Wellcome Genome Campus | OC3_1-7 Sars-Cov 2 life cycle

Hi there, and welcome to this introduction video for the replication cycle of SARS-CoV-2. We hope this summary gives you a good overview of this coronavirus lifecycle. So let's get started.

After infection, the life cycle of SARS-CoV-2 follows five steps-- attachment, penetration, biosynthesis, maturation, and release. The attachment step involves the specific binding of the coronavirus S protein to the cellular entry receptor angiotensin-converting enzyme 2, or ACE2.

In addition to the receptor binding, successful fusion requires a proteolytic cleavage of the S protein to S1 and S2 subunits by a host cell derived proteases. The S1 subunit is responsible for viral attachment to the extracellular part of S1, and S2 is responsible for fusion with the host cell membrane.

The next step is penetration by disruption of the cell lipid membrane through the lipids of the viral envelope fusing with those of the cell membrane. Once inside the cell, the envelope fuses with the endosome membrane and releases the viral genome into the cytoplasm, where the replication and assembly of new viral particles occur.

The start of the viral biosynthesis stage comes following the entry of the viral genome and its release into the cell cytoplasm. The RNA positive strand is first replicated into an RNA negative strand which is used either for replication to another RNA positive strand, for new virus assembly, or for transcription of subgenomic mRNA which can be translated into a variety of viral proteins.

2/3 of the SARS-CoV-2 genome is occupied by two large open reading frames which are responsible for producing two polyprotein replicas-- polyprotein 1A and polyprotein 1AB. The remaining 1/3 of the genome at the 3 prime end contains overlapping open reading frames, encoding four major structural proteins which acts as components of the mature virus. These are spike, membrane, envelope, and nucleocapsid proteins, as well as various other accessory proteins.

The maturation step starts with the translation of RNA encoding the nucleocapsid protein taking place in the cytoplasm, while mature forms of the membrane envelope and spike proteins are formed in the rough endoplasmic reticulum, or the ER. The nucleocapsid protein then surrounds newly synthesised RNA positive strands, forming the nucleocapsid.

The release of new virions starts with viral structures and nucleic acids subsequently assembling in the ER to Golgi intermediate compartment, or ERGIC. These new virions are packaged into Golgi vesicles, fused with the plasma membrane, and are released from the infected cell via endocytosis to further infect other cells.

This thus ends the life cycle of the SARS-CoV-2 virus. We hope this video was helpful, and we will see you again soon.