

A Guide to RNA Sequencing

One of the research tests performed by the UDN is called RNA sequencing (RNAseq). This handout will explain the basics of this research tool.



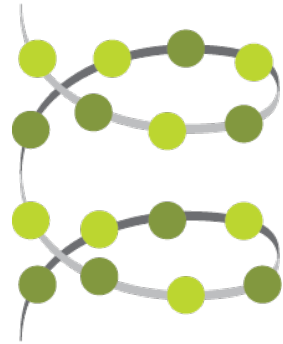
Genetics Introduction



Our cells contain **DNA**, the instructions that tell our bodies how to work.



RNA is created from DNA and contains the instructions for how to build proteins.



Proteins are created from RNA and have many important functions in the body.



For a review of DNA, please see the [NIH DNA Fact Sheet](#)

What is RNAseq?



RNAseq is a test that looks at the spelling of RNA.



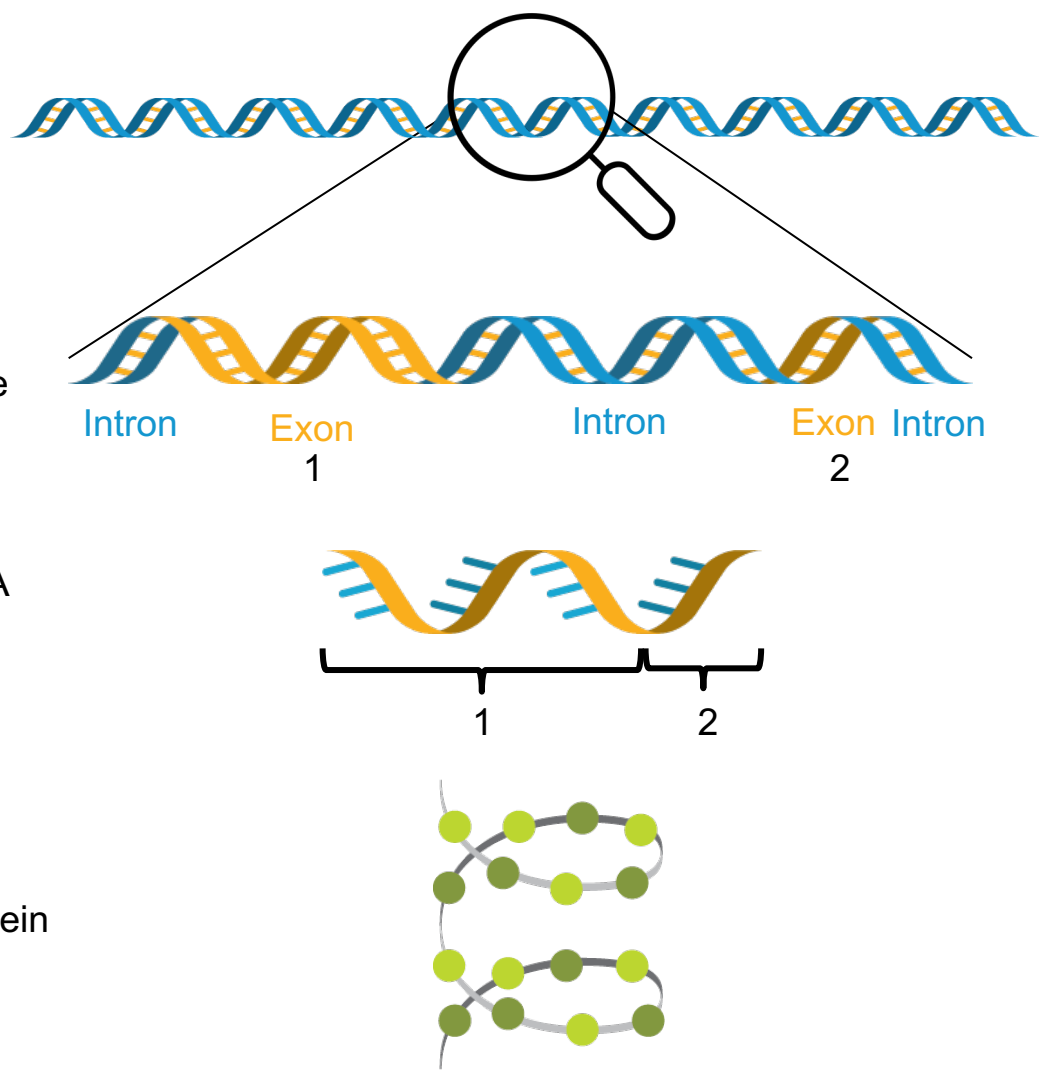
RNAseq can give more information to help provide a diagnosis.



RNAseq within the UDN is a research test. It may take a while to receive the results, and the results may not always lead to a diagnosis.

How is RNA made?

- ▷ DNA is made up of genes
- ▷ Genes are made up of introns and exons
- ▷ RNA is created from DNA and typically contains information from the exons
- ▷ RNA serves as a template to make proteins



Where is RNA made?

- ▷ Most cells in the body have the same set of DNA
- ▷ However, different types of cells make different RNA and proteins
- ▷ For example, **heart cells** may make different RNA and proteins than **brain cells**



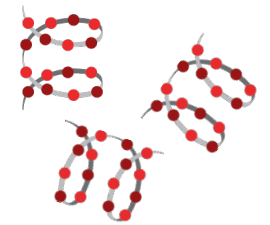
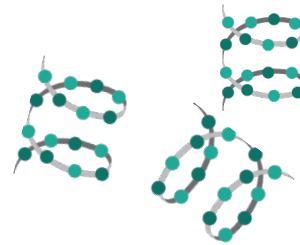
DNA



RNA



Protein

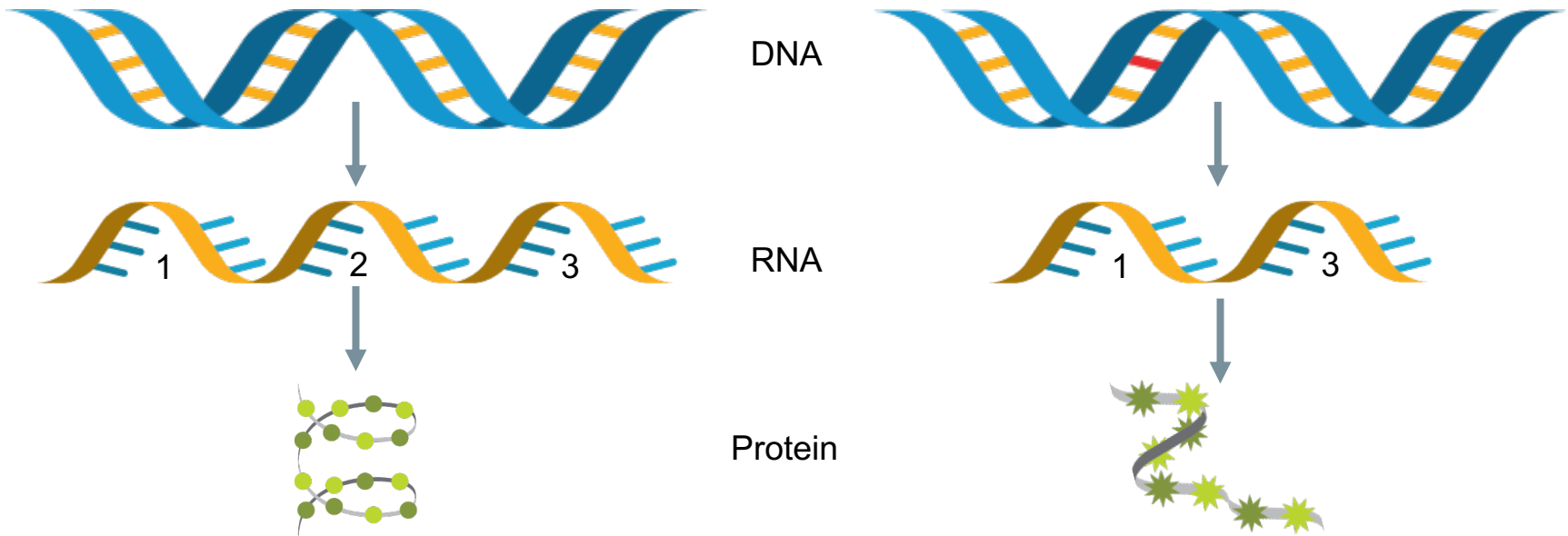


Cells



What is RNAseq looking for?

RNAseq looks at RNA to see if it was made correctly from DNA. If RNA is not made correctly, it may impact the amount or structure of proteins.



When the **RNA** is made correctly, we expect that the correct **protein** is made.

When pieces of **RNA** are missing or changed, the **protein** may not be made correctly.

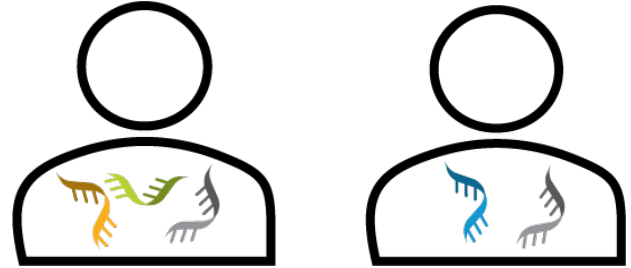
Why is RNAseq done?



Finding a diagnosis requires clinicians and researchers to put together many clues. RNAseq can provide information that the UDN can use to make a diagnosis.



RNAseq can help identify if a change found in DNA is affecting RNA.

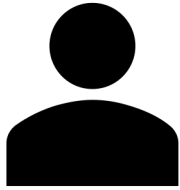


Researchers want to see if there are any RNA differences in an individual compared to other people.



RNAseq cannot provide information about every type of change in DNA. It only gives us information about changes that affect the way RNA is created.

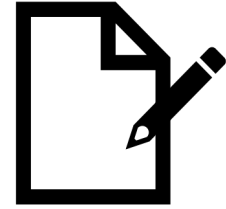
Who besides the participant will be tested?



In most cases, RNAseq is performed **only for the participant** with the undiagnosed disease.



Sometimes unaffected **family members** may also be tested. Your UDN team will decide if performing RNAseq on other family members is helpful.



If RNAseq will be performed on unaffected family members, they may need to sign an additional **consent form**.

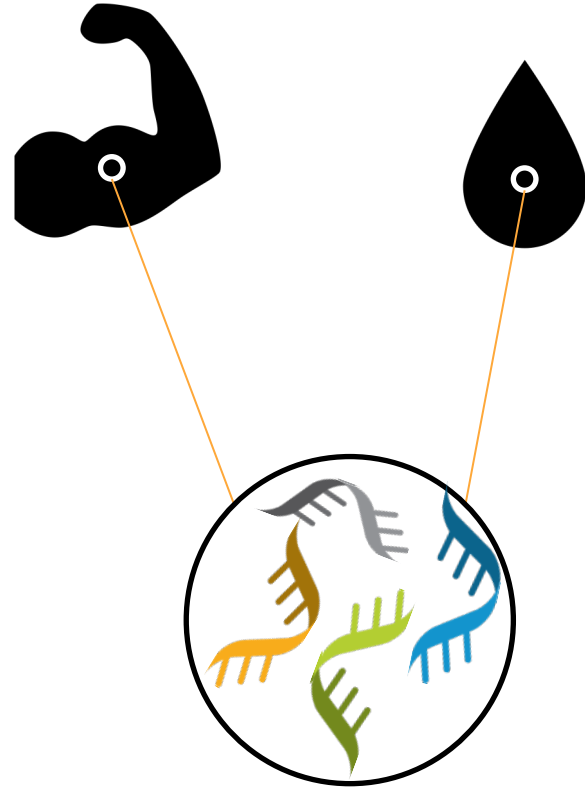


Not all UDN participants will have RNAseq

RNAseq is more helpful in some cases than in others. Your UDN team will decide if performing RNAseq makes sense in your case.

Which sample will be used?

- ▶ The UDN most frequently perform RNAseq on cells obtained from skin, muscle, or blood.
- ▶ Your UDN team will decide which tissue type is the **most appropriate** to test in your case.
- ▶ The tissue type selected varies based on symptoms and gene(s) of interest.

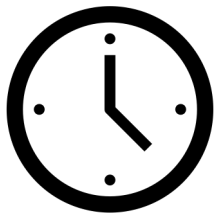


How will I get results from RNAseq?



RNAseq performed through the UDN is typically a research test, not a clinical test.

This means:



Your UDN team will contact you with results. There is **no standard timeline** for results.



You will **not receive a report**. However, your UDN team will discuss any relevant findings with you.



Some participants may receive an **uncertain result**, which could require more follow-up.



What kinds of results can I expect?

Results will be focused on specific genes or variants.
Possible outcomes include:



Evidence that supports a change in DNA is **causing disease**.



Evidence that supports a change in DNA **does not affect RNA**. This may still give us helpful information in working towards a diagnosis.

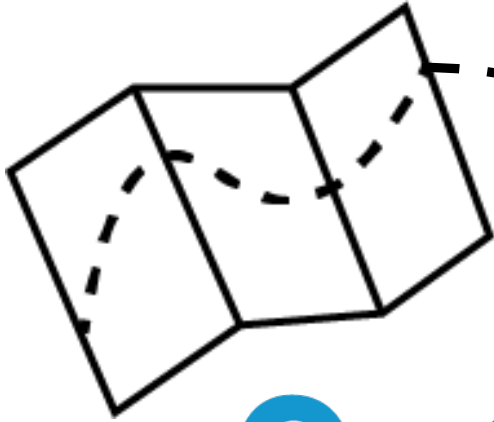


No definitive results or information about whether the variant is causing disease.

What's Next?

Next steps depend on the findings since every patient is unique.

Your UDN team will discuss any next steps with you.



If a diagnosis is not found, your case may be revisited as new strategies become available.



If RNAseq provides a clue but does not confirm a diagnosis, the UDN may do more research.



If a diagnosis is confirmed, follow-up options will be discussed.

Glossary

Word	Meaning
DNA	Genetic material that stores instructions which tell bodies how to work
RNA	Molecule that contains the instructions for how to build proteins
Protein	Molecule that does most of the work in cells and is required for the structure, function, and regulation of the body's tissues and organs
Gene	Portion of DNA that codes for a protein
Exon	Portion of a gene that has instructions for making proteins
Intron	Portion of a gene that has does not have instructions for making proteins but may be important in the process of making proteins.
Variant	A change in a gene that may or may not cause a health condition
Splicing	Process of connecting exons to each other and removing introns to create RNA template
Exome	Complete set of exons in DNA
Genome	Complete set of DNA, including all exons, introns, and spaces in between genes