ECGs and Tachyarrhythmias

The measurement an electrode records depends on its position relative to spread of activity and the amplitude on how much muscle is depolarising & how directly towards the electrode the excitation is moving. Upward signals may come from depolarisation moving towards the electrode or repolarisation moving away, whereas downwards signals can arise from depolarisation moving away for repolarisation moving towards.

**P Wave** – Atrial depolarisation
**Q Wave** – Septal depolarisation spreading to ventricle
**R Wave** – Main ventricular depolarisation
**S Wave** – End ventricular depolarisation
**T Wave** – Ventricular repolarisation
**U Wave** – Repolarisation of papillary muscle or Purkinje fibres (sometimes a normal finding)

**Limb Leads:**
- **Right Wrist** – Red
- **Left Wrist** – Yellow
- **Left Leg** – Green
- **Right Leg** – Blue

**Chest Leads:**
- **V₁-V₆** – Red, yellow, green, brown, black, purple

**Interpreting an ECG**

1. **Technical Details** – Patient identity, equipment calibration (10mm/mV, 25mm/sec)
2. **Rate** – 300/number of big squares in R-R interval; if irregular multiply QRS complexes in rhythm strip by 6. >100 = tachycardia; <60 = bradycardia
3. **Rhythm** – Regular (sinus if P waves present), irregular (AF if no P waves present)
4. **Axis** – Normal axis is between -30° & +90°; can be calculated by using isoelectric lead (lead where Q & R are of equal amplitude) to which the axis is perpendicular (90°). Angle <-30° is left axis deviation (LV hypertrophy, left anterior hemiblock), an angle >+90 is right axis deviation (RV hypertrophy)
5. **P Waves** – Present (if absent may indicate AF or SA node damage), sawtooth (atrial flutter); normal height & width is 2.5 small squares
   a. **P-mitrale** – Bifid P wave indicating LA enlargement; may be caused by mitral valve disease & HTN
   b. **P-pulmonale** – Tall P wave indicating RA enlargement; may be caused by COPD, pulmonary HTN or congenital heart disease
6. **Intervals** – PR interval (120-200ms), QRS complex (80-120ms), QT interval (<480ms; long QT syndrome suggests prolonged ventricular repolarisation, can lead to arrhythmias)
   a. **1st Degree Heart Block** – Prolongation of PR interval
   b. **2nd Degree Heart Block** – Can be Mobitz type 1 (Wenckeback phenomenon) in which there is progressive lengthening of the PR interval until a QRS complex is dropped or Mobitz type 2 (more serious due to risk of complete ventricular failure) where there is intermittent failure of the AV node to conduct atrial depolarisations to the ventricles that can be fixed (2:1, 3:1 e.t.c.)
   c. **3rd Degree Heart Block** – No relationship between P waves & QRS complex where the rate is usually 30-50bpm. May be caused by coronary artery disease, AVN/bundle of His fibrosis or drugs (digoxin, diltiazem)