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Letter to the Editor

COVID-19 pandemic and vaccination build herd immunity

Dear Editor,

From December 2019 until now, more than 90 million persons have been diagnosed with SARS-CoV-2 and the world lost more than 2 million people. The herd immunity will be achieved if the infected person reaches 50 to 90% of the targeted publications[1]. Whatever, the international scientific community concluded that any suggested approach of creating a durable protective herd immunity via natural infection is unethical and far away from achieving[2]. The consequences of the UK Prime minister's call about herd immunity has sounded an example of this[3]. There are at least three COVID-19 candidate vaccines that will be shortly available for public active immunization with naked or nanoparticulated mRNA. Human beings are vaccinated with many types of vaccines such as whole microbe (killed or attenuated), subunit (natural or recombinant protein), and capsular polysaccharide (free or conjugate). As yet, it is the first time to immunize humans with mRNA vaccine to control the COVID-19 pandemic and build up a protective immunity against SARS-CoV-2 (Figure 1).

The vaccination history demonstrated that many essential issues such as herd immunity threshold obtained against several virulent microbes could estimate and standardize. As of now, the threshold and durable herd immunity against Tetanus[4], Diphtheria[5], Haemophilus[6], and Measles[7] and other pathogenic microbes became well known (Table I).

Although many countries entered the second lockdown, the G20 (21-22. Nov, 2020) leaders did not hesitate to support the vaccination campaigns worldwide to mitigate and control the COVID-19 pandemic. In the light of the well-established parameters which must be offered in any candidate vaccine for human use, the candidate vaccines against COVID-19 have many questions open. For example, beyond vaccination, what is the herd immunity threshold expected (basic or full level)? Does the elicited immune response against mRNA vaccine rely upon the B and T cells-mediate immunity? What is the type and prevalence of immune response, T-cell dependent or T-cell independent immune memory? As previously shown, the durability of acquired immunity against seasonal coronaviruses is not observed or very short. Similarly, the observed acquired immunity in the recovered COVID-19 patients has quickly waned[8]. Will the active immunization offer a protective and sustained immunity for all ages and gender equally? Will the active immunization offer a protective and durable immunity for all racial gatherings similarly against COVID-19? Is the pregnant woman eligible to immunize with the mRNA COVID-19 vaccine? Have the candidate vaccines any non-tolerated reactogenicity (antibody-dependent enhancement of disease, hypersensitivity, and/or delayed-type hypersensitivity)? Will the active neutralizing antibodies produced against these vaccines reveal extensive somatic hypermutation or not? Will the mRNA vaccines arrive into the nervous system (central or peripheral)? The dysfunction and/or dysregulation of the injected mRNA translation is increasingly recognized. As previously reviewed[9,10] that when the mature and/or immature SARS-CoV-2 components reach the nervous system, they will make several neurodisorders[9]. Technically, do the candidate vaccines need to an efficient cold-chain to easily bring them into developed and developing countries similarly? Which is the standard technique (immunoassay, neutralization assay, or other) that will be eligible and accessible to estimate and evaluate the acquired immunity after vaccination with mRNA vaccines? Since the laboratory assays' variations make this determination even more complicated.

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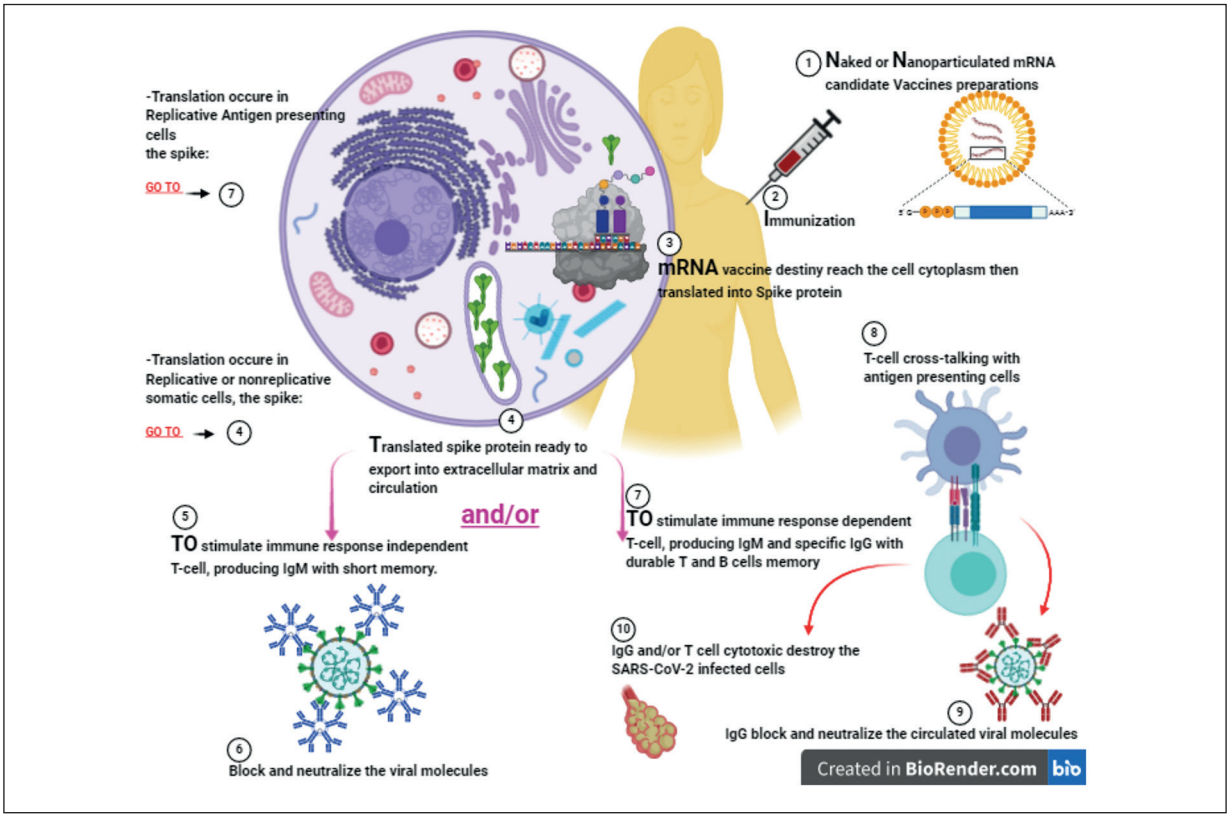

Figure 1. The expected fates and mechanism of mRNA vaccine in the human body. The immunized naked or nanoparticulated mRNA enters into the cell the cytoplasm of the replicative (immunity or no immunity cells) or non-replicative cells where it undergoes ribosomal translation into spike protein. According to the spike genetic codon selected (depends on the vaccine producer company), the translated protein will go to the endoplasmic reticulum where the spike protein processing and glycosylated. Depend on the cell types where these events happened, the mature spike protein export into the extracellular matrix then enters the circulation to be recognized by immune system arms as a foreign antigen. An immune-independent (the main marker is IgM with short memory) or immune-dependent T-Cell immune response (a perfect immune response) will be created. In case, the mRNA translation takes place within the immune cells such as Langerhans, Dendritic, Macrophage cells, or other antigen-presenting cells, the translated spike protein undergoes to furthermore endosomal digestion as foreign antigen then presented with a proper HLA to the T-helper cells. Subsequently, a sterilized and durable immune response will create through the synthesis of a specific IgG. Which IgG subtype will produce (is IgG1, IgG2, IgG3, IgG4 or all?). Is this immune response accompanied by Th1 immunity components?

To conclude, natural infections with SARS-CoV-2 could not build herd immunity. The only avenue to build that immunity is the vaccination against SARS-CoV-2 with the approved vaccines. Promising vaccines, most of which consist of mRNA of the viral spike protein, will be shortly available. As they innovated under the urgency of COVID-19 dissemination pressure, many essential questions about them are still opened.

Table I. Example for well-identified circulating herd immunity threshold post vaccination against presented some pathogens.

Type of vaccine	Basic protective	Full protective	Non-protective	Durability
Hib conjugatete	> 0.15 µg/ml	≥ 0.15 µg/ml	< 0.15 µg/ml	Durable
C. tetani	0.15 to 1.0 IU/ml	> 1.0 IU/ml	< 0.15 IU/ml	Durable
C. diphtheriae	0.01 to < 0.1 IU/ml	> 0.1 IU/ml	< 0.01 IU/ml	Durable
Hepatitic B virus	≥ 10 mIU/mL	10-100 mIU/mL	< 10 mIU/mL	Durable on booster dose

Conflict of Interest

The Authors declare that they have no conflict of interests.

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