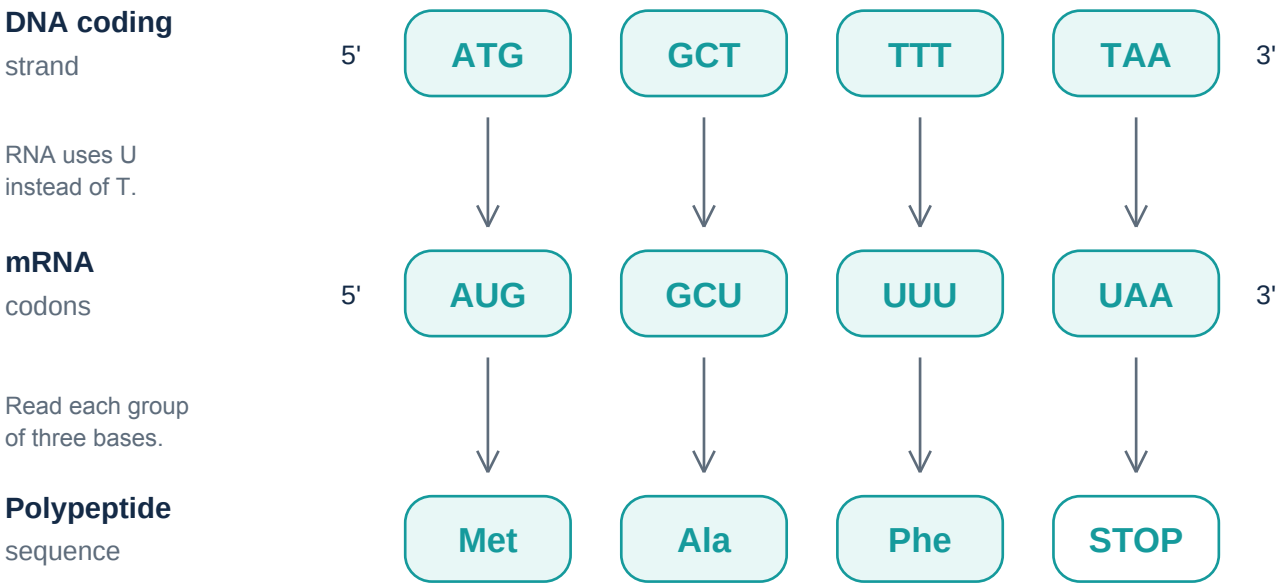
Read the message three bases at a time

The genetic code links base sequences to amino acids or stop signals. Here, a DNA group is called a triplet and an mRNA group is called a codon: each contains three bases.

1. A SHORT WORKED CODING SEQUENCE



Met = methionine; Ala = alanine; Phe = phenylalanine. STOP is a signal, not a fourth amino acid. The example gives a three-residue chain.

2. START AND STOP HAVE DIFFERENT ROLES

AUG is the usual start codon and also codes for methionine. UAA, UAG and UGA are stop codons in the standard code; they do not specify amino acids. Read the mRNA from the start in successive, non-overlapping triplets.

The DNA row is the coding (non-template) strand, written 5' to 3'. It matches the mRNA except for T/U. The complementary template strand is not shown. Real genes and polypeptides are much longer; transcription details follow next.

Triplets and codons: NHGRI, Codon.
Worked sequence and standard start/stop assignments: NCBI, The Standard Code.

Scope: Cambridge Biology 9700 syllabus, section 6.2, outcome 2, p. 24.

One shared code, many sequences

Universal describes shared codon meanings, not identical DNA sequences. Organisms can use the same decoding rules while making different polypeptides.

1. UNIVERSAL - MORE PRECISELY, NEARLY UNIVERSAL

In nearly all organisms, a particular codon specifies the same amino acid. For example, UUU specifies phenylalanine in the standard code. This shared system supports common ancestry. There are exceptions, including some mitochondrial codes.

4 × 4 × 4 = 64 possible triplets

61 amino-acid codons + 3 stop codons

2. DEGENERATE DOES NOT MEAN AMBIGUOUS

More than one codon can specify the same amino acid: UUU and UUC both specify phenylalanine. But each of these codons has one meaning in the standard code. The 61 amino-acid codons specify 20 common amino acids.

3. USE AN mRNA CODON TABLE CORRECTLY

mRNA CODON	STANDARD MEANING
UUU or UUC	Phenylalanine
AUG	Methionine; usual start
UAA, UAG or UGA	Stop; no amino acid

Read each mRNA codon 5' to 3', keeping the bases in their given order. Do not look up the complementary DNA template sequence directly in an mRNA codon table.

Universality, degeneracy and reading frame: OpenStax Biology 2e, section 15.1.
Codon counts: NHGRI, Codon. Table assignments checked against NCBI.

Scope: Cambridge Biology 9700 syllabus, section 6.2, outcome 2, p. 24.