ISSN: 2687-8100
Archives in
Biomedical Engineering & Biotechnology
DOI: 10.33552/ABEB.2020.05.000603
Iris Publishers

Mini Review

Biotechnology and Bioengineering Tools in COVID-19 Diagnostics - CRISPR and Beyond

Rwik Sen*

Department of Biomedical Engineering, Active Motif, USA.

***Corresponding author:** Rwik Sen, Department of Biomedical Engineering, Active Motif, USA.

Received Date: December 11, 2020

Published Date: December 22, 2020

Mini Review

Advances in bioengineering and biotechnology are an urgent need of the hour because of the ongoing pandemic of COVID-19. Coronavirus disease 2019 or COVID-19 is caused by SARS-CoV-2 which is a strain of a coronavirus called SARS-CoV or Severe Acute Respiratory Syndrome Corona Virus. Globally, COVID-19 has claimed lives 1,575,810 and infected 69,239,671 people. In this direction, biotechnological and bioengineering endeavors have shown several promising results to control the pandemic, which are discussed in this mini review.

Worldwide governments are aiming for COVID-19 testing to available on a large-scale. COVID-19 diagnostics include detection based on antibodies and nucleic acids, which are the most prevalent forms of COVID-19 testing. Nucleic acid-based tests involve sample collection from nasopharyngeal, oropharyngeal, or respiratory regions are collected and subjected to RT-PCR (Reverse Transcriptase PCR) [1]. In this process, SARS-CoV-2 RNA is converted to cDNA (complementary DNA), then primers specific to 3 loci of the viral cDNA are used for amplification [2]. The loci are ORF1ab which is the open reading frame of viral RDRP or RNA-Dependent RNA Polymerase, envelope protein or E gene, and nucleocapsid or N gene (Verma 2020). Either a singleplex or a multiplex format of RT-PCR is used.

A frequent problem reported in COVID-19 testing is false-negatives, hence complementation of RT-PCR with CT scans is recommended for efficient diagnosis of SARS-CoV-2 infection [3,4]. An improved and efficient version of RT-PCR testing of COVID-19 is the targeting of RdRp/helicase (Hel), spike (S), and nucleocapsid (N) genes of SARS-CoV-2 [5].

In antibody-based testing of COVID-19, immunoglobulins IgG, IgM, and IgA are probed by ELISA (Enzyme-Linked ImmunoSorbent Assay). These immunoglobulins are produced by the body as a defense response to viral entry and detected after different number of days following COVID-19 infection [2]. In addition to diagnostics, several groups have generated panels of antibodies against spike or S protein of SARS-CoV-2 which binds to human receptor ACE2 [6]. The antibodies neutralize S protein, hence preventing viral infection.

Another biotechnological advancement of COVID-19 testing is done by CRISPR-based methods where SARS-CoV-2 DNA Endonuclease-Targeted CRISPR Trans Reporter (DETECTR) uses CRISPR-Cas12 to detect COVID-19 [7]. Another COVID-19 detection process based on CRISPR uses recombinase-mediated polymerase pre-amplification of DNA or RNA which is a specific high-sensitivity enzymatic reporter unlocking (SHERLOCK) [8]. More methods based on CRISPR are developed to overcome the disadvantages of existing CRISPR-based tools for COVID-19 diagnosis.

In addition to the methods discussed above, there are other processes for COVID-19 diagnostics. Overall, a combination of biotechnological and bioengineering advances has led to the development of diagnostic and therapeutic interventions for COVID-19. Further research is needed to make them available to populations globally in a rapid, efficient, and inexpensive way to combat the pandemic.

Acknowledgement

None.

Conflicts of Interest

No conflicts of interest.

References

1. Corman VM, Landt O, Kaiser M, Molenkamp R, Meijer A, et al. (2020) Detection of 2019 novel coronavirus (2019-nCoV) by real-time RT-PCR. Euro Surveill 25(3).
2. Verma N, Patel D, Pandya A (2020) Emerging diagnostic tools for detection of COVID-19 and perspective. Biomed Microdevices 22(4): 83.
3. Ai T, Yang Z, Hou H, Zhan C, Chen C, et al. (2020) Correlation of Chest CT and RT-PCR Testing for Coronavirus Disease 2019 (COVID-19) in China: A Report of 1014 Cases. Radiology 296(2): E32-E40.
4. Fang Y, Zhang H, Xie J, Lin M, Ying L, et al. (2020) Sensitivity of Chest CT for COVID-19: Comparison to RT-PCR. Radiology 296(2): E115-E117.
5. Chan JF, Yip CC, To KK, Tang TH, Wong SC, et al. (2020) Improved Molecular Diagnosis of COVID-19 by the Novel, Highly Sensitive and Specific COVID-19-RdRp/Hel Real-Time Reverse Transcription-PCR Assay Validated In Vitro and with Clinical Specimens. J Clin Microbiol 58(5): e00310.
6. Wan J, Xing S, Ding L, Wang Y, Gu C, et al. (2020) Human-IgG-Neutralizing Monoclonal Antibodies Block the SARS-CoV-2 Infection. Cell Rep 32(3): 107918.
7. Broughton JP, Deng X, Yu G, Fasching CL, Servellita V, et al. (2020) CRISPR-Cas12-based detection of SARS-CoV-2. Nat Biotechnol 38(7): 870-874.
8. Kellner MJ, Koob JG, Gootenberg JS, Abudayyeh OO, Zhang F Sherlock (2019) Nucleic acid detection with CRISPR nucleases. Nat Protoc 14(10): 2986-3012.