

14.1

(1)

★ PROTEINS are the link between
Genotype and Phenotype!

Gene Expression - the process by which
DNA directs the synthesis of proteins.



- ① Transcription - DNA to RNA
- ② Translation - RNA to Protein

Experimental Background

1902 - Garrod \Rightarrow ALKAPTONURIA
 \Rightarrow "inborn errors in metabolism"

1930s - Beadle & Ephrussi
- *Drosophila* eye color mutations

\rightarrow Beadle & Tatum at Stanford

- bread mold Neurospora crassa (haploid species)

Technique \Rightarrow knock out specific genes to
see result and conclude function
of normal gene

Overview of Neurospora

- use of minimal & complete growth medium,
- X-ray induced mutation, pair-sterking process of elimination

!!
1958 - Nobel Prize



ONE gene - one enzyme hypothesis



the function of a gene is to dictate the production of a specific enzyme (PROTEIN)

J.K. !! → revisions

- ① NOT all proteins are enzymes
- i.e. Keratin (structural)
- i.e. insulin (hormone)

SO → "one gene - one protein" ???

BUT, proteins also formed from polypeptide chains (like hemoglobin)

SO maybe → "one gene - one polypeptide" ??

② WHAT genes also code for RNA molecules as well (ribosomal, transfer, etc)

SO whatever !!

Overview of Transcription & Translation

RNA → links DNA to Proteins

- (1) contains ribose instead of deoxyribose
- (2) is usually single-stranded instead of double-stranded
- (3) contains the nitrogenous base URACIL instead of Thymine

2020!!

Nucleic Acids - info is "written" in nucleotides

Proteins - info is written in Amino Acids (primary structure)

A-B

★ Transcription - one strand of the

DNA acts as a template for the production of a single-strand of messenger RNA (mRNA)

or any kind of RNA actually. (technical point)!

in nucleus

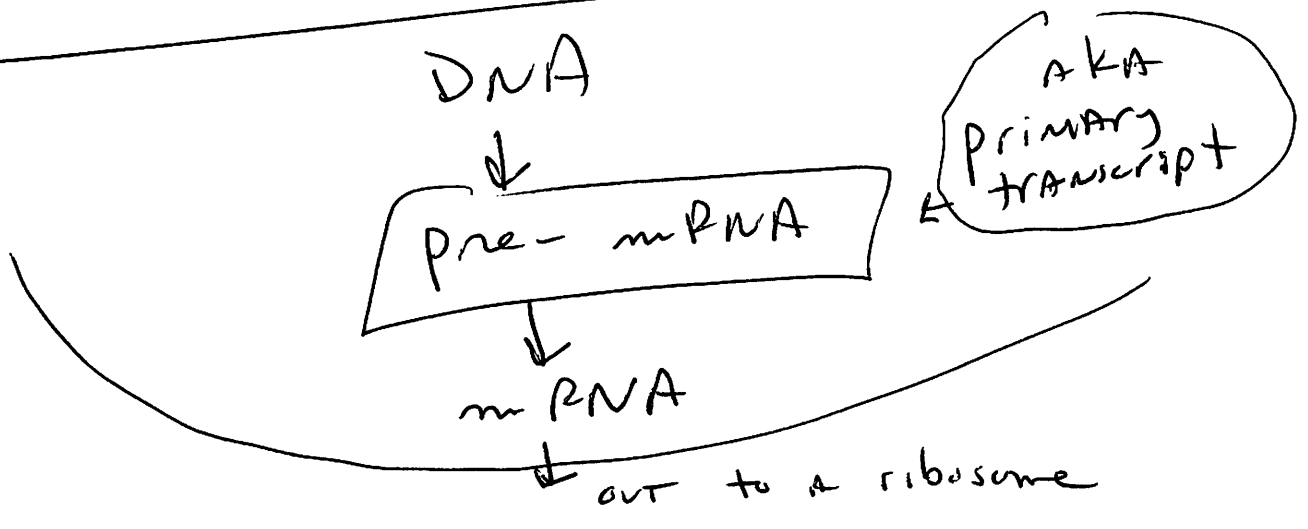
Translation - occurs at RIBOSOMES
outside the nucleus

⇒ nucleotide sequence of mRNA gets "translated" into the amino acid sequence of a ~~nucleotide~~ protein

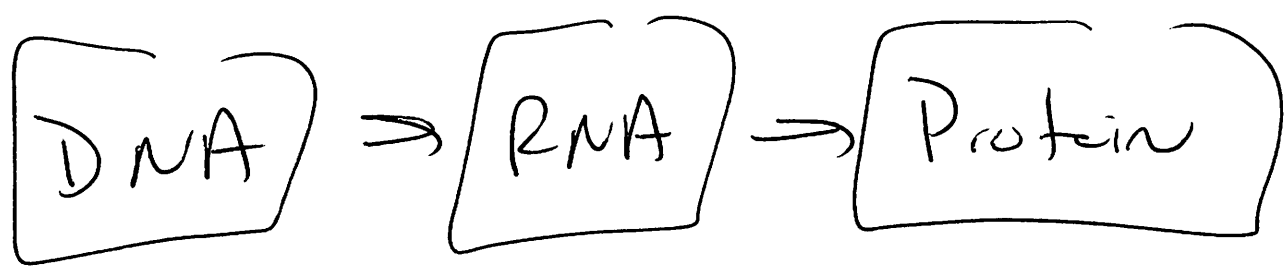
★ occurs in both prokaryotes and eukaryotes !!
→ because in prokaryotes DNA and ribosomes are NOT separated physically, Transcription/Translation can occur at SAME time

RNA Processing (in eukaryotes)

→ RNA transcript is MODIFIED before !!
it leaves the nucleus.



1956 - Francis Crick



“ CENTRAL DOGMA of Molecular Biology ”

Problem → how do 4 bases code for 20 amino acids ??

→ can't be one base for one AA

→ can't be 2 base code because $4^2 = 16$

Triplet code → must be $4^3 = 64$ which gives you enough for 20 AA's with LOTS left over. → START, STOP, redundancy

Template Strand

- the one strand of the 2 that is transcribed

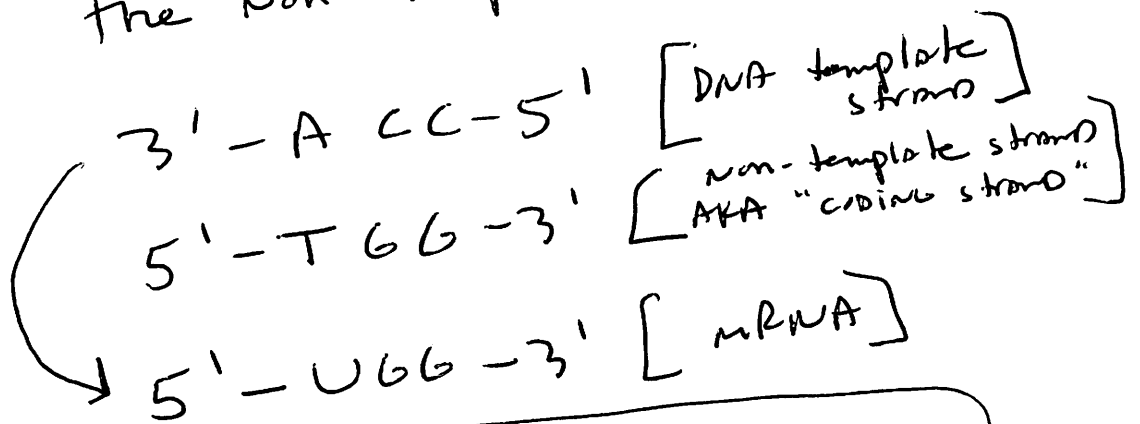
↳ can vary for different genes (i)

★ U PAIRS with A in mRNA instead of T pairing with A as it does in DNA (6)

CODONS

- mRNA nucleotide triplets
- written 5' → 3' direction.
- can refer to the triplets on the template strand or the non-template strand.

Example



NOTICE!!

the mRNA is actually the same as the non-template or "coding strand" except T is replaced by U

Common Question - relate # of codons to # of AA's to # nucleotides

i.e. How many bases in an ~~AA~~ protein with 50 AA's?