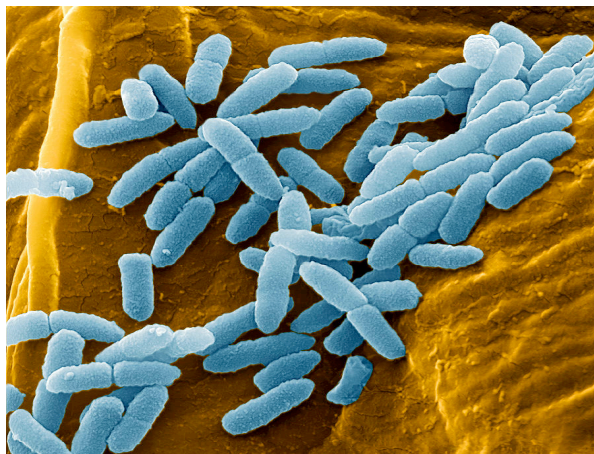


<b>Forum:</b>	Environment Commission
<b>Issue:</b>	Measures to prevent the resurgence of dormant pathogens as a result of climate change
<b>Student Officer:</b>	AhSong Cho
<b>Position:</b>	Chair of the Environment Commission

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## Introduction

Climate change has resulted in the significant growth of pathogens such as *Perkinsusmarinus*, a pathogen of the oyster *Crassostreavirginica*. There are different types of pathogens, but the most common types are bacteria, viruses, prions, protozoans, viroids, fungi, and human parasites. Research has revealed that there is a close tie between climate and pathogens, and have shown how the changes in the environment can affect the organisms which reside in it. The effects of climate change are tremendous, particularly in places such as jungles and rainforests where diverse creatures exist. For example, if the population of a plant species declines as a result of bacterial infections, organisms which depend on them as food sources will decline in population, followed by a decrease in carnivorous populations. Resurgence of pathogens is thus a threat to the world: not only do they affect the populations of wildlife, they also affect the whole population of humans.



*Caption 1: The magnified version of bacteria using SEM (Scanning Electron Microscope) technique*

## Definition of Key Terms

### Pathogen

Any type of agent that produces disease, especially a virus, bacterium, or microorganism.

### **Anthrax**

An infectious bacterial disease of animals, often cattle and sheep, transmitted to people by contaminated animal products such as wool. Three types of anthrax are cutaneous (skin) anthrax, pulmonary anthrax, and gastrointestinal anthrax; cutaneous anthrax is the most prevalent type in humans.

### **Global Warming**

An increase in the temperature of the earth's atmosphere generally attributed to the greenhouse effect.

### **Ribonucleic acid (RNA)**

A nucleic acid present in all living cells; its role is to act as a messenger carrying instructions from deoxyribonucleic acid (DNA) for controlling the synthesis of proteins, although in some viruses, RNA rather than DNA carries the genetic information

### **Biochar**

Charcoal made from plant matter and stocked in the soil in order to remove carbon dioxide from the atmosphere



*Caption 2: A picture of Yamal Peninsula*

## **General Overview**

### **Melting permafrost**

Researches show that the bacteria could be buried under thick ice in a dormant state, and resurge as the ice shelves melt. It is important to acknowledge such a phenomenon because people have not yet

developed antibiotics against them. In other words, if the world is suddenly exposed to those deadly bacteria, humans would not be able to protect themselves. One instance during which people were unable to avoid the effects of pathogens was the case of Yamal Peninsula in 2016. According to scientists, anthrax spores were hidden under the permafrost covering the peninsula for 75 years before an increase in the temperature of the surface layer of the permafrost by 2-4°C (between 1900-90) caused it to melt. This allowed it to spread into surrounding water sources, infecting reindeer. Then, over 20 people living in the area contracted the gastrointestinal strain of the disease. It is very likely that the large increase in temperature which initiated the spread of disease was caused by climate change. In case of similar circumstances, which seem likely seeing as a further 3°C increase in expected, doctors and researchers should develop vaccines for viruses that have high possibilities of resurgence.

### Resurgence of bacteria in Alaska

Fragments of RNA from Spanish flu viruses have been detected in corpses that were buried in Alaska. In 2011, Marina Podolnaya and Boris Revich conducted research and revealing that the change in environment poses severe outcomes if permafrost melts and viruses are released to nearby regions. National Aeronautics and Space Administration (NASA) scientists also came to same conclusion after they studied a type of bacteria, *Carnobacterium pleistocenium*. Even though this species had been dormant under Alaskan ice for about 32,000 years, they could resurge as increasing temperatures melt the ice.

### Infectious diseases

Contagious diseases and infectious diseases have been prevalent throughout the world for a long time -- Severe Acute Respiratory Syndrome (SARS), Ebola, Middle East Respiratory Syndrome (MERS), and malaria are some examples of such diseases. While those diseases are relatively uncommon these days, malaria has been a huge threat to the people, especially tourists who travel the world such as a Swiss tourist in Cape Town. Malaria is prevalent in warmer areas, and is most common in Sub-Saharan Africa, where the temperature is extremely high. Anopheles mosquitoes, which reside in hot, humid climates, started to infect more people than they could before global warming became a huge issue.

### Resistance to natural antibiotics

In 2011, scientists identified DNA from a 30,000-year-old bacterium that contained genes coding for resistance to beta-lactam, tetracycline and glycopeptide antibiotics. Moreover, *Paenibacillus* sp. LC231 was found to be resistant to 70% of known antibiotics, including “last resort” antibiotics (e.g. colistin) that are reserved for bacteria that have shown resistance to all other antibiotics. This is unsurprising because natural antibiotics secreted by other organisms would have been a threat to ancient bacteria,

making natural antibiotic resistance a significant selective advantage. Thus, it is conceivable that thawing permafrost may release bacteria with resistance to natural antibiotics, making synthetic antibiotics the only viable option for treatment. Currently, synthetic antibiotics are a minority, and greatly limit what doctors can use. This means that resistance to such antibiotics will build rapidly, further reducing the number of options.

Though these bacteria do not infect humans, genes for antibiotic resistance could be passed by conjugation, where bacteria exchange genetic material through direct contact. Therefore, if the global temperature continues to rise due to climate change, the world could face a new wave of antibiotic-resistant bacteria.



*Caption 3: The picture of mosquito that carries malaria*

## **UN Involvement, Relevant Resolutions, Treaties and Events**

### **United Nations Framework Convention on Climate Change**

Rather than striving to tackle the resurgence of dormant pathogens specifically, the UN has expressed their efforts by taking measures to combat climate change, committing themselves to annual meetings in the United Nations Framework Convention on Climate Change (UNFCCC). The UNFCCC, in the 1990s, once served to arrange the Kyoto Protocol to keep developed countries away from emitting greenhouse gas; from 2005, the UNFCCC has participated as the Conference of the Parties Serving as the Meeting of Parties to the Kyoto Protocol (CMP). Since climate change can be mainly attributed to greenhouse gas emissions, the UNFCCC set the main focus of their conference on decreasing the greenhouse gas release as a whole. Although the UNFCCC Conference of Parties (COP) has not succeeded reaching their goals immediately, after the third conference in Kyoto, Japan, major European countries and central industrialized countries have agreed to reduce the greenhouse gas release to an average of 6 to 8%.

### **The Paris Agreement**

The Paris Agreement was officially signed on December 12<sup>th</sup>, 2015 by the UNFCCC. The Paris Climate Accord aims to keep the increase in global temperature below 2 degrees Celsius during this century. In

order to stop the global warming from causing further damage to the world, each nation involved in the agreement was assigned to a specific requirement. All participants must provide updated information of whether they have met their requirements in 2020, the actual launch of The Paris Agreement.



*Caption 4: The United Nations Framework Convention on Climate Change*

## Kyoto Protocol

The Kyoto protocol was the first official agreement among nations made to reduce greenhouse gas emissions. Finalized in 1997 and put into action in 2005, the protocol aims to reduce concentrations of greenhouse gases in the atmosphere to a level that would not severely disrupt the climate system. A majority of the countries have signed the treaty, but More Economically Developed Countries (MEDCs) were not mandated to decrease greenhouse emissions. Peter Kent, the environment minister of Canada announced their withdrawal in 2011, stating that the Kyoto Protocol cannot work as it fails to cover the world's largest two emitters, the United States and China. Industrialized nations have made their promises to limit their annual carbon emissions to average of 5.2 %, and these efforts yield to about 30 % reduction in the pollutants emissions. However, global emissions had significantly increased during the period when the Kyoto Protocol was not yet approved; according to the Netherlands Environmental Assessment Agency, they have increased by almost 40% since the 1990s. While some nations and organizations have strived to meet the objectives of the Kyoto Protocols, others (including China and the United States of America) have continued to emit large quantities of greenhouse gases, exceeding the quantity that was reduced.

## Timeline of Events

Date	Description of event
April 7 <sup>th</sup> , 1995	The first UNFCCC Conference of the Parties in Berlin, Germany
December 11 <sup>th</sup> , 1997	The Kyoto Protocol was signed.
February 16, 2005	The Kyoto Protocol was entered into force.

December 15 <sup>th</sup> , 2011	Canada officially withdrew from the Kyoto Protocol
December 12 <sup>th</sup> , 2015	The Paris Agreement was signed by all parties of the UNFCCC
November 4 <sup>th</sup> , 2016	The Paris Agreement entered into action

## Possible Solutions

### Improving response to disease

As it is likely that dormant pathogens will return and infect humans, preventative measures against an epidemic should be taken. This includes improving methods of detection and treatment so that the first few cases of a disease can be identified and cured. One means of doing this is by reducing the amount of antibiotic resistance through the education of the general public about the prevalence of the issue. Everyone, especially medical practitioners, should be aware that antibiotics must be used only as a last-resort (rather than an over-the-counter drug as it is in many MEDCs). At the same time, countries should continue to research and develop new ways of treating diseases associated with dormant pathogens, focusing on antibiotics which would have potential applications for many other problems the world faces.

### Reducing greenhouse gas emissions

Reducing greenhouse gas emissions is one of the most inexpensive measures to prevent climate change. The United States Environmental Protection Agency (EPA) proposed power plant rules to promote the use of natural gas rather than other fossil fuels that release more carbon dioxide gases. Since the emission of carbon dioxide is one of the main factors that lead to the global warming, people should consider walking rather than riding transportation when traveling in short distances. Moreover, carbon dioxide emissions can be reduced by improving city planning. According to Intergovernmental Panel on Climate Change, 32% of energy consumption came from inefficient buildings in 2010. Another measure to combat the challenge is to use green-building standards to reduce emissions; in some MEDCs, the green-building standards have reduced total energy requirement for infrastructures.



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