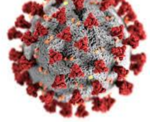
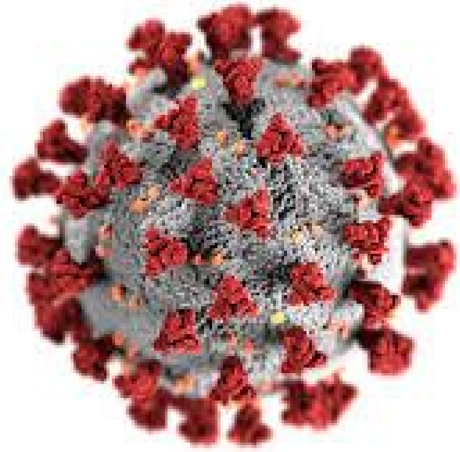




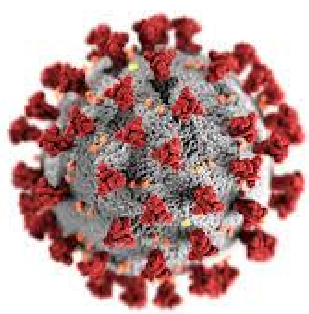
07.23.2020

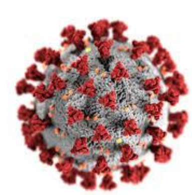
SARS-CoV-2

VIRAL COMPOSITION AND MOLECULAR FINGERPRINT

CanCOVID State of the Science Report: **Volume 1**

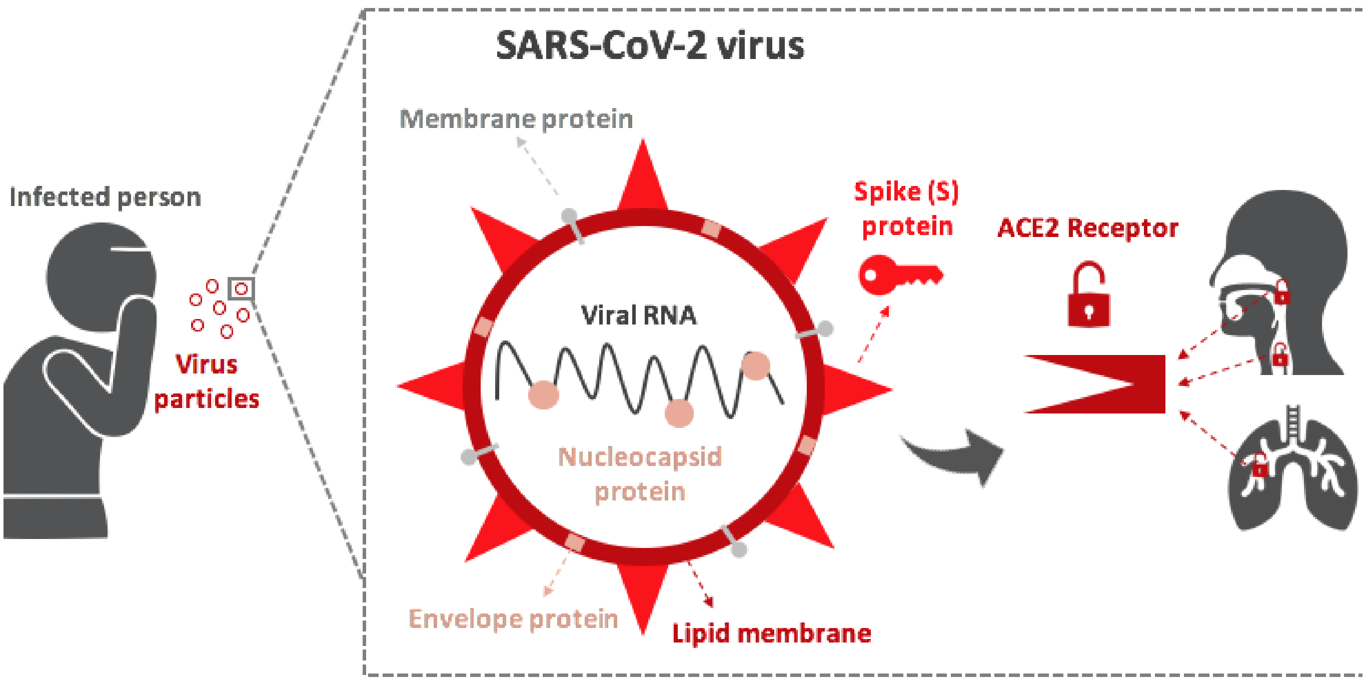
COVID Science evolves rapidly.
This information is up to date as of July 23, 2020.





CanCOVID

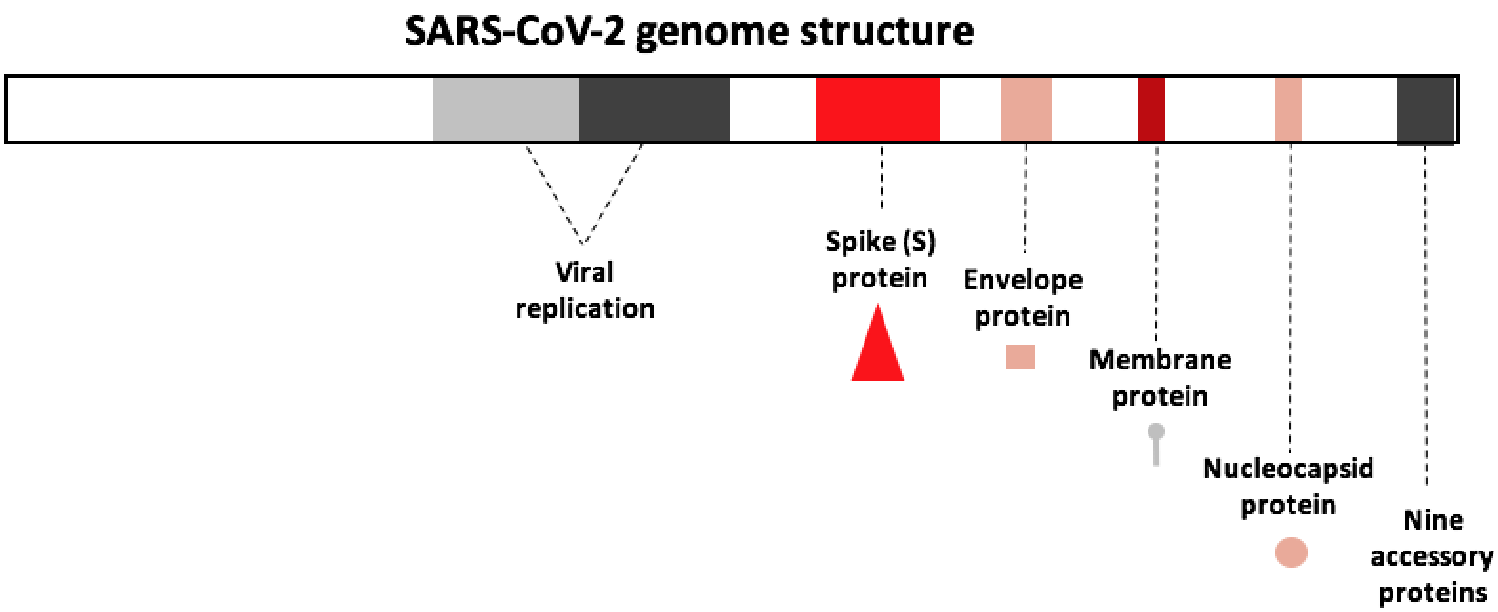
Science Backgrounder



Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is composed of a single strand ribonucleic acid (RNA) genome, surrounded by an envelope made of fat (lipids) and protein molecules.

The single strand of RNA encodes the proteins necessary for the virus to survive, allowing it to take over human cell machinery to make copies of itself and then spread to other people. The envelope provides a safe travel vehicle for the RNA strand during its journey from one human host to another. The envelope includes the S (or Spike) protein.

Think of the S protein as a key. The virus can only enter human cells if its S protein finds the right lock, in this case a protein on the outside of human cells known as the ACE2 receptor. Cells with the ACE2 receptor line our upper and lower airways, from the back of our nose and throat (aka nasopharynx), down to the lungs.



The unique RNA sequence of a virus serves as its fingerprint and can be used for virus sub-typing and to predict the response to vaccines. When a virus mutates, small changes to its RNA sequence occur, which can affect its structure and future behaviour.

Many SARS-CoV-2 mutations exist.

Sometimes, certain mutations can be traced to specific locations, which can be helpful for following the progression of the virus through populations. Molecular or genomic epidemiology is the field of science that tracks the molecular fingerprint of the virus as it travels from person to person, city to city, and country to country, letting us know if (and sometimes where and when) mutations have occurred.

Strategic Considerations for Policy Makers

Designing effective social and behavioural measures for preventing the virus from travelling from person to person (such as physical distancing and wearing masks) depends on a knowledge of how the virus is transmitted.

A working knowledge of the structure and survival mechanisms of the virus are essential for understanding how diagnostics, therapies and vaccines work.

For instance, many vaccine developers are targeting the S protein with the aim of training the body to recognize the protein and resist it, thereby blocking the virus from entering human cells.

Diagnosis of SARS-CoV-2 infection is based on detection of SARS-CoV-2 RNA from nasopharyngeal swabs.

The importance of tracking changes over time (molecular epidemiology) is three-fold:

- To understand how the virus is being transmitted at the regional, provincial, national and international scale.
- To monitor which strain(s) of the virus are involved in Canadian outbreaks.
- To keep abreast of how the virus is changing that may impact transmission, disease severity, and possibly the effectiveness of diagnostics, therapies and vaccines.

Critical Research Directions

How to prevent viral entry into human cells and how to prevent viral replication.

Monitoring for new mutant strains that could cause more severe disease or more resistance to treatments and immunity.

About this Report

CanCOVID's State of the Science Reports provide policy makers with scientifically vetted, timely, and easy-to-digest information about the state of the art in COVID-19 science research.

Framed from a policy perspective, these reports aim to help decision makers understand key aspects of COVID-19 science, where it is headed, and what issues should be considered when making policy decisions.

About CanCOVID

CanCOVID is Canada's transdisciplinary rapid response network for science-to-policy COVID-19 research.

CanCOVID uses digital collaboration tools to rapidly co-create and mobilize knowledge across Canada's diverse healthcare, research, policy, industry, and partner communities.

Our mission is to support needs-driven research and agile, evidence-based decision-making to help Canada steer quickly, safely, and compassionately through the COVID-19 pandemic.

Our members are affiliated a wide range of organizations from across Canada's universities, hospitals, research networks, industry, public health authorities, provincial and regional governments, community non-profits, and funding agencies.

Visit cancovid.ca or follow us at @CanCOVID for more information.

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ACKNOWLEDGEMENTS

WRITING Cara Tannenbaum, MD, MSc, Departmental Science Advisor, Health Canada

EDITING Don Sheppard, MD, Director, McGill Interdisciplinary Initiative in Infection and Immunity

ILLUSTRATIONS Jenna Haverfield, PhD, Canadian Institutes of Health Research