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Cellular Internalization and RNA Regulation of RNA Virus

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Abstract

Biological responses are regulated by various molecular networks. It is significantly important to reveal the mechanisms of diseases and cellular responses for the prevention and drug development. The infection mechanism of RNA virus consists of viral internalization, replication including RNA transcription, and expansion. RNA regulation of the RNA virus is critical for the replication of RNA virus. The therapy for the infectious diseases may target the viral internalization, replication and expansion. In this Editorial, the internalization and replication mechanism of RNA virus, especially novel corona virus SARS-CoV-2 which causes infectious diseases, is focused on and described.

Keywords

Novel coronavirus; RNA virus; RNA viral infection

Mechanism of Viral Infection

Coronavirus, which is a nanoparticle, is sphere-shaped and its diameter is 80-120 nm in average, where

it sometimes ranges from 50 nm to 200 nm [1]. Spike protein (S protein), so-called peplomer, on the surface of the particle binds to the receptor on the host cellular membrane, then internalized inside the cells. Viral RNA (plus strand) in the viral particles is replicated and translated into the viral structure protein in the host cells, which is followed by replication of new viral particles [2]. Coronavirus is recognized by the binding of S protein on the viral surface and angiotensin I converting enzyme 2 (ACE2) receptor on the cellular membrane, then internalized into the cell via processing of S protein by transmembrane serine protease 2 (TMPRSS2) protease [3].

Therapeutic Targets for RNA Virus

The inhibition of this internalization of the viral particle would theoretically prevent the viral infection and replication, which suggests the drug development targeting the internalization of the viral particle. The receptor recognition mechanism of this S protein on the surface of the nano-viral particle needs to be elucidated, which may lead to the identification of the target molecules of RNA viral infection to treat or prevent diseases. ACE2 has been identified as receptor for corona virus (SARS-CoV) [4]. ACE2, the first human homologue of ACE, functions as a carboxypeptidase on the cellular membrane, and hydrolyses angiotensin II, which plays an important role in renin-angiotensin system, to angiotensin (1-7) [5]. ACE 2 is highly expressed in gastrointestinal system such as small intestine and duodenum, as well as oral and nasal mucosa, lung, kidney and brain [6-8]. The interaction between ACE2 and S protein on the surface of viral particle may be a potential target to prevent coronaviral infection. Regarding the development of coronaviral vaccine, the sequences of S protein may be a crucial key for the recognition of the antigen by antibody. It has been revealed that SARS-CoV-2 has similar protein sequences to other RNA viruses which bind to ACE2 in the binding motif of S proteins. The coronavirus has viral RNA genome inside, of which RNA will be replicated by RNA polymerase [9,10]. The RNA polymerase inhibition is another target to treat the disease, while the molecular network of the RNA regulation mechanism needs to be examined for the safe application of RNA polymerase inhibitors.

Conclusion

The RNA viral infection consists of internalization, replication and expansion, which may be therapeutic targets for the treatment of the infectious disease. It would be the great advancement to understand the RNA virus strategy and biological molecular network responses.

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