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# BREAKTHROUGH ON FACE MASK WHICH CAN ARREST AND KILL COVID-19

Curie Limited – Aldrin OR



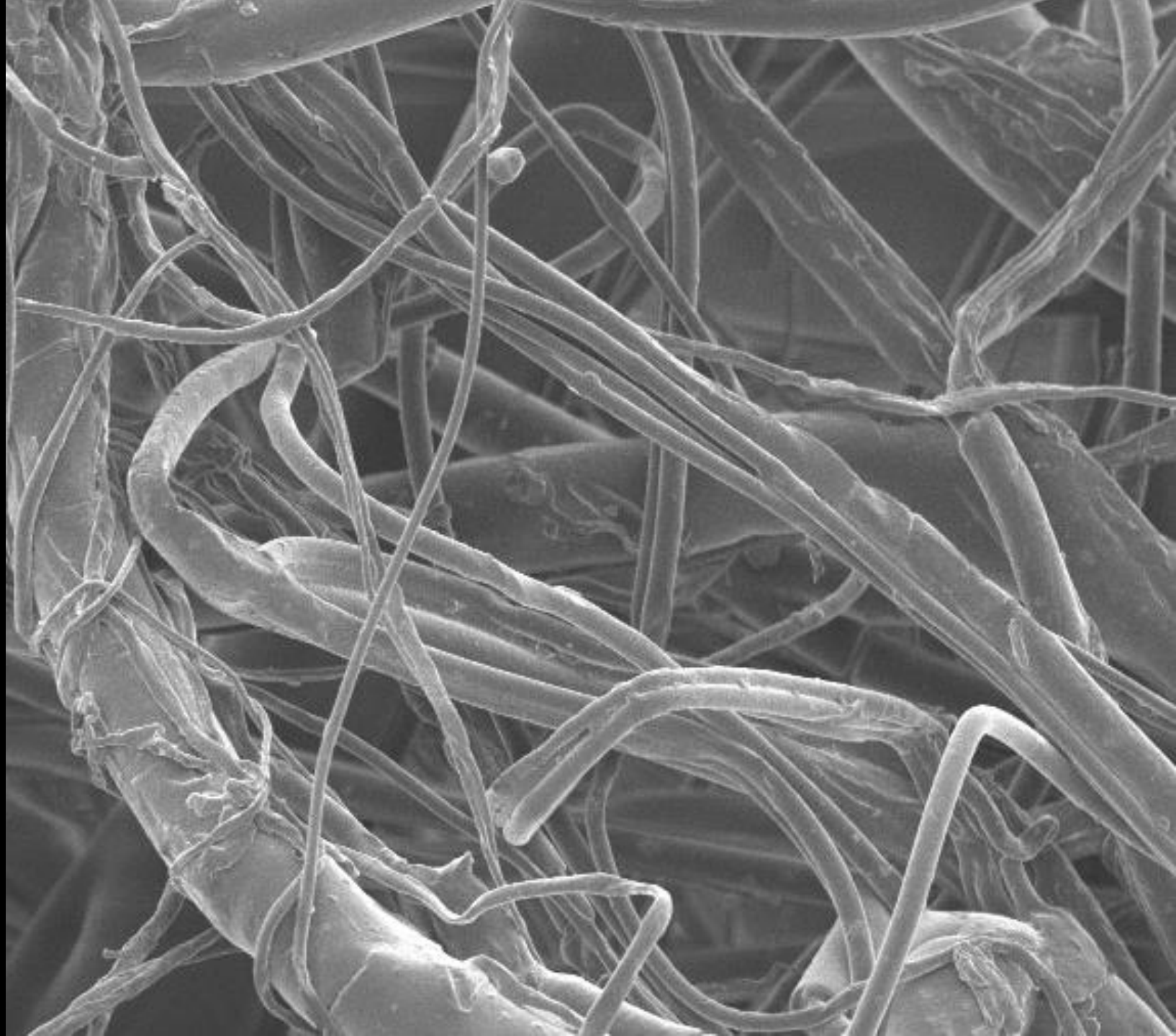
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# INTRODUCTION

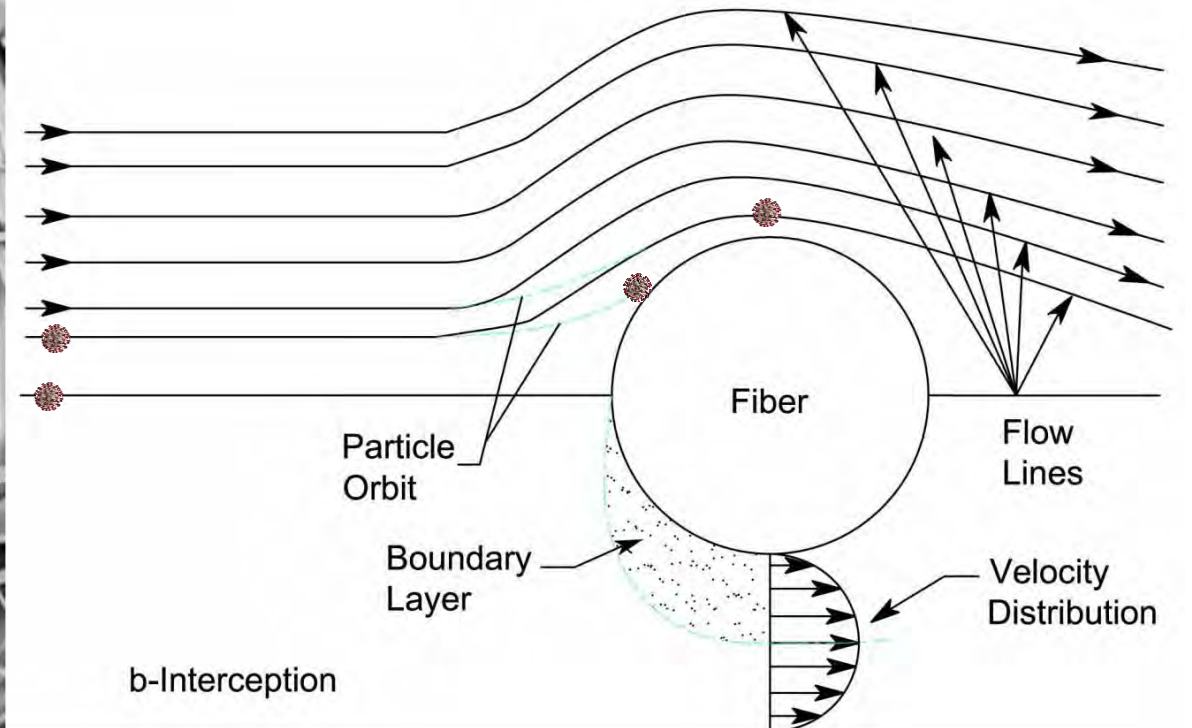
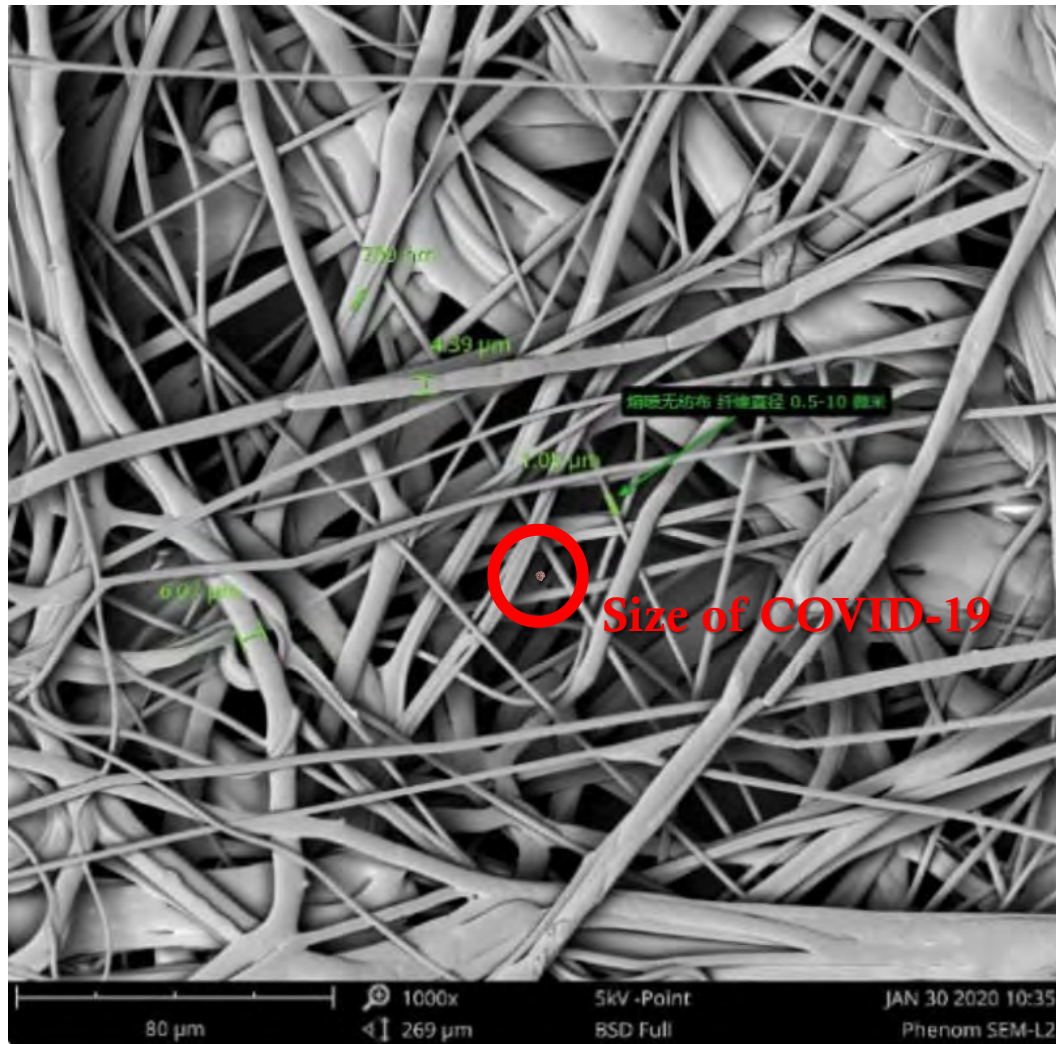
- Patrick Lee – Hong Kong Association for Testing, Inspection and Certification
  - Prof Eric Sze – The Open University of Hong Kong
  - Prof Anthony Law – The Hong Kong Polytechnic University
  - Prof William Yu – City University of Hong Kong
  - Prof Stephen Lee – Bolton University, UK
  - Aldrin Or – Curie Limited
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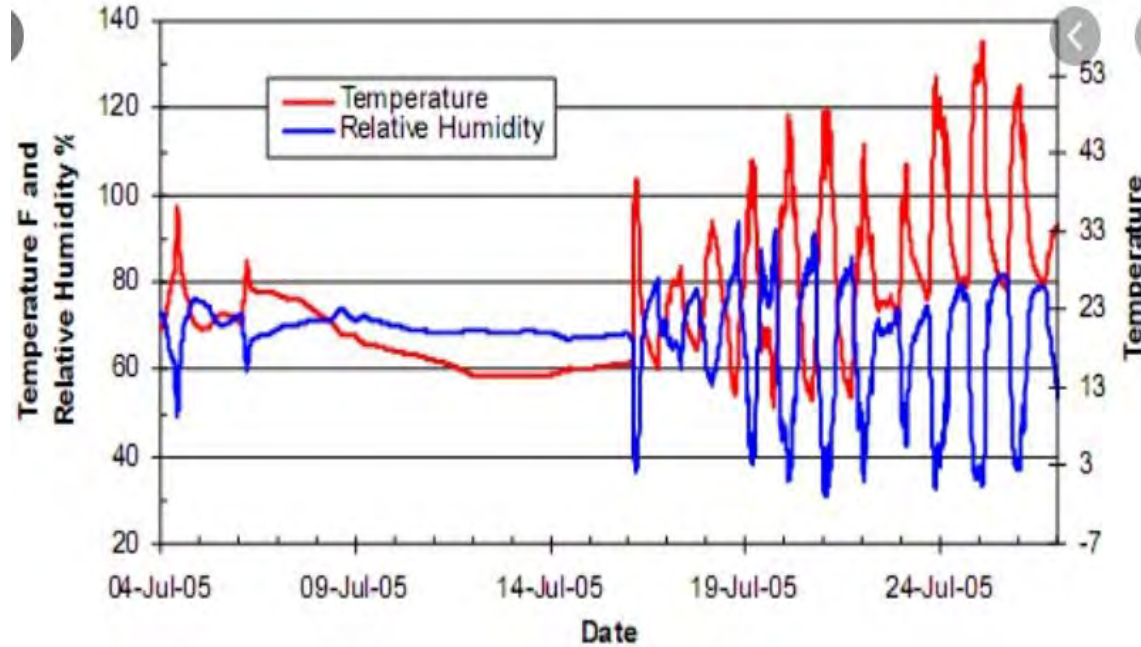
# THE DEFICIENCIES OF CURRENT FACE MASK



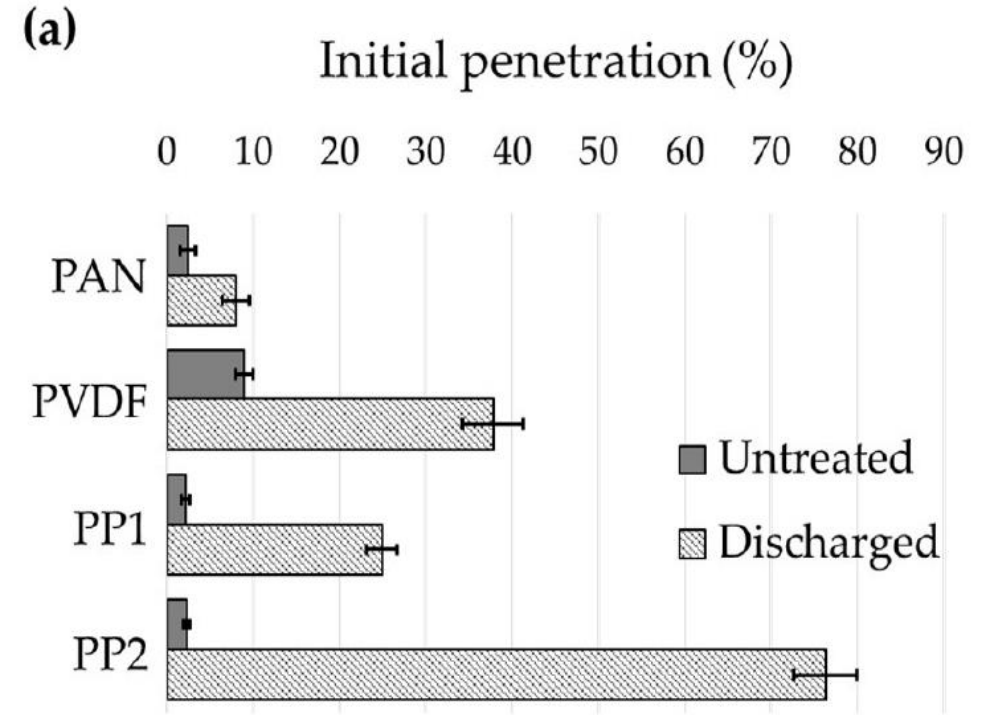




Meltblown rely on electrostatic force to arrest COVID-19

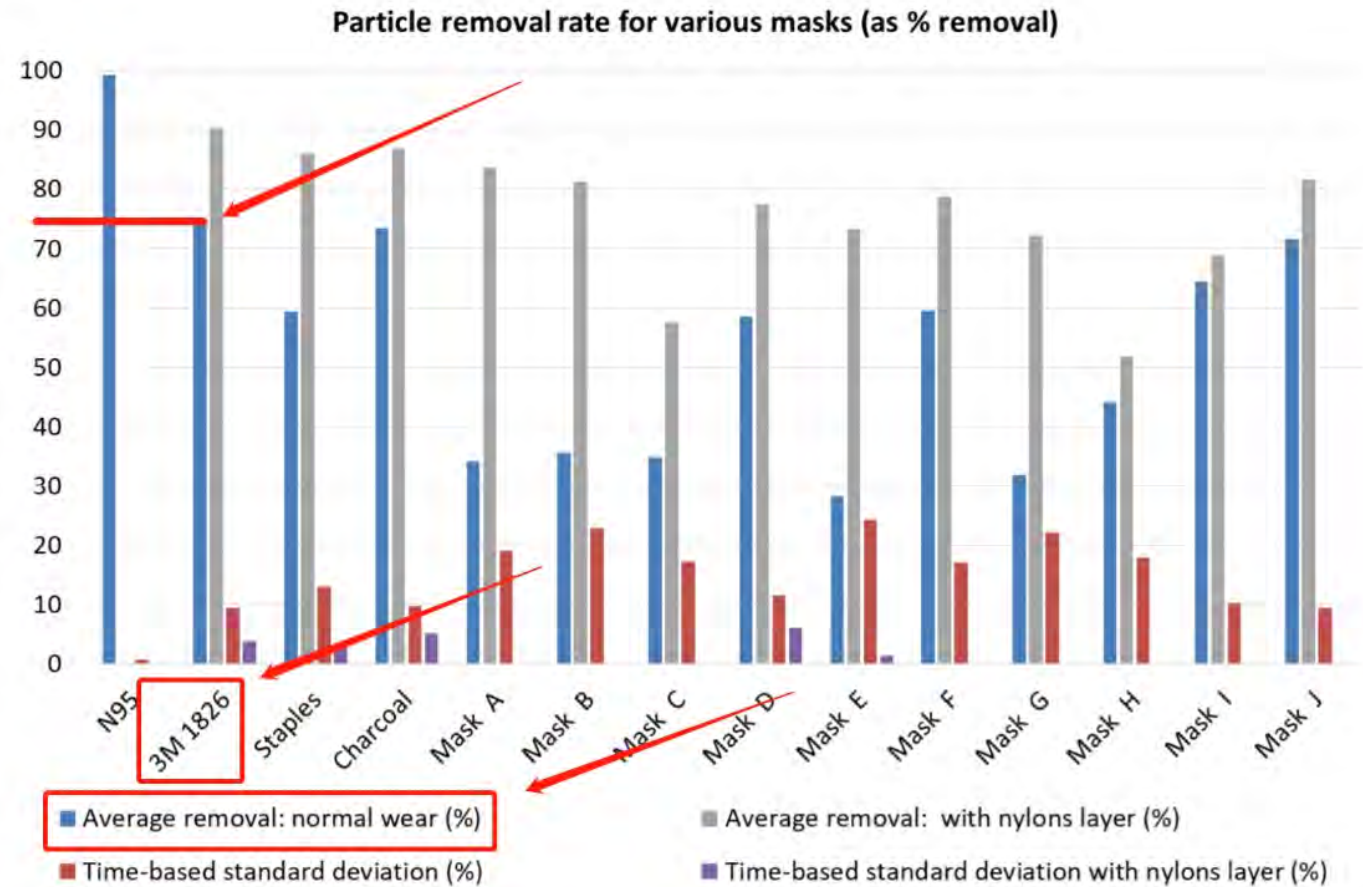


Temperature and Humidity Change in Ocean Freight



Filtration Efficiency Drop after Electrostatic Force Being Discharged

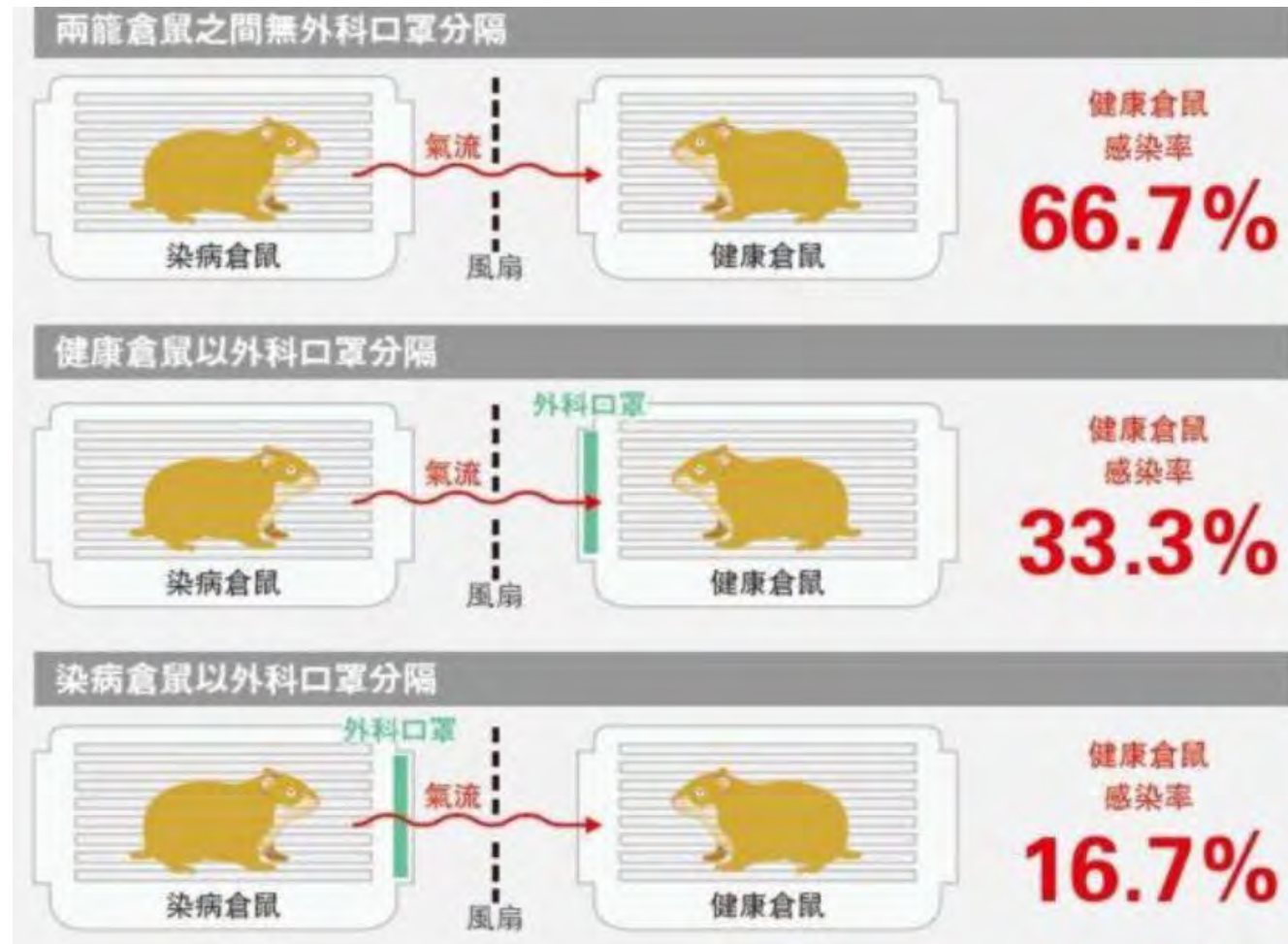
Electrostatic force would be discharged during transportation or wearing because of hot weather and high humidity



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Northeastern University found 3M masks only having 75% efficiency





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The University of Hong Kong found masks would only have 66.6% / 83.3% protection efficiency against latest mutation of COVID-19

## News

**Covid-19: North Dakota and Belgium have let infected health staff work on wards**

BMJ 2020 ; 371 doi: <https://doi.org/10.1136/bmj.m4455> (Published 16 November 2020)

Cite this as: BMJ 2020;371:m4455

Read our latest coverage of the coronavirus outbreak

Article

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Responses

Philippe Devos, head of Belgium's association of medical unions, said in an interview with *Deutsche Welle* that 10% of doctors and nurses at his hospital, CHC Montlegia, were at home sick because of covid-19, while in other hospitals in the country the absence rate was 25%.<sup>4</sup> "We don't have any solution any more," he said. "We are forced to ask them to work, if they agree."

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Belgium got over 25% of healthcare workers infected, they are geared with highest grade of masks and PPE



## COVID-19 has infected some **570,000 health workers** and killed 2,500 in the Americas, PAHO Director says

2 Sep 2020

*Despite downward trends, human cost of pandemic remains unacceptably high, with almost 4,000 deaths a day in region*

Washington D.C., September 2, 2020 (PAHO) – Health workers are especially vulnerable to COVID-19, and in the Region of the Americas,



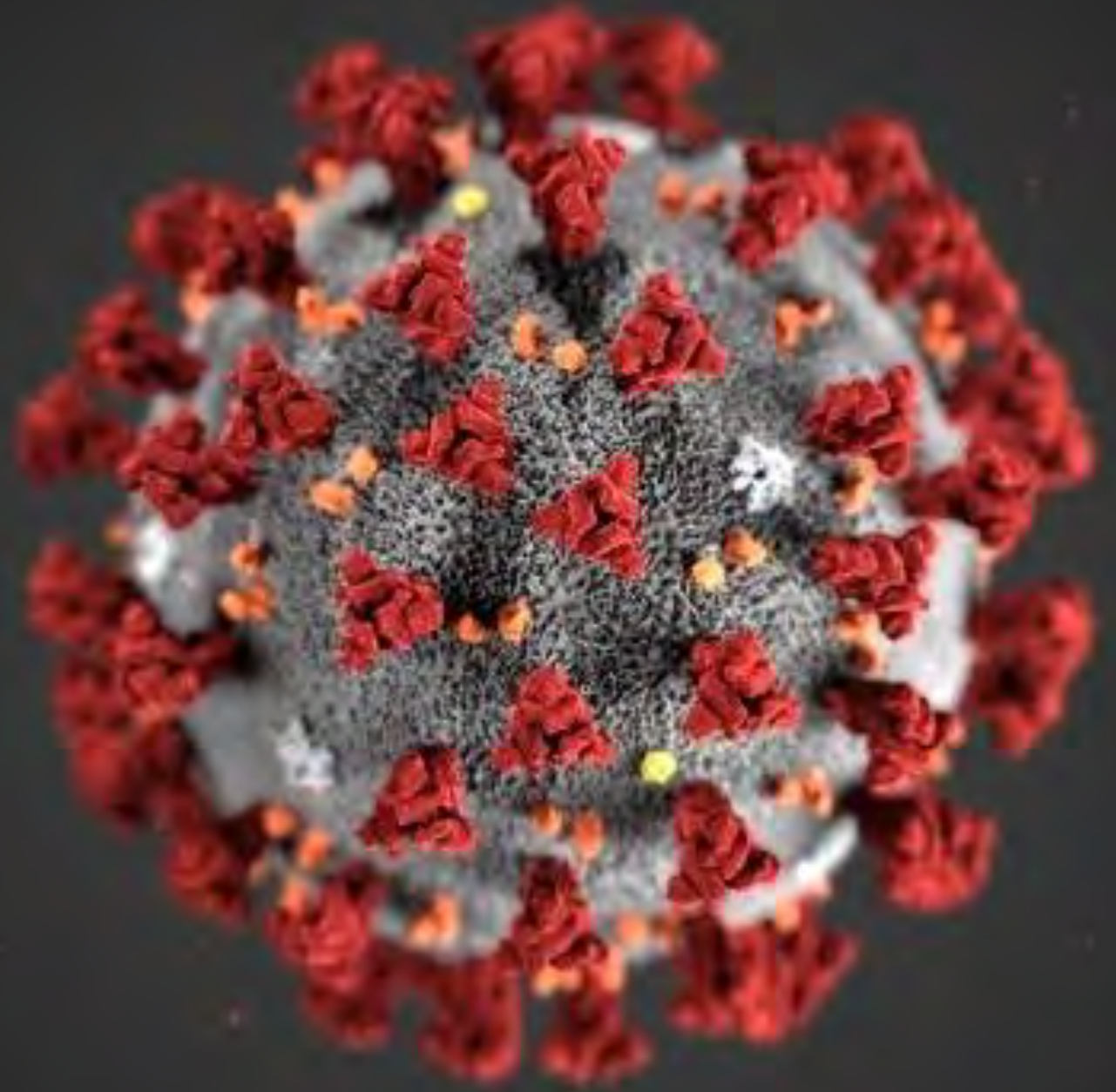
“We have the highest number of health care workers infected in the world,” PAHO Director Carissa F. Etienne said during a press conference today. “Our data shows that nearly 570,000 health workers across our region have fallen ill and more than 2,500 have succumbed to the virus.”

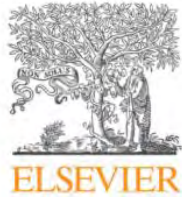
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US got over 570,000 healthcare workers infected, they are geared with highest grade of masks and PPE

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# THE INVENTION OF A NEW FACE MASK TECHNOLOGY





Contents lists available at SciVerse ScienceDirect

Virology

journal homepage: [www.elsevier.com/locate/yviro](http://www.elsevier.com/locate/yviro)

## Negatively charged residues in the endodomain are critical for specific assembly of spike protein into murine coronavirus

Qianqian Yao<sup>a</sup>, Paul S. Masters<sup>b</sup>, Rong Ye<sup>a,\*</sup><sup>a</sup> Department of Microbiology and Parasitology, School of Basic Medical Sciences, Fudan University, Shanghai 200032, China<sup>b</sup> Wadsworth Center, New York State Department of Health, Albany, New York, USA

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### ABSTRACT

Coronavirus spike (S) protein assembles into virions via its carboxy-terminus, which is composed of a transmembrane domain and an endodomain. Here, the carboxy-terminal charge-rich motif in the endodomain was verified to be critical for the specificity of S assembly into mouse hepatitis virus (MHV). Recombinant MHVs exhibited a range of abilities to accommodate the homologous S endodomains from the betacoronaviruses bovine coronavirus and human SARS-associated coronavirus, the alphacoronavirus porcine transmissible gastroenteritis virus (TGEV), and the gammacoronavirus avian infectious bronchitis virus respectively. Interestingly, in TGEV endodomain chimeras the reverting mutations resulted in stronger S incorporation into virions, and a net gain of negatively charged residues in the charge-rich motif accounted for the improvement. Additionally, MHV S assembly could also be rescued by the acidic carboxy-terminal domain of the nucleocapsid protein. These results indicate an important role for negatively charged endodomain residues in the incorporation of MHV S protein into assembled virions.

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# Spike protein over coronavirus is negative charged



# This coronavirus mutation has taken over the world. Scientists are trying to understand why.

Studying both versions of the gene using a proxy virus in a petri dish of human cells, Choe and her colleagues found that viruses with the G variant had more spike proteins, and the outer parts of those proteins were less likely to break off. This made the virus approximately 10 times more infectious in the lab experiment.

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Mutation of COVID-19 tend to have more spike proteins

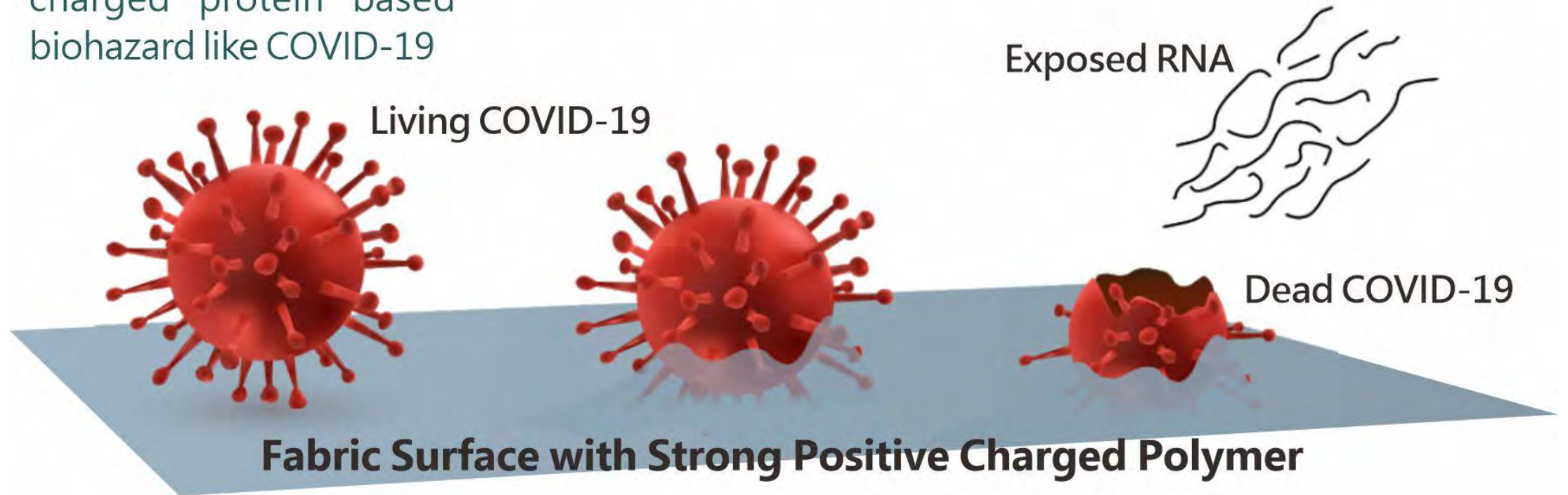


## Technical Path

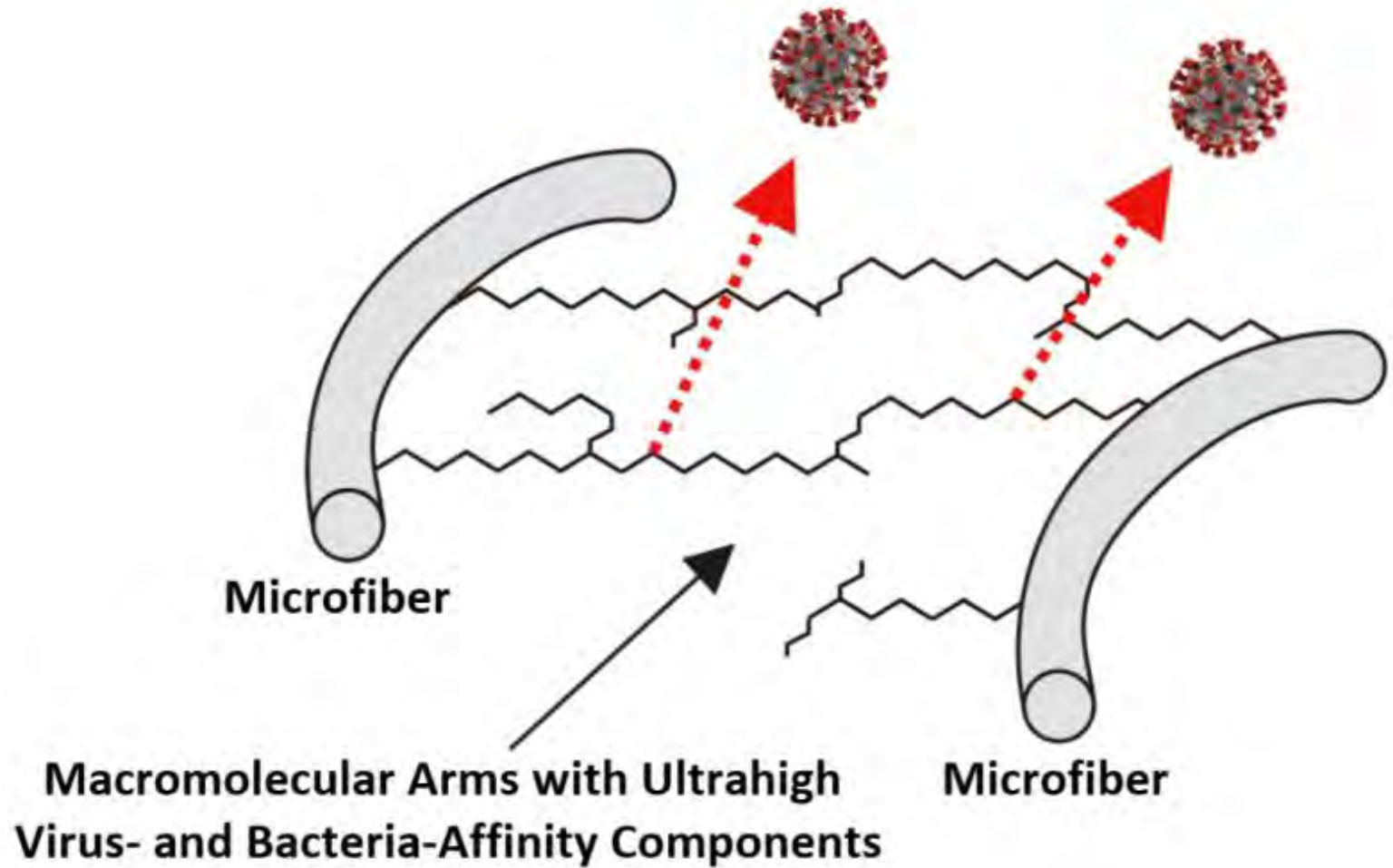
1. Strong positive charged polymer attract negative charged protein based biohazard like COVID-19

2. Polymer arrest biohazard like COVID-19

3. Polymer tear off envelope of biohazard like COVID-19

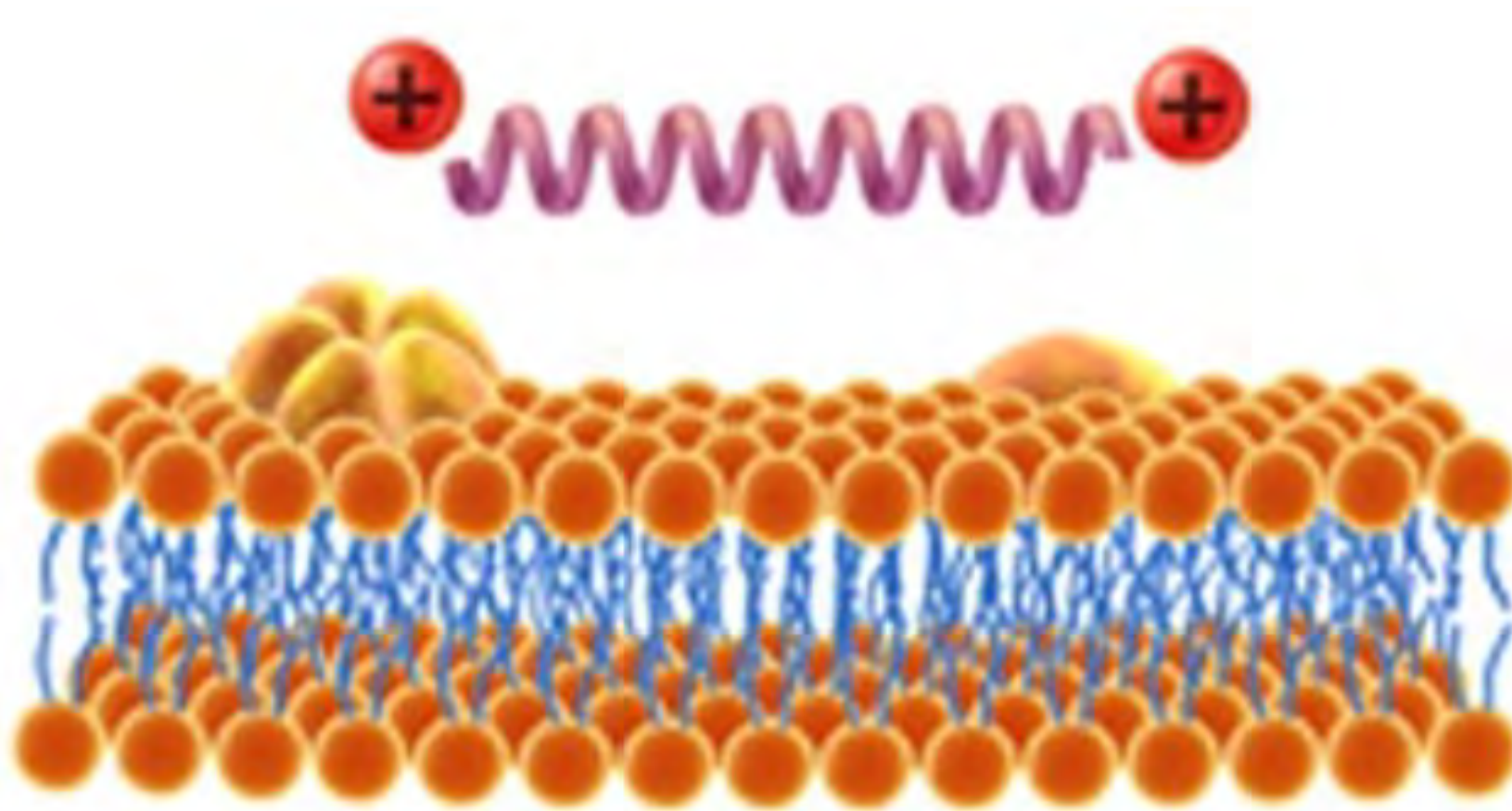


New approach is using strong positive charged polymer to build up a nano net between fabric base to arrest COVID-19



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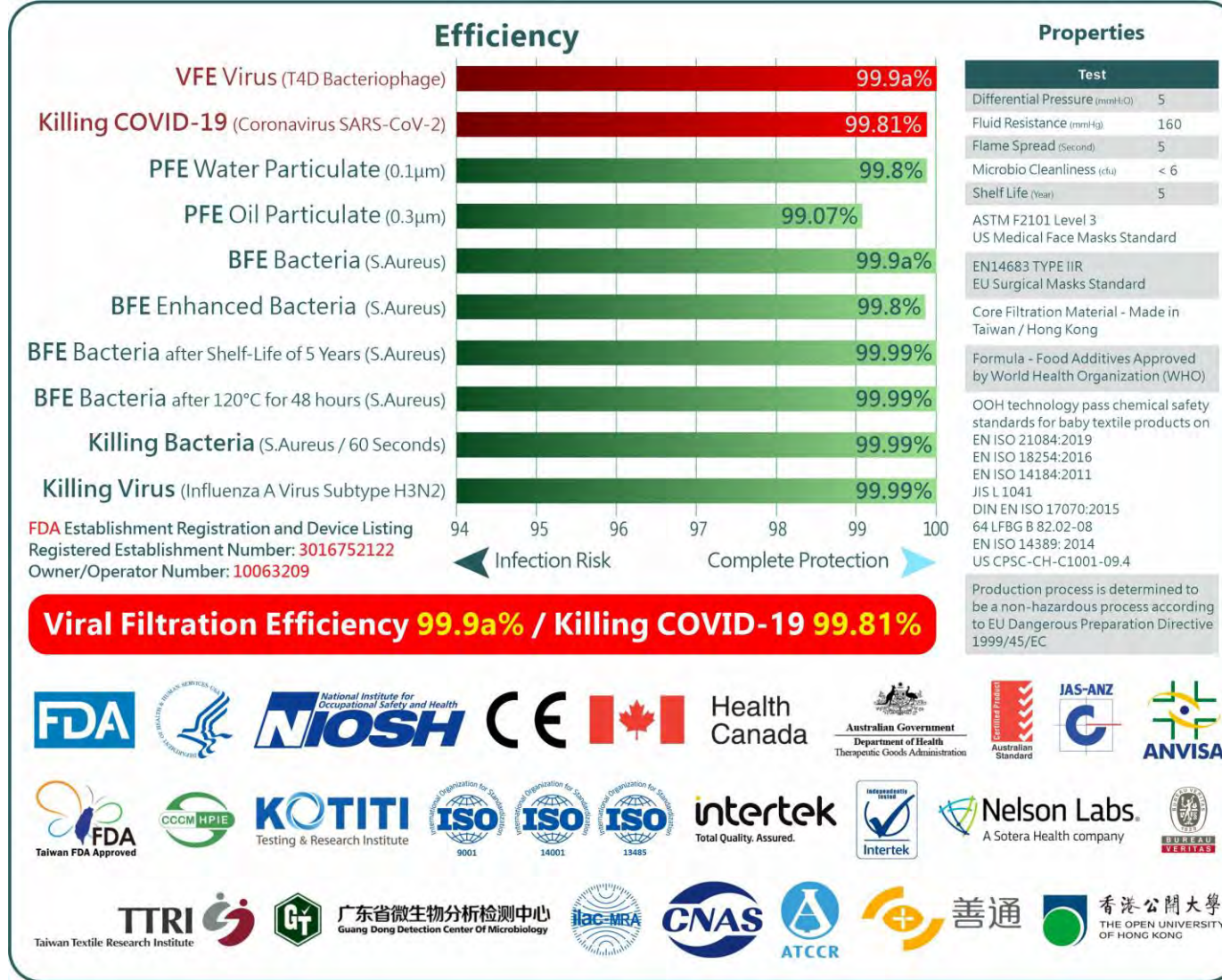
New approach is using strong positive charged polymer to build up a nano net between fabric base to arrest COVID-19



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Strong positive charged polymer will attract negative charged polar head in the envelope of COVID-19, then tear it off and kill it.





New approach reached above performance, achieving  
“Arrest + Kill” of COVID-19 at once.



**Results:**

Test Article Number	Percent VFE (%)
1	>99.9 <sup>a</sup>
2	>99.9 <sup>a</sup>
3	>99.9 <sup>a</sup>
4	>99.9 <sup>a</sup>
5	>99.9 <sup>a</sup>

<sup>a</sup> There were no detected plaques on any of the Andersen sampler plates for this test article.

The filtration efficiency percentages were calculated using the following equation:

$$\% VFE = \frac{C - T}{C} \times 100$$

C = Positive control average

T = Plate count total recovered downstream of the test article

Note: The plate count total is available upon request

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New approach arrest 99.9a% of virus

**Test results**

Virus Types	(NO)	$\lg(V_{a0h})$ ( $\lg\text{TCID}_{50}/\text{mL}$ )	$\lg(V_{b2h})$ ( $\lg\text{TCID}_{50}/\text{mL}$ )	$\lg(V_{c2h})$ ( $\lg\text{TCID}_{50}/\text{mL}$ )
COVID-19 virus MDCK cells	1	6.73	6.68	3.7
	2	6.68	6.56	4
	3	6.7	6.57	3.9
Average Value of $\lg\text{TCID}_{50}/\text{mL}$		6.70	6.61	3.88
Antiviral Activity Value		2.72		
Antiviral Activity Rate (%)		99.81		

New approach kill 99.81% of COVID-19

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# THE IMPORTANCE TO DEVELOP NEW STANDARDS FOR FACE MASKS



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# LOOPHOLE OF CURRENT MASK STANDARDS

- Focus of ASTM F2100 / NIOSH / EN14683 / EN149 are **Particulate Filtration Efficiency (PFE)**
  - PFE is using **neutral charged NaCl** to test penetration rate of masks
  - Physical properties and motions of NaCl are fundamentally **different from COVID-19**
  - Electrostatic force will work well on neutral charged object, but they would be **less effective** on **negative charged COVID**.
  - **Mutation of COVID** make it much **stronger in negative charged** than the 1<sup>st</sup> generation.
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# LOOPHOLE OF CURRENT MASK STANDARDS

- Current standards didn't consider
    - **Electrostatic lost** in transportation
      - Transportation and storage will deteriorate filtration efficiency
    - **Head motion** during wearing
      - Head motion will shake COVID inwards to our mouth during wearing
  - We made masks according to an outdated standard
  - Masks with outdated standards fail to protect people from mutation of COVID-19
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# OUR SOLUTION FOR UNITED NATIONS



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**同心抗疫** *Together,  
We Fight the Virus!*

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