2020
HORIZONS

HANA ACADEMY SEOUL
ENGLISH MAGAZINE

2020
HORIZONS
- Editor's Comment

Above all, I want to appreciate every member of our club, Horizons, for letting me get such an honorable chance to design a magazine that consists of high-quality and various articles. While editing it, I could find that these articles would make you think about the social problem and widen your knowledge. Since it was my first chance to edit and design a school magazine, there was a lot of trial and error, but finally, I could finish editing this magazine. I hope you could enjoy it since our club members tried their best in each position. Thank you

- Horizons Editor 박주원

2020 was a chaotic year indeed. All things have hindered the progress, and whether we would ever finish this magazine was so unsure, but yet we did made it to an end. We, HORIZONS, are proud to publish our magazine of 2020. I can guarantee that every single articles were written out of deliberation, and the readers would find new ideas from them. I would like to appreciate all of our club members for finishing this astonishing work during these hard times, and also I want to thank our readers for taking time to read our articles. It was such an honor for me to have a chance to edit the articles and design this magazine. I hope our readers enjoy the magazine as much as we did.

- Horizons Editor 박시후

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2008 Financial crisis and its lesson

문규리

Nobody could have think of such a crisis until the incident broke out. System of financial market collapsed, and it caused a large negative effect on the real economy. Firms and banks around the world went bankrupt. The explanation above is about the 2008 financial crisis. In fact, it was a preordained conclusion.

There had already been caution for months before the crisis. The U.S. was in trouble because of the wrong policies for the housing market and the ambitiousness of economic players. As the economy overheated, home developers and financiers focused on expanding the market without weighing the possibility of repayment of housing financing. High interest home loans to low-income people, including immigrants, surged. Eventually, the collapse of real estate prices resulted in the financial crisis, and the aftereffects continue to the present days.

This was not a problem just for the U.S. The whole world is economically interdependent and interacted with other's interests. However, as money flows freely among countries, one country's financial crisis causes a negative impact on the economies of many other countries around the world. The 2008 financial crisis in the U.S. affected many other countries, causing a global economic downturn.

This U.S. financial crisis and change are giving lessons to our housing market. The importance of housing financial supervision should be emphasized, and distressed-debt has to be managed properly. The beginning of the crisis was subprime mortgage, which accounted for only a fraction of the financial market. Subprime mortgages provided loans to people with low credit ratings. Here, it was difficult to repay loans, and these subprime mortgages were split and repackaged. Those were sold to investors in the form of traditional mortgage securities. This sense of complacency was widespread. In the short term, it seemed to work. It also helped keep housing prices up. But not in the long run. The default on loans begun to soar. In the end, the housing market began to decline, and repackaged mortgage securities caused huge losses to investors. Also the problem of identifying who own distressed-debt, which is a debt that is severely depressed for some reason, wasn't an easy task.

Lots of economic players had a hard time. To avoid repeating this situation, to prepare for another crisis, the world should be ready with a proper financial system. It is true that loan regulations of housing financing are important in the process of dealing with the financial crisis. However, effort on policies are also needed to prevent excessive side effects like the collapse of the housing supply system. In particular, various policies for financial market will have to be reviewed.

What is universal basic income
박상현

The movie <I, Daniel Blake> was a shock for me. I can't forget what Daniel said:

"IF YOU LOSE YOUR PRIDE AS A HUMAN BEING, YOU LOSE EVERYTHING."

Nowadays when COVID 19 prevails, there are many 'Daniel Blakes' who claim to withdraw blockade saying that it is the same to die by the virus or to die by famine. People don't know when COVID 19 will end as there is no vaccine and this pandemic brings animated discussion on 'Universal Basic Income' (UBI for abbreviation)

UBI means income that is distributed to everyone at an equal amount without considering their wealth and whether they work. It seems quite radical; however , in 15th century, Thomas More first referred UBI in his well-known book 'Utopia'

American social psychologist and Nobel laureate Herbert Simon claimed that 90% of all income is from nature and by-product of accumulated knowledge and he suggested a concept of 'commons' . Although income also depends on one's effort, from his point of view, income depends on resources such as soil, water, atmosphere, environment, and accumulated knowledge until a specific time . This is the main background of the idea of distributing the same amount of income to every member of society .

Yet, there are many controversial issues regarding UBI. Typically, conservative parties and progressive parties in politics evaluate UBI differently. In 2016 Swiss, there was a national referendum on UBI. Its gist was to give 3 million won per person per month instead of stopping the rest of welfare policies but it was voted down with 77% rejection.

For one person, 3 hundred thousand won per month is small amount of money to keep a good standard of living. However, in Korea , a budget of 187 trillion won is needed to support UBI. This is equal to one-third of Korea's annual budget. Also, UBI is not a temporary expenditure, so money for UBI is needed every year. Besides, to implement UBI, other welfare policies should be stopped or tax should be increased. Considering these aspects, UBI requires social consent .

Hence, the Korean deputy prime minister Hong Nam-ki suggested selective provision of UBI, saying that "It is better to support the poor than giving money to the rich to buy their bread with ." This is because of problems concerning financing and decline in labor motivation . To this comment, people on the opposite position retorted this claim with paradox of redistribution.UBI is and will be a topic of discussion not only in our society but also in the world. What do you think about it?
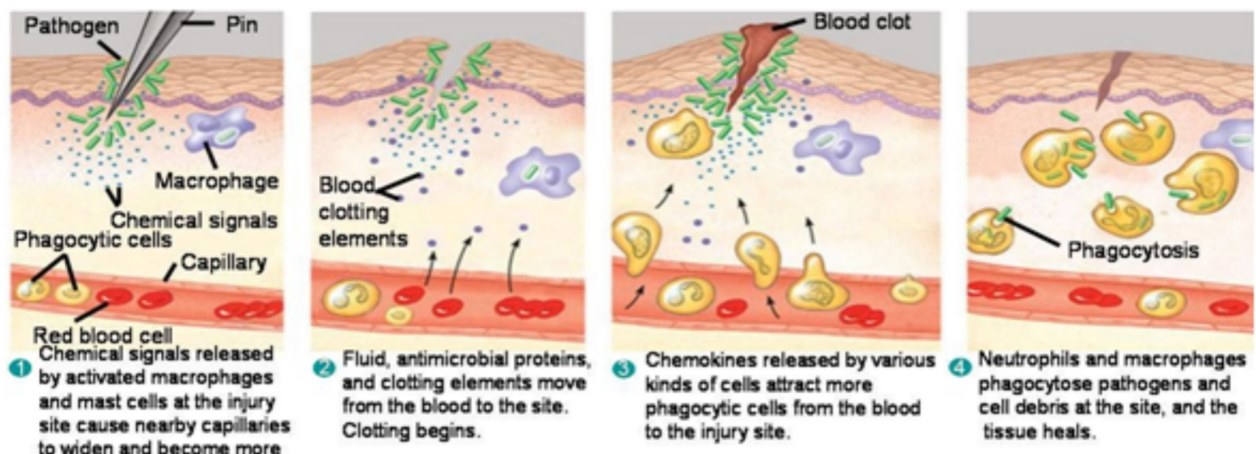
Our body keeper, NK Cell!
성연우

Our bodies are protected from a number of external hazards without us knowing. Our bodies operate their own defense system, even in every little situation such as getting a paper cut or getting pricked by a pencil. A variety of cells are involved in our bodies' defense system, and in this article, we will delve the NK cell among the immune cells in our body. Before that, why don't we first take a quick look at the body's defense mechanism?

There are non-specific and specific defense in our body's immune system. Non-specific defense is also called primary defense, which means congenital immunity. Non-specific defenses include external defenses and internal defenses. In the internal defense process, there is bacterial action and inflammatory response. When bacteria enter a wound, macrophages (a type of white blood cell) eat the bacteria, and the inflammatory response occurs.

However, if this does not solve the problem, the specific defense response activated. This is also called secondary defense, and is the body's immune system, which (as its name suggests) reacts only to certain antigens (e.g. pathogens, or toxins secreted from pathogens). There is cellular and body fluid immunity in specific immune responses. Cellular immunity refers to the direct removal of pathogen infected cells by CTLs, Cytotoxic T lymphocytes. Body-fluid immunity refers to the process in which cells called plasma cells release antigen response 'antibodies' into body fluids, thereby deactivating antigens and making the antigens easier to be consumed by white blood cells.

1. Chemical signals released by activated macrophages and mast cells at the injury site cause nearby capillaries to widen and become more

2. Fluid, antimicrobial proteins, and clotting elements move from the blood to the site. Clotting begins.

3. Chemokines released by various kinds of cells attract more phagocytic cells from the blood to the injury site.

4. Neutrophils and macrophages phagocytose pathogens and cell debris at the site, and the tissue heals.

We've just had a brief introduction about the immune system of our body. In the process of activating our immune system, a lot of immune cells are involved , including NK Cells. Now, let's talk about the NK Cell. NK Cell(Natural Killer cell) is an immune cell, which is responsible for non-specific immunity. The role of NK Cell is similar to CTLs. CTLs are cells that respond in the aforementioned specific defense. CTLs are responsible for directly removing pathogen-infected cells. Similarly, NK Cells detect abnormal cells and kill them directly. But what's different from CTL is that they can identify cells without certain antigens. Basically, cells in our body need the right antigen to remove abnormal cells. Therefore, it is necessary to have receptors that fit the antigen. However, NK Cells have a variety of immune receptors instead of specific ones, enabling immediate elimination of abnormal cells. This is important because they recognize normal cells and target cells through various receptors and selectively eliminate target cells. Then, how can the NK cell be activated, and what is the mechanism of selective removal ?

NK cells constantly come into contact with other cells to detect abnormal cells and optionally remove them if abnormalities are detected. Activation receptors and inhibitors on the surface of the NK cell which primarily respond by recognizing and reacting to ligand (a substance that uniquely binds to large molecules such as receptors) whose expression increases when the target cells are in an abnormal state. Because each receptor has a different ligand specificity, it detects the target cell through various activation receptors and removes it. Typical activation receptors include NKG2D, NCRs, 2B4, and DNAM-1 . In the case of NKG2D, the intracellular molecules YLBPs and MULT1s, where expression increases during chromosome cause damage, cancer incidence, and infection .

Other receptors also play an important role in detecting and eliminating cancer incidence. In addition, activation receptors can effectively induce killing activity in NK cells only through certain combinations. Individual receptors themselves are insufficient to activate NK cells, but the combination of certain receptors induces synergistic activations.

We found out that NK cells are activated in this way and detect target cells; then how do they distinguish target cells from normal cells? If this function of NK cells doesn't work properly, a very dangerous situation might happen: normal cells can be killed. For normal cells, MHC 1(which allows normal cells to avoid attacks from the NK cell) exists on the surface of the cell. The inhibitory receptor in the NK cell is MHC 1. However, through reduction in MHC 1 or a ligand increase in activation receptors, cancer cells or infected cells are removed by NK cells.

So, we have learned about the NK cell. Unlike other anti-cancer immune cells, NK cells can detect and immediately remove cancer cells without further activation. It can be used for cancer diagnosis, prognosis, and so on, when it is applied to research.
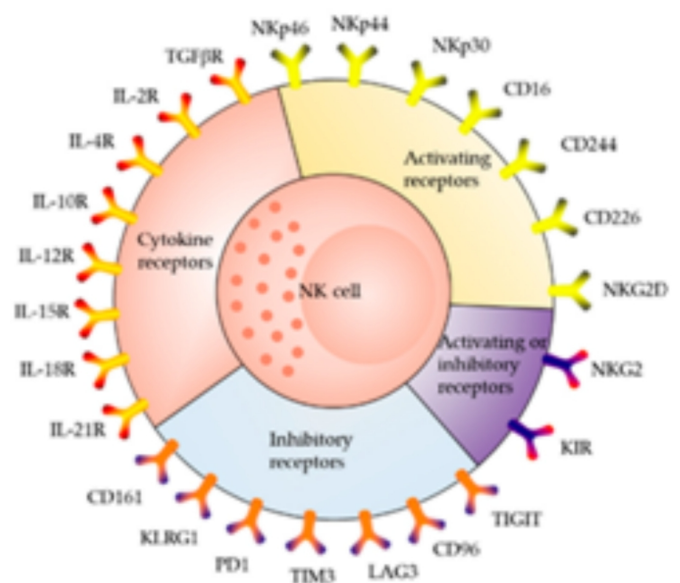
The Earth is too Bright!
# – Problems of Light Pollution
장우진

If you ask people what they think is a global environmental issue, a lot will probably talk about fine dust or global warming. Besides these ideas that people are familiar with, there are many other environmental issues; one of which is light pollution.

Light pollution has emerged as a global environmental issue because dazzling light that interferes with life has a significant impact on the ecosystem as well as daily life. With the aim of "recovering the night sky of 100 years ago," the International Dark Sky Week(end of April) has been launched, and many people are working to solve the problem of light pollution.

A recent study shows that 60 percent of the European population and 80 percent of the North American population are no longer able to see stars in the night sky because of light pollution. A third of the world's population cannot see the Milky Way with their naked eyes at night. When you just look around, you can easily see how much light you are exposed to at night. It's hard to expect to find stars shining in the night sky.

Light pollution is not just a matter of being able to see galaxies or stars. If a person continues to be exposed to light of more than 10 Lux (Lux; the level of light about a meter away from a single candle), human biorhythms will be ruined and the secretion of melatonin, a sleep hormone, will be inhibited. Inhibition of melatonin secretion is likely to cause health problems due to a lack of sleep and decreased immunity in the body. Light pollution has been shown to damage not only humans but also animals. According to a study by researchers at the University of Leiden in the Netherlands, mice exposed to artificial lighting for a long time showed a rapid decrease in bone density, skeletal muscle, and chronic inflammation.
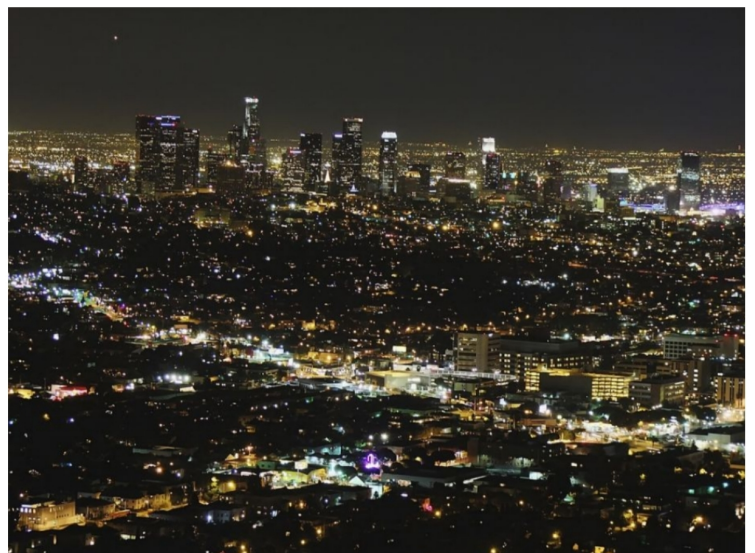
The output of crops has also been shown to fall with long-term exposure to artificial lighting at night, reducing yields of perilla seeds and rice. In Korea, for the first time, a case of compensation for crop damage caused by artificial lighting was made, and in 2015, the Central Environmental Dispute Mediation Committee decided to compensate farmers who grow perilla seeds in Gunpo, near Uiwang Station in Gyeonggi Province, after they demanded compensation for the decrease in crop yields due to night lighting from railway stations.

Today, companies are launching many satellites for the space internet business. As a result, there are concerns that astronomical observations will be disrupted. Satellites emit light pollution because the solar panels on the satellite to charge the battery reflect light towards the Earth. One of the alternatives to solve the problem is to make sunscreens that can be folded or unfolded. Despite such efforts, experts predict that it will be difficult to conduct through astronomical observations in the next 10 years. country's total land. The figure is so high that it ranked second in 20 major countries.

In the "World Light Pollution Map", published in the "Science Advances" in 2016, South Korea was classified as the country with one of the most light pollution. According to researchers' analysis of photos taken by Earth observation satellites at night in 30,000 locations around the world over the past decade, light pollution areas in Korea occurred in about 90 percent of theThe number of complaints regarding light pollution received from all over Korea has been increasing every year, from 3,850 in 2014 to 6,978 in 2016 and 7002 in 2018. The "Act on the Prevention of Light Pollution by Artificial Lighting" has been introduced, but the standards for allowing lighting are applied differently. Even if the management areas are set, fines can only be imposed after a five-year grace period.

Just as people strive to reduce carbon dioxide, an international agreement is needed to reduce the use of light electricity. The light pollution can be solved when people know what the problem is and seek solutions together.

How long is the coastline of the United Kingdom?

최윤영

Have you ever seen this picture before? Maybe not the same picture, but you may have seen some pictures which are similar to this. These kinds of pictures have a common feature: repeated structures. You'll recognize it easily by just looking at it. But just to have more confidence, let's cut the picture and look at it in more detail. You'll find that the picture actually looks identical to the original. This geometric structure is called a "Fractal".

"Fractal" has the feature of self-similarity and recursiveness. If we magnify a part of something and it looks similar to the original one, we say that it is self-similar. Recursiveness means that it is repetitive. Therefore, we can say that a fractal is a geometric structure in which a small part is repeated infinitely in a form similar to the whole structure.

Great Britain
Coastal Maps

<-costline of United Kingdom

The idea of fractal started from a question by Mandelbrot: "How long is the coastline of the United Kingdom?" The coastline of the UK was measured differently on every map. No matter how much it is magnified, the coastline would never be a complete line segment. The coastline is an anfractuous curve, which looks similar to the coastline.

To measure the length of the curve, we should undergo some trial and error. For example, imagine that you have 1cm ruler and 1mm ruler. To measure the length of curve with a linear ruler, we can cut the curve into pieces and measure each piece and calculate the length approximately. Imagining this whole process, we can easily find out that using a smaller unit will result in a more accurate length. Also, the result measured by a 1mm ruler will have a larger value than the other. Then imagine a smaller ruler, an atom, and electron, anything microscopic that you think of. If you measure the curve with it, you would have a value that is much larger, or it could even diverge to infinity.

Back to the previous example, how many atoms will we need to measure the coastline of the UK? The number of atoms will converge to infinity. This means that the length of the coastline is also infinity. This sounds like a contradiction, but it can be explained by mathematics.

Before talking about the answer, look at the picture on the right, which is an example of a fractal. As you can see, the total area of this equilateral triangle is limited. When we set up the length of one side as 'a', the total area would be ((root 3)/4)*a^2. Then how about the total perimeter? By using geometric series, the common ratio is 3/2, which means that the geometric series diverges. The total perimeter calculated is infinite.

In math, we assume a dot as a zero dimension, which doesn't have an area or a length. A straight line or line segment is one dimension, which only has a length and no area. Now, think of a 1cm line segment. If we try to express the line segment with dots, we need infinite dots. Then can we say that the length of the line segment is infinite? But didn't we set up the length as 1cm? This contradiction occurs because we tried to measure the length using zero dimension.

One distinct feature of a fractal is that the dimension of the fractal is a decimal number. What does it mean, and how can we define it? When we double the length of each side of the square in two dimensions, 4 of the original squares is created. Similarly, in three dimensions, 8 of the original hexahedron is created by the same process. Therefore, when we define the dimension by the number of repetitions, the dimension of a fractal could be a decimal number.

If we integrate these ideas, we may get a plausible explanation of the coastline question. The length of the coastline was calculated as infinite because we tried to measure the fractal using line segments. But since a fractal is not one dimensional, a problem occurs if we try to measure it with one dimension. For better understanding, think of a curve in Euclidean geometry.
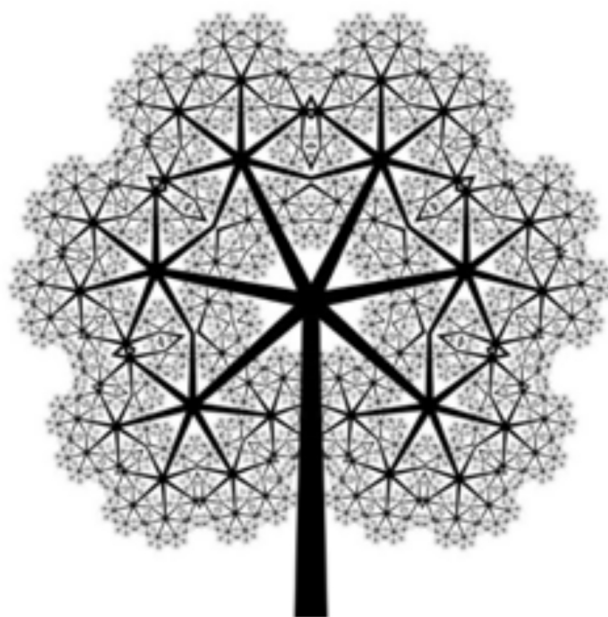
When we magnify the curve, we know that it will look like a straight line. Now, think of a curve in a fractal. In this situation, the curve will still look like a curve no matter how much we magnify it. This is the feature of fractals mentioned before, "self-similarity." Therefore, measuring the fractal using a one-dimensional line is not the correct way to proceed. This has an additional implication as well: we can't explain fractals with Euclidean geometry because they are too complex. (We should use complex number plane to analyze fractals using geometry. But we will skip this part in this article.)

I hope this gave you a new perspective towards learning mathematics. As you already well know, there are lots of fractals in nature. Even though we do not know the scientific reason explaining the existence of fractals, we do live in a wonderful and interesting world of fractals.

NGO and its Significance in Modern Civic Society

20064 노현지

Recently, there was an issue about an organization raising doubt about its misusing contributions donated to them. It received more attention because the organization was for the rights of the victims of military sexual slavery by Japan, an issue which our nation is very sensitive about. This organization, called The Korean Council for Justice and Remembrance for the Issues of Military Sexual Slavery by Japan (aka Korean Council), works towards the just resolution of the issue and prevention of wartime sexual violence. It is a civic group without any governmental connections, though it has contributed a lot to the awareness of the issue. They take action toward the realization of the message of the victims to restore their dignity and human rights and to achieve a peaceful world. Then what became an issue? The charge was that instead of helping the victims they ought to be responsible for, they had used the money in other purposes such as an operational fund. Here, we could have some doubts in our minds. What responsibilities does a civic group have towards the citizens? Additionally, how does a civic group get formed, and why? We ought to know the basic concept of how and why a civic group exists, and the importance it has in the modern society.

A civic group is also called an NGO, or non-governmental organization. It consists only of citizens that are gathered for a similar goal. According to NGO.org (the non-governmental organizations associated with the United Nations), "[an NGO is] any non-profit, voluntary citizens' group which is organized on a local, national or international level ... Task-oriented and driven by people with a common interest, NGOs perform a variety of service and humanitarian functions, bring citizen concerns to Governments, advocate and monitor policies and encourage political participation through provision of information." Among the wide variety of roles that NGOs play, the following three can be identified as the most important

Supporting Innovation, Demonstration and Pilot Projects :

NGOs have the advantage of selecting particular places for innovative projects and specify in advance the length of time which they will be supporting the project - overcoming some of the shortcomings that governments face in this respect. NGOs can also be pilots for larger government projects by virtue of their ability to act more quickly than the government bureaucracy.

Facilitating Communication :

NGOs use interpersonal methods of communication, and study the right entry points whereby they gain the trust of the community they seek to benefit. They would also have a good idea of the feasibility of the projects they take up. The significance of this role to the government is that NGOs can communicate data to the policy-making levels of government, information about the lives, capabilities, attitudes and cultural characteristics of people at the local level.

NGOs can facilitate communication upward from people to the government and downward from the government to the people. Communication upward involves informing the government about what local people are thinking, doing and feeling while communication downward involves informing local people about what the government is planning and doing. NGOs are also in a unique position to share information horizontally, networking among other organizations doing similar work.

Advocacy for and with the Poor :

In some cases, NGOs become spokespersons or ombudsmen for the poor and attempt to influence government policies and programs on their behalf. This may be done through a variety of means ranging from demonstration and pilot projects to participation in public forums and the formulation of government policy and plans, and by publicizing research results and case studies of the poor. Thus, NGOs play the roles from advocates for the poor to implementers of government programs; from agitators and critics to partners and advisors; from sponsors of pilot projects to mediators.

It is true that the previous three roles are the most common, but we should also know that there are thousands of different civic groups in our society that each work for different reasons. In order to understand what the organization is responsible for, it is important to recognize the ultimate goal they work on, which widely varies.

Now that we know what an NGO is, and its roles in our society. We can look back into the previous issue. What is the responsibility of the Korean Council? In their internet homepage, it says :

"We will work towards educating the history of the Japanese military sexual slavery to future generations, caring for women and children suffering from war, and achieving true peace and human rights for all…..Furthermore, we will strive for the restoration of victims' dignity and human rights, remembrance of the Japanese military sexual slavery issue, and prevention of wartime sexual violence through just resolution of the issue…. We will educate the future generation to remember the issue of Japanese military sexual slavery through history education and commemoration projects and to contribute to the prevention of sexual violence in conflict."

It is somewhat ironic if people blame this organization for the reason that they utilized their donation for their financial needs in operating the group, since their inception was not only protecting the victims but also to prevent further damage in the future. Civic groups in the modern society are here to speak for the individuals. As the society gets more and more diverse, it is important for people to gather their voices to safeguard any values that are neglected in it. We should always keep in mind that all organizations here in the society have their value in existence, not to suit people's tastes but to achieve their goals as a member of the system. It is important to get to know what worth the group seeks.

Use of deep learning in junk DNA

박성은

98 % of the human genome is junk. Junk DNA refers to non-coding DNA, which means it does not contain genetic codes. Such is the reason for it being referred as "Junk" DNA; it was considered "useless". The part containing genetic information is called the exon, and the part where it doesn't include any genetic information is called the intron. Therefore, junk DNA is the intron. Usually, more developed and complicated organisms have stronger possibilities of having more junk DNA. Junk DNA in human were considered especially unnecessary. However, as technology developed, scientists figured out that junk DNA can be useful. Junk DNA can have an important role in genetic systems when we use deep learning to sort them.

In 2019, scientists from Princeton University developed an Artificial Intelligence algorithm containing deep learning to analyze the sequence of the human genome. This algorithm binds base pairs of the entire genome to other base pairs around them and continues to analyze them until all mutations are found. Then, it produces the lists of sequences of bases for proper gene control and mutations that might interfere with gene control. Through this algorithm, the scientists figured out that mutations due to junk DNA can contribute to autisms. Also, this helped us to realize the study of Junk DNA might affect our lives and the study and biological development in better ways.

There are a few disadvantages of developing deep learning for the classification of junk DNA. Firstly, without further developments for deep learning, knowledge of junk DNA will stay the same, just as it is now. The knowledge about junk DNA is imperfect. Without exactly knowing how to use them, there is no way to utilize them because ignorance of the outcome can cause bigger disasters. It's only been a year since scientists discovered the possibility of using junk DNA. Therefore, it would require a long time, a larger workforce, and scientific development. Even when the deep learning in junk DNA is developed fairly well, there's less chance of its being publicized enough for everyone, like other biological developments. This can also lead to a focus on profit rather than health and scientific discovery.

2%
Genes

98%
"Junk"
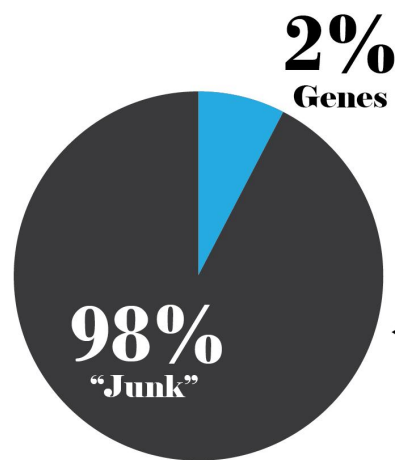
◀ **Figure 1**

There are only 20,887 protein-coding genes in the human genome. Human genome has 3 billion DNA sequences.

Despite the disadvantages, scientists are working hard to develop junk DNA usage, because it can be used in various fields. With Deep Learning processes, we can easily analyze DNA sequences. By figuring out this sequence, we can conduct a greater control of genes including junk DNA, and we can use it to find mutations of genes. Then, it can be used to study different diseases and disabilities like scientists from Princeton discovered earlier. There can be numerous other uses of junk DNA development through deep learning. The discovery of junk DNA has given rise to expectations of scientific development as it has infinite potential for being successful.

Even though there are chances of its being a failed discovery, the development of knowledge of junk DNA is undoubtedly worth it, as it can be used in various areas of biology. Therefore, it is a great challenge to keep studying and sponsoring junk DNA development. If people concentrate on public benefits and scientific discoveries, junk DNA will definitely act as a modern foundation of genetic study. In that way, we can reduce and overcome problems such as diseases, which are currently endangering creatures including humans, to make a better future for all creatures around the world.

WHY MARS IS OUR BEST CHOICE

JOONSOO PARK
박준수

Mars is the most explored planet in our solar system. The first Mars exploration began in 1960 with the former Soviet Union (now Russia). Marsnik 1 was launched for the intended Mars flyby, but failed. Russia continued dozens of attempts to explore Mars up to 2012, which had been mostly unsuccessful. The greatest achievement they ever made was that Marsnik 5 entered Mars' orbit in 1974, which, unfortunately, lost communication after nine days. Europe also gave several tries to explore Mars, which did not go well either. The Mars Express, however, jointly developed by Russia and the European Union, was successfully launched in June 2003 and is still exploring Mars' orbit. There have been numerous following attempts, but the failure ratio of landing on Mars has led people to call it the curse of the Martians.

Compared to the failure of Russia and Europe, the expeditions by America had been rather successful. The American Mars Expedition began in 1964 with the Mariner Project. In 2003, NASA in the United States succeeded in landing the twin exploration robots, 'Spirit' and 'Opportunity', on Mars. Spirit, which had been designed to live up to 3 months, endured for six years and two months and officially declared its end of duty in 2011, due to being stuck in a hole in the sand. Opportunity survived until 2018, but unfortunately since June, communication has been lost, and a photo taken by the Mars reconnaissance satellite has confirmed Opportunity to be non-functional.

▲ **Figure 1 : an exploration robot is on Mars.**

Another US exploration robot, Curiosity, was launched in 2011. Curiosity, like any other rover, was given the main task of finding if creatures could survive on Mars. It analyzed the soil on the surface, revealing the fact that water had flowed in the past. On May 5, 2018, yet another probe was sent to Mars. The exploration robot 'Insight' was aboard. After 26 days of flight, Insight landed on the surface of Mars on November 26. If Curiosity's main mission was to explore the surface of Mars, Insight's role was to look inside Mars and investigate the formation of Mars and the billions of years of change it has gone through.

So why? Why is it that Mars, compared to any other planet, has been explored so enthusiastically? The simplest answer is because it's 'close'. With the exception of Venus, which has an average distance of 42.2 million miles (24.8 million at minimum), Mars, with the average of 142 million miles (35.8 million at minimum), is the closest livable planet to Earth. Let us exclude Venus, since its excessively thick carbon dioxide atmosphere sets the planet to a lethally high temperature, making it the hottest planet in our solar system. Another reason for the exclusion is that whereas the average distance has significant difference, the minimum distance to Earth differ far less between the two planets, due to Mars' eccentric orbit.

However, before asking 'why Mars ', you might ask 'Why? '. What is our fundamental reason for exploring extraterrestrial planets? There are two main reasons. The first is that we need an alternative. Stephen Petranek, American writer, and editor of Breakthrough Technology Alert, once gave a TED talk on 10 ways of how our world could be destroyed in an instant. He explained that humankind could be wiped out; whether by asteroids, diseases, etc. This possibility backs up our claim of the necessity of inhabiting another planet for survival. The other is that mankind has an instinct for exploration. Historically, human explorations have played major roles in the development of civilization and technology. What the infamous Columbus had achieved is just a fragment of what the entire human kind had accomplished through exploration.

Back to Mars, besides being one of the closest to our home planet, what's so attractive about it? Within the solar system, Mars' environment is the most similar to Earth's, which is still a long shot from being identical. It is less than half the size of Earth and has a very thin atmosphere. Because 96% of it is carbon dioxide, breathing is impossible, and the average temperature is 81 degrees below zero. Despite this, however, it is still considered to be more favorable for survival than any other planet in the solar system. The reason? It's not exactly an ideal home we could think of, but we could make it remarkably close to that; Mars has potential.

In another TED talk, 'How we'll live on Mars', Petranek provides specific plans for inhabiting Mars, mentioning the solution for three major problems. The first thing to worry about is water. It's challenging to transport water directly from Earth to Mars. Therefore, it is necessary to secure a way to produce water at the planet. Well, it has been found that Mars' soil contains up to 60% moisture. The numerous exploration satellites orbiting Mars have sent photos of many craters on it with thin layers of ice. In the future, scientists plan to produce electricity by using solar panels and use it to melt that ice.

The next important question is how to breathe. MIT engineering scientist Michael Hecht created a device called "MOXIE" that uses reverse fuel cells to suck up the Martian atmosphere and exhale oxygen - basically a mechanical plant, especially effective since 96% of the Martian atmosphere is carbon dioxide, and 78% of the carbon dioxide consists of oxygen. According to NASA, future rovers will be transporting this device to Mars.

The last major problem, food, only requires a temporary solution. Once water starts running on Mars again, cultivating on Mars probably won't be much of a challenge. It seems The Martian is not purely fictional after all. Until then, we obtain food by hydroponics, and receiving what we lack from Earth.

Currently, countries around the world are eager to develop technology for humans to live on Mars and to send probes to Mars. The European space agency(ESA) and Russia's Mars Expo plan to launch a Mars probe this year. China is also preparing to explore Mars. The Chinese probe will depart in 2020 and fly 400 million km for over seven months to land on Mars. NASA plans to send a manned probe to Mars in 2030. Tesla CEO Elon Musk plans to launch a spacecraft to Mars by 2025, five years ahead of NASA, and rival eBay CEO Jeff Bezos unveiled 'New Glenn' to explore the Moon and Mars. Going to Mars is bound to happen much more quickly than you think.

▲ Figure 2 : Surface of planet Mars.

WHO SAID DISASTER IS
F A I R
TO EVERYONE?

윤희해

MAGUIRE

Disasters, in this case, a virus, are universal, but the damage caused by them is bound to develop unevenly depending on the social status and class of the people affected. As mentioned in John Mutter's <Disaster Profiteers>, "disasters are briefly natural; however, before and after that, disasters are pure social phenomena."

10 truck drivers from COUPANG have died from overwork in 2020 alone. We are presently living in a world where "untact" – un-contact - work is important. But, while laborers related with IT were able to deviate from the infection route through untact labor such as telecommuting, low-income workers were exposed to the risk of COVID-19. Many of the vulnerablepeople in society are forced to go out to labor sites to earn daily revenue and continue to work no matter how sick they are. In this period of 'untact', the lower social classes are 'contacting' more than ever. The fear of infection and the working environment are unfairly distributed among classes. We can easily see that the impact of COVID-19 is causing greater damage to the lower classes due to polarization caused by Neoliberalism.

The results of the 'Perceptions of Post COVID-19' survey conducted by Global Research in June revealed the reality of disaster inequality. According to the survey, 49.5% of the respondents said their incomes declined after the COVID-19 crisis.

It means that half of the respondents were suffering from reduced income caused by the economic downturn of our society. In particular, 51% of the respondents whose monthly average household income was less than 2 million won said that their income had been reduced. This means that the socio-economic costs of infectious diseases are being distributed unevenly according to income levels.

This is largely due to insufficient jobs, which has been noticeably decreasing since COVID-19. According to the May employment trend released by the National Statistical Office on June 10th, the number of temporary and daily workers decreased by 653,000 from the previous year. The number of self-employed people with employees also dropped by 200,000. It can be thought that temporary laborers and owner-operators, the most vulnerable groups in our labor market, suffered the most in this situation.

Now, we are able to face our society's insufficiency of welfare for the people who really need it. The holes in our social safety nets are plainly exposed for us to see. COVID-19 is a disaster, and it's an ordeal for us, yes – but we can make it into an opportunity to make right what has been wrong for a long time. We have already recognized the problem, the only thing left for us to do is to solve it.

Damages COVID-19 Made in Our Economy

최은석B

Most of the readers probably had stayed home last spring because of the unexpected advent of COVID-19. COVID-19 has changed our lives in many ways and it has created great damage especially to economics. How much damage did COVID-19 give to the Korean economy? What are some other efforts by the government to overcome this serious economic crisis? Let's find out.

First, how much damage did COVID-19 cause to our economy? According to the Korea Institute for Industrial Economics and Trade, all industries except for one are predicted to have their amount of exports drop very largely. Exports in industries like cars and displays are predicted to plummet by the rate of almost 30%. Car industries are especially in a serious problem as they are unable to sell cars to countries like the U.S. and many of their factories in other countries like China and India have stopped working. As the COVID-19 situation will not be solved soon, this problem is getting worse. It seems that only an invention of vaccination for COVID-19 would solve this serious problem.

Serious concerns also rise as many countries in the world seem not to be able to get better. The New York Times stated that the GDP of the U.S. dropped highest since the financial crisis in 2008, and unemployment is worst since the Great Depression. Because the U.S. has the largest economy in the world, it might affect other countries including Korea. If the worst situation comes, many countries in the world including Korea may go through another depression. A vaccine for COVID-19 would be an answer, but we aren't sure when the vaccine would be invented, so we need to try hard to prevent a worst situation.

So, what are some efforts by the Korean government? The best-known effort is the emergency relief grant. It was given to all people in Korea to increase consumption. Although some people might disagree. data show that the emergency relief grant did help increase the consumption in Korea. An increase in consumption led to more income for markets which had had a serious decrease in their profits.

What are other efforts the Korean government made? One of them is the rate cut. The reserve bank cut the interest rate for two times, making the interest rate almost 0%. This was intended to make more money released so that companies can borrow money easily. Now, there are many disagreements over whether the rate cut helped saving companies that were in danger of bankruptcy. Some say that rate cut was done well as it was intended, but others say that it was other economic policies and the decrease of the confirmed cases that helped our economy get better.

So, there were some economic problems caused by COVID-19. Although the government and many people are trying hard to make this situation better, it seems that the fundamental solution for this situation is the invention of a vaccine. Before the vaccine is invented, we must try hard to prevent spreading the COVID-19 and to improve the situation better.
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Cherishing the memory of George Floyd. Why do they plunder?
이윤찬

"BLACK LIVES MATTER."

This is a short but profound sentence. It express out rage of black people. And it also became the most popular phrase around the world.

Few months ago, a black man died. His cause of death is suffocation, by a police officer, a white police officer. The process of his dying recorded by others and spread all over the world. African – Americans and people of color resentment surpassed the uppermost limit and they ran out to the street. They pleaded their right, as black, as human, as citizens in the United States. Still these days, people are protesting to change their society. However, the aspect of protest becomes more vigorous day by day. Police hit citizens and citizens fought back to police.

Of course, not all protests are not vigorous, the proportion of the people who acted vigorously still in creases. Even a month ago, plundering occurred. So me protests invaded the grocery market, outlet like H&M, Uniqlo, high class restaurants, and took everything that could be exchanged for money. Boss es and owners called the police all night, but American police couldn't stop all protests. Police could not go into action to all spots where protests were plundering.

And more surprisingly, plundering during protesting time did not first occur in the USA. Then, you may co me to some questions.

WHY DO THE PEOPLE PLUNDER?
Let's think about this question from a psychological.

No matter how individuals are good or bad, when in dividuals gather, then think like this; "I am not alone, so I can do whatever which I couldn't do when I was alone!". Mass psychology activates. The more people participate, the individuals who become increasingly daring. However, you can confuse this word, mass psychology with collective intelligence. To separate these words clearly, collective intelligence has been used in positive example like team project which was succeeded, and mass psychology in negative example like plundering.

The author of Collective Intelligence, James Surowiecki, told us that in order to activate collective intelligence, all member in the same group should have the same opportunity to speak so make sure there is no any biased speaking. It cannot be ensured to protests in the street. Mass psychology has several peculiarities, suggestibility, impulsiveness, expansion, and narrow-minded bigotry. In plain language, people easily follow the protestors, spontaneously, their emotions are exaggerated, enforced and being hostile to oppositions. So mass psychology with some furious protestors, not all— it could be heard discriminate, but most of them are low-income bracket or temporary employees — give themselves recklessly to plunder.

In addition, plundering might include some arrogance actions against police officers. For a long time, conflict between blacks and white police officers continuously happened. Not only George Floyd, many other blacks experienced excessive force, and the most of the attackers were white people.

Experiencing the case of George Floyd, people of color's bad experience rose up to their mind, and resisted the police authority. So, plundering many stores is the best thing to show their protestor's power to police authority. In fact, portesters couldn't stop them.

The purposes of the protest are praying for the deceased or sometimes requiring a social change to government authority. The method of protest do not need to be violent all time. Proper violence was not matched with protest and that method is inefficient. It just expresses people's anger, not to provoke a voice to change the US society and change the world. And, authority, especially police, have to prevent protestors with suitable, humanitarian ways. Not all protestors are plundering, or attackers of police.

Cherishing the memory of a George Floyd one more, and I hope that there may be the peace in US society.

INTERNET HARASSMENT
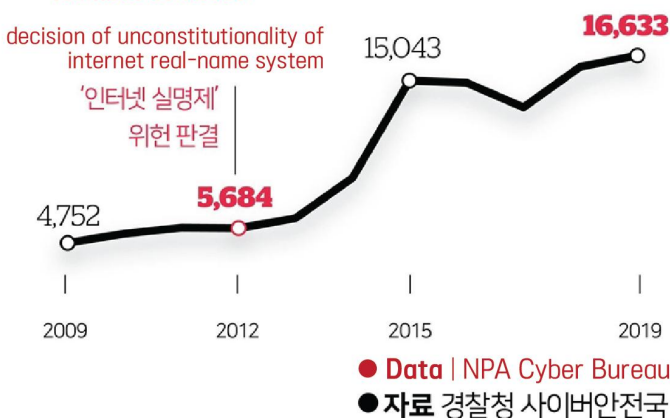## : Analyzing from a Psychological and Social Perspective

황성범

Negative reviews of celebrities have been a chronic problem in our society, especially since the development of the internet. Last year, singer Sulli and Goo Hara committed suicide due to a great deal of negative comments on the internet. Even though the number of celebrities who chose to commit suicide over this issue is not to be overlooked, the malicious comments and 'internet harassment' are unceasing.

최근 사이버 명예훼손 모욕 사건

고소·고발 건수(단위: 건)

Number of cases

decision of unconstitutionality of internet real-name system

'인터넷 실명제' 위헌 판결

4,752

5,684

15,043

16,633

2009   2012   2015   2019

● **Data** | NPA Cyber Bureau
● **자료** 경찰청 사이버안전국

▲ **Figure 2 : Recent incidents of Cyber defamation**

According to the Korean National Police Agency Cyber Bureau, the cases of cyber defamation and insults are increasing. Not only celebrities which I mentioned but the general people are no longer far from internet harassment. We can easily find malicious comments everywhere on the internet due to the rapid development of platforms such as SNS and YouTube, that makes it easy to share our opinion. Some people use 'internet lynching' to describe the character of internet harassment. The word 'lynching' is historically, intensely, racially charged, which represents hate, injustice, and the wholesale killing of black people in America. Although it is very hard to compare this word to internet harassment, we can infer that malicious comments show a similar nature as witch hunts on the internet. Also, it is showing the seriousness and cruelty of this problem. Then, what is the answer to, "Why internet harassment is happening?"

The anonymity of the internet is widely known to people as the cause of negative comments and harassment. This has been proved by multiple studies. In Pluto's book 'Republic', the tale 'Ring of Gyges' tells the problem of anonymity. Gyges, the herder who served the king of Lydia kills the king, by obtaining a ring that makes himself invisible. However, the truth is, anonymity itself makes people speak more freely, in a positive way, rather than a negative one. Behind the anonymity of the internet, we can debate, and talk about sensitive issues and even the hidden truth of reality which we cannot say in public. Ensuring anonymity for accusers or witnesses for crimes is the most representative example of the net function of anonymity. Then how could have negative comments grown to become such a serious social problem?

Unlike unidirectional media in the past, the internet allowed people to communicate through comments. Comments have the journalistic character which recreates the information and gives an impact to other people's opinion. Though we know that not all information is true on the internet, people easily believe wrong information including an opinion created by comments. Researchers and psychologists have proved that if the information fits into our prejudice and worldview or many people believe it, people tend to accept the information without doubt. 'Infodemic'(information + epidemic), which means a wide and rapid spread of misinformation, may be the reason why unconfirmed negative comments run rampant.

We can also find the reason from a psychological view. According to the Spiral of Silence theory proposed by Elisabeth Noelle-Neumann, people actively express their position if they agree with the public opinion in society. On the other hand, people who have different opinions are more likely to keep silent due to the fear of being isolated from the group. Media is an important factor in expressing the dominant idea in society. While the dominant idea is being reinforced and becomes stronger than it really is, others seem to be weaker than they really are. During this spiral process, people with opposing ideas from the public give up on criticizing, then are pushed back and rejected, eventually

The book 'Eichmann in Jerusalem: A Report on the Banality of Evil' by Hannah Arendt lets us think about the problem of internet harassment. Hannah Arendt said with this book "not thinking about what is wrong and right is itself evil." As I mentioned, internet harassment mostly consist of people who accept information without critical thinking. This means that internet harassment is likely to be based on uncritically and impulsively accepted misinformation, which leads to harassment, to emotional and irrational violence.

The characteristics of internet harassment, which is overly emotional and tries to reject other people's opinions, can also be a problem. According to Gustave Le Bon's study about the "psychological crowd", a new body and group mind are formed regardless of individuals' behavior in the crowd. Once a psychological crowd is formed, it is in the subconscious and becomes impulsive, capricious, hypersensitive, authoritarian, conservative, and unquestioningly persuaded. Invalid arguments, personal attacks, and disparagement can occur due to these characters of the exclusive crowd.

The internet comments are not just untrustworthy opinions. The internet is meant to be a place where people communicate and interact freely and make rational public opinions which can have a positive effect on society, like the public sphere of Jürgen Habermas. To use the internet wisely, we all know how to behave: critical thinking and respect.
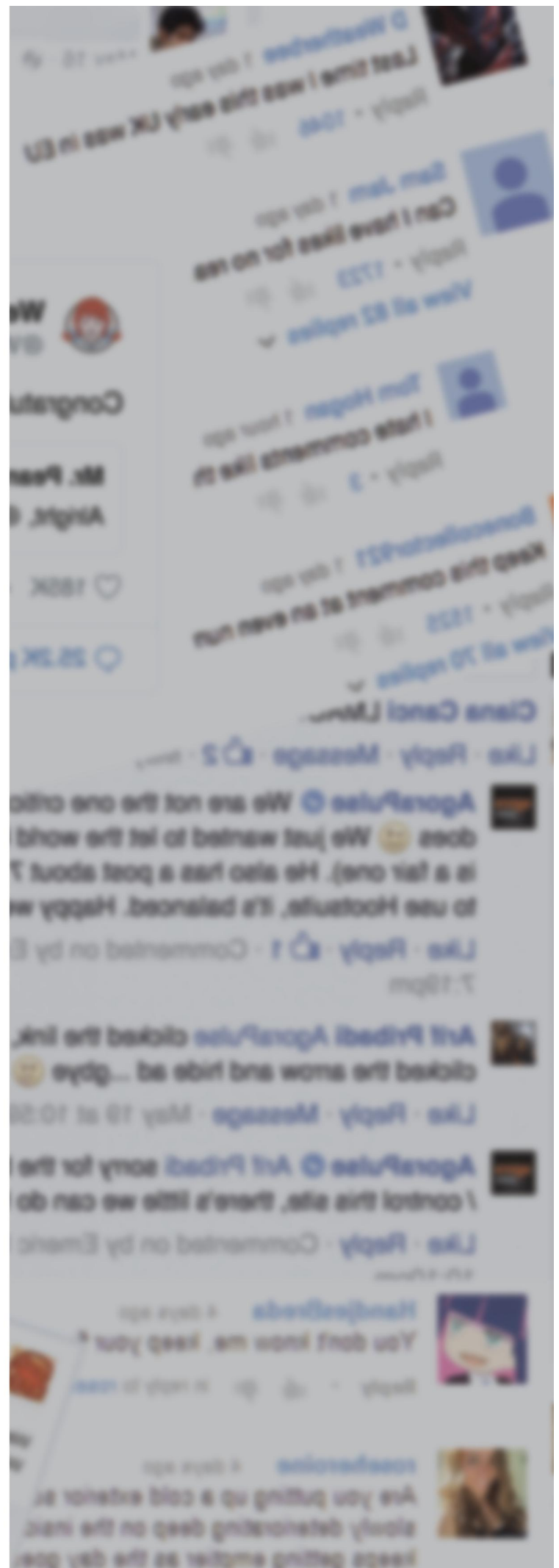
# Hacking COVID-19 : Treatments, Vaccines, Masks

송은수

Development of a Covid-19 Vaccine and Treatments

People are curious about when the Covid-19 vaccine will be coming out. Experts believe it will take at least a year and a half. Why is it taking so long? It's complicated, but generally involves sequencing of Covid-19's RNA and developing an effective and safe vaccine based on Covid-19's structure.

Sequencing of Covid-19's RNA

To develop a vaccine, we need to figure out what Covid-19's RNA looks like. Unfortunately, Covid-19 is so new to us that we don't have much information about its structure. However, recently, Professor Kim Bitnaeri and her team discovered the base sequence of the virus.

The research team analyzed both the genes and the RNA transcript of the Covid-19 virus by using two types of next-generation base sequencing methods, one of them being nanopore direct RNA sequencing. While finding the exact location of the virus gene, they discovered hidden RNAs and several variations of it. It enabled us to understand the composition of the entire body of the virus (RNA produced in cells). In other words, the gene map revealed the complexity of Covid-19. Covid-19 has genes in the form of RNA, not DNA. The virus penetrates host cells and replicates RNAs containing genetic information while producing various sub-generic RNAs based on genomic RNAs. This sub gene synthesizes several proteins that make up the viral particle structure, such as spikes and cladding, and together with the cloned genes forms the complete virus within the host cell. Afterward, it escapes cells and infects new cells.
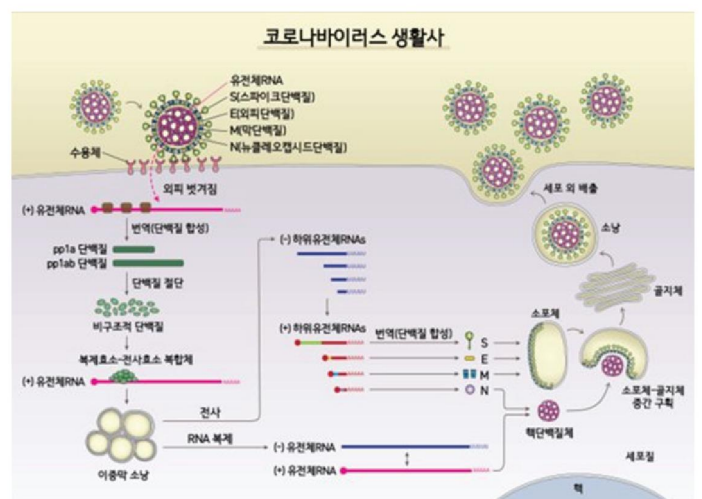
▲ Figure 1 : Life cycle of the Coronavirus

Developing an Effective and Safe Vaccine

RNA characteristics are prone to mutations that add to the complexity of research and development of a viable vaccine. The Covid-19 virus has spread all over the world, often mutating into 3,000 to 6,000 variations. It's hard to say for sure, but the sheer number of variations cast doubt on whether researchers can develop a successful vaccine or vaccines that work against all or significant portion of mutated viruses. Still some scientists believe the basic structure of the virus will not be different even if a mutation occurs. If a vaccine works well in the lab, it still has to go through animal testing and human trials to confirm efficacy and safety. Therefore, it takes significant time to make it available to people all over the world.

Vaccines typically take about 10 years to be developed, approved for use and actually used. Unlike normal vaccines, the Covid-19 vaccines are not going through full toxicity tests and the development is speeding up drastically by reducing the duration of clinical trials for people. Currently, 165 different types of vaccines are being made around the world, and about 30 of them are being tested for their effectiveness on people. In particular, countries that took the lead in vaccine development have already began the final phase of the third clinical trial. The goal is to start the first inoculation at the end of the year. In the case of other vaccines, they don't get to be used right away since it takes time to mass-produce and distribute. For the Covid-19 vaccine, it is being ready to be produced while being tested to shorten even a little amount of time. Here are a few countries that are developing vaccines:

UK : Production for emergency use* is available in October. The joint development team of AstraZeneca and Oxford University is conducting phase 3 clinical trials in Brazil, Britain, and South Africa (47,000 people).

China : Since last July, they have started using emergency vaccinations on medical staffs, and have decided to expand usage further. Their vaccines have been approved for a year in the military. The state-run pharmaceutical company also started its third clinical trial and is speeding up its efforts to make it available among common people before the end of the year.

U.S.A. : Announced that if phase 3 clinical trials showed 50% percent of effectiveness-which is lower than the standard of 70 percent-they'd turn it produce the vaccine. The federal government is financing companies (approximately needs 12 trillion won) to mass-produce the product as soon as the effect is confirmed.

Russia : They officially registered the world's first Covid-19 vaccine. The vaccine was named Sputnik V after the world's first satellite launched into space during the Soviet Union. However, critics say that the vaccine has not been tested sufficiently for safety and efficacy because it has not completed its second clinical trial. The government said it would give vaccines to high-risk groups, including medical staff, but 52 percent of Russian doctors said they would not receive them.

Korea : Korea is still in the first phase of clinical trials, so it is a little behind other countries. It's expected to be made by mid- to late next year. However, the technology and facilities to mass-produce vaccines are so efficient that pharmaceutical companies AstraZeneca and Oxford University have promised to produce the vaccine in the domestic plant of SK Bioscience, a Korean company.

Vaccines will be priced differently from country to country. The same vaccine that costs $200 in the U.S. may cost $2 in underdeveloped countries. The price probably averages to $40.

The focus right now is on developing an effective and safe vaccine, but we will also need to develop treatments in the event of an infection.

The joint research team led by Zhou Chang, a researcher at China's West Lake Institute (WIAS), published in the journal Science on the 6th of November its observations of the detailed three-dimensional structure of the spike protein on the surface of Covid-19 through Cryo-EM (Cryogenic electron microscope) and findings on how the spike protein combines with human respiratory cells.

Covid-19 is a variant derived from SARS (Severe Acute Respiratory Syndrome) coronavirus (SARS-CoV), and its operating principles were known to be similar to SARS-CoV. Researcher's believe the spike protein on the surface of the virus combines with 'Ace 2', a receptor that is expressed on the surface of human respiratory cells.

Therefore, finding antibodies that can block receptors may not only fundamentally prevent Covid-19 infections, but may also suppress severity of the infection. To develop antibodies, one needs to know the structure of the binding site between the virus and the human cells.

The researchers succeeded in closely observing the detailed structure of the Covid-19 spike protein and its combination with ACE2 at a high resolution of up to 2.9A (one-billionth of a meter) level with Cryo-EM.

The analysis showed that in practice, Covid-19 goes through a process very similar to other corona viruses and infects the human body. The Covid-19 spike protein was combined with ACE2 interacting largely in three areas. "The combination was mainly through Dipole-to-pole interaction," Chang explained. Dipole-pole interaction refers to the interaction caused by electrostatic forces between two polar molecules.
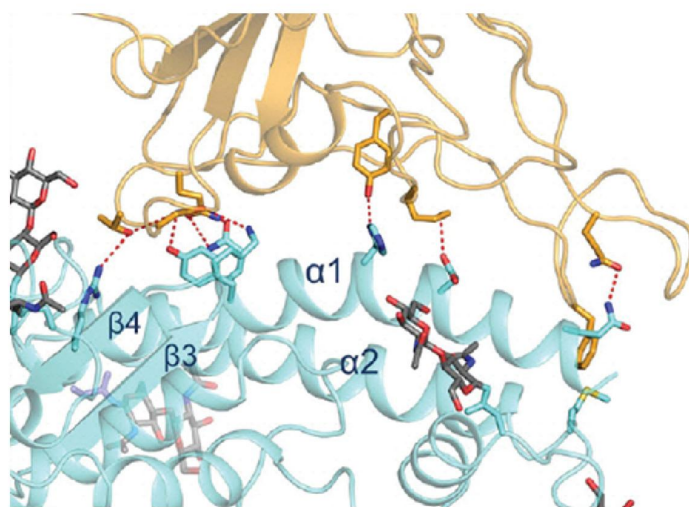
Based on this observation, there are two potential options on how to fill in the gaps of the virus.
1. Cutting off the spike of the virus. (cure): When a virus gets into human cells, they multiply. However, without the spike proteins, they cannot multiply, which will eventually allow to human host to recover.
2. Preventing spike interaction (prevention): Researchers are trying to cut off the spikes and develop vaccines. As the virus cannot increase in numbers without spikes, they help create the antibodies beforehand.

In light of the time and cost involved in developing an effective and safe vaccine, what can we do in the meantime?

Before the Covid-19 vaccine is released, the most effective prevention of infection is "wearing masks."

In the early spread of Covid-19, medical experts said wearing masks didn't have much effect in preventing the disease. The World Health Organization (WHO) also recommended that wearing masks is necessary only for people with symptoms. But now the situation has changed completely, revealing the great power of masks.

Scientists compared and analyzed the infection rate of Covid-19 before and after Italy and New York City made it mandatory to wear masks. The infection rate, which was not budging even during the home quarantine and other containment measures, dropped sharply when it became mandatory to wear a mask. Isolation and hand washing can block contact spread, but it can't block both droplets and airborne infection.

All officially certified products are fine to use. KF94 Health masks or KF-AND non-alignment masks are licensed in Korea. It would be safer to use products that have been proven safe effective by the Ministry of Food and Drug Safety.

What's more important than the type of mask: using it properly to cover your nose and mouth. If you just cover your mouth and leave your nose exposed, it won't work.

So far, we've have discussed the lengthy timeline for developing an effective and safe vaccine, but in the meantime all of us can do our part by taking meaningful and proven precautions such as properly wearing masks.

HORIZONS

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