Describe the structure and function of the blood brain barrier

Structure
- Mechanical barrier
  - Endothelial cells
    - Tight junctions between cells formed by membrane proteins (e.g. occludin) prevents paracellular flow
    - Lack fenestrations
    - Lack transcellular pathways such as vesicles
    - Selective transport proteins (e.g. GLUT, various amino acid transporters)
  - Pericytes embedded in basement membrane
  - Astrocyte end feet
    - Supportive role for endothelium
    - Aquaporin regulation
- Physiological barrier
  - Enzymatic inactivation
    - Enzymes within endothelial cells metabolise substances absorbed from capillary lumen
      - Monoamine oxidase
      - Cholinesterase
      - Aminopeptidase and endopeptidase
  - Efflux pumps
    - Substances that are absorbed across the luminal capillary membrane may be pumped back into capillary lumen by efflux pumps
      - P-Glycoprotein
      - ABC-Transporter
- Areas of brain outside BBB
  - Subfornical organ
  - Organum Vasculosum Lamina Terminalis
  - Pituitary
  - Area postrema
Function
- Regulate uptake of nutrients and electrolytes into brain
- Regulate migration of leukocytes and inflammatory responses in the brain
- Buffer brain parenchyma and interstitium from fluctuations in blood
- Prevent toxins and pathogens entering brain
- Some substances (such as water) pass BBB readily
  - These are characterised by
    - Small molecular weight
    - Lipophilic (thiopentone)
    - Uncharged (e.g. atropine vs. glycopyrrolate)
    - Poorly protein bound

Examiners Comments

There was general lack of understanding of the conceptual framework of the blood brain barrier (BBB) and its function. To attain a pass, candidates were required to describe the concept of BBB as a physical and a transport barrier, describe the role of tight junctions and glial cells and identify important barrier functions with some examples of things commonly transported across or excluded.