

Can *anything* evolve by Natural Selection?

1

Heredity

- What is a phenotype? What is a genotype?
- How are phenotypes created?
- What are the relative influences of genetics and environment on phenotype?

2

DNA

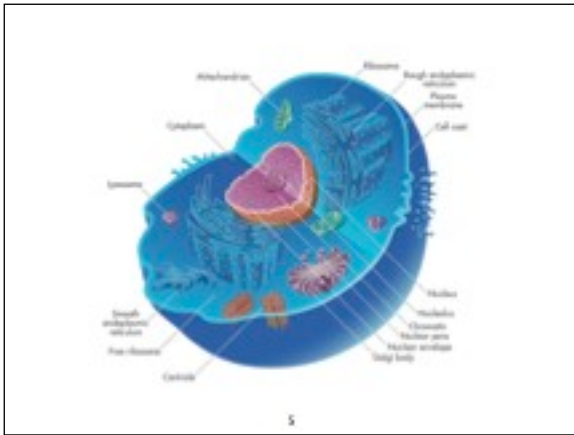
- What is DNA?
 - What is its shape? Why is the shape important?
- Where is it found?
- What does it do?

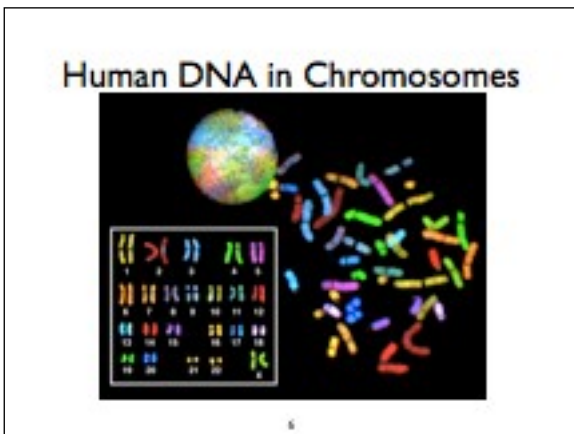
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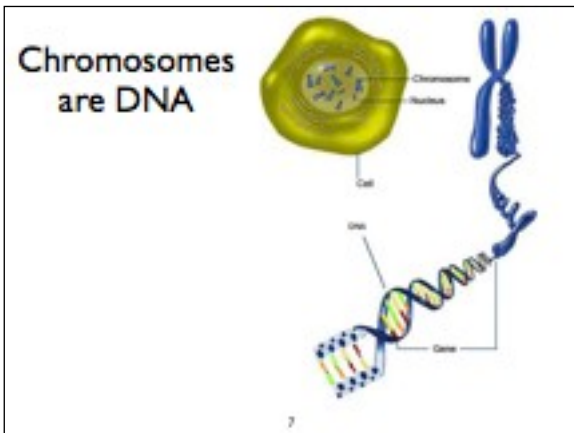
3 Part question

- How does the genetic code create a characteristic?
- How come we resemble our parents? That is, how is our heritable information passed from generation to generation?
- Where does variation in the code come from?

4







DNA

- A SEGMENT OF DNA is a particle of inheritance
- All scrunched up in nucleus – supercoiled into tiny packs
- Forms the Chromosomes
- Really long! Haploid genome of one gamete = about 1 meter
- Double helix

8



9

DNA made of 4 bases

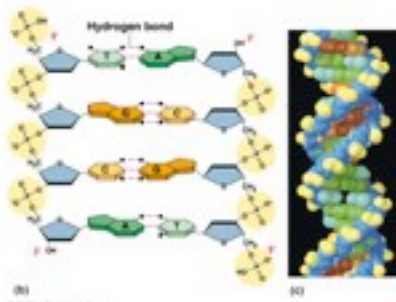
- Adenine
- Guanine
- Cytosine
- Thymine



A→T
G→C

10

DNA structure



11

Particle of Inheritance?

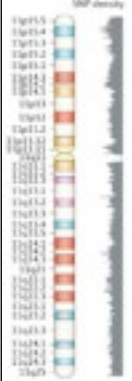
- A segment of a chromosome
- A segment of DNA
- A series of bases
- A gene
- An allele
- A segment of DNA with a particular job

12


DNA's Job

- DNA carries the code for making proteins
- Proteins are the building blocks of the body
- What proteins you make or don't make determines your phenotype
- Different sequences can create different proteins and therefore different phenotypes

13



**Example:
Sickle Cell
Anemia**



- part of 11p15.5 makes hemoglobin B
- "normal" 11p15.5 makes "normal" hemoglobin
- sickle cell results from a different sequence

Examples

- Provide structural support (collagen)
- Regulate metabolic processes (digestion, body temperature, melanin production, etc)
- Influence gene expression: hormones, enzymes
- Regulatory genes

15

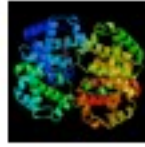
Proteins

- Made of amino acids
- 20 amino acids
- Different combinations and lengths for different proteins
- Insulin = 51 AA long; Hb = 574 AA

16

How does DNA make a protein?

Has to give the instructions on how to build the amino acid chain



Gives the order of amino acids

Sequence of bases gives sequence of amino acids

17

TABLE 3-4 The Genetic Code

AMINO ACID SYMBOL	AMINO ACID	DNA TRIPLET	mRNA CODON
Ala	Alanine	GCA, CGG, GGT, CGC	GCU, GCC, GCA, GCG
Arg	Arginine	GCA, GCG, GCT, GGC, TCT, TCC	CGU, CGC, CGA, CGG, AGA, AGG
Asn	Asparagine	TTA, TTG	AUU, AUC
Asp	Aspartic acid	CTA, CTC	GUC, GAC
Cys	Cysteine	ACA, ACC	UGU, UGC
Gln	Glutamine	ATT, ATC	CAA, CAG
Glu	Glutamic acid	CTT, CTC	GAA, GAG
Gly	Glycine	CCA, CCG, CCT, CCC	GGU, GGC, GGA, GGG
His	Histidine	ATA, ATG	CAU, CAC
Ile	Isoleucine	TAA, TAG, TAT	AUU, AUC, AUA
Leu	Leucine	AAT, AAC, GAA, GAG, GAT, GAC	CUA, CUG, CUU, CUC, CUA, CUG
Lys	Lysine	TTT, TTC	AAA, AAG
Met	Methionine	TAC	ATG
Phe	Phenylalanine	AAA, AAG	UUU, UUC
Phe	Proline	GGG, GGG, GGT, GGC	CCU, CCC, CCA, CCG
Ser	Serine	AGA, AGG, AGT, AGC, TGA, TGG	UCU, UCC, UCA, UCG, AGU, AGC
Thr	Threonine	TGA, TAG, TGT, TGC	ACU, ACC, ACA, ACG
Tyr	Tryptophan	ACC	UGG
Tyr	Tyrosine	ATA, ATG	UAU, UAC
Val	Valine	CAG, CAG, CAG, CAC	GUU, GUC, GUA, GUG
Terminating triplets		ATT, ATC, AAT	UAA, UAG, UGA

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18

DNA is

- Universal
- Triplet
- Redundant

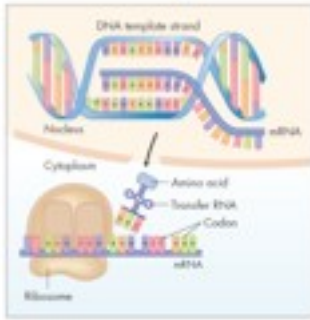
19

Protein synthesis

- TRANSCRIPTION - the copying of DNA by mRNA
- TRANSLATION - the meeting of mRNA and tRNA to translate the base sequence into a chain of amino acids

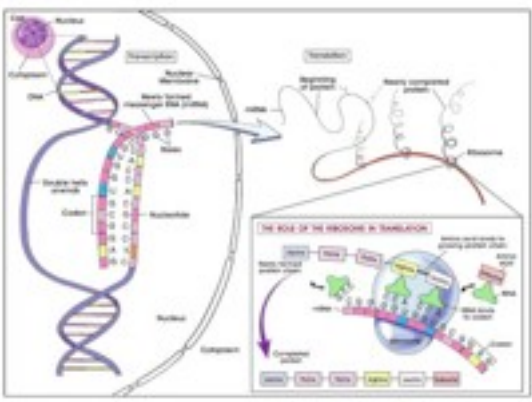
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Protein Synthesis

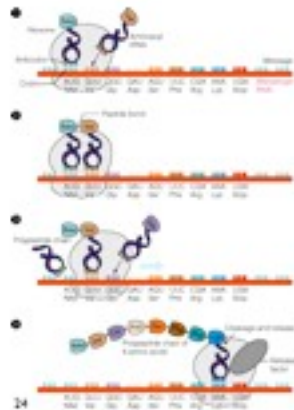


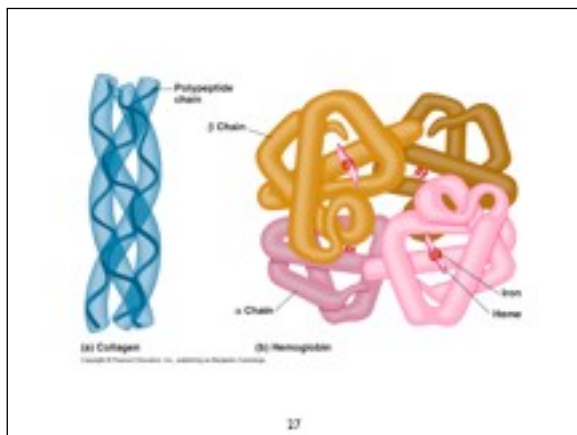
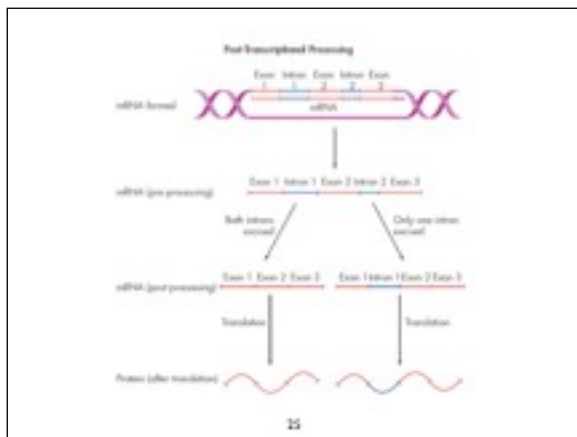
Transcription





Translation





3 Part question

- How does the genetic code create a characteristic?
- Where does variation in the code come from?
- How come we resemble our parents? That is, how is our heritable information passed from generation to generation?

This is how a protein is created --
But this is only the start

We don't just have one copy of a gene, we have two, and we have to know

- *How do these two copies combine to create a phenotype?
- *How do we get our two copies?
- *How is variation produced?

29

Example: Sickle Cell



Example: Blood Type

- ABO
- A creates an antigen on the blood, which will result in antibodies against B
- B creates an antigen on the blood, which will create antibodies against A
- O creates no antigens - but will create antibodies against both
- AB creates both antigens, and therefore no antibodies

31

Example: Eye Color

- actually created by pigment genes at at least 3 locales
- Blue eyes are due to the lack of other pigmentation
- One allele makes nothing, others make pigmentation.

33