



# INTERNATIONAL JOURNAL OF ADVANCE RESEARCH, IDEAS AND INNOVATIONS IN TECHNOLOGY

ISSN: 2454-132X

Impact factor: 6.078

(Volume 6, Issue 2)

Available online at: [www.ijariit.com](http://www.ijariit.com)

## Alternatives to mitigate Corona

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### ABSTRACT

*Coronavirus is most pandemic virus and it is challenging too for the scholars and scientists to discover its vaccine. Like every organism in nature struggling for survival, they evolve or mutate. Similarly, the coronavirus has changed its genome sequence to adapt to the new species. In fact, research has shown COVID-19 has mutated repeatedly in ways to boost its survival which results in more difficulties to discover its vaccine. We can't hit the coronavirus directly and neither our immune system is capable enough to fight with it, but by killing the infected cells, we can kill the corona virus too.*

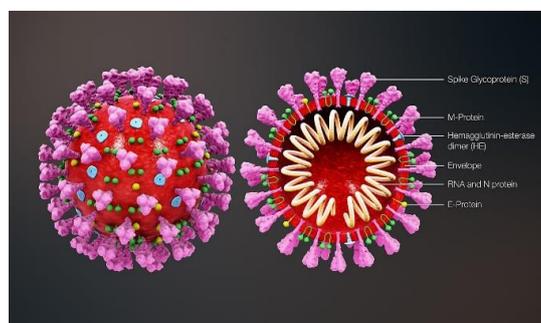
**Keywords**— Multiplicity of infection (MOI), *P. falciparum*, Bilirubin Synthesis, CQ Heme Complex, SARS

### 1. HISTORY

Scientist first identified a human corona-virus 1965. Corona viruses are a big family of different viruses. Some of them cause the common cold in people, other infects animals including bats, camels and cattle. Symptoms included fever, dry cough, dyspnea, diarrhoea, sore throat, ventilator use, breathing problems, shortness of breath etc. The SARS emerged in southern china in 2002 and quickly spread to 28 other countries. More than 8000 people were infected by July 2003, and 774 died. A small outbreak in 2004 involved only 4 more cases. MERS started in Saudi Arabia in 2012, almost all of the nearly 25000 cases have been in people who live in or travel to Middle East. In December 2019, COVID-19 came into existence from Wuhan, china. Till today it has infected approximately 26.53 lakh people and caused the death of around 2.18 lakh people and these numbers are increasing exponentially every day.

### 2. INTRODUCTION

The group of viruses which can cause mild to lethal effects on mammals and birds are called corona viruses. It causes severe infections in respiratory tract and some common cold like symptoms in mammals (including humans) and birds. Corona virus is one of the largest RNA based virus causing lethal effects in humans, other mammals and birds. It has large pleomorphic spherical particles with bulbous surface projections. The average diameter of viruses is around 120nm and the envelope layer is made up of lipid bilayer and is around 80nm in diameter. Inside the envelope the nucleocapsid which are bound to RNA genome.

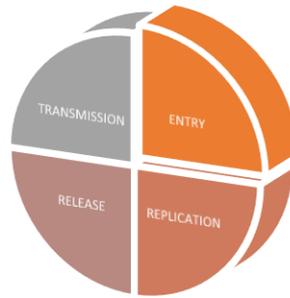


Source: <https://www.scientificanimations.com/wiki-images/>

The Spike (S) protein in virus can binds with the cellular receptors present on the cell surface including ACE-2, GRP78 and CD147 to gain access into the cell. After setting foot into the cell, virus manipulates the mechanism of cell for making replicas of itself. Usually our immune system molds up antibodies to disable the access of any virus to the receptors but in case of covid-19, our immune system is unable to develop antibodies and to develop a vaccine of it we have to go through a long process which may take months or years so we have to work on new methodologies to fight with these viruses.

### 3. HYPOTHESIS

Coronavirus binds with cellular receptors to get access into cell then it replicates itself within the host cell. Its life cycle can be represented as:



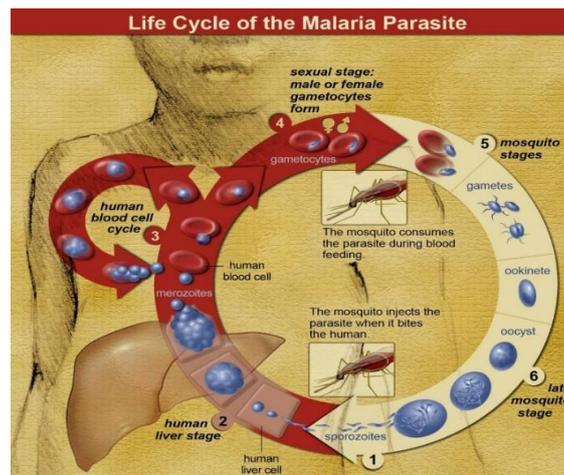
We can't hit it directly but by killing the infected cells, we can kill the corona virus too. This can be achieved by producing toxic substances within the infected cells or by transporting them to infected cells.

#### 3.1 Conception

One of the toxic substances that can be synthesized within the cells is heme and can be produced from hemoglobin (as an intermediate) in the process of bilirubin synthesis or hemoglobin breakdown. In this synthesis, hemoglobin converts into Heme and Globin polypeptide chains by macrophages. The free heme is toxic to the cells that's why it is broken-down into biliverdin by action of Heme Oxygenase, which is then reduced into bilirubin by biliverdin reductase. So, to increase the concentration of heme in RBC we have to restrict its further conversion. We can do it by some drugs but the quantity of heme produced in this way is quite less. So, to synthesize more amount of heme we can use some pathogens like plasmodium falciparum (a malaria causing pathogen).

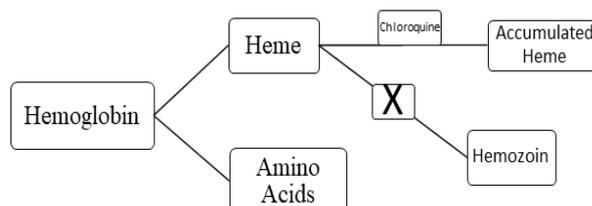
#### 3.2 Procedure

P. falciparum has different life stages in humans including; sporozoites, merozoites, trophozoites and gametocytes.



Source: <https://en.m.wikipedia.org/wiki/Plasmodium>

Out of these stages, merozoites is capable to breakdown the hemoglobin molecule into heme which is an intermediate, formed during the synthesis of hemozoin. The merozoite use hemoglobin to obtain its nutrition. It converts hemoglobin into heme as heme is toxic also to it so it reduces it into hematin and then to hemozoin which then can be used as a nutrition for it. So, for the synthesis of heme in blood cells we need to restrict its conversion to hemozoin and it can be accomplished by using antibiotics like chloroquine which can bind heme molecules and prevent their polymerization into hemozoin as a result of this inhibition, heme accumulates within the cells. So, the use of these merozoites along with chloroquine can produce the required amount of heme which can be used to kill infected cells.



This process needs hemoglobin breakdown which may give rise to other problems to the patient like aplastic anemia, Chronic kidney disease and Cirrhosis so to avoid these diseases we need to maintain RBC level in the blood for that we can use drugs like ESAs or Nurokind syrup which helps to stimulate RBC production. Moreover, these pathogens (P. falciparum) are unsafe for human body so their concentration should be maintained according to the medical condition of patient. Nearly if 30-40% of the total RBC are parasitized then the condition is usually fatal so their concentration in blood must be maintained in such a way so that less than 20% of RBCs could infect or it may vary according to the medical condition of patient.

### **3.3 Result**

Once *P. falciparum* is injected into human body, it takes approx. one week to transform into merozoites (as primary stage is sporozoites) which bind itself with RBCs. At this stage the concentration of merozoites should be calculated using MOI and their proportion should be maintained accordingly. After invading into RBC, merozoites starts replicating and begins to synthesize hemozoin from hemoglobin by chain reactions, so by injecting chloroquine we can restrict the production of hemozoin and enhance the accumulation of heme in RBC. As RBC is the main constituent of respiratory system which is most affected by Covid-19, the heme synthesized in the RBC can kill the cells along with corona virus. This should be done in a cyclic process so that patient can get time to enhance RBC level and the same cycle should be repeated until the patient is properly cured. To fasten the cycle, we can inject the cell cultured merozoites directly into blood stream which can reduce the medication time of about 1 week for every cycle.

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