The little known origin of the N95 respirator

The N95 respirator, one of the most important medical protective devices available today, has undergone a complete development and development history spanning more than a century.

It is hard to find a symbol more suited to the current Covid-19 pandemic than the N95 gas mask. The mask fits snugly around the face and is capable of filtering up to 95% of airborne droplets, such as viruses, toxic fumes, which other equipment (such as surgical masks) cannot do. Life-saving equipment is now becoming a global shortage and it represents the most extreme challenge the world faces in its battle with Covid-19.

So how did such a fragile polymer snap become the most important medical device of the 21st century - especially in today's circumstances? It all started in 1910 from a little-known doctor who wanted the world to be one of the worst diseases ever known.

The first mask designs

According to Christos Lynteris, a senior lecturer at the Department of Sociology of Sociology of Saint Andrew University, long before knowing that bacteria and viruses can spread in the air and make us sick, people A mask has been used - but not to prevent the spread of disease.

Plague masks for 17th century doctors

At that time people thought that diseases such as plague were caused by miasma or poisonous gas rising from the ground. This concept drove the design of famous disease masks across Europe in the 1600s. These elongated masks mimic bird beaks and have two breathing holes on the side that can be placed. Incense (or incense) into it.

People think that by stopping themselves from smelling the plague, they will not be infected with this deadly disease. Doctors - who are assigned to identify the disease - will wear these masks and mark the infected person by tapping on the stick.

It was not until the 1870s that when scientists knew more about bacteria, the concept of miasma gradually declined with the horror design of the gas mask.

The picture depicts the horror of ancient plague doctors

Since 1897, doctors began to wear surgical masks when working. But at the time, they were no different than a handkerchief towel wrapped around the face, and they were not designed to filter sick carriers in the air - even now. They are made only to prevent doctors from coughing or sneezing into wounds during surgery.

This is the most important difference between a mask and a gas mask. This is also the reason why medical experts are so worried when they are being instructed to wear surgical masks when interacting with Covid-19 patients, while not having gas masks. These respirators are not only made of materials other than masks, but also very close to the face, so that the air filtration of breathing air is maximized.

First respirator - born of plague and stigma

In the fall of 1910, an epidemic broke out in Manchuria - at that time a complex area of ??dispute between Russia and China. While the disease has caused terribly high mortality rates, to " *100% of infected people, no one survives* " - as Mr. Lynteris said, it also created a race for science. Both Russia and China want to demonstrate their scientific capabilities, from which to lay claim to sovereignty.

The Chinese side sent a young doctor named Wu Lien-the to lead his efforts. Although graduating from Cambridge, but among a large pool of international scientists and doctors from around the world to learn about this deadly disease, Wu became " *completely unimportant* ". But after an autopsy was carried out, Wu found that the disease was spread through the air, rather than through fleas, as many suspected.

Medical workers with anti-epidemic masks in the outbreak of pneumonia in Manchuria in 1910.

With this judgment and based on the surgical masks he had seen in the West, Wu designed a firmer mask from gauze and cotton, which could be wrapped around the face and added many layers of cloth to air purifier. His invention was a breakthrough at the time, but receiving it was only the suspicious and disdainful eyes of colleagues.

Lynteris said: " *There was a famous old doctor in the area, a French doctor (Gérald Mesny) . and when Wu explained to the French doctor his theory that this epidemic was pneumonia and contagious. through the air, the Frenchman insulted him . in a discriminatory manner "What can we expect from a Chinese?" And to prove his*

point, Mesny came in and took care of him. the patient was hospitalized without Wu's mask, and he died two days later from the disease . "

Although other doctors in the region quickly developed their own type of masks, Wu's mask won everything. It has a great design. It can be made by hand from cheap and readily available materials.

From January to February 1911, the production of masks increased at a dizzying pace when everyone wore it. From the medical staff, soldiers and some even wear them everyday. Not only help prevent the spread of disease, these masks also become symbols of modern medicine.

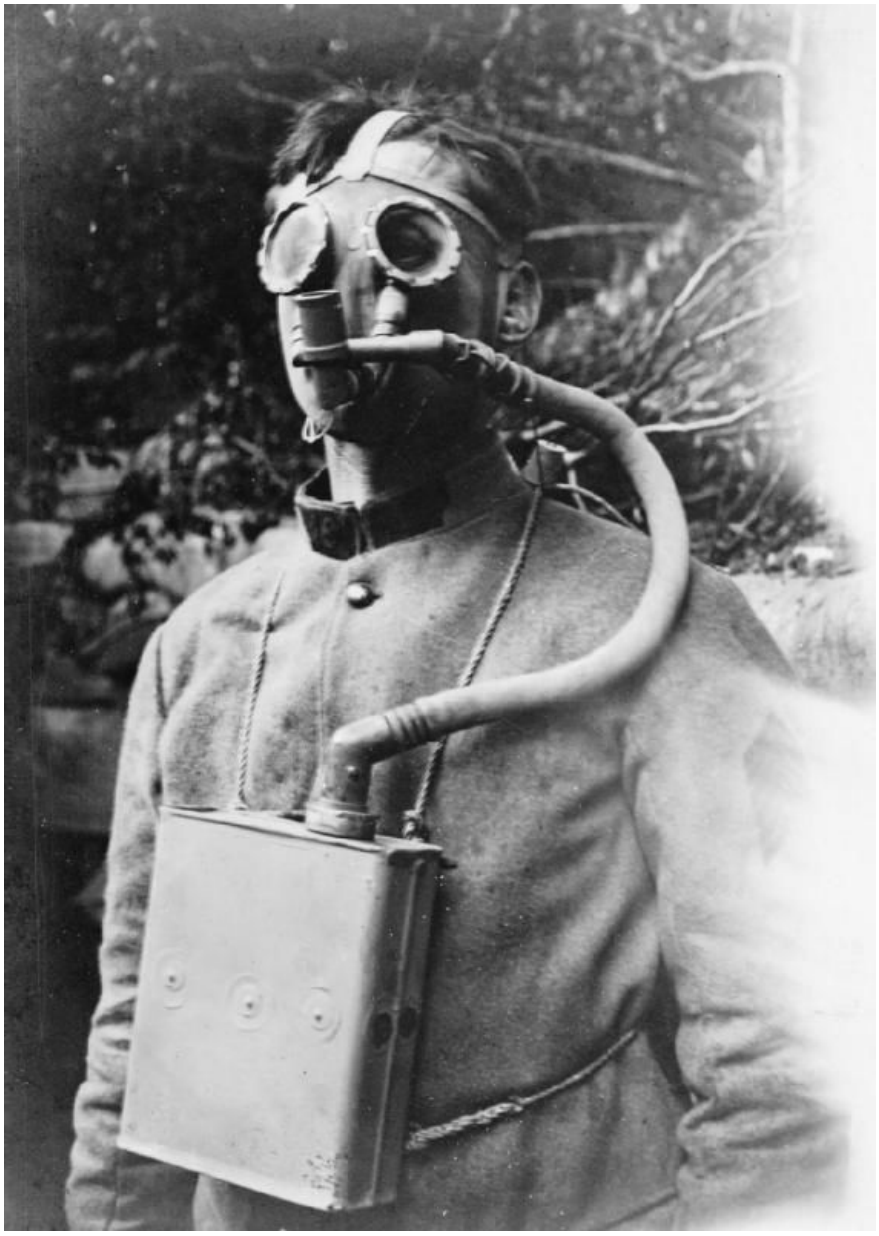
And by the time the Spanish flu pandemic appeared in 1918, Wu's mask became even more famous in the scientific community as well as the public. Companies around the world have stepped up production of similar masks to help reduce the spread of flu.

Garage employees and passengers wear masks during the 1918 flu pandemic.

And then the N95 mask was born

The N95 mask is a descendant of Mr. Wu's design. During World War I and World War II, scientists invented toxic gas masks that covered people's heads to purify breathing air. Such masks, but lined with glass fiber filters, began to be used in the mining industry to prevent black lung disease.

Although effective in protecting health, they are quite bulky and heavy. The main reason lies in the filter. In addition, fiberglass makes breathing harder and the hooded design makes the wearer hot. Therefore, this is dangerous for people working in the construction environment when they often inhale asbestos but do not want to wear these masks because the construction site is already quite hot.



The type of gas masks used during World War I.

Therefore, by the 1970s, the Department of Mines and the National Institute of Health and Safety created the first criteria for " *disposable respirators* ".

3M was the first company to develop a disposable N95 dust mask and was approved in 1972. Instead of using fiberglass, the company reused a technology they had developed to making the tape harder for the filter. The company uses molten polymers and blows it into tiny layers of filaments to make these fibers harder and use

them as filters.

Therefore, particles in the air, whether silicon dust or viruses, pass through the filter and become trapped in the labyrinth of hard fibers. In addition, 3M adds extra charge to this layer of filter material, which helps attract even smaller particles towards these fibers. Meanwhile, because the gap between these fibers is quite large, users can still breathe easily.

But at some point, when these gaps are filled with these particles, it's harder to breathe. That's why the N95 respirator cannot be used for longer than 8 hours at a time in dusty environments. It still filters out the dust and particles later, but breathing becomes more difficult, and that's the reason for replacing it daily.

And over the decades that followed, N95 masks were gradually used in a variety of industries before the demand for respirators soared in the 1990s when drug-resistant tuberculosis increased again.

To prevent TB germs from spreading in the air, N95 respirators became standard equipment for health-care workers, and doctors also began wearing them to help tuberculosis patients. Even so, these masks are rarely used in hospitals today, and their demand only soared during outbreaks like Covid-19 today.

As for China, gas masks like Wu's design have never been so important to this country. Most recently during the SARS outbreak, Chinese people had to wear these face protectors to prevent the spread of the disease. Later, when cities like Beijing were polluted with air, people also increased their masks to filter out toxic gas.

N95 mask is not perfect. It is designed to fit close to the face of the user, including children or beards, but if not sealed, it will not work as advertised. In addition, N95 variants for use in high-risk rooms do not have breathing valves, so they can cause heat to wear.

But the N95 mask has had hundreds of years of development to deal with various crises. And that development will continue even after the Covid-19 pandemic is over. 3M says the company is continually re-evaluating its N95 mask, refining its parts, from filters to its ergonomic shape.

Nikki McCullough, head of Occupational Health and Safety at 3M, said: " . *we want them to look simple so they are intuitive and easy to use. We are always improving the technology. I have thousands of scientists at 3M to study it* . "