Q15 Explain the role of the skin (Sept 2013)

Skin

- Largest organ in the human body (12-15% of body weight)
- Receives 300-500m blood flow/min in the 70kg male, or 8-10% of cardiac output
- Skin blood flow can increase by 30 fold or decrease by 10 fold in thermoregulation
- Skin is the largest interface with the external environment
- Comprised of three layer – dermis, epidermis, and subcutaneous tissues

Functions

- Temperature regulation
    - Normal core body temperature maintained between 36-38 degrees
    - Heat can be lost via radiation, conduction, convection and evaporation; it can be gained via increases in metabolism, shivering, exercise, nonshivering thermogenesis, and behavior modification
    - Skin plays important role as it contains afferent receptors (bulbs of Krause and Ruffini), which transmit impulses via Aδ and C fibres respectively to the spinothalamic tract and then the medulla and hypothalamus
    - Anterior hypothalamus regulates temperatures increases and the posterior hypothalamus regulates temperatures decreases
    - Temperature can then be regulated via heat loss or gain:
        - Skin role in heat gain –
            - Subcutaneous vasoconstriction, which reduces heat loss via convection and radiation
        - Skin role in heat loss –
            - Subcutaneous vasodilatation (opens up AV shunts in hands, feet, lips and ears, enhanced by bradykinin, increasing skin blood flow dramatically and thus the area for heat transfer between skin and environment)
            - Sweating – 2.4kJ/ml of water evaporated (latent heat of vapourisation of water)

- Immunoprotective function
    - Physical barrier to antigen entry and against mechanical, thermal and physical injury
    - Protection against UV damage by melanocytes
    - Dendritic cells role in antigen presentation; rich capillary network in dermis for transport to lymph nodes

- Sensory function
    - Rich innervation provides afferent to CNS of noxious stimuli

- Water regulation
    - Average water loss by diffusion through skin 300-400ml/day, modulated by cholesterol-filled stratum corneum, water losses increased dramatically with loss of this layer (such as in burns)
    - Fluid lost through sweat varies with activity level; at rest about 100ml/day, can increase to 12L/day

- Other
    - Synthesis of cholecalciferol
    - Aesthetic function