# WRITE AN RNA TRANSLATOR

## WEEKS 2-6

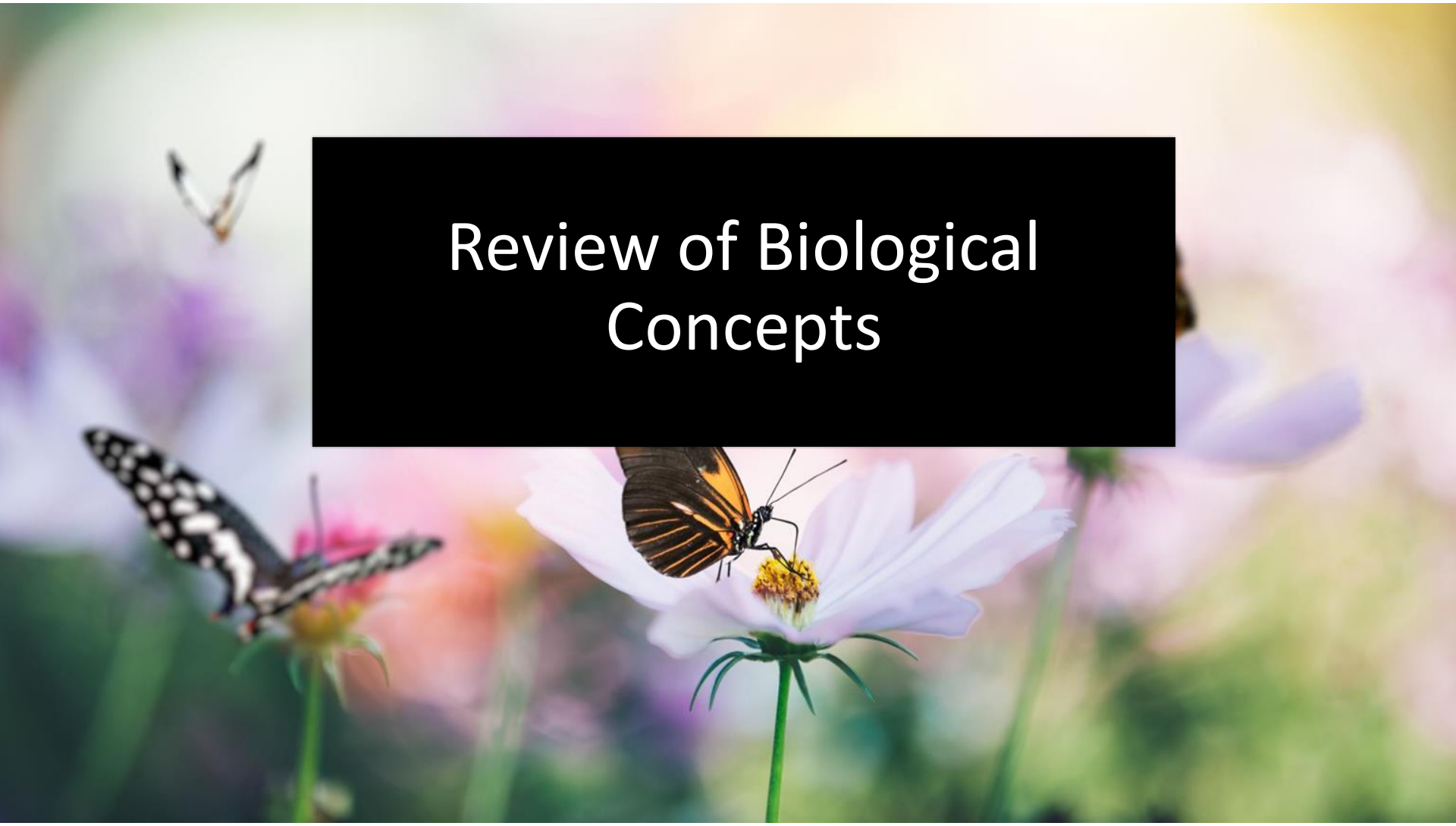
# Objectives of Today's class

Weeks 2-6:

- Learn basics of programming in python.
- Write an RNA translator.

Today:

- Review of Biological Concepts (DNA, RNA, Codons)
- Learn fundamental programming tools:
    - **Indexing**
    - **Slicing/Subsetting** data
    - Reading Files
    - **List** data
    - **Loop** data to automatize processes



# Review of Biological Concepts

# DNA and RNA Nucleotides

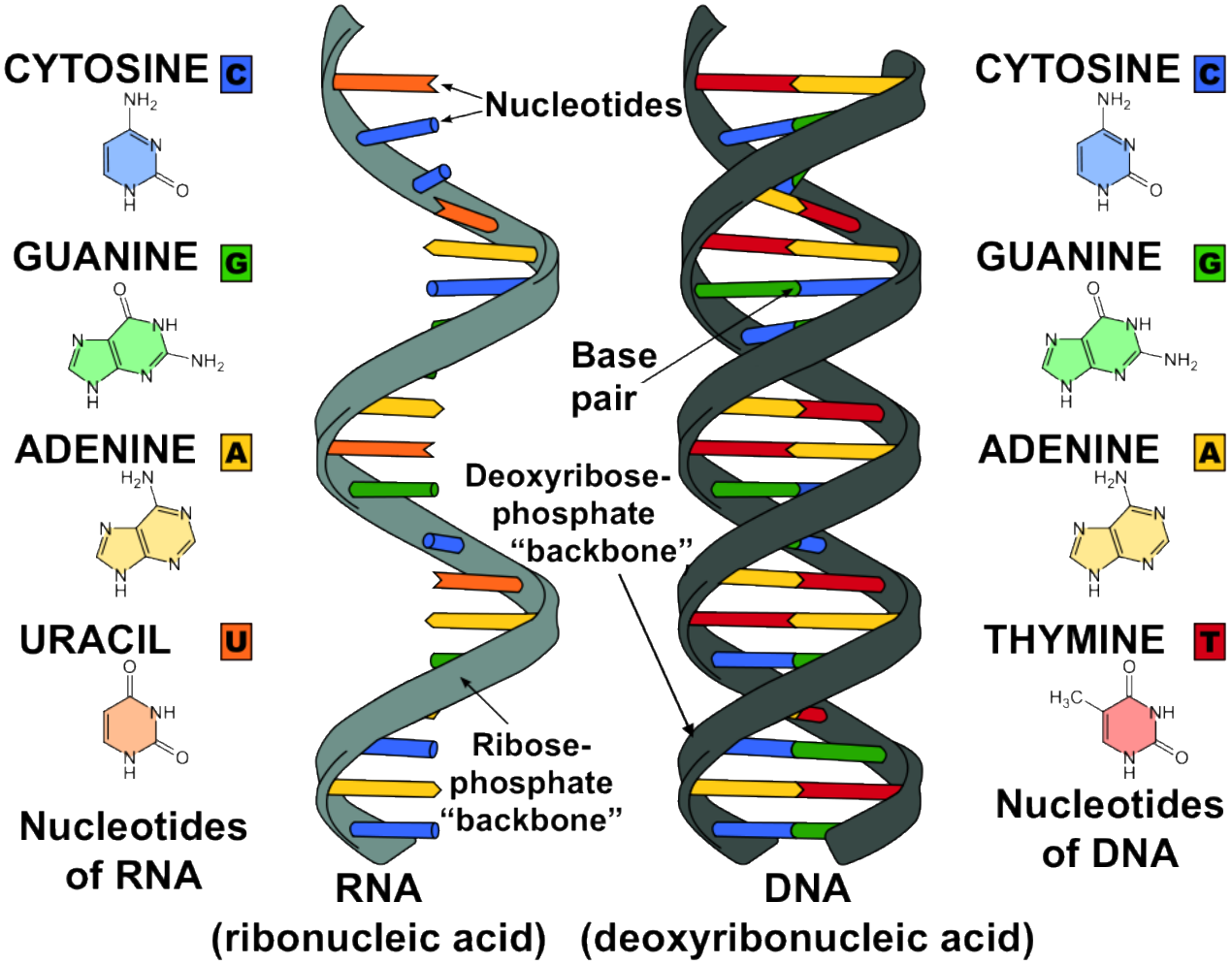
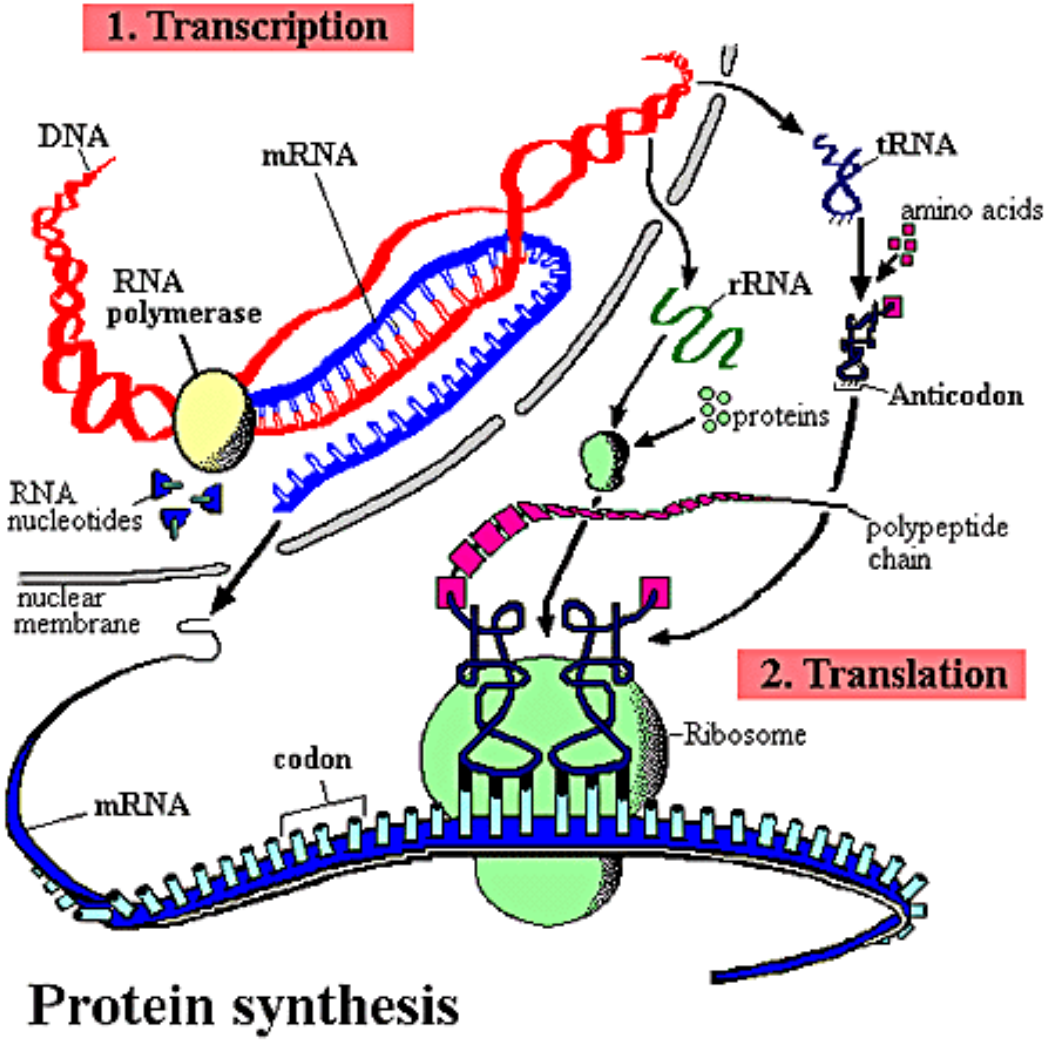



Image from Wikimedia and KhanAcademy

# RNA and codon translator



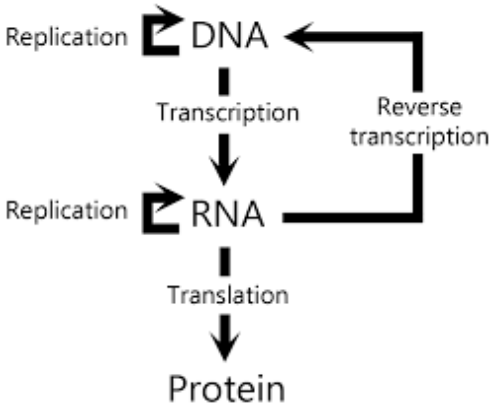
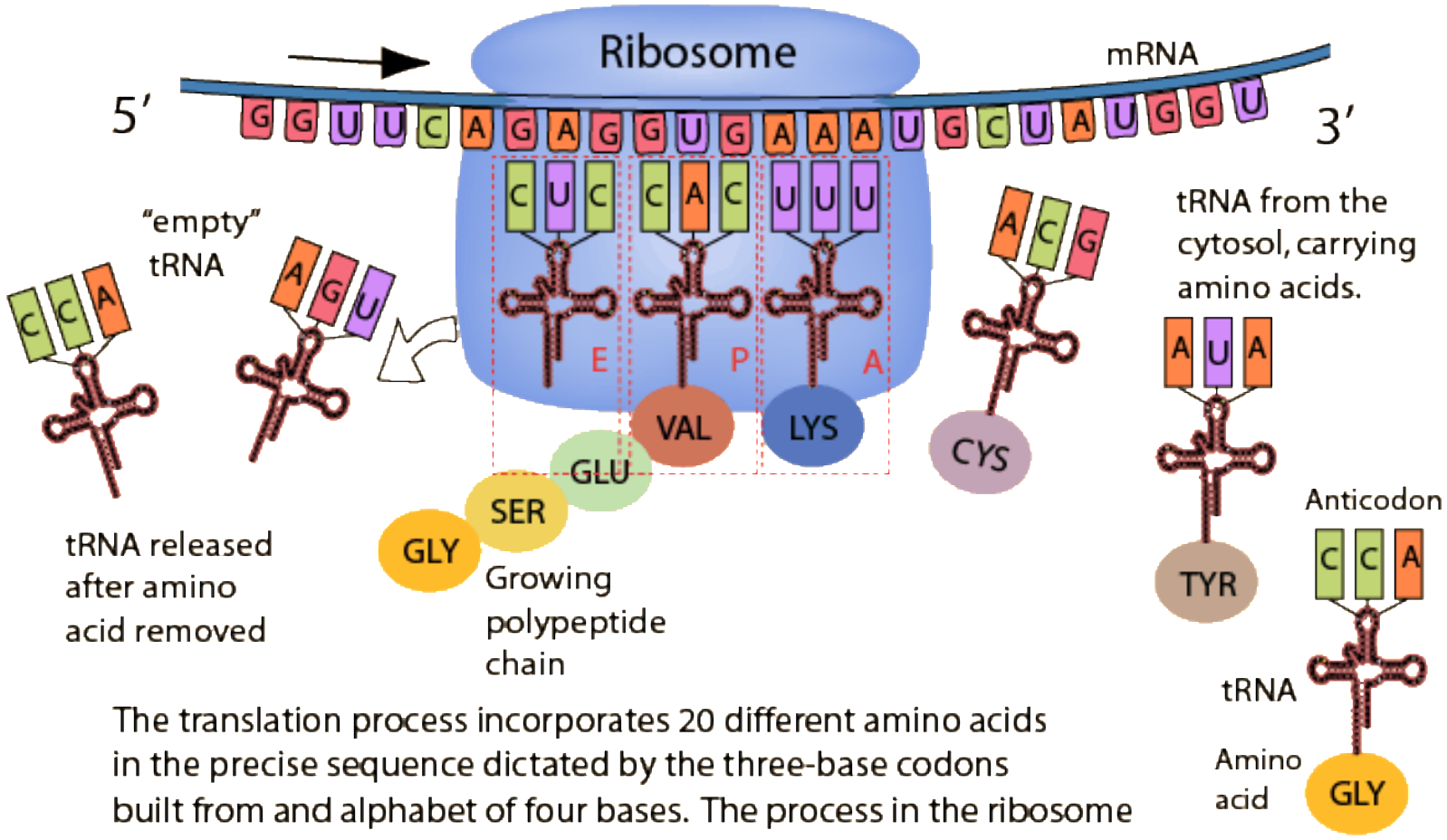




Image by Patrick R. Wright

Graphics Gallery website of Access Excellence @ the National Health Museum

# RNA and codon translator




The translation process incorporates 20 different amino acids in the precise sequence dictated by the three-base codons built from and alphabet of four bases. The process in the ribosome builds the polypeptide chains tha will become proteins.

Image from Karp. Cell and Molecular Biology

# RNA and codon translator

## Chart of the Genetic code

| First letter | Second letter: U | Second letter: C | Second letter: A | Second letter: G | Third letter |
|---|---|---|---|---|---|
| U | UUU Phe | UCU Ser | UAU Tyr | UGU Cys | U |
| | UUC Phe | UCC Ser | UAC Tyr | UGC Cys | C |
| | UUA Leu | UCA Ser | UAA Stop | UGA Stop | A |
| | UUG Leu | UCG Ser | UAG Stop | UGG Trp | G |
| C | CUU Leu | CCU Pro | CAU His | CGU Arg | U |
| | CUC Leu | CCC Pro | CAC His | CGC Arg | C |
| | CUA Leu | CCA Pro | CAA Gln | CGA Arg | A |
| | CUG Leu | CCG Pro | CAG Gln | CGG Arg | G |
| A | AUU Ile | ACU Thr | AAU Asn | AGU Ser | U |
| | AUC Ile | ACC Thr | AAC Asn | AGC Ser | C |
| | AUA Ile | ACA Thr | AAA Lys | AGA Arg | A |
| | AUG Met | ACG Thr | AAG Lys | AGG Arg | G |
| G | GUU Val | GCU Ala | GAU Asp | GGU Gly | U |
| | GUC Val | GCC Ala | GAC Asp | GGC Gly | C |
| | GUA Val | GCA Ala | GAA Glu | GGA Gly | A |
| | GUG Val | GCG Ala | GAG Glu | GGG Gly | G |

Image by Chegg.com/study

## Amino Acids

| Full Name | Abbreviation (3 Letter) |
|---|---|
| Alanine | Ala |
| Arginine | Arg |
| Asparagine | Asn |
| Aspartate | Asp |
| Aspartate or Asparagine | Asx |
| Cysteine | Cys |
| Glutamate | Glu |
| Glutamine | Gln |
| Glutamate or Glutamine | Glx |
| Glycine | Gly |
| Histidine | His |
| Isoleucine | Ile |
| Leucine | Leu |
| Lysine | Lys |
| Methionine | Met |
| Phenylalanine | Phe |
| Proline | Pro |
| Serine | Ser |
| Threonine | Thr |
| Tryptophan | Trp |
| Tyrosine | Tyr |
| Valine | Val |

# RNA and codon translator

Use the codon table to translate the mRNA into an Amino acid sequence

RNA: CAGGAGUUUGUGCGUGGCCAUUUUUAU

RNA: CAG GAG UUU GUG CGU GGC CAU UUU UAU

Protein: Gln Glu Phe R G H F Y

# RNA and codon translator - Exercise

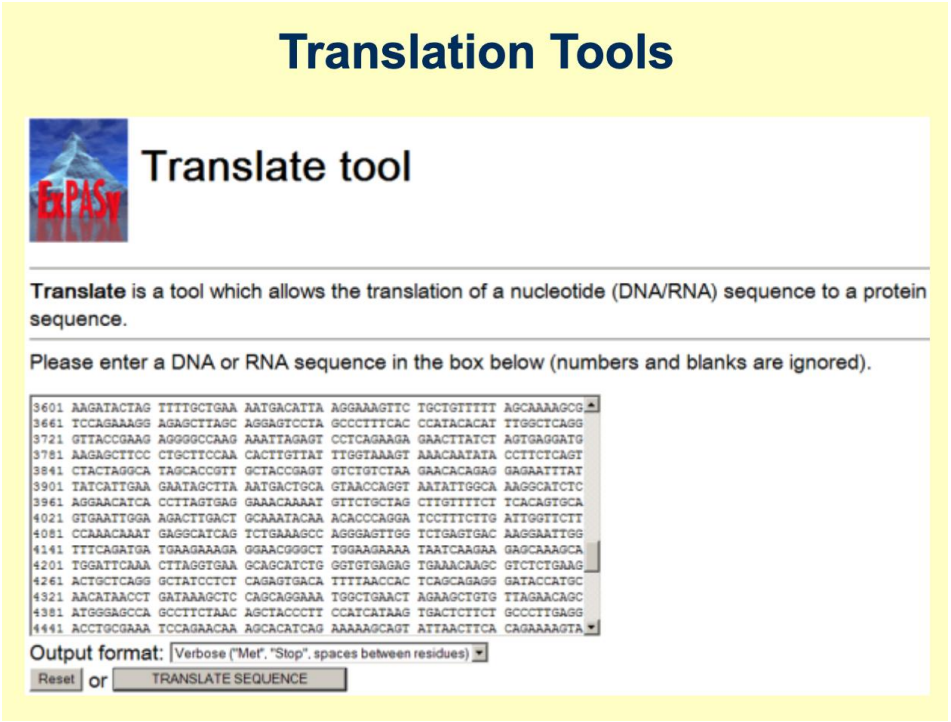
RNA: UAGUUUGUGCGUGGCCAGGUUAAU

Find the correct protein sequence by using the Chart of the genetic Code

# What happen with long sequences?

## How can we speed the process?

NCBI
National Center for Biotechnology Information




## Uses programming as a tool

# Steep and tools to build the RNA translator

# RNA Translator in Python

## Steps:

What do you think should be the steps to program an RNA translator in Python?