Process of DNA replication

DNA replication is a semi-conservative process where the DNA molecule unwinds and unzips because of the enzyme DNA helicase so the hydrogen bonds between the bases break. The free DNA nucleotides line up alongside each single DNA strand and hydrogen bonds form between the complementary bases. The enzyme DNA polymerase links the adjacent nucleotides with phosphodiester bonds in condensation reactions to form new complementary strands. Overall, two DNA molecules are created.

Process of transcription

The DNA helicse unzips and unwinds the DNA at the gene that codes for the desired protein. The enzyme RNA polymerase then attaches to the DNA. The template strand is transcribed - an mRNA molecule is created using complementary RNA nucleotides. Phosphodiester bonds form between the RNA nucleotides of the mRNA strand. The mRNA moves out of the nuclear pores of the nuclear envelope.

Process of translation

The mRNA molecule attaches to a ribosome. The mRNA binds to the small subunit so that 2 mRNA codons face the 2 binding sites of the larger subunit. A tNRA anticodon sequence complementary to the mRNA codon sequence brings along a particular amino acid. Within the cytoplasm, free amino acids become attached to the correct tRNA molecules. Complementary anticodon UAC hydrogen bonds to the start codon. The second codon faces the next binding site and the complementary tRNA amino acid complex binds to it. A peptide bond forms between the 2 amino acids via a condensation reaction between the amine group of the amino acid and carboxyl group (COOH) of the next, forming a dipeptide. The tRNA returns to the cytoplasm where it can collect another amino acid 9. This process continues until a stop codon is reached. There are no anticodons to thee codons so no amino acids. Polypeptide chain detaches from the ribosome.

Human lung adaptations

- Rate of diffusion is proportional to surface area - alveoli have a large surface area.

Human lung adaptations (cont)

- Rate of diffusion is proportional to difference in concentration - breathing maintains a difference in gas concentrations
- Rate of diffusion is proportional to difference in concentration - blood flow maintains a difference in gas concentrations
- Rate of diffusion is inversely proportional to diffusion distance - walls of alveoli and capillaries are one cell thick
- Diffusion distance is reduced due to flattened cells forming alveoli and capillary walls
- Rate of diffusion is proportional to diffusion constant - cell membranes are relatively permeable to non-polar gas molecules

Human lung adaptations (cont)

Perfect exam answer (4-6 marks): The human lungs are adapted for gas exchange because the diffusion distance for gas exchange is reduced due to the flattened cells forming alveoli and capillary walls. The rate of diffusion is proportional to the surface area because the alveoli have a large surface area for gas exchange. Furthermore, the walls of the alveoli and capillaries are one cell thick so the rate of diffusion is inversely proportional to the diffusion distance and blood flow maintains a difference in gas concentrations

NB: Fick's law states that the larger the surface area, difference in concentration and shorter the diffusion distance the quicker the rate. You need to remember this for these kinds of exam questions.

Difference between transcription and replication

DNA Replication	Transcription
• Replication produces **double stranded DNA molecules**	• Transcription produces a **single stranded RNA molecule**

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Difference between transcription and replication (cont)

• Replication involves **DNA nucleotides**	• Transcription involves **RNA nucleotides**
• Replication uses **DNA polymerase**	• Transcription requires **RNA polymerase**
• Replication produces **identical copies**	• Transcription produces a **complementary copy**

Compare and constrast deletion & substitution

• Deletion could affect every codon but **substitution will only affect one codon.**

• Deletion is **more likely to affect the position of the start codon/stop codon** and results in a different sequence of amino acids whereas **substitution may not affect the sequence of amino acids.**

• Substitution may code for the same amino acid due to the **degenerate nature of the genetic code.**

Subs. (replacement) and loss (deletion)

• loss causes whole amino acid sequence (beyond mutation) to change / cause frame shift / eq ;

Subs. (replacement) and loss (deletion) (cont)

• replacement only changes one { codon / amino acid / may not change the amino acid of third base / eq }

• number of amino acids remain the same with replacement

Note: subs. just means 'substitution'.

Endocytosis and exocytosis

• both endocytosis and exocytosis involve the usage of vesicles

• both endocytosis and exocytosis involve energy from ATP

• endocytosis involves substances/molecules entering the cell	• exocytosis involes molecules/-substances leaving the cell
• endocytosis involves the formation of vesicles from the cell surface membrane	• exocytosis involves vesicles fusing with the cell surface membrane

Diffusion and active transport

• both diffusion and active transport move molecules through the phospholipid bilayer/cell surface membrane

Diffusion and active transport (cont)

• molecules can move through proteins in both diffusion and active transport

• diffusion occurs down a concentration gradient	• active transport occurs against a concentration gradient
• diffusion is a passive process that doesn't require ATP	• active transport does require ATP

CF stages

Remember this is for a healthy individual.	**Remember this is for a CF sufferer.**
1. Na+ is actively pumped across the basal membrane	1. Cl- is pumped into the cell across the basal membrane.
2. Na+ diffuses through sodium channels in the apical membrane	2. Cl- diffuses through the open CFTR channels.
3. Cl- diffuses down electrical gradient	3. Na+ diffuses down the electrical gradient into the mucus

CF stages (cont)

4. Water is drawn out of cells by osmosis due to the high concentration in the fluid tissue	4. Elevated salt concentration in the mucus draws water out of the cell by osmosis.
5. Water is drawn out of the mucus by osmosis	5. Water is drawn into the cell by osmosis

Why is genetic screening used?

• to confirm diagnosis

• for testing embryos

• to identify carriers

Core practical 3

• independent variable: the different temperatures of water surrounding the beetroot

• dependent variable: transmission of light through the sample of water surrounding the segment

• control variables: age/species of the beetroot, temperature, volume/temperature/ of solution, time beetroot is left in solution

• measurement of absorbance of solution using a colorimeter

• repeats at each temperature to calculate the permeability of the beetroot membrane

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