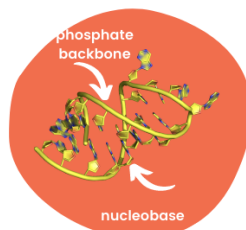


Solving molecular puzzles of RNA structure and function

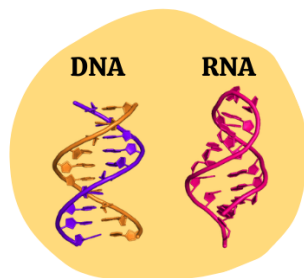
Eichhorn research group at UNL

What is RNA?

RNA, or ribonucleic acid, is an essential molecule of life. RNA is made up of nucleotides that are linked to each other through a phosphate backbone to form a polymer. RNA is most commonly known as a messenger, or template, to make proteins. However, over 90% of the human genome makes RNA that does NOT go on to make proteins! These "non-coding" RNAs have many important functions in cellular processes.



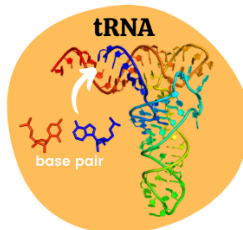
How are RNA and DNA different?



- DNA is "double-stranded" meaning it has two separate strands that interact. RNA is "single-stranded" - it has one strand that folds on itself.
- Both have a phosphate backbone, sugar, and nucleobase. DNA has nucleobases A, G, C, and T while RNA has nucleobases A, G, C, and U.
- RNA and DNA have different names because of a difference in the sugar groups. DNA (deoxy-) has one less oxygen in its sugar and this contributes to differences in 3D structure and biological function.

How does RNA fold up into 3D structures?

Nucleobases can hydrogen bond to each other to form base pair interactions. Canonical base pairs are A-U and G-C, although many noncanonical base pairs also occur. Consecutive base pairs lead to formation of an RNA helix.



RNA in the news: COVID-19

- The SARS-CoV-2 coronavirus has an RNA genome - all its genetic information is stored as RNA, not DNA.
- The Moderna and Pfizer-BioNTech vaccines are made up of messenger RNA that makes the COVID-19 "Spike" protein. This protein is on the outside of the virus and gives coronavirus its name (corona=crown)
- When these vaccines make the spike protein in our bodies, our immune system creates antibodies, protecting us from infection.

Spike protein



Want to learn more?

- DNA vs RNA by the Amoeba Sisters https://www.youtube.com/watch?v=JQByjprj_ma
- What is the RNA world hypothesis? by Stated Clearly <https://www.youtube.com/watch?v=KlxnYFCZ9Yg>
- Understanding mRNA COVID-19 Vaccines <https://www.cdc.gov/coronavirus/2019-ncov/vaccines/different-vaccines/mrna.html>
- Video of RNA folding process from NWU <https://news.northwestern.edu/stories/2021/01/new-videos-show-rna-as-its-never-been-seen/>

INFORMATION SOURCES

<https://www.amoebasisters.com/parameciumparlorcomics/dna-vs-rna>
<https://microbenotes.com/rna-properties-structure-types-and-functions/>

INFOGRAPHIC MADE USING CANVA

Let's Play!

Before the workshop

Go to:

<https://www.pbs.org/wgbh/nova/labs/lab/rna/>

RNA VirtualLab

Nature's best kept secret is a wonder molecule called RNA. It is central to the origin of life, evolution, and the cellular machinery that keeps us alive. In this Lab you'll play the role of a molecular engineer by solving RNA folding puzzles. Then take your skills to Eterna, where you can design RNAs that could be at the heart of future life-saving therapies.

Watch the intro

PLAY GAME

GAME ENGINE BY THE ETERNA PROJECT
CARNegie MELLON UNIVERSITY

VIDEO INTRO

ABOUT THIS LAB

EDUCATOR GUIDE

At the workshop

RNA VirtualLab

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Click here and play "The Basics"

PLAY GAME

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Think about:

- How do the 4 bases of RNA pair up?
- What are some important structures that RNA adopt?
- Which base pair is the strongest?

After the workshop

- Keep playing!
 - Go through trials 1-3
 - Register and play at eternagame.org

