

① The genetic code is a degenerate code, which means that there is redundancy so that most amino acids are encoded with more than one triplet combination (codon). Although it is a redundant code, it is not ambiguous under normal circumstances, a given codon encodes only one given amino acid.

② Protein synthesis is often at the level of initiation ~~and~~ of translation, making it a critical step. This regulation occurs by both cis-regulatory elements, which are located in the 5' and 3' UTRs (Untranslated Regions) and trans-regulatory acting factors. A breakdown in this regulation machinery can perturb cellular metabolism, leading to various physiological abnormalities. The highly structured UTRs, along with features such as GC-richness, upstream open reading frames and internal ribosome entry sites, significantly influence the rate of translation of mRNAs.

③
$$\text{Total cells/ml} = \frac{\text{Total cells counted} \times \text{dilution factor}}{\text{Number of squares counted}} \times 10000 \text{ cells/ml}$$

$$\text{Total cells/ml} = \frac{500 \times 8 \times 10000}{8} = 5 \times 10^6 \text{ cells/ml}$$

④ Each amino acid corresponds to codons sequences of 3 base pairs. If we have 1500 base pairs we will have 500 codons. However we will get only 499 ~~codons~~ amino acids because the last one is stop codon which terminates the protein synthesis. molecular weight of protein molecule is $499 \times 110 \text{ Da}$

⑤ In active transport the molecules are moved across the cell membrane, pumping the molecule against the concentration gradient using ATP. In passive transport, the molecules are moved within and across the cell membrane and thus transporting it through ~~at~~ the concentration gradient without using ATP.

⑥ A serial dilution is a series of sequential dilutions used to reduce a dense culture of cells to a more usable concentration. Each dilution will reduce the concentration of bacteria by a specific amount. So, by calculating the total dilution over the entire series, it is possible to know how many bacteria you started with.

⑦ The key difference between batch culture and continuous culture is that batch culture is a technique used to grow microorganisms under limited nutrient availability in a closed system while continuous culture is a technique used to grow microbes under optimum and continual supply of nutrients in an open system for eg. in industries.

⑧ Because the lagging strand needs to be replicated in the opposite direction of the way the replication fork is proceeding. And DNA polymerase can proceed only 5' to 3' and 5' to 3'. Thus, short fragments are produced as the replication fork expands. Otherwise DNA polymerase would need to wait until the fork reached the end of the molecule to replicate the lagging strand.

⑨ Because one side of each sugar molecule is always connected to the opposite side of next sugar molecule, each strand of DNA has polarity; these are called the 5-prime end and the 3-prime end, in accordance with the nomenclature of the carbon in the sugars.

⑩ When microbiological media has been made, it still has to be sterilised because of microbial contamination from air, glassware, hands etc. within a few hours there will be thousands of bacteria reproducing in the media so it has to be sterilised quickly before microbes start utilizing the nutrients.

⑩ Messenger RNA (mRNA) molecules carry coding sequences for protein synthesis and are called transcripts. ~~transfer RNA~~ transfer RNA (tRNA) molecules carry amino acids to the ribosome during the protein synthesis.

⑪ The phosphate residue is attached to the hydroxyl group of 5' carbon of one sugar and the hydroxyl group of the 3' carbon of the sugar of the next nucleotide which forms a 5' - 3' phosphodiester linkage.

⑫ Phagocytes surround any pathogens in the blood and engulf them. They are attracted to pathogens and bind to them. The phagocytes membrane surrounds the pathogen and enzymes found inside the cell break down the pathogen in order to destroy it. As phagocytes do this to all pathogens that they encounter, they are called non-specific.

⑬ sense strand DNA - 5' ATG CATA CTT A 3'
antisense strand - 3' TAC GTAT GTA AT 5'

transcription - ~~ATG AUC U~~
(mRNA) ~~ATG CATA CTT A~~
UAC GUA UG A AU
