

Slide  
1

**How Genes Are Expressed**

**BIO 100 Principles of Biology**

Cedarville University

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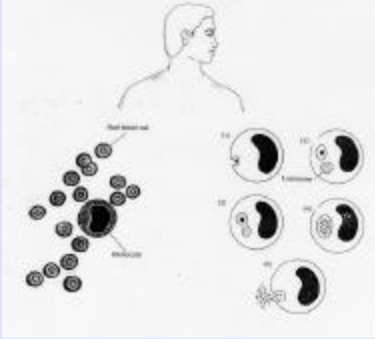
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Slide  
2

**? The Puzzling Problem ?**

HOW CAN CELLS  
FROM THE SAME ZYGOTE  
BE SO DIFFERENT IN  
STRUCTURE AND  
FUNCTION?



The diagram shows a human silhouette with arrows pointing to a cluster of cells on the left and a series of developmental stages on the right. The cluster of cells is labeled 'Differentiated cells' and 'Zygote'. The developmental stages are labeled '1st cleavage', '2nd cleavage', '3rd cleavage', and '4th cleavage', showing the progression from a single cell to a complex organism.

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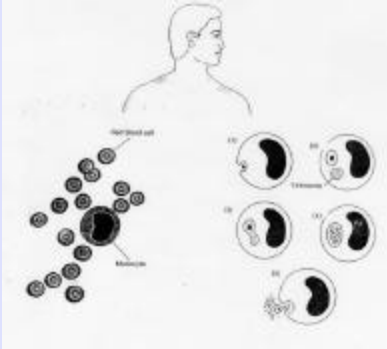
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Slide  
3

**> Answer <**

CELLS FROM THE  
ZYGOTE HAVE THE  
SAME GENES, BUT  
DIFFERENT GENES  
ARE EXPRESSED AS  
CELLS DIFFERENTIATE.



The diagram is identical to the one on Slide 2, showing a human silhouette with arrows pointing to a cluster of cells on the left and a series of developmental stages on the right. The cluster of cells is labeled 'Differentiated cells' and 'Zygote'. The developmental stages are labeled '1st cleavage', '2nd cleavage', '3rd cleavage', and '4th cleavage', showing the progression from a single cell to a complex organism.

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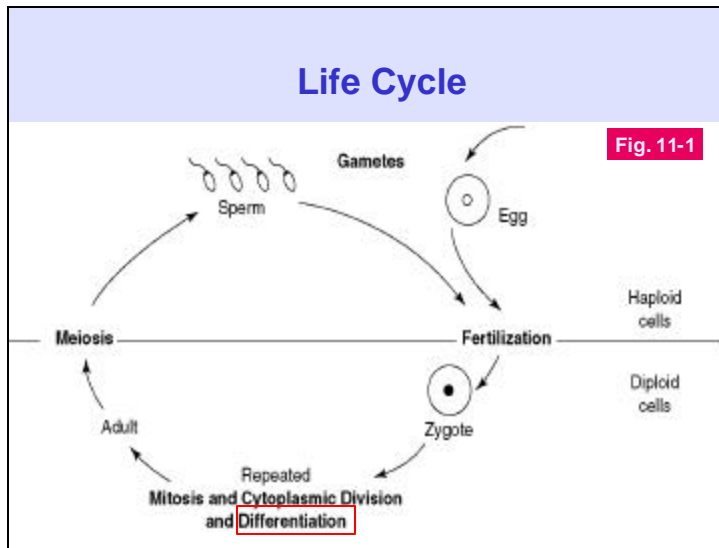
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Slide  
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**Two Separate Questions**

1. How are genes expressed?

2. How is gene expression controlled

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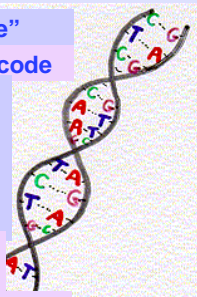
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Slide  
6

**Review of DNA (deoxyribonucleic acid)**

1. DNA is an “information molecule”
2. Nucleotide sequence determines code
3. GENE = “segment of DNA...  
which codes for the synthesis  
of one protein molecule”
4. PROTEIN = chain of amino acids
  - a. 20 different amino acids
  - b. Sequence prescribed by RNA
  - c. Protein carries authority of a gene



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Slide  
7

**How are genes expressed?**

**Reword the Question:**

How does the DNA code direct the  
sequencing of amino acids  
to form a protein?

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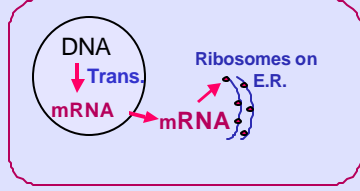
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Slide  
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**DNA to RNA**

1. DNA stays in the nucleus -- “master copy”
2. mRNA (messenger RNA) a complementary copy, moves to ribosomes to direct protein synthesis
3. TRANSCRIPTION = RNA synthesis in nucleus from a segment of DNA



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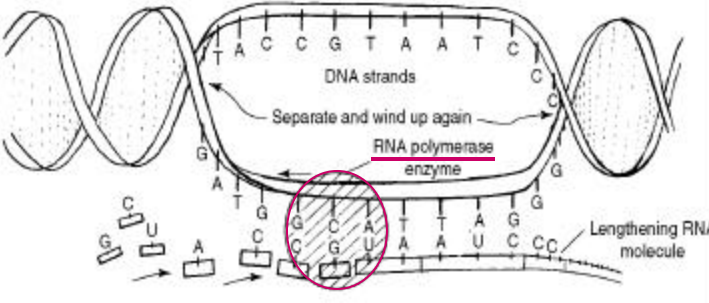
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Slide  
9

**DNA to RNA = Transcription**

1. DNA stays in the nucleus -- "master copy"
2. mRNA (messenger RNA) a complementary copy, moves to ribosomes to direct protein synthesis
3. TRANSCRIPTION = RNA synthesis from a segment of DNA



The diagram illustrates the process of transcription. A DNA double helix is shown with one strand being transcribed. The DNA strands are labeled 'DNA strands' and 'Separate and wind up again'. An 'RNA polymerase enzyme' is shown moving along the DNA, synthesizing a 'Lengthening RNA molecule'. The RNA sequence being synthesized is G C C A A U C C C. The DNA sequence being transcribed is T A C C G T A A T C. The RNA sequence is complementary to the DNA template strand.

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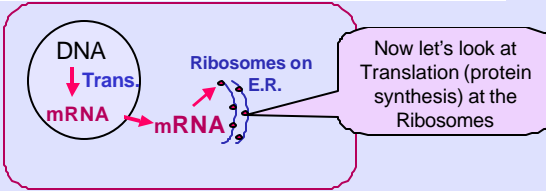
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Slide  
10

**DNA to RNA**

1. DNA stays in the nucleus -- "master copy"
2. mRNA (messenger RNA) a complementary copy, moves to ribosomes to direct protein synthesis
3. TRANSCRIPTION = RNA synthesis in nucleus from a segment of DNA



The diagram shows a circular DNA molecule with an arrow labeled 'Trans.' pointing to an mRNA molecule. The mRNA molecule is shown moving towards a structure labeled 'Ribosomes on E.R.'. A callout box points to the ribosomes with the text: 'Now let's look at Translation (protein synthesis) at the Ribosomes'.

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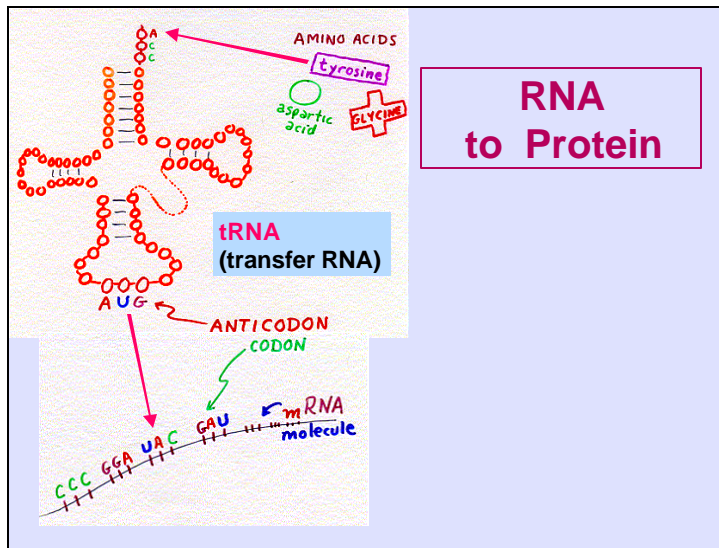
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Slide 14



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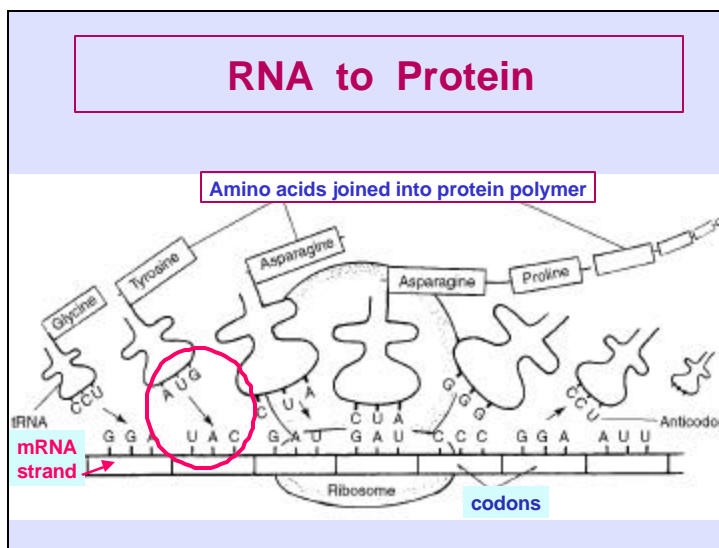
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Slide 15



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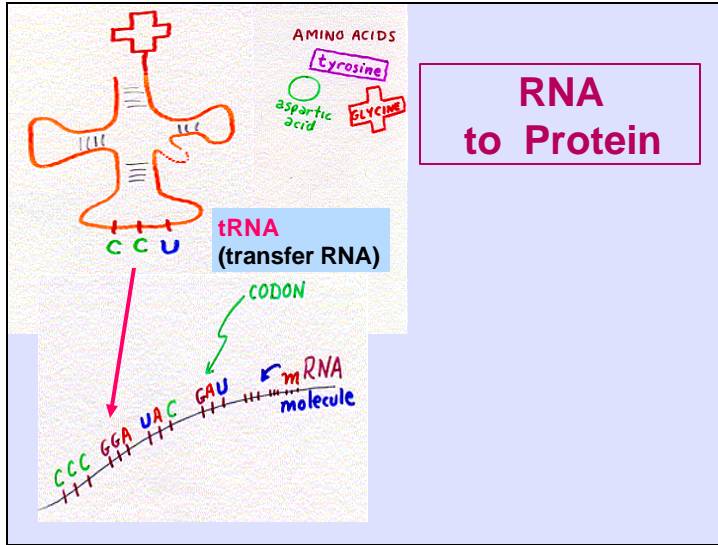
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Slide  
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Slide  
17

**Breaking the Genetic Code**

First Letter of Codon	Second Letter of Codon			Third Letter of Codon
	U	C	A	
U	phenylalanine	serine	tyrosine	cysteine
	phenylalanine	serine	tyrosine	cysteine
	leucine	serine	STOP	STOP
C	leucine	serine	STOP	tryptophan
	leucine	proline	histidine	arginine
	leucine	proline	histidine	arginine
	leucine	proline	glutamine	arginine
A	leucine	proline	glutamine	arginine
	isoleucine	threonine	asparagine	serine
	isoleucine	threonine	asparagine	serine
	isoleucine	threonine	lysine	arginine
G	START	threonine	lysine	arginine
	valine	alanine	asparagine	glycine
	valine	alanine	asparagine	glycine
	valine	alanine	glutamic acid	glycine
G	valine	alanine	glutamic acid	glycine
	valine	alanine	glutamic acid	glycine

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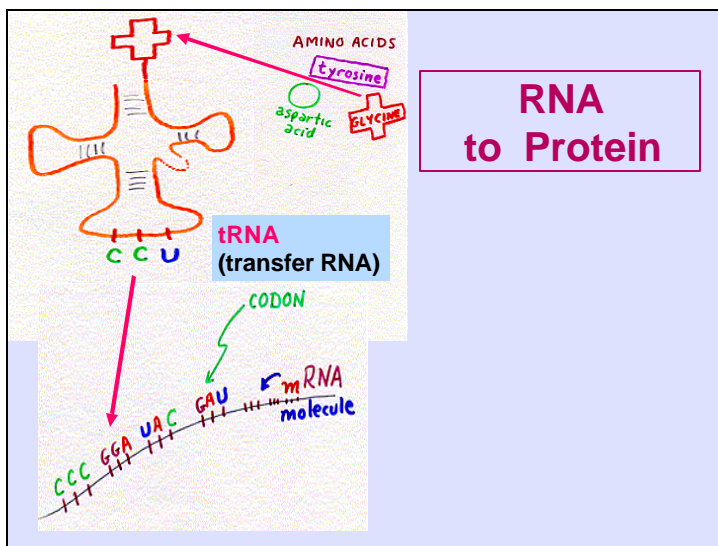
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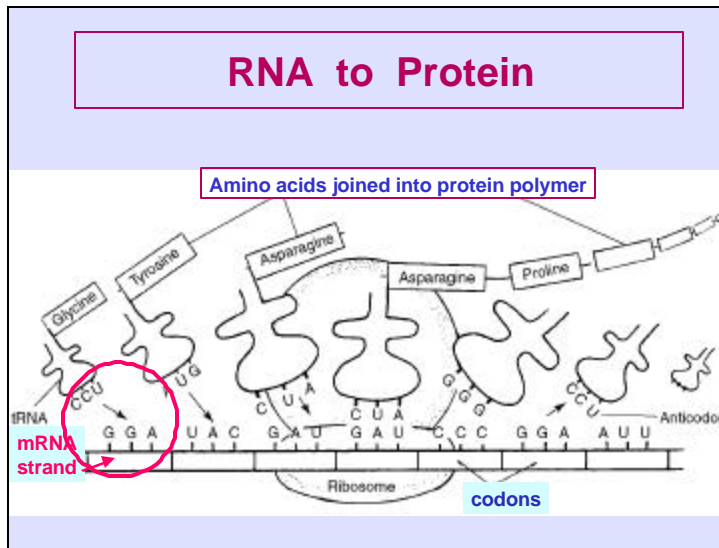
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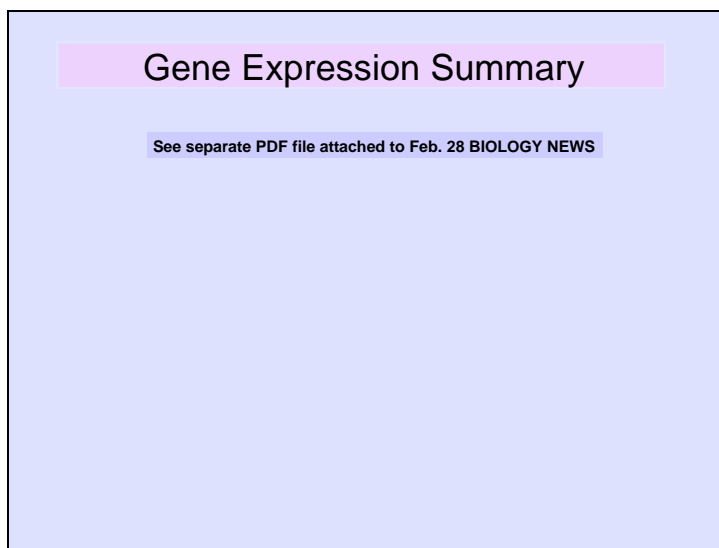
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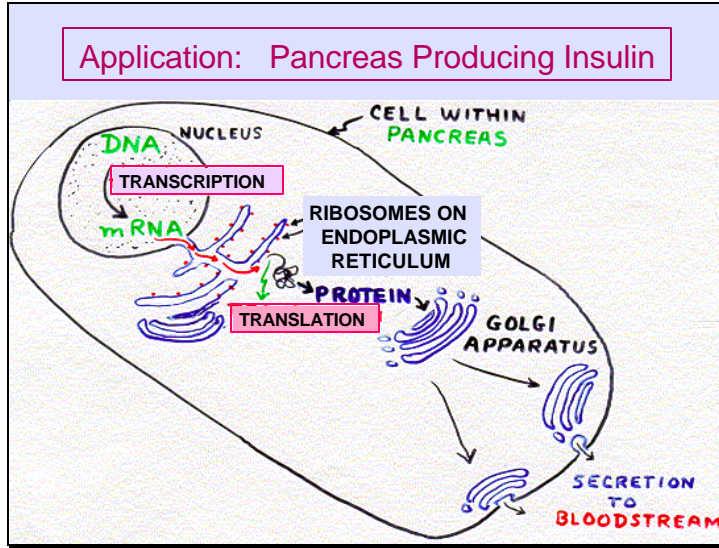
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Slide  
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**Two Separate Questions**

1. How are genes expressed?

2. How is gene expression controlled?

Next Lecture: How Is Gene Expression Controlled?

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