

INTRODUCTION TO BIOINFORMATICS

**PROMISE**

PICTURE THIS!


Many patients have been coming into your clinic over the last 3 weeks. In fact, the number appears to double each week. Help our doctors understand the disease and use your judgment to decide on a treatment.





A patient named Randy comes into the office with complaints of fever, headaches, and sore throat. You suspect a lung infection, but further tests are required.

Start by reviewing Randy's info and filling in his Patient Chart.



PATIENT CHART

| | | | |
|--|------------------------|---------------------|---|
| PATIENT NAME: Randy Lyhee | | AGE: 42 | SEX AT BIRTH: <input checked="" type="checkbox"/> Male <input type="checkbox"/> Female <input type="checkbox"/> Unassigned |
| WEIGHT: 146 | BLOOD PRESSURE: 110/55 | HEART RATE: 150 bpm | |
| KEY SYMPTOMS: <ul style="list-style-type: none">- 102 Degree Temperature- Sore throat- Headache | | | |
| INITIAL DIAGNOSIS: Lung Infection | | | |



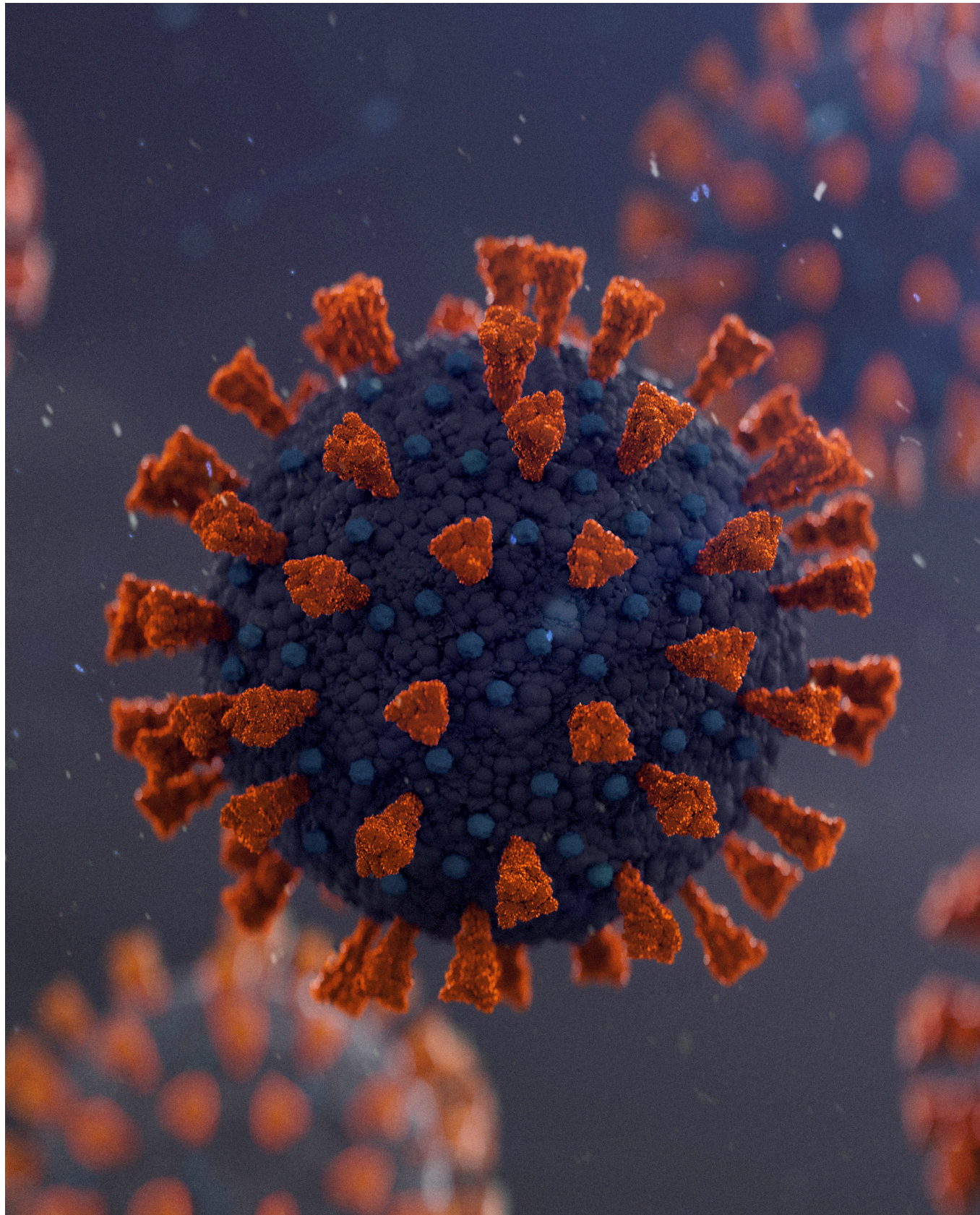
ORDER TESTS

To diagnose Randy, you order a radiograph. You also administer antimicrobial treatment for three days.

TEST RESULTS

Antimicrobial Treatment: Irregular
no reduction of symptoms in three days

Radiograph: Irregular
evidence of pneumonia



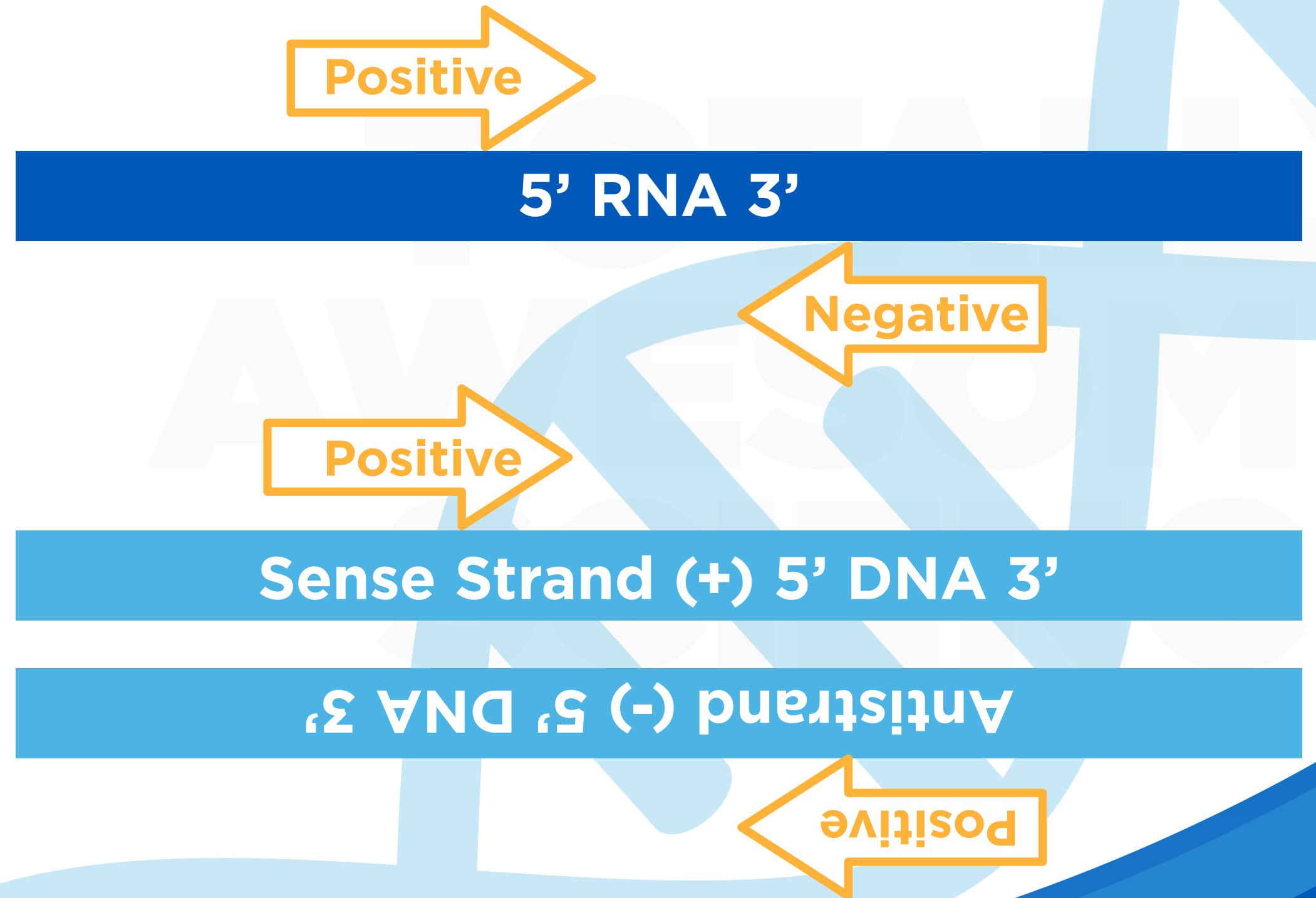
VIRUS REPORT!

Unidentified virus was

- RNA
- Single stranded
- Positive Sense
- Enveloped
- 29881 Base pair length (RNA bases)
- 9860 Amino Acid encoded

READING DNA & RNA

Like words on a page are read from left to right, DNA is read in a specific direction.



READING DNA & RNA

RNA

Sense (Positive sense)

Words are usually read from left to right

Sense (Negative sense)

Thgir ot tfel morf dear yllausu era sdrow

DNA

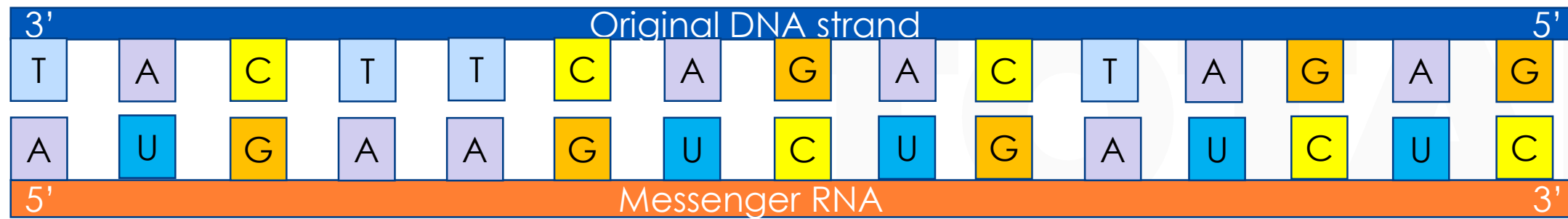
Sense strand

Words are usually read from left to right

Worps ere nsuery dear morf left to right

Antisense strand

TRANSCRIPTION RULES



In DNA the base pairing rules include Adenine-Thymine; Guanine-Cytosine. RNA contains Uracil instead of Thymine.

The pairing is as follows:

- Adenine → Uracil
- Thymine → Adenine
- Cytosine → Guanine
- Guanine → Cytosine

TRANSCRIPTION CAN TAKE MANY FORMS

- DNA TO RNA -



Polymerase

RNA

DNA

TRANSCRIPTION CAN TAKE MANY FORMS

- RNA TO DNA -



Polymerase

RNA

DNA

TRANSCRIPTION CAN TAKE MANY FORMS

- RNA TO RNA -



Polymerase

RNA

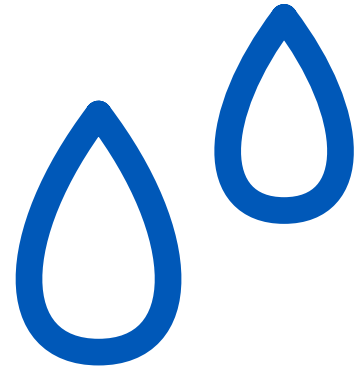
DNA

TRANSLATION

Segments of DNA that hold the code to make a protein are called genes.

Each gene can make an average of three proteins.

What human proteins do you know about?



HEMOGLOBIN

A protein with 4 chains that carries oxygen for your red blood cells



MELANIN

A protein that is found in skin cells that help protect your cells from UV radiation



LACTASE

An enzyme that helps your digestive system to break down lactose-the sugar found in milk

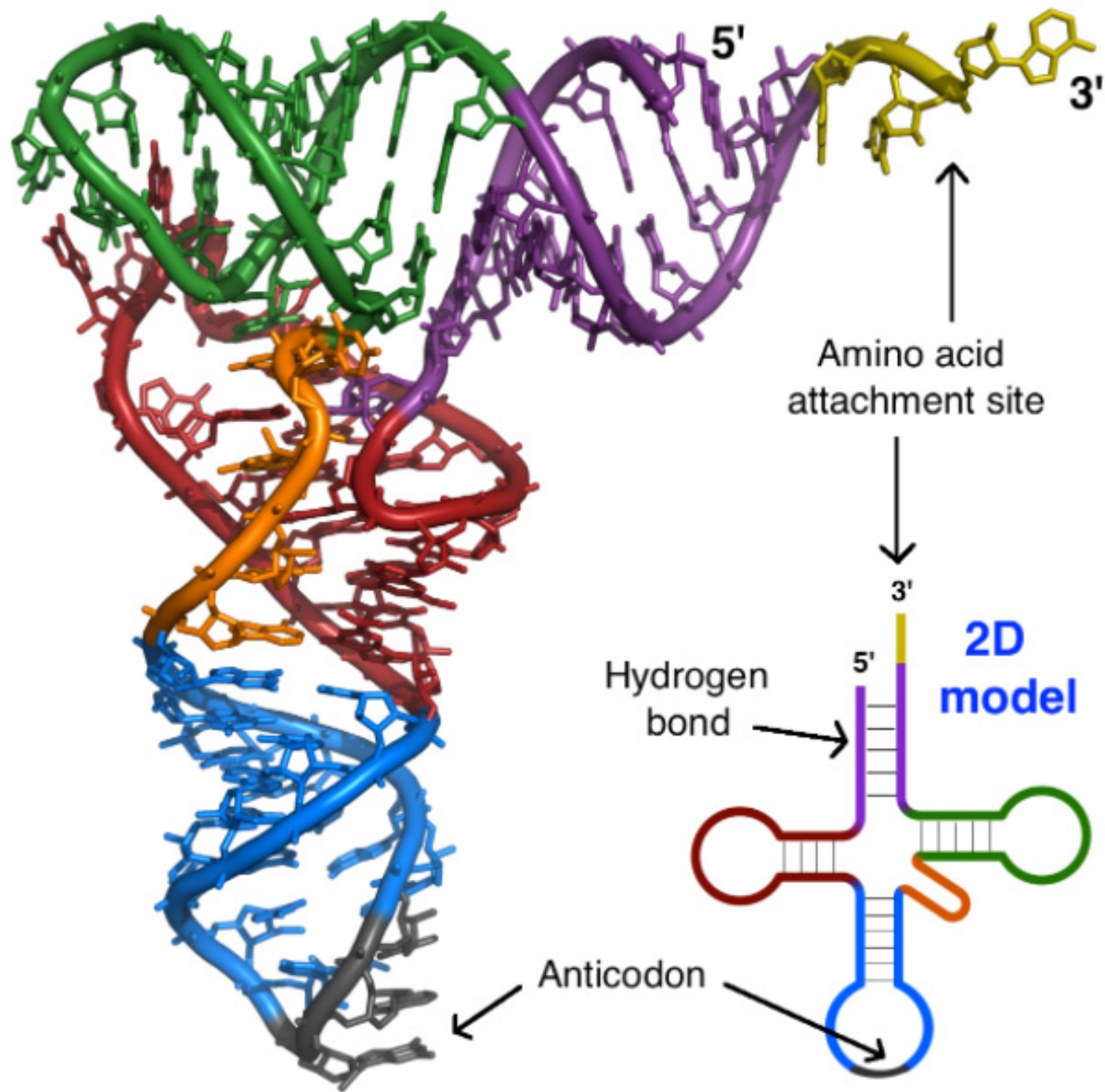


Image modified from "tRNA-Phe yeast," by Yikrazuul (CC BY-SA 3.0). The modified image is licensed under a CC BY-SA 3.0 license.

In order to change RNA code to amino acid sequence, a “translator” is needed. This is the function of transfer RNA.

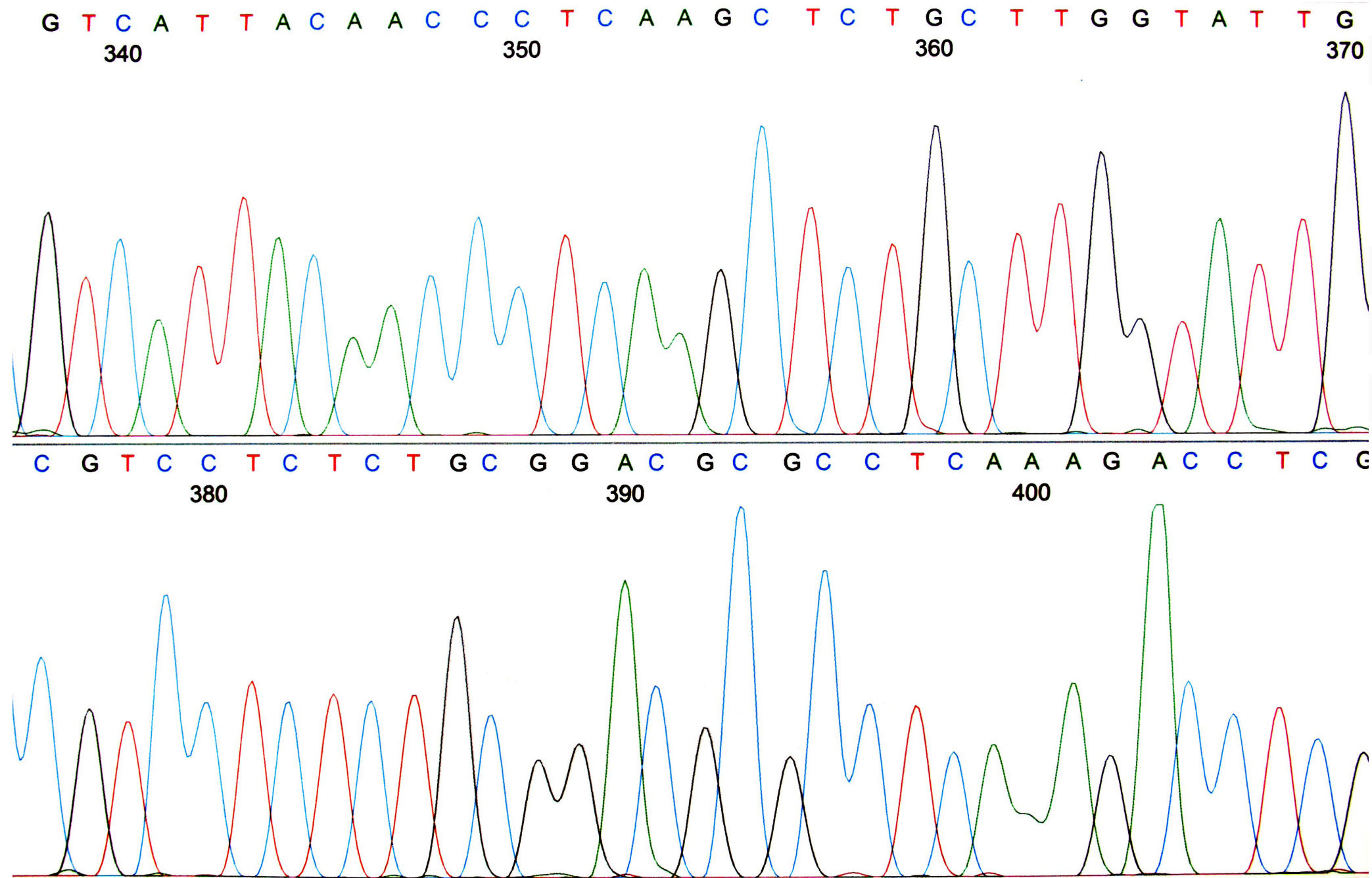
tRNA contains an anticodon on one end and an amino acid on the other.

WHAT IS NEW ABOUT THIS VIRUS?



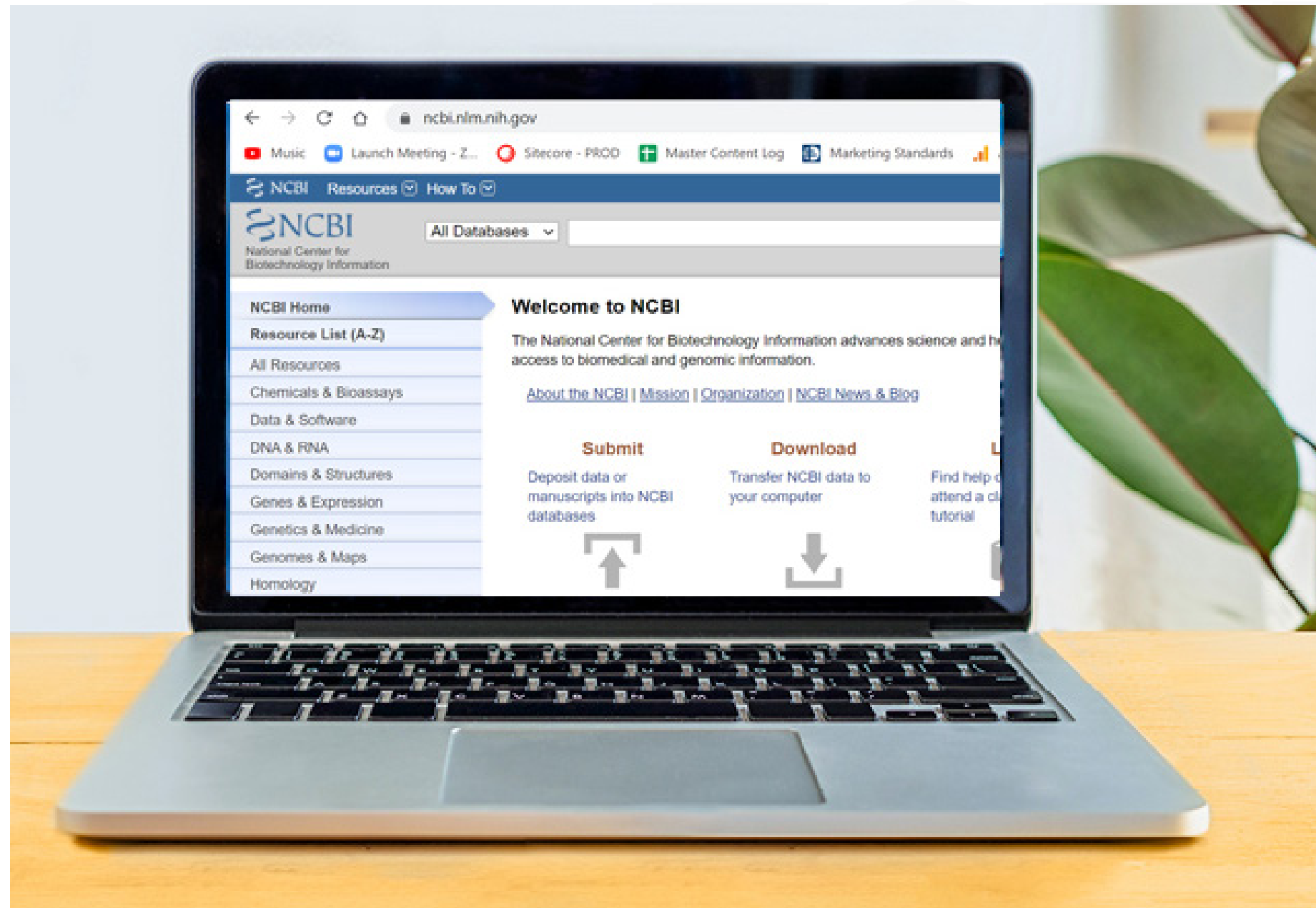
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VIRUS SEQUENCED!



The mysterious virus has been identified through a database search. It was found to be similar to SARS-Cov-2.

National Center for Biotechnology Information



ALLIANCE
FOR
GENOME
SCIENCE

WATCH THIS!



JILLY
ME
ICE

Name: _____



INVESTIGATING VIRAL PROTEIN

BACKGROUND

1. What do scientists think about this virus?
2. This virus does not have a cell wall. How is it considered living?
3. Where do new viruses come from?

RESEARCH:

SARS-CoV-2 protein structure and the following questions about the function of the protein. Write your answers below and collect your data.

E ENVELOPE PROTEIN
<https://tinyurl.com/yx...>

NSP1
<https://tinyurl.com/yx...>

1. My protein is _____
2. My protein has _____
3. My protein is _____
4. My protein appears to be _____
5. What is the function of the protein?

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Name: _____



ANALYSIS OF CORONAVIRUS EVOLUTION

Coronaviruses (CoV), like Severe Acute Respiratory Syndrome (SARS-CoV), are positive sense RNA viruses that have been circulating from animal populations into human populations for many years. Researchers collected complete genome sequences from several populations of viruses and constructed a phylogenetic tree to represent their evolutionary relatedness (Figure 1).

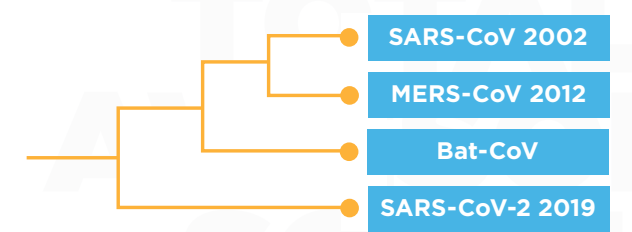


Figure 1. Phylogenetic tree representing evolutionary relatedness among corona virus strains based on whole viral genomes sequence comparison

A researcher studying adaptations in CoV sequenced the spike protein (S) in the human coronaviruses SARS, MERS, SARS-CoV-2, and Bat coronavirus. There are several substitutions found only in the SARS-CoV.

| | Bat-CoV | MERS-CoV | SARS-CoV | SARS-CoV-2 |
|------------|---------|----------|----------|------------|
| Bat-CoV | - | | | |
| MERS-CoV | 61.16% | - | | |
| SARS-CoV | 21.89% | 58.76% | - | |
| SARS-CoV-2 | 2.12% | 61.37% | 22.53% | - |

Table 1. Percentage of differences in the spike protein among CoV species

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DISCOVER MORE ON VIRAL PROTEINS!

Complete the Investigating Viral Protein and the Analysis of Coronavirus Evolution handouts.



Now that you know about viral proteins, let's get back to Randy. You have diagnosed him with COVID 19. What is the best treatment plan?

