

~~① Antisense strand : 3' - TAC GAA CCA ATT - 5'~~

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mRNA encoding : 3' - AUG CAA UGC - 5'

② 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'. 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.

③ length of coding region = 1800 base pairs.  
each amino acid corresponds to 3 base pairs  
no. of codons =  $\frac{1800}{3} = 600$  codons.

We will get 599 amino acids because the last one is stop codon. molecular weight =  $599 \times 110$  Da

④ The P-site (for peptidyl) is the second binding site for tRNA in the ribosome. The other two sites are the A-site (Aminoacyl), which is the first binding site in the ribosome, and the E-site (exit), the third. During protein translation, the P-site holds the tRNA which is linked to the growing polypeptide chain.

⑤ 5' to 3' polarity refers to the carbon numbers of the sugars ribose and deoxyribose ring. It refers to the orientation of a single strand of DNA or RNA. The phosphate group attached to the 5' end of one nucleotide and the hydroxyl group at the 3' end of another nucleotide have the potential to form phosphodiester bonds, and hence link adjacent nucleotides. This linkage provides the sugar-phosphate backbone that gives DNA its structural rigidity. Any single strand of DNA/RNA will always have an unbound 5' phosphate at one end and an unbound 3' hydroxyl group at the opp. end.

⑥ When a protein is denatured, secondary and tertiary structures are altered but the peptide bonds of the primary structure between the amino acids are left intact. Since all structural levels of the protein determine its function, the protein can no longer perform its function once it has been denatured.

⑦ Number of antigen binding sites  
 $\text{IgG} = 2, \text{IgM} = 10, \text{IgA} = 2$

### ⑧ Defined Media

Composed of pure biochemicals off the shelf. Exact chemical composition is known.

### Complex media

Contains complex materials of biological origin such as blood or milk or yeast extracts for which accurate chemical composition is not determined.

⑨ 
$$\text{Total cells/mL} = \frac{\text{Total cells counted}}{\text{no. of squares}} \times \text{dil factor} \times 1000$$
 cells/mL

dilution factor = 8  
cell count = 800  
no. of square = 5

$$\text{Total cells} = 800 \times \frac{8}{5} \times 1000$$



$$\frac{800 \times 8 \times \overset{200}{1000}}{5} = 800 \times 8 \times 200$$

$$= 1280000 \text{ cells/mL}$$

⑩ After RNA is transcribed, it is often modified to create a mature RNA that is ready to be ~~translated~~ translated. Processing mRNA involves the removal of introns that do not code for protein. Spliceosomes remove the introns and ligate the exons together, often in different sequences than their original order of newly transcribed mRNA. A GTP cap is added to 5'-end and a poly-A tail at 3'-end. This mature mRNA then leaves the nucleus and enters the cytoplasm. Once in the cytoplasm, the length of time the mRNA resides there can be altered to control the amount of protein that is synthesized.

⑪ Inoculation is the process of introducing microorganisms or suspension of microorganisms into a culture medium.

Incubation is the process of allowing inoculated microorganisms to grow under required growing conditions.

(12) The principle of Pour Plate method: In this method, serial dilutions of the inoculum (serially diluting the primary specimen) are added within sterile petri plates to which is poured melted and cooled agar medium and completely mixed by revolving the plates which are then left to solidify.

(13) In order to be capable of engaging the key elements of adaptive immunity (specificity, memory, diversity) antigens have to be processed and presented to immune cells. Antigen presentation is mediated by MHC class I molecules, and the class II molecules found on the surface of antigen-presenting cells and certain other cells.

MHC class I and II molecules are similar in function: they deliver short peptides to the cell surface, allowing these peptides to be recognised by CD8<sup>+</sup> and CD4<sup>+</sup> T cells. The diff. is that the peptides originate from different sources: endogenous and exogenous. There is also so called cross-presentation in which exogenous antigens can be presented by MHC class I molecules. Endogenous antigens can also be presented by MHC class II when they are degraded through autophagy.

(14) Methionine and tryptophan are the only two amino acids that are coded for by just a single codon (AUG and UGG respectively).



⑮ Fats and oils are called triglycerides because they are esters composed of three fatty acids units joined to glycerol, a trihydroxy alcohol.

A triglyceride is called a fat if it is a solid at  $25^{\circ}\text{C}$ ; it is called an oil if it is liquid at that temperature. These differences in melting points reflect differences in the degree of unsaturation and number of carbon atoms in the constituent fatty acids.

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⑯ Neutralizing antibodies can inhibit the infectivity by binding to the pathogen and block the molecules needed for cell entry. This can be due to the antibodies statically interfering with the pathogens or toxins attaching to host cell receptors.

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⑰ 
$$\text{No. of cells/ml} = \frac{\text{No. of colonies} \times 1000}{\text{dilution} \times \text{Volume of culture (in ml)}}$$

$$= \frac{80 \times 1000}{10^{-6} \times 200}$$

$$= 400 \times 10^6 \text{ cells/ml}$$

$$= 400 \times 10^6 \times 10^{-3} \text{ cells/l} = 4 \times 10^5 \text{ cells/litre}$$

(18) The fundamental underlying mechanism of autoimmunity is defective elimination or control of self-reactive lymphocytes. The genetic and environmental factors also contribute to autoimmunity.

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(19)

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