RNA in the age of COVID-19

The world has massively evolved over 21 centuries particularly with science and technology, most of which will appear magical to medieval folks should they mysteriously resurrect in our era. Even with the immense advancement, recurrence of pandemics remains a nuisance. COVID-19 similar to earlier plaques such as the Spanish flu, tuberculosis, and H1N1 pandemic infected millions and claimed thousands of lives. A major trait that sets apart the current plaque from previous ones is its RNA genome similar to Ebola and HIV, and the extensive knowledge on RNA biology currently available. Thus, role of RNA is important in the age of COVID-19 and the reasons are as follows.

SARS-CoV2 virus causes COVID-19 and has an RNA genome that functions as the heart of the pathogen, hijacking host cellular machinery to produce viral proteins required for replication, immune evasion, and infection progression. Our deep understanding of the translational mechanism with RNA as template, and the replication process where a complimentary copy of the RNA is made by RdRp-mediated (RNA-dependent RNA polymerase) synthesis has carefully directed scientists in the race for effective therapies and vaccines, producing significant strides within an extremely short period of time. Examples of RNA-based drugs against SARS-CoV2 presently undergoing investigation which otherwise would not include remdesivir, a nucleotide analogue that acts through delayed chain termination mechanism to inhibit RdRp, and RNA interference-based (RNAi/siRNA) therapies.

Knowledge in RNA biology has yielded techniques for RNA extraction, amplification, and sequencing which facilitate thorough analysis of genome organization and mutation signatures. In the case of SARS-CoV2, this provides information on origin, transmission paths, evolution trends, and foresights into future outbreaks and infection control measures to adopt. In addition, the tools developed have also accelerated in vivo and in vitro studies to better understand virulence, pathogenesis and immune evasion strategies that cause the rapid transmission and high mortality rate of SARS-CoV2.

In the face of a pandemic, proper diagnosis is crucial. Knowledge in RNA Biology has tremendously contributed to the development of RNA-based detection methods like RT-PCR for early detection, isolation to contain the spread and treatment. Furthermore, common symptoms for early diagnosis arise from immune response triggered by the pathogen’s RNA and proteins. Together with definitive tests, these guide medical personnel on treatments to relieve excessive inflammation and immune infiltration. Imagine the level of ignorance on clinical management and exacerbated casualities if the mechanism of this response remained concealed. Finally, rumor has it that the virus will disappear in summer. The truth in this center on temperature effects on RNA structure and processes particularly RNA synthesis and, both are favored in low temperatures. This could explain the disparities in COVID-19 incidence and mortality rates between tropical and temperate regions of the world and require further investigation.

RNA biology is therefore indispensable in disease control and prevention. While RNA structure and processes have established a strong basis for rapid response to novel infections, continued research will provide new insights and novel tools ahead of ambushing pandemics.