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CRISPR Based Approach for Detection and Treatment of SARS-Cov-2

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Abstract

The COVID-19 has now become a Public Health Emergency of International Concern. Presently only one diagnostic test i.e qPCR test is available to detect the COVID-19 and no treatment method is available so CRISPR/cas9 technology is one of the promising area to detect and treat this disease.

Introduction

The Novel Coronavirus disease 2019 (COVID-19) which is also known as severe acute respiratory syndrome Coronavirus 2 (SARS-Cov-2), has now become a Public Health Emergency of International Concern. In December, the first case of COVID-19 was found in china after that it transmitted all over the world very rapidly and infects the large population and has emerged as a severe epidemic that causes severe respiratory syndrome in humans [1]. To date, there is only one diagnostic test i.e. qPCR test to detect the COVID-19, but inadequate reagent kits and equipment have slowed down the disease detection. So there is an urgent need to develop another detection and prevention method to control the severe epidemic disease worldwide. Researchers at Howard Hughes Medical Institute, Cambridge and McGovern Institute for Brain Research at MIT, USA developed a new CRISPR base protocol known as CRISPR-based SHERLOCK (Specific High Sensitivity Enzymatic Reporter UnLOCKing) technique for the detection of COVID-19 which requires less than an hour [2]. So CRISPR/cas9 technology is one of the promising areas to treat this disease.

Recently the new CRISPR/cas9 technology has widely used for genome editing to cure many diseases like retinal disorder, sickle-cell anemia, cancer immunotherapy, lung cancer metastasis, and many other diseases. CRISPR (clustered regularly interspaced short palindromic repeat) is part of the bacterial genome system, which makes the bacterial cells immune to the virus. The CRISPR was first observed in *Escherichia coli* [3] and serve as an adaptive immune system in bacteria against bacteriophages [4]. The clustered regularly interspaced short palindromic repeat-associated nuclease Cas9 (CRISPR-Cas9) produced DNA Double-Strand Breaks (DSBs) at specific sites in the genome by targeted recognition and cleavage.

CRISPR systems, found in 90% of archaeal and 40% of bacterial genomes are highly diverse, with variation in PAM sequences and the number and type of Cas proteins [5]. The CRISPR system has three types of mechanisms i.e Type I, Type II, and III. In type I, and type III CRISPR, various types of Cas proteins participate in the recognition and destruction of the target. However, in the type II CRISPR-Cas9 system a low number of Cas proteins are involved, so thereby engineering of type II CRISPR system

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much simpler [6]. There are two main components in CRISPR/cas9 technology one is cas9 enzyme and guide RNA (gRNA). The gRNA recognizes the target site and the cas9 enzyme cut the target site and causes insertion or deletion in the target site of the gene [5]. There are various online tools like CRISPOR and CHOPCHOP which can be used for designing of gRNA.

The main difficulty to treat Coronavirus disease by CRISPR/cas9 is that COVID-19 is a positive-strand RNA virus and target site of cas9 enzyme is DNA so to overcome this problem researchers at the New York Genome Center and New York University have developed a new type of CRISPR screen technology which target the RNA and this CRISPR enzyme is known as Cas13 which target the RNA instead of DNA [7,8]. The Cas13 enzyme is Type VI CRISPR (clustered regularly interspaced short palindromic repeats) enzymes that have newly been recognized as programmable RNA-guided. So CRISPR-based genetic screening may provide an opportunity to identify and cure the COVID-19 shortly.

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