Outline normal impulse generation and conduction in the heart. Describe the features present in a normal heart that prevent generation and conduction of arrhythmias.

Impulse generation
- Occurs in specialised cardiac pacemaker cells due to a slow depolarisation in phase 4 caused by the opening of T-type Ca channels.
- Influenced by:
  - PNS - muscarinic receptors - ACh - slowing
  - SNS - adrenergic beta 1 receptors - faster
- SA node has the fastest rate and usually sets the HR
- AV node and Bundle of His have pacemaker cells also but are slower

Conduction in normal heart
- Begins SA node, 5 cm/sec
- Through atria (thorel, bachmann and wenkebach) 100 cm/sec
- Slows at AV node 4 cm/sec (AV node pause)
- Bundle of His 100cm/sec
- Purkinje fibres 400cm/sec

Features which prevent conduction abnormalities
- Conducting pathways are characterised by multiple intercalated discs and gap junctions which improve conduction in the event that an upstream pacemaker is blocked, the downstream pacemaker can take over.
- Excessive firing of pacemaker cells:
  - The AV node (due to the AV delay) stops the conduction of impulses with rates >220 eg. atrial flutter and 2:1 or 3:1 block.
- Re-entry (re-excitation of myocytes prior to the next pacemaker potential)
  - Structurally:
    - AV gate being the only point between the atria and ventricles only allows forward conduction (nil retrograde)
    - Abnormalities cause WPW
  - Physiologically:
    - The Purkinje fibres and normal myocytes are not pacemakers cells.
    - They have a phase 1 and 2 which lengths the refractory periods.
    - If there is a re-enterant pathway they will not conduct in the absolute refractory period

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