CHECKLIST OF KEY CONCEPTS

Localisation of proteins

1. Typically proteins are localised in specific compartments of the cell. This means that mechanisms are required to target individual proteins to their destination.
2. Proteins destined for the cytoplasm, mitochondria, peroxisomes and nucleus are made on free ribosomes. Those for lysosomes, membranes, endoplasmic reticulum (ER) and secretion are made on ribosomes attached to the ER.

Role of the endoplasmic reticulum

3. The ER is a closed structure and ribosomes bind to it via a specific signal sequence at the N-terminal end of proteins that are targeted to the ER. Once synthesised these proteins move via the smooth ER (no ribosomes are attached) to the Golgi apparatus.
4. Binding of ribosomes to the ER, with attached nascent protein, occurs at specific receptor sites. It requires GTP that is hydrolysed during the process.
5. Protein folding occurs within the ER, followed by covalent modification such as N-glycosylation and O-glycosylation.

Role of the Golgi apparatus

6. The Golgi apparatus modifies proteins and despatches them to their target destination. Movement of proteins from the ER to the Golgi occurs via transport vesicles.
7. Lysosomes are formed from proteins moving from the Golgi and structures called endosomes. Lysosomes recycle proteins that are taken up from outside the cell by clathrin-coated vesicles as well as degrading enzymes that have been marked for destruction.

Localisation signals of proteins

8. Some secretory proteins, such as serum proteins, are released as they are made but others are stored in secretory granules until they are required.
9. Secretory granules (or secretory vesicles) recognise specific receptors on the membrane called v-SNARES via t-SNARES. This association is GTP dependent.
10. Integral membrane proteins contain an anchor signal that results in them being held in the membrane. Many proteins traverse the membrane multiple times.
11. Most mitochondrial proteins are nuclear coded. These are made as preproteins, containing a signal sequence that is removed subsequently. Mitochondrial matrix proteins are transported across the inner mitochondrial membrane in an ATP-dependent process.
12. Movement of large molecules into and out of the nucleus is by means of nuclear pores. These are large structures consisting of more than 30 proteins.
13. Proteins contain sequences that cause them to localise in the nucleus and, in addition, there are nuclear export signals. This process is aided by importins and exportins in a GTP dependent process. The movement of proteins to and

from the nucleus is regulated in a number of ways, including binding to other proteins, and phosphorylation.