

Opinion Paper

Eleftherios P. Diamandis*

COVID-19 and the Le Chatelier's principle

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Introduction

Story has it that in ancient times, the audacious humans attempted to build a city, Babel, and a tower tall enough to reach heaven. They never succeeded! About 10 years ago, I witnessed a similar situation; the construction of a 100 story residential tower next to my own 20 story condominium. Every morning, having breakfast at my 17th floor apartment, I was watching the three year-long effort, from digging the huge foundations to finishing the structure. This marvel now shines as the tallest residential building in Canada. The structure has over 1,000 individual apartments, 10 large elevators and is the home of over 3,000 people! The stairway counts more than 1,000 steps.

Sometimes I wonder. If there is a fire in the building, what is going to happen? What about a strong earthquake or a terrorist attack? I am sure somebody thought of all this. After all, the Burj Khalifa skyscraper in Dubai, at 830 m high, is almost twice as tall. But did the builders consider the consequences of a highly contagious infection with this huge human density? I doubt it.

After the COVID-19 pandemic started in early 2020, a lot of people wondered why? Was this bad luck, like a random event that just happened? Or was it an event that was cultivated and triggered by human behavior? More specifically, was this attributed to the way we designed our society and its activities? I believe the latter is true. Here, I

will attempt to investigate some possible root causes for the pandemic, in hopes that this mishap will teach us how to avoid similar future disasters. See my related videos on the subject [1–3].

Before COVID-19, humanity was stricken by other, bigger and smaller disasters that provided clues as to where we were heading. But we did not take note and we may not even have any appetite to change our ways because we may lose some acquired and seemingly non-negotiable pleasures. I am not advocating of going back to the Stone Age but the truth of the matter is that in Stone Age, the SARS-CoV-2 virus (the virus that causes COVID-19) would have no chance of causing a pandemic. Not even a chance of infecting more than a handful of people, because the virus could not travel on its own and the Stone Age people did not fly Trans-Atlantic, let alone trans-village.

Le Chatelier's principle

Le Chatelier's principle, named after the French chemist, posits that *“When an external stress (change in pressure, temperature or concentration) is applied to a system in chemical equilibrium, the equilibrium will change in such a way as to reduce the effect of the stress”*. In other words, a change in a system will evoke a counter-change which will bring the equilibrium to a new point.

This principle operates with almost everything we do. For example, it is known that when fruit production in the Serengeti is reduced, the number of elephants is reduced proportionally. But what is it that is changing on Earth that could induce a potentially catastrophic counter-change? The answer is everything, from the living inhabitants (humans, other species and plants), to the atmosphere, to water, soil, climate, etc. And the changes, caused by humans or other factors, are sometimes dramatic. It has been estimated that about one million out of 8.5 million species of plants, animals and other organisms are in imminent danger of extinction [4]. Estimates show that 50% of the organisms that existed 50 years ago have already gone extinct, not to mention those species that are gone before we even identified them. We will likely be losing more than 80% of the world's species, the reason being human overdevelopment and its associated consequences, such as global warming. There is an amazing

*Corresponding author: Eleftherios P. Diamandis, MD, PhD, FRCP(C), FRSC, Department of Pathology and Laboratory Medicine, Mount Sinai Hospital, Toronto, ON, Canada; Professor, Medical Biochemist, Department of Laboratory Medicine and Pathobiology, University of Toronto, Toronto, ON, Canada; and Biochemist-in-Chief, Department of Clinical Biochemistry, University Health Network, 60 Murray St. Box 32, Floor 6, Rm L6-201, Toronto, ON, M5T 3L9, Canada, Phone: +1 (416) 586 8443, E-mail: Eleftherios.diamandis@sinahealth.ca. <https://orcid.org/0000-0002-1589-820X>

diversity on planet Earth and it is to our best interest to study it and learn of the consequences of its changes to human survival. Perhaps a possibility that never cross our mind is that if other species are vulnerable to extinction, why not humans?

Regarding COVID-19, a relevant question could be: When do we think that the next virus will jump species and is enabled to infect humans? Since all species evolve slowly, including the viruses, it is only a matter of time when the next virus will strike humans. When we were shaken in the 80s by the HIV virus, which we are still fighting, one causative factor was thought to be the sexual revolution, the increase in illicit drug use and the international travel. We then considered to either change our ways, find cures and vaccines, or pay the price. HIV killed 30 million people. The discussions about causes, public policies, therapies and changes in human behavior were similar then and now, for HIV and COVID-19, respectively.

The SARS scare of the 2000s and of MERS and Ebola a bit later, were additional warnings but we did not take seriously the option to change our ways. The Spanish flu pandemic killed 50 million people but it is a long way in the past and humans have short memories. They forget easily and then commit the same mistakes.

The root cause of the current pandemic is not just bad luck or conspiracies of some nations to keep the disease secret. It is the relentless war between the eight billion highly intelligent and very greedy humans and everything else that lives or exists on this planet. And we, the greedy creatures, did not realize as yet that the more we expand our greediness, the rest of the planet will resist and strike back, as per Le Chatelier. The strikes against humans could manifest as wild fires, tsunamis, floods, extreme heat and new diseases and pandemics. Just consider the highly complex consequences of heat to human health and the trigger of a myriad of homeostatic changes in many vital organs [5]. The more we abuse the planet, the more it will resist and pay us back with interest.

Changing perspectives

I mention below just a handful of situations that very few of us considered before the pandemic but now we need to re-examine on how to act. There are thousands of other examples.

(1) I used to travel from Toronto to my homeland Cyprus regularly, to visit relatives. This required a 24 h trip

which included passing through busy airports and staying on the plane for 12 h. I never thought that this travel could be a health hazard but now I do.

- (2) I used to attend sports events locally and internationally, squeezed into 20,000–100,000 capacity stadiums next to people I do not know. I thought that was fun, but not anymore.
- (3) I used to ride the subway to visit my daughter and squeezed like a sardine in rush hours with thousands of unknown others. Now I prefer to drive.
- (4) I used to go to boat cruises but now I am scared to even think of the possibility to be infected and stay on the ship for weeks.

Closing remarks

Human overdevelopment causes significant changes to the planet and its inhabitants and the planet reacts back in unpredictable and potentially very consequential ways. Humans must study and understand what changes are potentially dangerous and avoid them early. A classical example is climate change. We also need to respect and protect the other species for their own good and our own good. If we continue to perturb the equilibrium on the planet we should be ready to face the inevitable counter-changes and pay the associated price.

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