Study finds that SARS-CoV-2 can shut down mitochondria, the cellular “power plants”

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A recent study published by the journal *Science Translational Medicine* found that SARS-CoV-2 infection inhibits the ability of mitochondria to produce energy in the body’s cells. This is the latest of thousands of studies published on the myriad negative impacts of SARS-CoV-2, the virus that causes COVID-19, underscoring the reckless and criminal character of the “herd immunity” mass infection policy now in place globally amid the ongoing COVID-19 pandemic.

The mitochondrion is often referred to as the “powerplant of the cell” because of its key role in making a compound called adenosine triphosphate or ATP. ATP is ubiquitous in cells, playing a crucial role in a vast array of cellular processes by providing the energy needed to make them happen.

The mitochondrion has five major enzyme complexes involving 160 polypeptides that carry out the process of ATP production. These polypeptides are encoded by the DNA in both the mitochondrion itself and the cell’s nucleus.

The study, produced by a multi-institutional group of researchers led by a team at Children’s Hospital of Philadelphia (CHOP) and the COVID-19 International Research Team (COV-IRT), found that SARS-CoV-2 can shut down cellular manufacture of key polypeptides in the five enzyme complexes. The mechanism by which it does so is to prevent transcription of the genes that encode the polypeptides into messenger RNA or mRNA.

The cell uses mRNA to build polypeptides in the process of translation. When transcription is suppressed, there are fewer mRNAs available to translate, and thus fewer polypeptides translated from them, in turn reducing the number of enzyme complexes in the mitochondrion for making ATP.

This phenomenon occurred in multiple tissues, including the mucosa of the nasopharynx, the heart, lungs, kidneys, and lymph nodes. In some cases, once the immune system cleared the SARS-CoV-2 virus, cells were able to resume production of the complexes. But in human autopsy specimens, the researchers found that production of these complexes in many tissues remained suppressed beyond viral clearance.

The researchers hypothesized that sustained suppression of mitochondrial energy production in the heart and kidneys resulted in the death of the patients they studied at autopsy. They also conjecture that ongoing inhibition of the mitochondria after infection in survivors might also play a role in the symptoms of Long COVID, especially general fatigue and malaise, two of the most common and often debilitating symptoms suffered by Long COVID patients.

Notably, at autopsy there was a tissue differential in whether genes encoding the peptides making up the enzyme complexes remained suppressed after viral clearance. In particular, lung tissue uniformly rebounded, with upregulation of the genes in order to make up for the deficit incurred during viral infection. In the heart, the sustained post-infection suppression was total, whereas it was only partial in the kidneys and lymph nodes.

The study found that not all polypeptides that compose the five enzyme complexes were suppressed. Indeed, the cell attempted to upregulate manufacture of the enzyme complexes in response to the deficit of ATP. Those genes not suppressed by the virus were upregulated, with increasing transcription and thus increasing translation and abundance of the associated polypeptides. However, without the missing polypeptides that were suppressed, assembly of additional enzyme complexes was blocked.

The researchers found other effects of SARS-CoV-2 on the mitochondrion. First, it induces the transcription of other mitochondrial genes that activate the immune system's inflammatory response. Second, it suppresses the transcription of genes involved in a host of other mitochondrial functions. Third, it promotes the process of glycolysis—which converts glucose to pyruvate. This latter effect is important to viral replication because pyruvate is a substrate used to create lipids and nucleic acids, which are important in the process of creating new virions in the cell.

The finding that SARS-CoV-2 shuts down ATP production in mitochondria of cells is surprising. A review from 2022 of viral effects on mitochondria makes no mention of anything similar. It also suggests mechanisms for the higher fatality rates of SARS-CoV-2 infection relative to other viruses such as influenza, as well as for some of the symptomatology of Long COVID. These subjects—as well as the mechanism by which mitochondrial energy production remains suppressed after viral clearance—require further study.

This study illustrates once again why novel pandemic viruses must be taken seriously and confronted with the full force of modern public health approaches to limit viral spread. The indifference of the ruling class and its dismissal of SARS-CoV-2 as being merely "a cold" or "the flu" fly in the face of numerous studies showing that SARS-CoV-2 is a virus like none other that humanity has yet confronted. It is far more consequential than its predecessors, and thus the total repudiation of a proper public health response amounts to an unprecedented social crime.

This latest study once again underscores the need for the international working class to take up the fight for a global elimination strategy, to stop the spread of COVID-19 once and for all. The International Committee of the Fourth International (ICFI), the world Trotskyist movement which publishes the *World Socialist Web Site*, has fought for such a strategy from the very beginning of the pandemic. No other political tendency in the world has advocated such a policy or approached the pandemic with the precautionary principle.

Significantly, principled scientists continue to stress the viability of such a strategy. In a recent editorial from the John Snow Project—a international group of scientists warning of the ongoing dangers of SARS-CoV-2—they stressed the viability of a global elimination policy:

> The algorithm for containment is well established—passively break transmission chains through the implementation of nonpharmaceutical interventions (NPIs) such as limiting human contacts, high quality respirator masks, indoor air filtration and ventilation, and others, while aggressively hunting down active remaining transmission chains through traditional contact tracing and isolation methods combined with the powerful new tool of population-scale testing.
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> Understanding of airborne transmission and institution of mitigation measures, which have heretofore not been utilized in any country, will facilitate elimination, even with the newer, more transmissible variants. Any country that has the necessary resources (or is provided with them) can achieve full containment within a few months.

An essential lesson of the pandemic for the international working class is that a comprehensive public health program to stop the pandemic, as well as prevent the future emergence of new human viruses requires the overthrow of capitalism and its replacement with a world socialist society, based on economic planning that prioritizes human life and equality.