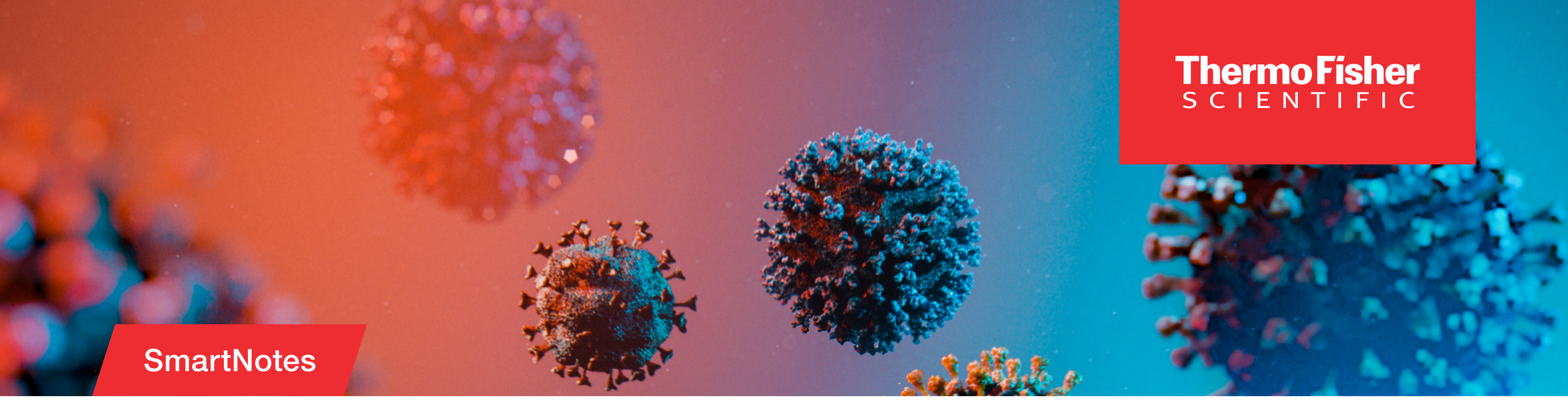


How more efficient specimen collection could help prevent exposure to enveloped RNA viruses.

Even before the emergence of SARS-CoV-2, respiratory infections, the majority of which are caused by enveloped RNA viruses, were a leading cause of mortality worldwide. In fact, they accounted for an estimated 2.7 million deaths in 2015.[1]

Public health policies place a huge emphasis on managing outbreaks of these highly contagious viruses, with PCR testing playing a central role in robust responses, particularly during respiratory disease seasons. Traditional approaches, however, present challenges.

Along the workflow, there are multiple points at which the sample could be accidentally released, threatening the reliability of results and safety alike, and many traditional inactivation media contain a guanidine-based chemical that can put staff and the environment at risk.

Thermo Scientific™ InhibiSURE™ Viral Inactivation Medium formula is non-hazardous, and eliminates the need for deactivation steps.

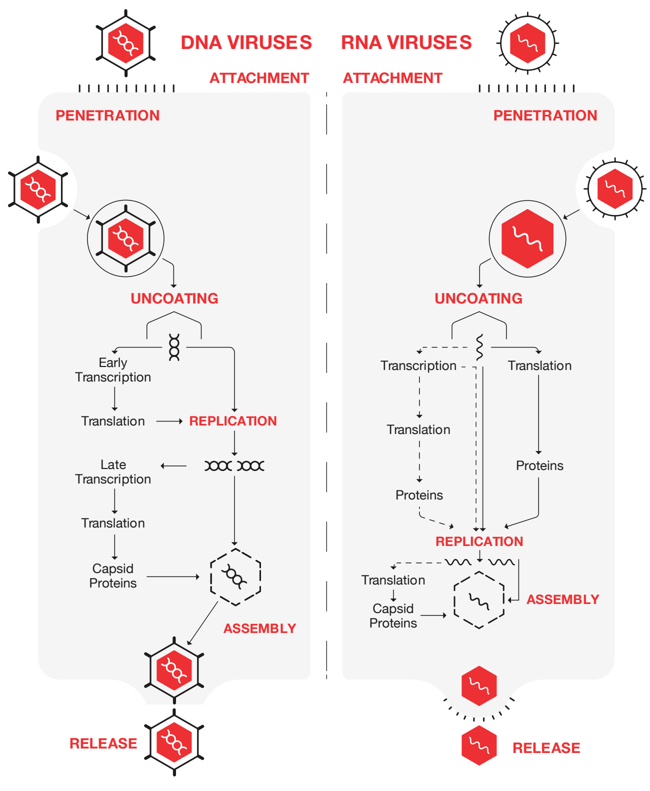
It inactivates highly contagious enveloped RNA viruses, such as SARS-CoV-2, respiratory syncytial virus (RSV), parainfluenza, and influenza A, in just 30 minutes, making it an invaluable tool in the fight against these potentially deadly pathogens.

What is an enveloped RNA virus?

The National Institutes of Health (NIH) National Human Genome Research Institute defines a virus as an "infectious microbe consisting of a segment of nucleic acid, either DNA or RNA, surrounded by a protein coat".[2]

Viruses contain either DNA or RNA, and are enveloped or non-enveloped:

- DNA versus RNA viruses. DNA viruses are packaged with their polymerase machinery, allowing them to replicate in the host cytoplasm directly. RNA viruses, on the other hand inject their genetic material into the cytoplasm of the host cells, which then transcribe and replicate the viral proteins.[3]
- Enveloped versus non-enveloped viruses. Non-enveloped viruses are made up of genetic material, surrounded by a protein capsid. Enveloped viruses have a lipid envelope that covers the protein capsid.[4]



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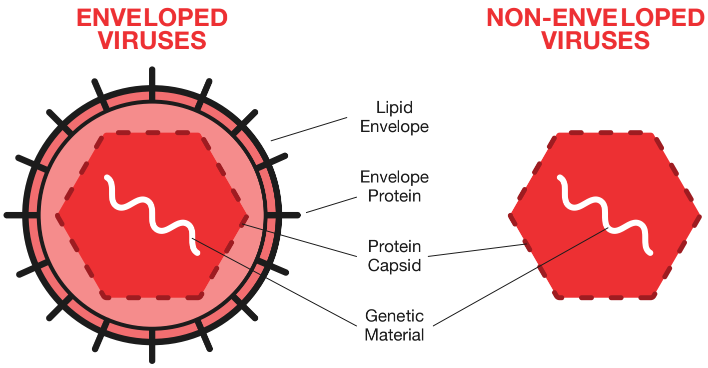


"RNA viruses have high mutation rates—up to a million times higher than their hosts—and these high rates are correlated with enhanced virulence and evolvability, traits considered beneficial for viruses,"

The characteristics of RNA and enveloped viruses both proffer high rates of mutation which may go some way to explaining why some of the most clinically important viruses are of the enveloped RNA variety.

SARS-CoV-2:[6]

As of 21 December 2022,
SARS-CoV-2 had caused:

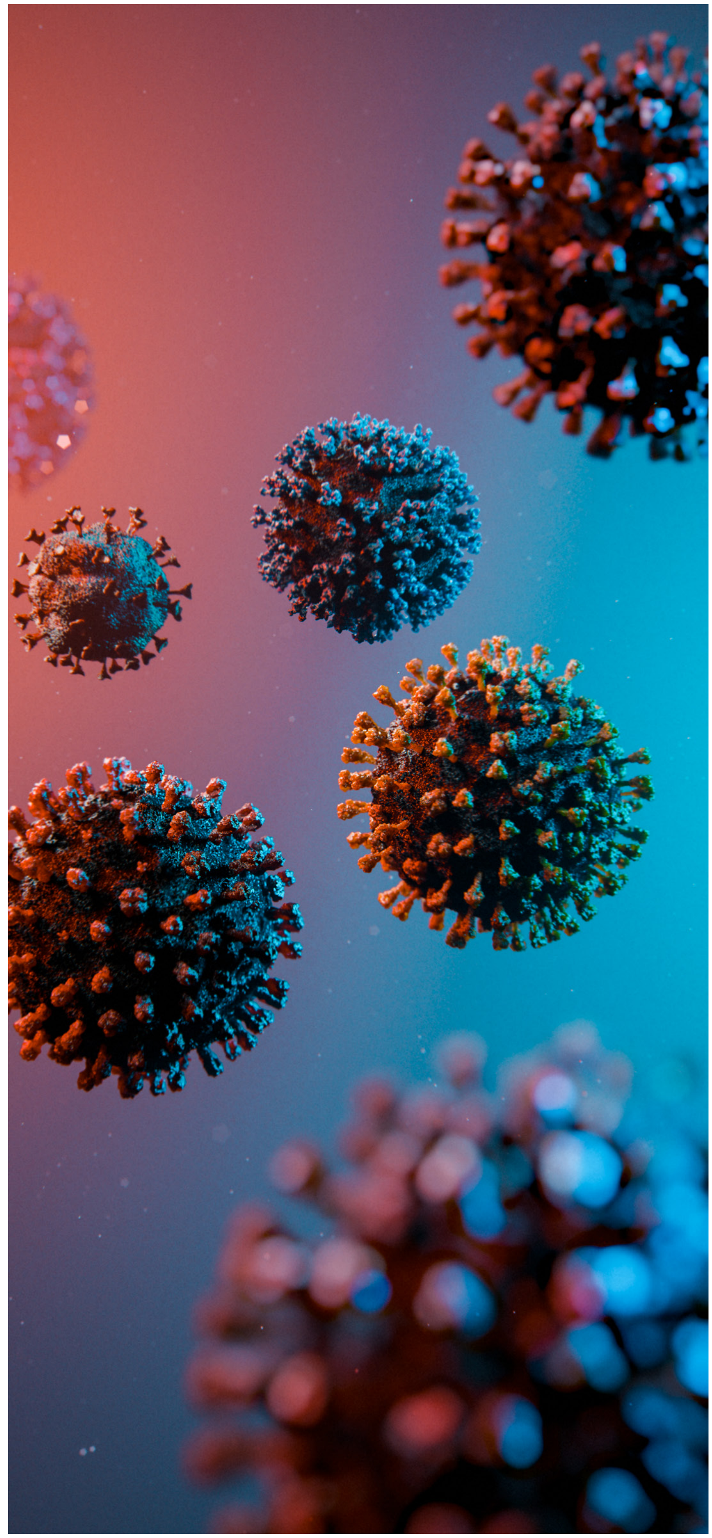
649,753,806 reported infections
6,648,457 deaths

Influenza:[7]

- Worldwide, estimated 389,000 deaths are associated with influenza every year
- Influenza accounts for around 2% of all global respiratory deaths
- Around 67% of people who die from influenza are aged 65 and over

RSV:[8]

- Globally, there are around 33 million cases of RSV every year
- Between 66,000 and 199,000 children under the age of five die with RSV every year



Outbreak prone

Because of their high mutation rates, enveloped RNA viruses are prone to outbreak, making them an important public health concern. SARS viruses, influenza A to C, and RSV, for example, all sit at level four on the pathogen pyramid.[9]

As we have seen in recent years, viruses are not constrained by national borders. In a world of mass national and international travel, virulent pathogens can move around the world in their human hosts, resulting in pandemic-levels of infection.[10]

1 **December 21st 2019**
Chinese Centre for Disease Control & Prevention report cluster of patients with 'pneumonia of an unknown cause'

2 **January 11th 2020**
China reports first death from illness caused by 'virus'

3 **January 20th 2020**
First cases found outside China - Japan, South Korea and Thailand

4 **January 21st 2020**
First case confirmed in USA where man in 30s returned from trip to Wuhan

5 **January 23rd 2020**
The city of Wuhan (population 11 million) is cut off by Chinese authorities - 100,000 people had already departed

6 **January 29th 2020**
2 cases test positive in UK - 2 Chinese nationals staying in a hotel in York

7 **February 1st 2020**
Spain confirms first case in the Canary Islands

8 **February 2nd 2020**
First death of Coronavirus reported outside of China - 44yr old man in the Philippines

9 **February 14th 2020**
France announces first death in Europe - 80yr old Chinese tourist. Egypt confirms first case in Africa

10 **February 21st 2020**
Virus appears in Iran

11 **February 23rd 2020**
Italy sees a major surge in cases

12 **February 26th 2020**
Brazilian authorities confirm a 61yr old man tested positive after returning from Italy

13 **February 28th 2020**
Sub-Saharan Africa records its first infection

14 **February 29th 2020**
USA confirms first Coronavirus death

March 23rd 2020
Worldwide figures stand at more than 270,000 cases and 11,000 deaths

March 31st 2020
Spain reports 85,195 cases and 8,189 deaths

April 2nd 2020
Worldwide cases passes 1 million

April 10th 2020
Number of deaths worldwide passes 100,000

April 15th 2020
Confirmed infections globally passes 2 million

Prevention over cure

Treatment options for respiratory viruses are limited.[11] According to a review of antiviral agents in this arena, few drugs have been approved for treating respiratory virus infections, and most of these are specific inhibitors of influenza viruses.[12]

In addition, the high mutation rates seen in enveloped RNA viruses can result in subpopulations that are able to survive even in the presence of antivirals.

Instead, management strategies tend to rely on prevention, which relies on:

- immunisation, though it is worth noting that no vaccine is currently available for RSV and that influenza vaccine effectiveness is limited by their "best guess" development strategy, in which experts attempt to predict which strains will be prevalent in the year ahead.
- containing the spread through testing and infection control.

Testing times

Effective outbreak prevention and response is reliant on robust data, including those generated by PCR testing. Without reliable geography-specific information on virus prevalence, policy makers are powerless to deploy infection control measures.

During the acute phase of the COVID-19 pandemic, for example, countries around the world implemented strict track and trace systems, based on microbiological testing, in a bid to at least slow the spread of the deadly disease.

Yet testing for highly virulent enveloped RNA viruses is fraught with challenges throughout each step of the workflow.

Sample collection and transportation[10]:

Biohazard risk: Enveloped RNA viruses' route of infection is via inhalation. Accidental release during sample collection and transportation may result in the formation of droplets or aerosols which can represent a biohazard risk.

Efficiency risk: Samples prepared with traditional viral transport media require refrigerated transport, at temperatures of 2 to 8°C, to the laboratory.

Sample receipt:

Efficiency risk: Sample containers are examined for leaks in a microbiological safety cabinet prior to opening, slowing down workflows.

Inactivate samples

Biohazard risk: Accidental release during sample inactivation may result in the formation of droplets or aerosols which can represent a biohazard risk to laboratory staff.

Efficiency risk: Some laboratories use heat to inactivate the virus, adding an additional step to the workflow. Others may use chemicals to achieve the same outcome, a process that must be carried out in a safety cabinet.

Extract nucleic acid:

Toxicity risk: Many viral inactivation media are available, some of which inactivate the virus at the point of collection, streamlining processes. Most of these, however, contain a guanidine-based chemical that, when mixed with bleach or strong acids, can release toxic cyanide gas.

Real-time PCR

Analyse and report

Be InhibiSURE

Our Thermo Scientific™ InhibiSURE™ Viral Inactivation Medium supports safety and streamlines workflows.

It inactivates RNA enveloped viruses, such as SARS-CoV-2, RSV, parainfluenza and influenza A in just 30 minutes, and it stabilizes viral RNA at ambient temperature for transportation. What's more, it does all of this with a proprietary, non-hazardous formulation.

> *"Every lab in the world is looking for safer alternatives to some of the horrible chemicals we use because we don't want to expose people to these risks,"*
> Ruth Harvey, assistant director of the Worldwide Influenza Centre

InhibiSURE Viral Inactivation Medium:

- helps keep staff safe, inactivating RNA enveloped viruses within 30 minutes of sampling with a non-hazardous formula that does not contain a guanidine-based chemical that, when mixed with bleach or strong acids, can release toxic cyanide gas.
- enhances simplicity with a convenient, leakproof, format that can be used with unprocessed nasal swabs, nasopharyngeal swabs or throat swabs on automation preparation racks and decappers.
- enhances efficiency, removing the need for de-activation steps, and is suitable for use with bead and column-based PCR systems. We advise customers validate InhibiSURE with their PCR system.
- By streamlining workflows and supporting safety, InhibiSURE Viral Inactivation Medium boosts productivity, making for more efficient RNA enveloped virus PCR testing processes that can contribute to the control of dangerous respiratory viruses.

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Learn more at **thermofisher.com/inhibisure**

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