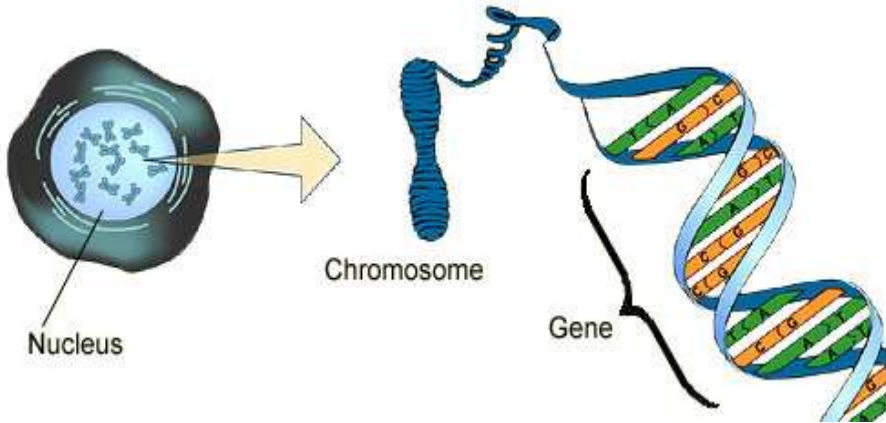


GCSE 9-1 Biology Revision Topic 3 - Genetics

Structure of DNA (DeoxyriboNucleic Acid)



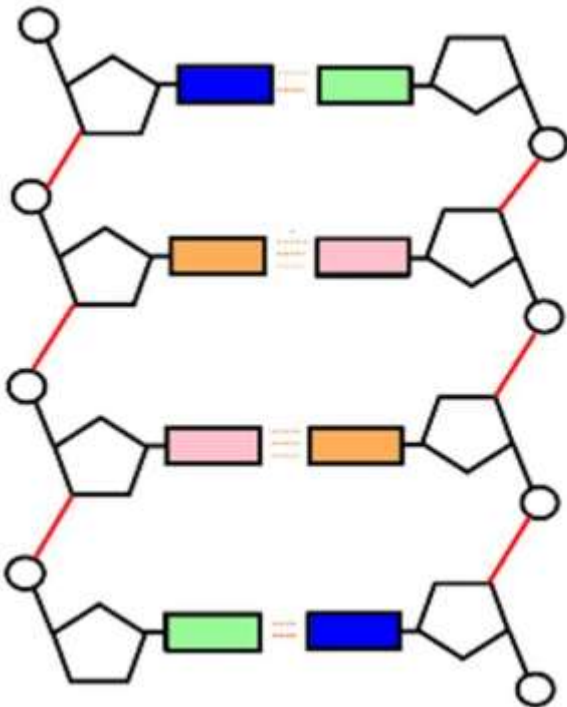
DNA extraction steps from fruit:

Grinding the fruit separates the _____

Detergent breaks open the _____

Ice cold ethanol precipitates the _____

On the diagram of DNA label the: base, phosphate, deoxyribose sugar, hydrogen bond



The structure of DNA was determined by X Ray _____ by Rosalind Franklin then the model of DNA was determined by Watson and _____. They showed that:

- DNA has a _____ helix shape.
- They determined the diameter of DNA
- It has ____ strands
- The backbone is made of _____ and _____
- The bases are __, __, __, __, they are joined by weak _____ bonds
- The complementary pairings of the bases are ____ & ____ and ____ & ____
- A length of DNA is a _____ and it codes for a _____

1. If a section of DNA has 33% Adenine (A) bases, what percentage will be Guanine (G)?

2. DNA is a polymer, what makes up the monomer?

3. Describe the difference between a chromosomes, gene and DNA

DNA vs RNA

	DNA	RNA (mRNA and tRNA – used in protein synthesis)
Sugar		
Bases present		
Number of strands		
Can leave the nucleus (X or √)		

Protein synthesis

A gene codes for a protein and is made by protein synthesis in the _____. All cells need protein eg enzymes, transport proteins, hormones.

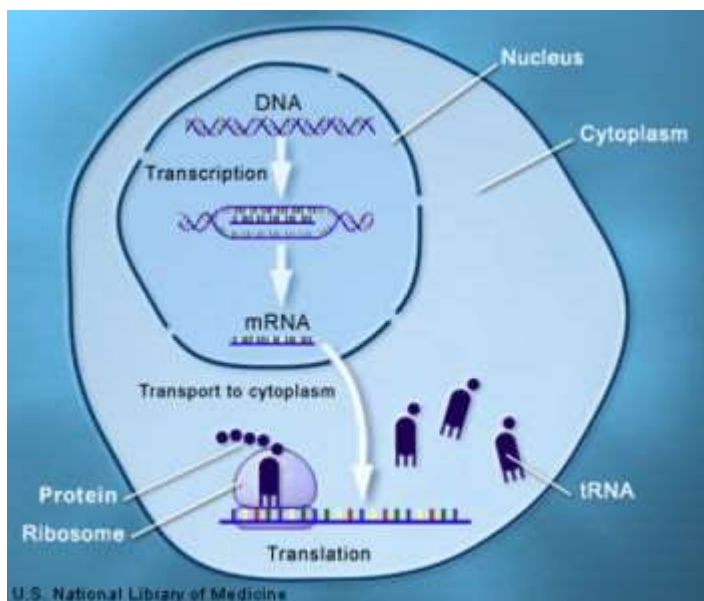
Protein synthesis involves 2 stages which are enzyme controlled:

Stage 1 TRANSCRIPTION –a complementary strand of mRNA is formed from a section of DNA

- The DNA of a gene _____, separating the DNA into 2 strands
- The enzyme RNA _____ binds to a non coding region of DNA in front of the gene
- Complimentary RNA nucleotides add in to form a strand of _____
- A pairs with ___ and C pairs with ___ (note no T (thymine), replaced by U (uracil))
- mRNA leaves the nucleus through _____ in the nuclear membrane, DNA zips back up into its double helix

Stage 2 TRANSLATION –a protein is formed using the mRNA. mRNA goes to a ribosome in the cytoplasm

- Each set of 3 bases on the mRNA form a _____
- Each set of 3 bases on the tRNA form an _____
- tRNA carrying specific _____ acids enter the ribosome, they have complimentary anticodons to the mRNA codons (A-U and C-G)
- The amino acids join up with _____ bonds to form the protein
- The protein then folds to produce a specifically shaped protein eg an enzyme with its _____ site



Covert the bases:

DNA	ATG		
mRNA codon		CGA	
tRNA anticodon			UAC

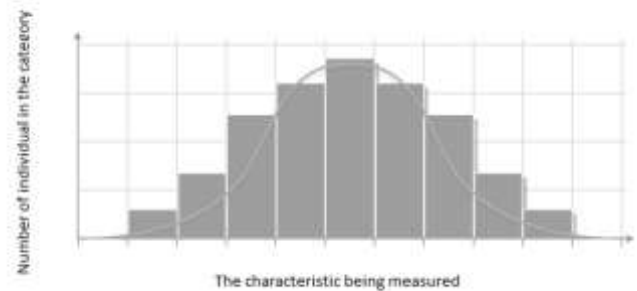
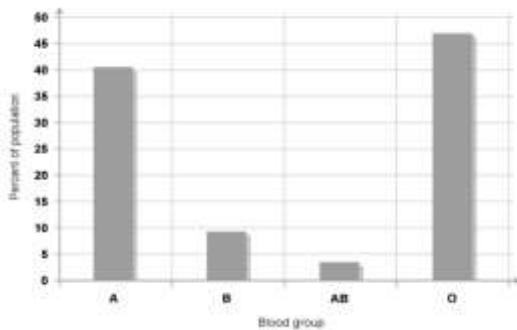
1. A protein is made of 153 amino acids, how many bases there were in the DNA?
2. A gene is made of 186 bases, how many amino acids will make up the protein?
3. What is the role of mRNA and tRNA in protein synthesis?

Variation in a species is due to _____ and the _____ and is often a mix of the 2. For example your skin tone will be determined by your genes and by exposure to sunlight and UV light.

We can categorise variation by: *(fill in the table gaps)*

Category:	Category:
Gives a range of values, no categories	Gives categories of data
Data gives a normal distribution	Not a normal distribution
_____ graph used to plot data	_____ graph used to plot data
Example of category:	Example of category:

Match the graph to the type of variation:



Mutations

A mutation is a change in _____ bases, it can be a _____, _____ or an _____.

Causes of mutations include:

Changing the DNA will change the _____ produced in transcription, which can then change the sequence of _____ (joined in translation). Effect of mutation on a protein can be:

- a non functional protein
- a protein that doesn't work as well
- a better functioning protein
-

Reproduction = production of new individuals, 2 forms:

Sexual reproduction advantages	Asexual reproduction advantages

Genetics

Match the key terms to their definition

Genotype	What is observed, or what the organism looks like, due to the organism's genotype (and environment) eg blue eyes, tall plant
Phenotype	The sex cells (ova or sperm in animals and pollen or ovule in plants)
Homozygous	A thread of DNA, made up of a string of genes
Heterozygous	The genetic makeup of an organism in terms of the alleles present (eg Dd, BB)
Gamete	Both alleles are the same (eg BB, dd)
Allele	An allele that is only expressed when there is no dominant allele present
Gene	This allele is always expressed in the phenotype when present either on its own or when 2 are present (eg S, A, SS, AA)
Chromosome	A length of DNA that is the unit of inheritance and codes for a specific protein
Dominant	Each form of a gene (eg tall or short in wheat plants, blue eyed or brown eyed in humans)
Recessive	The alleles for a gene are different (eg Ss, Aa)

Number of chromosomes in human body cell =

Number of chromosomes in human gamete =

What did Mendel discover in the 1800s?

He cross bred pea plants to study genetics and discovered the basis of inheritance for the 1st time (despite the fact that DNA was not understood). He created pure-bred plants so that identical offspring were always produced when bred with a pea plant of the same type. On cross breeding dwarf and tall pea plants, all offspring were tall. On cross breeding the tall offspring, $\frac{1}{4}$ were dwarf and $\frac{3}{4}$ tall

Mendel summarised his work with three laws of inheritance:

- Each gamete receives only one 'factor' for a characteristic
- The version of a 'factor' that a gamete receives is random and does not depend on other 'factors' in the gamete
- Some versions of a 'factor' are more powerful than others and always have an effect in the offspring

1. Cross out the less scientific words and replace with the terms: allele, gene, dominant, recessive as appropriate in Mendel's laws above
2. What does pure breeding mean?
3. Mendel covered his pollinated pea plant flowers in bags, suggest why

Monohybrid punnett squares

The alleles for cattle coat colour are B = brown, b = white, give the genotypes for:

Heterozygous =

Homozygous dominant =

Homozygous recessive =

1. A heterozygous bull mates with a heterozygous cow, show the punnett square of this cross

	Mother's alleles	
Father's alleles		

what is the:

- Probability of a brown cow
- Probability of a brown male
- Probability of a white cow
- Probability of a white female

2. A heterozygous rabbit with a brown coat was bred with a rabbit with a black coat (homozygous recessive), the 4 bunnies were all black. Use a punnett square to calculate the predicted outcome and then explain the difference between this and the actual outcome

	Mother's alleles	
Father's alleles		

Sex determination

What is the genotype for a female?

Genotype for a male?

Which gamete determines the gender of any offspring?

Is this determined at: birth/fertilisation/fetal development in uterus?

Use a punnett square to show why there is an equal chance of producing a male or a female

	Female gametes	
Male gametes		

A couple have 3 boys, the female is pregnant again, what is the probability of another boy?

Multiple alleles and codominance

Many inherited characteristics are due to a single gene that has more than 2 alleles eg blood group, rabbit coat colour.

To distinguish multiple allele genes from those that are just dominant and recessive, the allele is shown as a superscript to a letter (eg blood group alleles are A, B, O are written as I^A , I^B , I^O)

Alleles A and B are _____ in that they are both expressed in the phenotype eg blood group AB. Allele O is recessive

What are the genotype(s) for blood group: A = B = AB = O =

1. A woman has blood group O and has a baby with blood group B, what are the possible genotypes of her partner?
2. A couple are both blood group AB, use a punnett square to determine the blood groups of their potential children and the probability of each

	Female gametes	
Male gametes		

Sex linked disorders

There are sex linked genetic diseases eg haemophilia, Duchene muscular dystrophy, colour blindness. The alleles for the genes are located on the _____ chromosome only. The X and Y chromosomes are not matching as the X chromosome is bigger and has extra genes.

To distinguish sex linked disorders the allele is shown as a superscript to the X chromosome eg X^B or X^b

For a recessive disease such as haemophilia for a man to be affected he will require _____ copy of the allele, while a woman to be affected she will require _____ copies of the allele

Using the letters H = normal blood clotting, h = haemophilia, give the genotypes for:

Affected male = affected female= carrier female=

Homozygous unaffected female=

1. For a boy to inherit haemophilia what genotype(s) will his mother have to be? Show using a punnett square

Human Genome Project (HGP)

The genetic information in an organism is called its _____. The Human Genome Project, or HGP for short, was started at the end of the last century. Its aims, included:

- to work out the order or sequence of all the three billion base pairs in the human genome
- to identify all the genes
- to develop faster methods for sequencing DNA

The sequencing project was finished in 2001, and work continues to identify all the genes in the human genome. The data is being used to develop new medicine and treatments for diseases

Advantages of HGP	Disadvantages of HGP

Questions

Nov 12 Q5

*(c) Sickle cell disease is another genetic disorder caused by a recessive allele (**d**).

Explain the inheritance of sickle cell disease in a family with a heterozygous father and a homozygous recessive mother.

You should use a genetic diagram or Punnett square and percentage outcomes in addition to your explanation.

(6)

June 2017 B2 q5

*(b) Describe how a gene is transcribed for use in the cytoplasm.

(6)

B2 march 2013 q5

*(b) Describe the structure of DNA, including the roles of the scientists involved in its discovery.

(6)

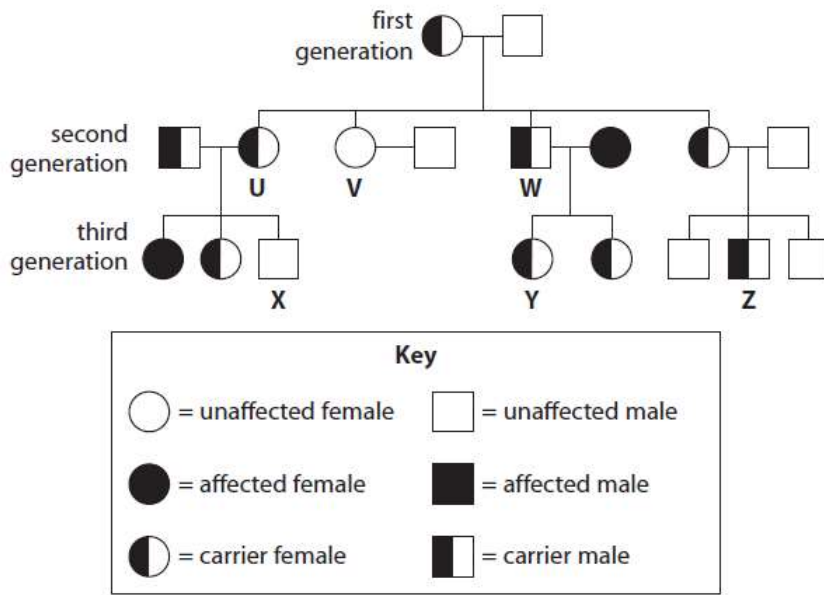
March 13 q6 – diagram on next page

*(b) Explain why it is important that individuals **X**, **Y** and **Z** have pedigree analysis completed before they consider having children.

You should use diagrams and mathematical calculations to illustrate your answer.

(6)

The family pedigree shows the inheritance of sickle cell disease through three generations.



AQA SAM 2 q7

Syndrome H is an inherited condition.

People with syndrome H do **not** produce the enzyme IDUA.

Figure 9 shows part of the gene coding for the enzyme IDUA.

Figure 9



0 7 . **5** Circle the base that shows a mutation on Strand K in **Figure 9**.

[1 mark]

0 7 . **6** The enzyme IDUA helps to break down a carbohydrate in the human body.

The enzyme IDUA produced from Strand **K** will not work.

Explain how the mutation could cause the enzyme **not** to work.

[5 marks]