



**University of  
Zurich<sup>UZH</sup>**



# **Proteomics**

## **A Brief Glossary of Protein Terms**

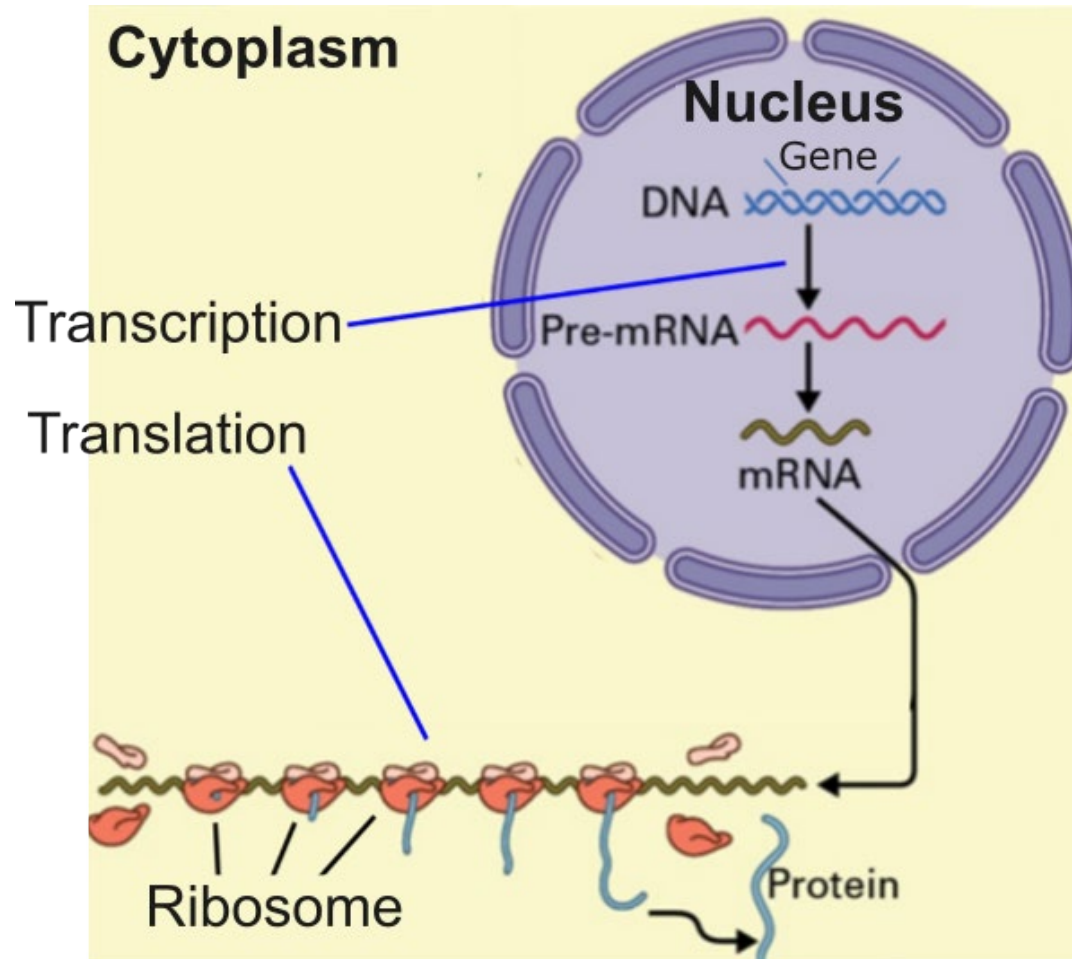
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Swiss Institute of  
Bioinformatics

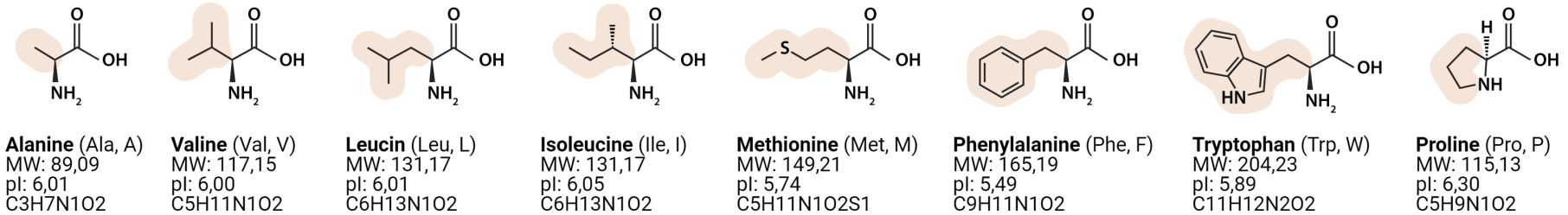
# Gene expression – the biosynthesis of proteins encoded in genes



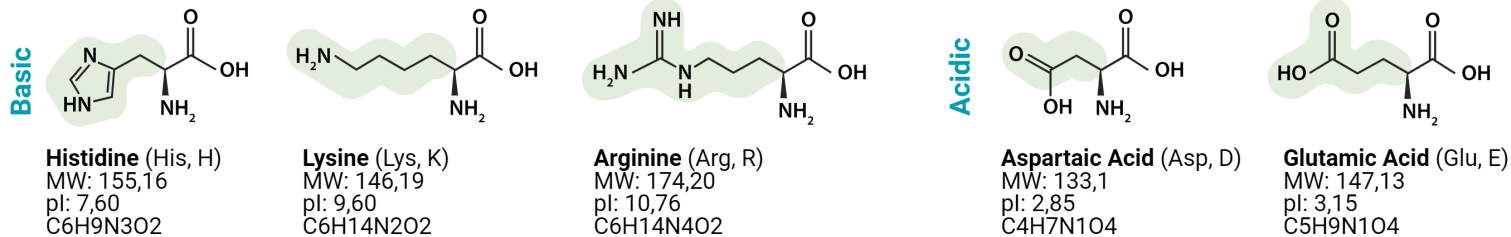
During gene expression, specific regions of genomic DNA are transcribed to produce pre-mRNA. This pre-mRNA is then spliced, capped, and polyadenylated to form mature mRNA. The mature mRNA is transported to the cytoplasm, where ribosomes translate it into proteins.

# The building blocks of proteins are the 20 amino acids

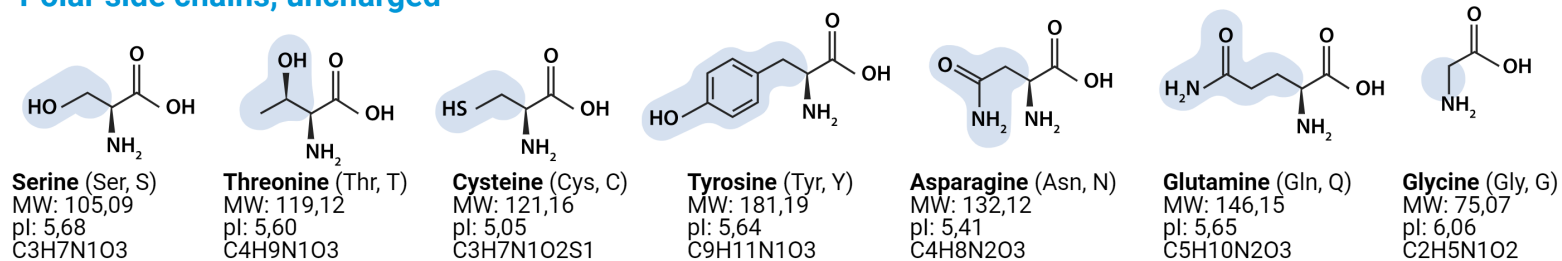
## Non-polar side chains, uncharged, hydrophobic



## Electrically charged side chains



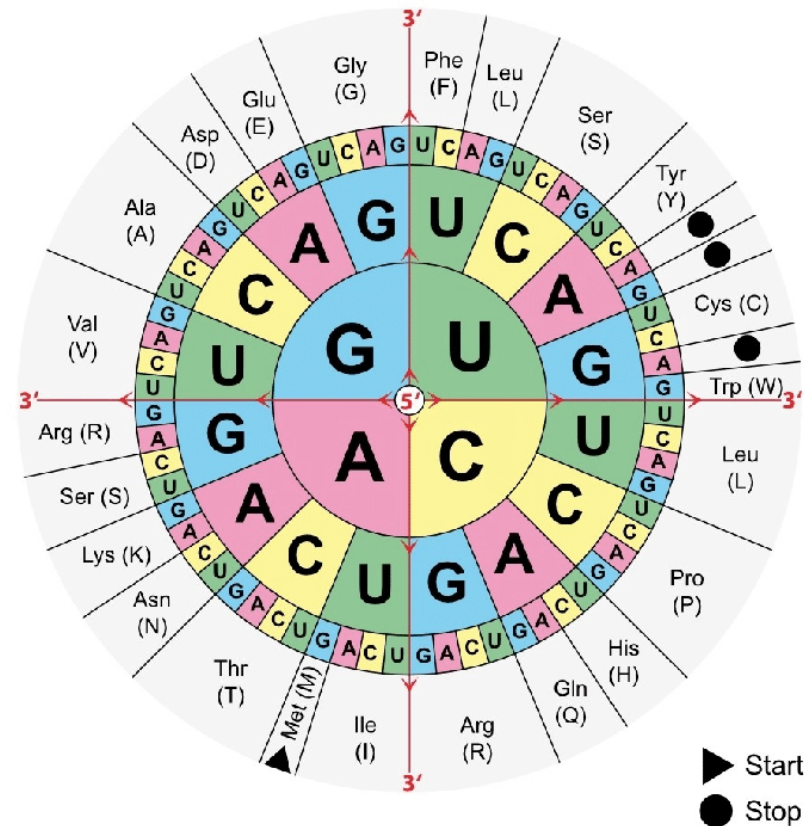
## Polar side chains, uncharged



# Translation of the mRNA sequence into amino acid sequence

RNA → PROTEIN

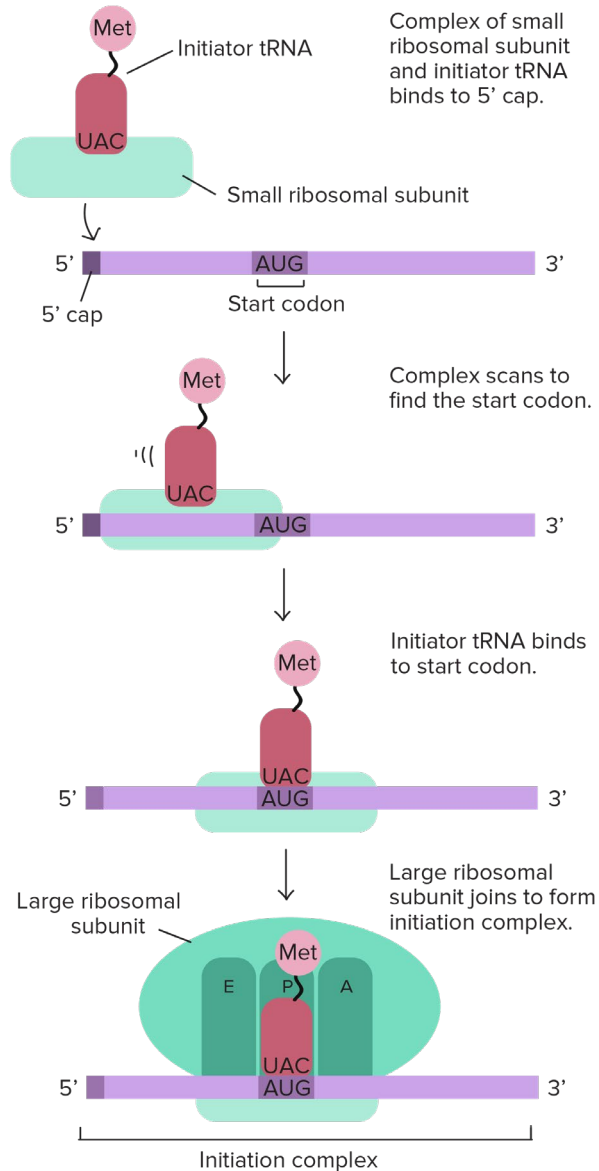
To express the genetic information, the mRNA is translated to produce proteins. The genetic code serves as a translator between the nucleotide sequence and the amino acid sequence.



Amino acids	Three-letter code	Single letter code	Amino acids	Three-letter code	Single letter code
Alanine	Ala	A	Leucine	Leu	L
Arginine	Arg	R	Lysine	Lys	K
Asparagine	Asn	N	Methionine	Met	M
Aspartic acid	Asp	D	Phenylalanine	Phe	F
Cysteine	Cys	C	Proline	Pro	P
Glutamine	Gln	Q	Serine	Ser	S
Glutamic acid	Glu	E	Threonine	Thr	T
Glycine	Gly	G	Tryptophan	Trp	W
Histidine	His	H	Tyrosine	Tyr	Y
Isoleucine	Ile	I	Valine	Val	V

# Translation – Initiation

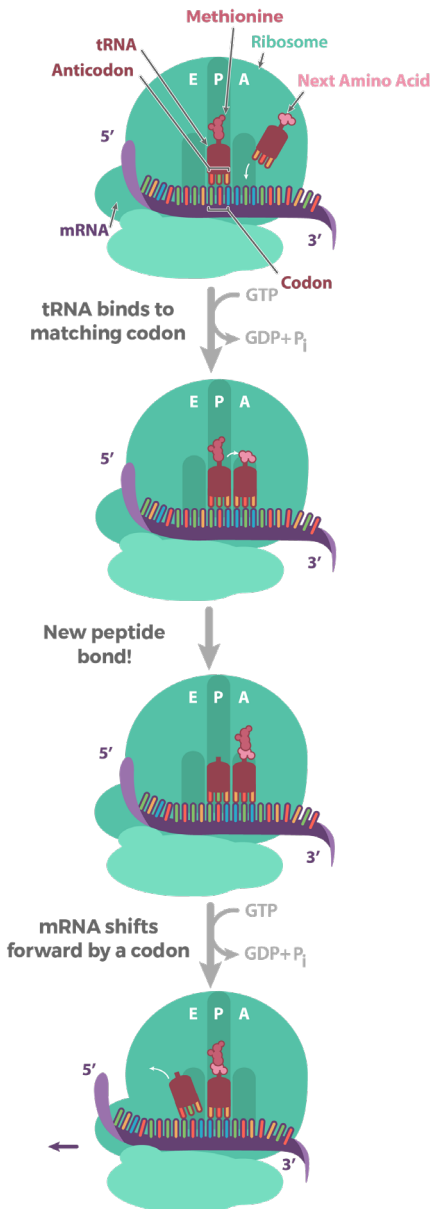
## Eukaryotic translation initiation



- 1) A complex consisting of the small 40S ribosomal subunit, the initiator methionine-tRNA (Met-tRNA<sub>i</sub>), and various translation initiation factors starts at the 5'-cap of the mRNA and scans the mRNA in search of an AUG start codon.
- 2) Once the scanning complex finds the start codon, the anticodon of the Met-tRNA<sub>i</sub> binds to the start codon.
- 3) The initiation factors then dissociate, and the large 60S ribosomal subunit arrives.
- 4) The docking of the subunits and the formation of a complete, functional ribosome on the mRNA is completed, and elongation can begin

# Translation – Elongation and Termination

## First round of elongation



**Elongation is the extension of the polypeptide chain in the ribosome.**

- 1) The first methionine-carrying tRNA starts in the middle slot of the ribosome, the P-site. Next to it, in another slot called the A-site, a new codon is exposed. The A-site is the landing site for the next tRNA, whose anticodon must be a perfect (complementary) match to the exposed codon.
- 2) Once the appropriate tRNA has landed in the A-site, the two amino acids are joined with a peptide bond. After the peptide bond is formed, the mRNA is pulled through the ribosome by exactly one codon.
- 3) This shift allows the first, now empty, tRNA to drift out through the E-site, and a new codon is exposed in the A-site, and so on.

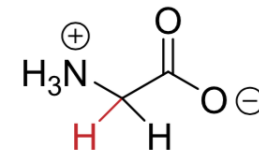
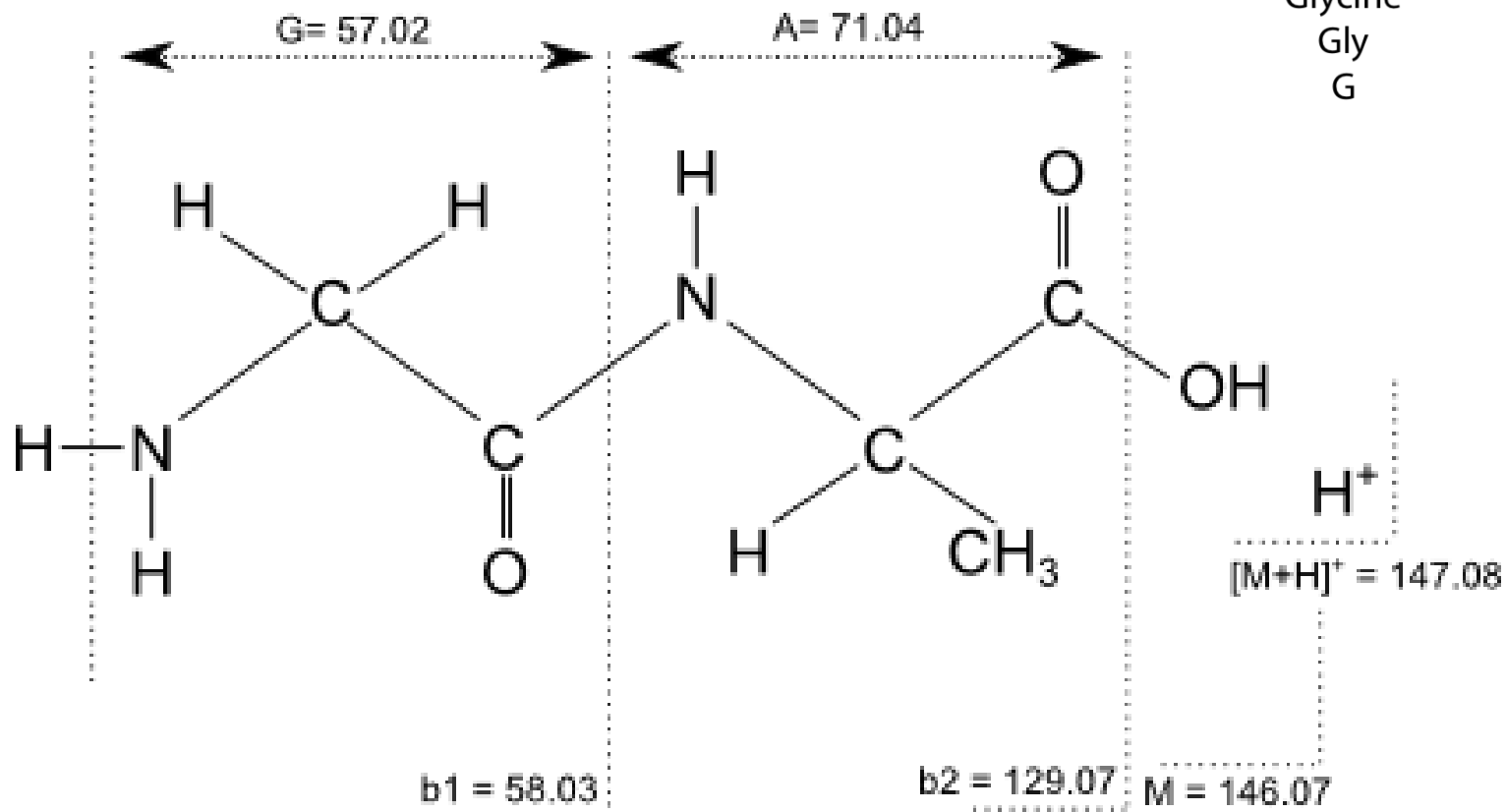
**Termination ends the translation.**

Termination occurs when a stop codon in the mRNA (UAA, UAG, or UGA) reaches the A-site. At this point, instead of a new amino acid, a water molecule is added to the last amino acid of the chain, and the newly formed protein is released.

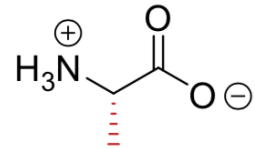
# Protein N- und C-terminus

The protein N-terminus consists of an amine group (NH<sub>2</sub>)

The protein C-terminus consists of a carboxyl group (COOH)



Glycine  
Gly  
G



Alanine  
Ala  
A

# Why proteome research?

Proteomics is the large-scale study of proteins and the proteome, which is the entire set of proteins produced or modified by an organism or system.

Proteomics includes the study of:

- protein roles, structures, quantities, localisation, and functions
- post-translational modifications
- protein interactions with DNA, RNA, other proteins, etc.

and how all these change in time, between conditions or in response to stimuli

