Coronavirus, COVID-19

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Replication of Coronavirus

1. With their S-protein, coronaviruses bind on cell surface molecules such as the metalloprotease "spike". Viruses, which accessibly have the HE-protein, can also bind on N-acetyl neuraminic acid that serves as a co-receptor.

2. So far, it is not clear whether the virus get into the host cell by fusion of viral and cell membrane or by receptor mediated endocytosis in that the virus is in-corporated via an endosome, which is subsequently acidified by proton pumps. In that case, the virus have to escape destruction and transport to the lysosome.

3. Since coronaviruses have a single positive stranded RNA genome, they can directly produce their proteins and new genomes in the cytoplasm. At first, the virus synthesize its RNA polymerase that only recognizes and produces viral RNAs. This enzyme synthesize the minus strand using the positive strand as template.

4. Subsequently, this negative strand serves as template to transcript smaller subgenomic positive RNAs which are used to synthesize all other proteins. Furthermore, this negative strand serves for replication of new positive stranded RNA genomes.

5. The protein N binds genomic RNA and the protein M is integrated into the membrane of the endoplasmatic reticulum (ER) like the envelope proteins S and HE. After binding, assembled nucleocapsids with helical twisted RNA bud into the ER lumen and are encased with its membrane.

6. These viral progeny are finally transported by golgi vesicles to the cell membrane and are exocytosed into the extracellular space.

Model of coronavirus replication.

Figure 1. Therapeutic agents that could be used to block 2019-nCoV from infecting cells.
Coronaviruses are a family of enveloped, single-stranded, positive-strand RNA viruses classified within the Nidovirales order. This coronavirus family consists of pathogens of many animal species and of humans, including the recently isolated severe acute respiratory syndrome coronavirus (SARS-CoV). This review is divided into two main parts: the first concerns the animal coronaviruses and their pathogenesis, with an emphasis on the functions of individual viral genes, and the second discusses the newly described human emerging pathogen, SARS-CoV. The coronavirus part covers (i) a description of a group of coronaviruses and the diseases they cause, including the prototype coronavirus, murine hepatitis virus, which is one of the recognized animal models for multiple sclerosis, as well as viruses of veterinary importance that infect the pig, chicken, and cat and a summary of the human viruses; (ii) a short summary of the replication cycle of coronaviruses in cell culture; (iii) the development and application of reverse genetics systems; and (iv) the roles of individual coronavirus proteins in replication and pathogenesis. The SARS-CoV part covers the pathogenesis of SARS, the developing animal models for infection, and the progress in vaccine development and antiviral therapies. The data gathered on the animal coronaviruses continue to be helpful in understanding SARS-CoV.

Yushun Wan 1,*, Jian Shang 1,*, Rachel Graham 2, Ralph S. Baric 2, Fang Li, Receptor recognition by novel coronavirus from Wuhan: An analysis based on decade-long structural studies of SARS