NAME_____

VIDEO NOTES: "DNA: The Secret of Life"

1. When did the secret of life get discovered?
2. How many chemicals make up DNA?
3. What school in England is home to the discovery of DNA?
4. How old was Crick when he started working with DNA?
5. What 2 things are chromosomes made of?
6. What are the 4 ingredients in DNA?
7. Who were the 2 people that worked at King's College on DNA?
8. What did Maurice Wilkins help create that was used in WWII?
9. Who was the 3RD person/group looking for DNA?
10. Pauling used the Laws of _____to figure out the structure of DNA.
11. What does the video suggest about the men working for/with Rosalind Franklin?
12. When did Watson & Crick 1ST announce that they'd found the structure of DNA?
13. What did Rosalind Franklin do when she saw Watson & Crick's model?
14. What was wrong with it?
15. Who was Watson & Crick's boss?
16. What happened to Watson & Crick after their blunder?
17. Who was the chemist that came to dinner in Cambridge with Watson & Crick?
18. What did Pauling ask Wilkins for?
19. What did Franklin's photo suggest the pattern of DNA looked like (letter)?
20. What did Watson think Franklin was going to do to him when she saw him in her office?

21. According to diffraction theory, what does an ‘X’ suggest?

22. What does Wilkins say science ought to be?

23. When were Watson & Crick allowed to resume working on DNA at Cambridge University?

24. What were their models originally made of?

25. What did they notice about the shapes of the bases?

26. When did Watson & Crick truly figure out the shape of DNA?

27. “A always goes with ____ and G always goes with ____.”

28. What’s the name of the English pub where Watson & Crick announced their news?

29. What did Franklin’s last notebook entry suggest about DNA’s shape?

30. Who got Nobel prizes for DNA?

31. Where does Crick teach now?

32. What direction did Crick work in to figure out DNA?

33. What is the product of the “DNA machine”?

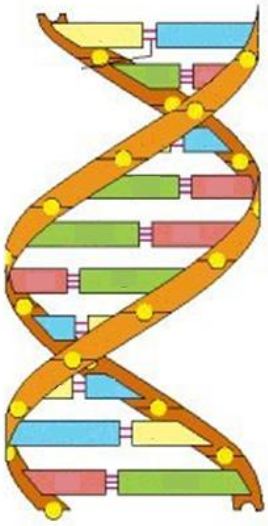
34. According to the video, what is Crick working on?

35. What does Wilkins lecture about at King’s College in London?

DNA: The Molecule of Heredity

STRUCTURE AND FUNCTION

- a nucleic acid
  - C, H, O, N, P
  -
  - Components of nucleotides:
    -
    -
    -



      - Purines =
        -
      - Pyrimidines =
        -
  - nucleotides connect/combine to form 2 long chains
  - chains are joined by_____= ladder
  - _____= 2 twisted strands; looks like a twisted ladder

- all living things are made up of DNA w/combinations of these 4 bases are different_____
- the more closely related two organisms are, the more alike the order of nucleotides in their DNA will be
  - scientists use this information to determine evolutionary relationships

_____

- International research program to determine sequence of nucleotide bases for human species
- complete in 2003 → data analysis continues

REPLICATION OF DNA

- each organism on earth has a nucleotide sequence that was obtained from its parents
- sequence goes back ~ 3.5 billion years to the 1st organisms on earth!

- Why replicate?
  - Cell has to_____
  - Replication = _____
- How to replicate?

- *remember, DNA is made of 2 strands, each w/sequence of nucleotides
    - _____on one strand pairs with_____on the other
    - _____on one strand pairs with_____on the other
    - Each strand serves as a pattern to make a new DNA molecule
- An enzyme breaks the H-bonds that hold the 2 strands together "unzips" the molecule
- As DNA unzips, free nucleotides (from surroundings in the nucleus) bond to the single strand by_____
  _____
- a different enzyme bonds these new nucleotides into a chain
    - process continues until entire molecule has been unzipped & replicated
    - each new strand formed is a complement of one of the original "parent" strands
    - when all DNA has been copied, there are_____of the organism's genetic info
        - genetic makeup_____

GENES AND PROTEINS

- proteins are complex polymers (long chains) of amino acids
- different proteins have different functions
    - i.e. enzymes control chemical rxns, others build & repair cell structures
    - in general -> proteins determine_____
    - each_____
      _____
        - message of_____
    - human cell = 50,000 to 100,000 genes

DNA CODE

- genetic code = sequence of N-bases along 1 strand is _____
- ____different amino acids ("AA"); DNA contains only 4 types of bases
  - single base can't represent a single AA
  - sequence of 2 bases only gives 16 possible combos for AA's
  - sequence of 3 bases provides more than 20 combos for AA's
    - codon = each set of _____
      - called the_____
    - ____combos are possible to code for AA's
      - order of N-bases will determine the _____
      - ____codons code for AA's
        - more than one codon can code for the same AA, but for any one codon, there can be only one AA
      - remaining 3 codons are signals to stop making the chain = _____
- HISTORY – genetic code was figured out by studying the DNA of *Escherichia coli* bacteria
- Code is exactly the same in humans and every other known organism
  - Code is said to be "Universal" b/c codons represent the same AA's in all organisms

Powerful evidence that all organisms alive today shared a common ancestor billions of years ago!

TRASCRIPTION – FROM DNA TO RNA

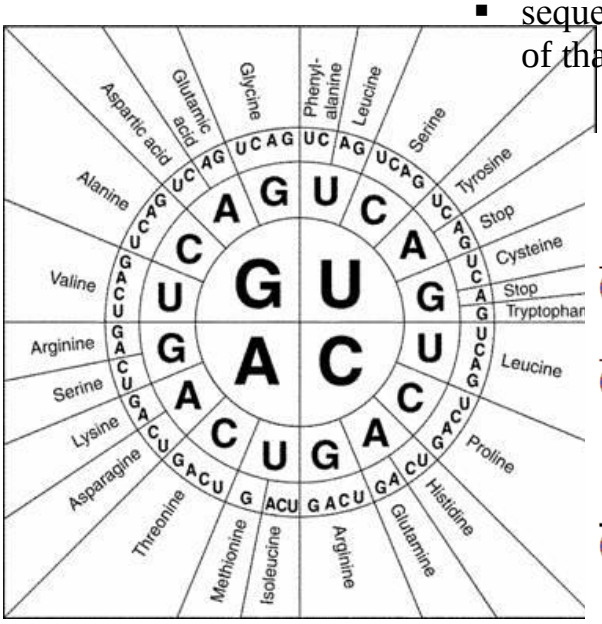
- _____in the cytoplasm
- DNA is found_____… how is info from the genetic code brought to the ribosomes for protein synthesis
- RNA = another type of nucleic acid
  - Differs from DNA in 3 ways:
    - 1. Usually made of a_____
    - 2. contains the_____
    - 3. has_____(instead of thymine)
  - RNA is the form in which _____
- Making RNA by transcription
  - Transcription = enzymes make an_____strand
  - Process is similar to that of replication

- Main difference = process results in the formation of 1 single-stranded RNA molecule instead of 1 double-stranded DNA molecule
- Messenger RNA (mRNA) = RNA copy that _____ _____ of the cell
  - Carries information for making a protein chain to the ribosomes
- Ribosomal RNA (rRNA) = some parts of DNA code for _____

Helps produce enzymes needed to bond AA's together during protein synthesis

TRANSLATION – FROM RNA TO PROTEIN

- when mRNA is made, it carries a complimentary copy of the DNA code for a protein chain… how is mRNA language used to make a sequence of AA's?
- translation = process of _____ _____ that make up protein
  - in order to make proteins, 20 different AA's dissolved in the cytoplasm must be brought to the ribosomes
- transfer RNA (tRNA) = brings _____ so they can be assembled into proteins via base pairing
  - correct translation of the code depends on the _____
  - end result of translation is the _____ that make up the structure of organisms and help them fxn
  - Importance of proteins
    - Infinite (not known #) variety of proteins can be made from the same 20 AA's
    - sequence of AA's in a protein determines the characteristics of that protein



CTG GTA TGG CGT AGT ACC ATT

_____ _____ -- _____ -- _____ -- _____ -- _____ -- _____ -- _____ _____
(process) (molecule)

_____ _____ -- _____ -- _____ -- _____ -- _____ -- _____ -- _____ mRNA
(process) (molecule)

_____ -- _____ -- _____ -- _____ -- _____ -- _____ -- _____ Protein
(molecule)

translation
(process)

_____ -- _____ -- _____ -- _____ -- _____ -- _____ -- _____ _____
(molecule)

GENETIC CHANGES

- Mutation =_____
  - Point Mutation = a_____in DNA
    - An incorrect AA is inserted into a growing protein chain during translation
    - i.e. THE DOG BIT THE CAT. (makes sense… right?)
      THE DOG BIT THE CAR (huh?)
  - Frameshift Mutation = a single base is_____from DNA
    - When the mRNA strand moves across the ribosome, a new AA is added to the protein for every codon on the mRNA strand
    - A single base may be lost/added from the DNA strand => this sequence is then transcribed into mRNA and

      _____
  - Chromosomal Mutations
    - Changes may occur at the chromosomal level
    - Sometimes parts of chromosomes are broken off and lost during cell divisions
    - Chromosomes may break and then rejoin incorrectly
    - Effects of chromosomal mutations
      - Occur in all living organisms; esp. common in plants
      - Gametes may end up with extra copies of genes or complete lack of certain genes
      - Few chromosomal mutations are passed on to the next generation _____
- In cases where zygote develops-_____

- Errors in Disjunction
  - Nondisjunction =_____

    _____
    - Both chromosomes move to the same pole of the cell
  - Trisomy, triploidy, and monosomy
    - Trisomy = zygote has_____
      - Gamete w/an extra chromosome is fertilized by a normal gamete
      - _____= zygote has 3 chromosomes of the 21st pair… baby has _____

- Triploidy = gamete has _____
    - Total lack of separation of all of the chromosomes; offspring is (3N)
- Monosomy = lacks _____ chromosomes
    - Offspring that's missing chromosomes usu. dies
    - ex. human females are only X instead of XX, offspring does NOT die!

- Causes of Mutations
    - Generally random events _____
    - Provide variation necessary for evolution of species
    - Many environmental agents cause mutations
        - X rays, UV light, radioactive substances, exposure to certain chemicals
    - Often result in _____
        - Birth defects or cancer

2. Using the following sequence of nucleotides, complete the table. (USE PAGE 303 OF YOUR TEXT FOR THE AMINO ACID CHART). Finally, match up the amino acids. You will see that the tRNA chain has already been translated for you. Try to figure out what type of mutation(s) (if any) have occurred. If you discover a mutation, circle the spot of the tRNA mistake and label what type of mutation (point mutation and/or frameshift mutation) occurred. Write in the **incorrect** amino acid chain with the mutation. Then write the **correct** amino acid chain the way it should have appeared without the mutations as well as the correct tRNA anticodons.

	GTG GGG GTT TCT ATA AAA ACT	
_____ (process)	_____ -- _____ -- _____ -- _____ -- _____ -- _____ -- _____	_____ (molecule)
_____ (process)	_____ -- _____ -- _____ -- _____ -- _____ -- _____ -- _____	_____ (molecule)
	_____ -- _____ -- _____ -- _____ -- _____ -- _____ -- _____	**Protein** incorrect AAs
translation (process)	**CAC CCC CUA AGA UAC UUU GA**	**tRNA** incorrect anticodons
	_____ -- _____ -- _____ -- _____ -- _____ -- _____ -- _____	**Protein** (corrected)
translation (process)	_____ -- _____ -- _____ -- _____ -- _____ -- _____ -- _____	**tRNA** (molecule)

Across
1. full name of DNA
5. base that matches with cytosine in DNA and RNA
8. any mistake or change in the DNA sequence
11. sequence of Nitrogen-bases along 1 strand of DNA is a code to make proteins
13. the structure of DNA was announced on _____ 28, 1953
16. organism studied to help scientists figure out the genetic code
17. school in England where the DNA structure was discovered
18. # of possible codons
20. lacking one or more chromosomes
22. 20 different structures that make up proteins
23. complex polymers of amino acids
24. set of 3 Nitrogen-bases
25. remaining 3 codons signal the chain to _____
27. people credited with the discovery of the structure of DNA
30. the zygote usually _____ if it has a chromosomal mutation
31. copy that carries the informaiton from DNA out into the cytoplasm of the cell

33. brings amino acids to the ribosomes so they can be assembled into proteins

35. change in a single base-pair in DNA
38. failure of chromosomes to separate during meiosis
42. simple sugar of RNA
43. random event that causes a change in the DNA sequence
44. changing the nformation in a sequence of mRNA bases to a sequence of amino acids that make up proteins
45. gamete has 3 complete sets of chromosomes
46. cytosine, thymine & uracil

Down
1. shape of DNA, looks like a twisted ladder
2. also called Trisomy 21
3. base that matches with uracil in RNA
4. making an RNA copy from DNA
6. group shared by DNA & RNA
7. international research program that mapped the sequence of DNA in humans

9. the zygote has an extra chromosome
10. smaller subunits of DNA
12. single base is added or deleted from DNA

14. type of bonds that join the bases together in DNA
15. N = haploid, 2N = diploid, and 3N = _____
17. base that matches with guanine in DNA and RNA
19. did not get a Nobel prize for her work with DNA
21. if the zygote with a chromosomal mutation develops, it is usually _____

26. occurs when part of a chromosome is broken off and lost during cell division

28. made of protein & DNA
29. helps produce enzymes needed to bond Amino Acids together when making proteins
32. type of protein that breaks the H-bonds in DNA to unzip the molecule
34. copying DNA
36. base that matches with adenine in RNA
37. adenine & guanine
39. simple sugar of DNA
40. # of codons that code for an amino acid
41. base that matches with adenine in DNA