2020).***[***"Aerosol and Surface Stability of SARS-CoV-2 as Compared with SARS-CoV-1"***](https://www.nejm.org/doi/10.1056/NEJMc2004973)***. New England Journal of Medicine.***[***doi***](https://en.wikipedia.org/wiki/Digital_object_identifier)***:***[***10.1056/NEJMc2004973***](https://doi.org/10.1056/NEJMc2004973)***.***

**8.[^](https://en.wikipedia.org/wiki/Coronavirus_disease_2019%22%20%5Cl%20%22cite_ref-21%22%20%5Co%20%22Jump%20up) *CDC (12 March 2020).***[***"What healthcare personnel should know about caring for patients with confirmed or possible coronavirus disease 2"***](https://www.cdc.gov/coronavirus/2019-ncov/hcp/caring-for-patients-H.pdf)***(PDF). CDC. Retrieved 31 March2020.***

***9.*^*["New coronavirus stable for hours on surfaces"](https://www.nih.gov/news-events/news-releases/new-coronavirus-stable-hours-surfaces).***[***National Institutes of Health***](https://en.wikipedia.org/wiki/National_Institutes_of_Health)***. 17 March 2020.***[***Archived***](https://web.archive.org/web/20200323032520/https%3A/www.nih.gov/news-events/news-releases/new-coronavirus-stable-hours-surfaces)***from the original on 23 March 2020. Retrieved 23 March 2020.***

**10.[^](https://en.wikipedia.org/wiki/Coronavirus_disease_2019%22%20%5Cl%20%22cite_ref-23%22%20%5Co%20%22Jump%20up) *Velavan, T. P.; Meyer, C. G. (March 2020). "The COVID-19 epidemic". Tropical Medicine & International Health. n/a (n/a): 278–80.***[***doi***](https://en.wikipedia.org/wiki/Digital_object_identifier)***:***[***10.1111/tmi.13383***](https://doi.org/10.1111/tmi.13383)***.***[***PMID***](https://en.wikipedia.org/wiki/PubMed_Identifier)[***32052514***](https://pubmed.ncbi.nlm.nih.gov/32052514)***.***

**11.**[***b***](https://en.wikipedia.org/wiki/Coronavirus_disease_2019#cite_ref-CDC2020Testing_24-1)[***"Coronavirus Disease 2019 (COVID-19)"***](https://www.cdc.gov/coronavirus/2019-ncov/lab/guidelines-clinical-specimens.html)***. Centers for Disease Control and Prevention. 11 February 2020.***[***Archived***](https://web.archive.org/web/20200304165907/https%3A/www.cdc.gov/coronavirus/2019-nCoV/lab/guidelines-clinical-specimens.html)***from the original on 4 March 2020. Retrieved 26 March 202***

**12.*a***[***b***](https://en.wikipedia.org/wiki/Coronavirus_disease_2019#cite_ref-:3_25-1)***Jin YH, Cai L, Cheng ZS, Cheng H, Deng T, Fan YP, et al. (February 2020).***[***"A rapid advice guideline for the diagnosis and treatment of 2019 novel coronavirus (2019-nCoV) infected pneumonia (standard version)"***](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7003341)***. Military Medical Research. 7 (1): 4.***[***doi***](https://en.wikipedia.org/wiki/Digital_object_identifier)***:***[***10.1186/s40779-020-0233-6***](https://doi.org/10.1186/s40779-020-0233-6)***.***[***PMC***](https://en.wikipedia.org/wiki/PubMed_Central)[***7003341***](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7003341)***.***[***PMID***](https://en.wikipedia.org/wiki/PubMed_Identifier)[***32029004***](https://pubmed.ncbi.nlm.nih.gov/32029004)***.***

**13.^**[***"CT provides best diagnosis for COVID-19"***](https://www.sciencedaily.com/releases/2020/02/200226151951.htm)***. ScienceDaily. 26 February 2020.***[***Archived***](https://web.archive.org/web/20200318210532/https%3A/www.sciencedaily.com/releases/2020/02/200226151951.htm)***from the original on 18 March 2020. Retrieved 2 March 2020.***

**14. *Letko M, Marzi A, Munster V (2020).***

***Functional assessment of cell entry and receptor usage for SARS-CoV-2 and other lineage B betacoronaviruses". Nature Microbiology. 5 (4): 562–56* [^](https://en.wikipedia.org/wiki/Coronavirus_disease_2019%22%20%5Cl%20%22cite_ref-Zhang_Penninger_Li_Zhong_p._64-0%22%20%5Co%20%22Jump%20up)**

**15. *Zhang H, Penninger JM, Li Y, Zhong N, Slutsky AS (March 2020).***

[***"Angiotensin-converting enzyme 2 (ACE2) as a SARS-CoV-2 receptor: molecular mechanisms and potential therapeutic target"***](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7079879)***. Intensive Care Medicine. 46 (4): 586–590***

**16.X*u H, Zhong L, Deng J, Peng J, Dan H, Zeng X, et al. (February 2020).***

[***"High expression of ACE2 receptor of 2019-nCoV on the epithelial cells of oral mucosa"***](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7039956)***. International Journal of Oral Science. 12 (1)* 6.[^](https://en.wikipedia.org/wiki/Coronavirus_disease_2019%22%20%5Cl%20%22cite_ref-66%22%20%5Co%20%22Jump%20up) *Gurwitz D (March 2020).***

 **"Angiotensin receptor blockers as tentative SARS‐CoV‐2 therapeutics". Drug Development.**

**17. *Hamming, I.; Timens, W.; Bulthuis, M. L. C.; Lely, A. T.; Navis, G. J.; Goor, H. van (2004).***

 ***"Tissue distribution of ACE2 protein, the functional receptor for SARS coronavirus. A first step in understanding SARS pathogenesis". The Journal of Pathology. 203 (2): 631–637.***