# Cyanosis

Dr Jon Bramall
Consultant in Anaesthesia and Intensive Care Medicine

**CAP10 Cyanosis**

| The trainee will be able to assess a patient presenting with cyanosis to produce avalid differential diagnosis, investigate appropriately, formulate and implement a management plan | | |
|---|---|---|
| **Knowledge** | **Assessment Methods** | **GMP Domains** |
| Know the causes of cyanosis, cardiac & respiratory | E, C, Mi, ACAT | 1 |
| Know how to formulate a differential diagnosis and be able to differentiate from methaemoglobinaemia | E, C, Mi, ACAT | 1 |
| **Skills** | | |
| Perform a full clinical examination differentiating between the various causes of cyanosis | E, C, D | 1 |
| Be able to perform and interpret the appropriate tests, e.g. x-rays and ECG | E, C, D | 1 |
| Understand the safe prescribing of oxygen therapy | E, C | 1 |
| **Behaviour** | | |
| Involve senior promptly in event of significant airway compromise | ACAT, C | 2 |
| Involve specialist team as appropriate | ACAT, C | 2 |

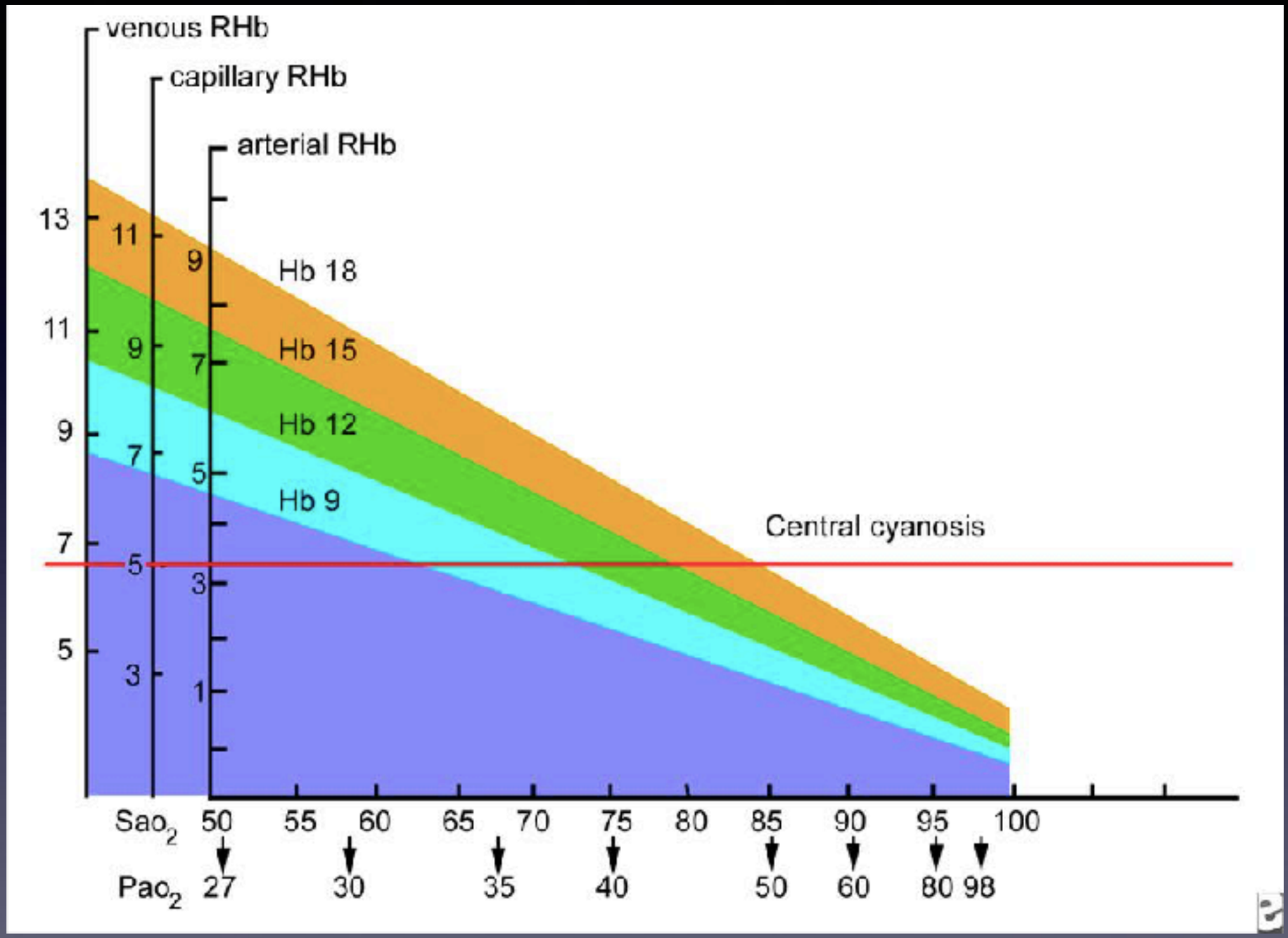
# What colour do Smurfs go when you choke them?

“Cyanosis is defined as the bluish or purplish discolouration of the skin or mucous membranes due to the tissues near the skin surface having low oxygen saturation”

**–Wikipedia**

# Cyanosis

**Bluish hue that occurs in the presence of ~60 g/L deoxyhaemoglobin or dyshaemoglobinaemias**

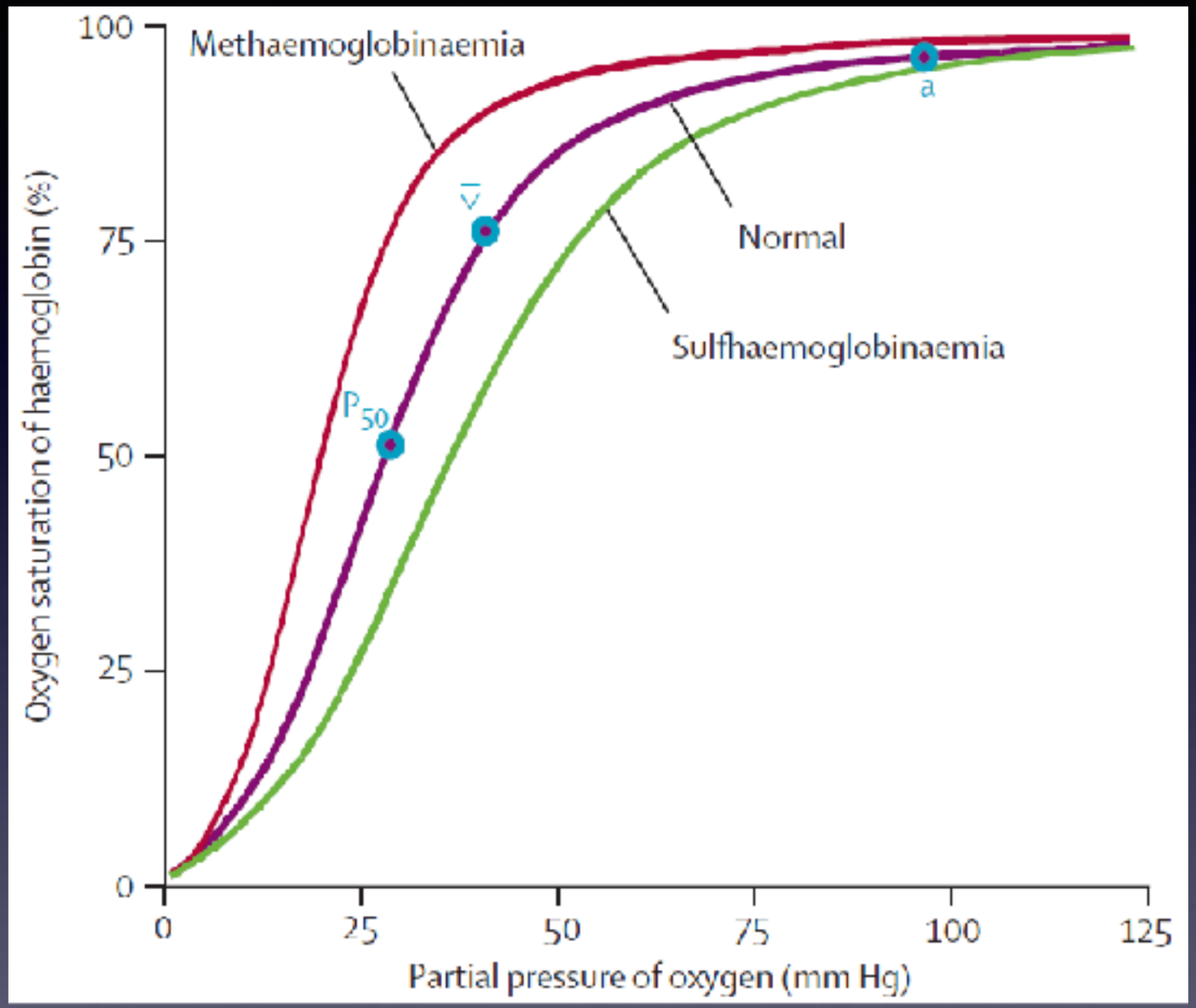

venous RHb
capillary RHb
arterial RHb
13
11
9
7
5
11
9
7
5
3
9
7
5
3
1
Hb 18
Hb 15
Hb 12
Hb 9
Central cyanosis
Sao2 50 55 60 65 70 75 80 85 90 95 100
Pao2 27 30 35 40 50 60 80 98

# Cyanosis
# Causes

- Diseases causing hypoxaemia
- Shunt
- Peripheral
- Abnormal Haemoglobin

# Peripheral Cyanosis

- Normal PaO2 and Normal SpO2?
- Causes:
  - Central causes
  - Reduced Cardiac output
  - Cold
  - Redistribution
  - Arterial or venous obstruction


Methaemoglobinaemia
Normal
Sulfhaemoglobinaemia
a
V
P50
100
75
50
25
0
0
25
50
75
100
125
Oxygen saturation of haemoglobin (%)
Partial pressure of oxygen (mm Hg)

# Oxygen Content

$$CaO_2 = \underbrace{1.34 \times Hb \times SaO_2}_{\text{Oxygen carried by blood}} + \underbrace{0.01 \times PaO_2}_{\text{Oxygen in solution}}$$

# Methaemoglobinaemia

- Fe2+ oxidised to Fe3+
- Unable to bind to O2
- Normal level >1.5%

# Methaemoglobinaemia Causes

Congenital

- cytochrome b5 reductase deficiency
- haemoglobin M disease

Acquired (toxin/drugs)

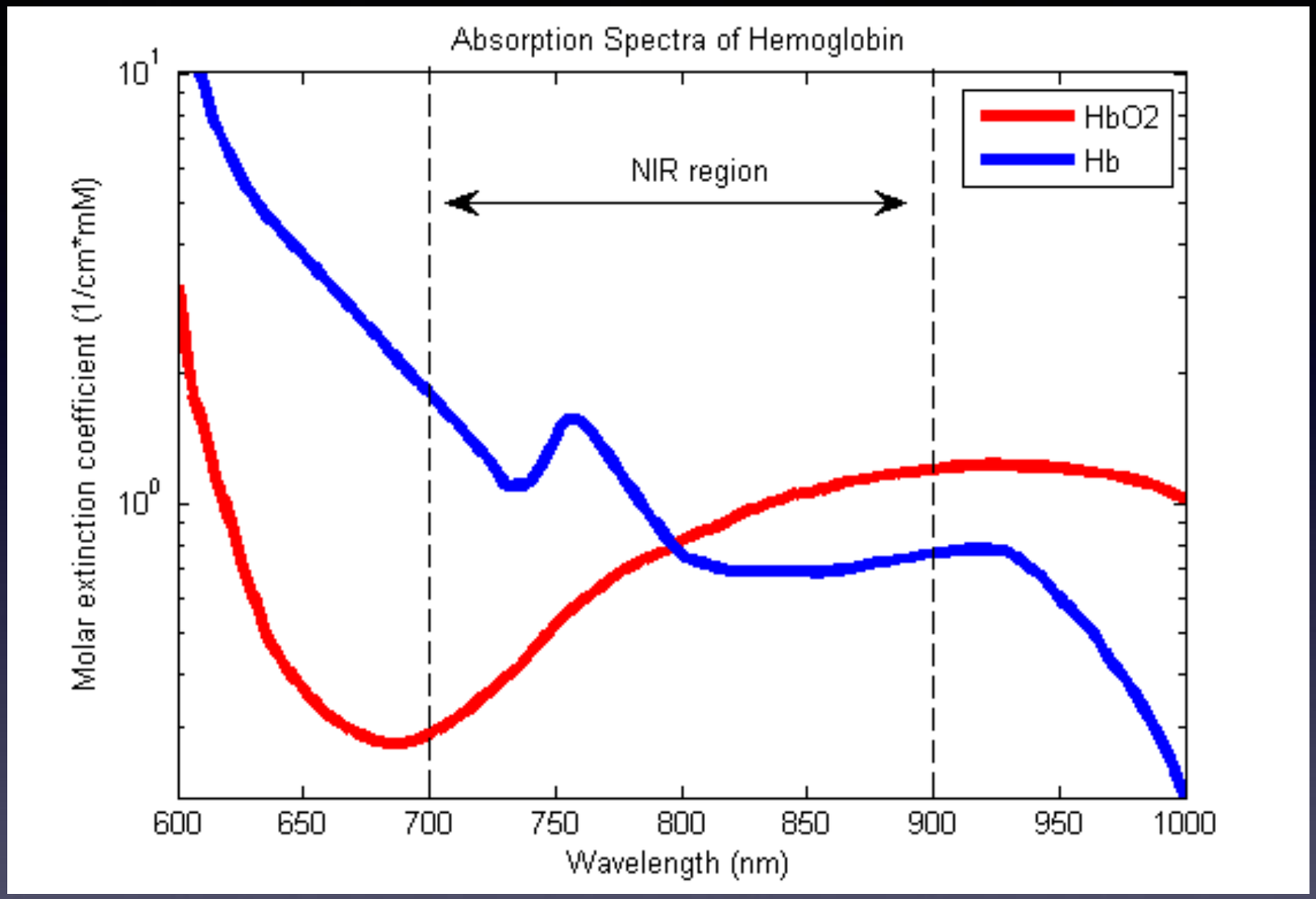
- aniline dyes
- benzene derivatives
- chloroquine
- dapsone
- prilocaine
- metoclopramide
- nitrites (nitroglycerin, NO, sodium nitroprusside)
- sulphonamides

# Methaemoglobinaemia Clinical Features

- cyanosis!
- symptoms and signs of decreased oxygen delivery
    - e.g. chest pain, dyspnea, altered metal state, end organ damage
- SpO2 reading 85-90%
- blood samples typically have a chocolate brown hue
- Normal PaO2

# Methaemoglobinaemia Management

- High flow O2
- Stop precipitants (or avoid if congenital)
- methylene blue (1-2mg/kg over 5 minutes)
    - provides an artificial electron acceptor to facilitate the reduction of MetHb via the NADPH-dependent pathway
- Alternatives:
    - ascorbic acid (if methylene blue contra-indicated, e.g. G6PD deficiency)
    - exchange transfusion
    - hyperbaric oxygen




# How does a sats probe work?

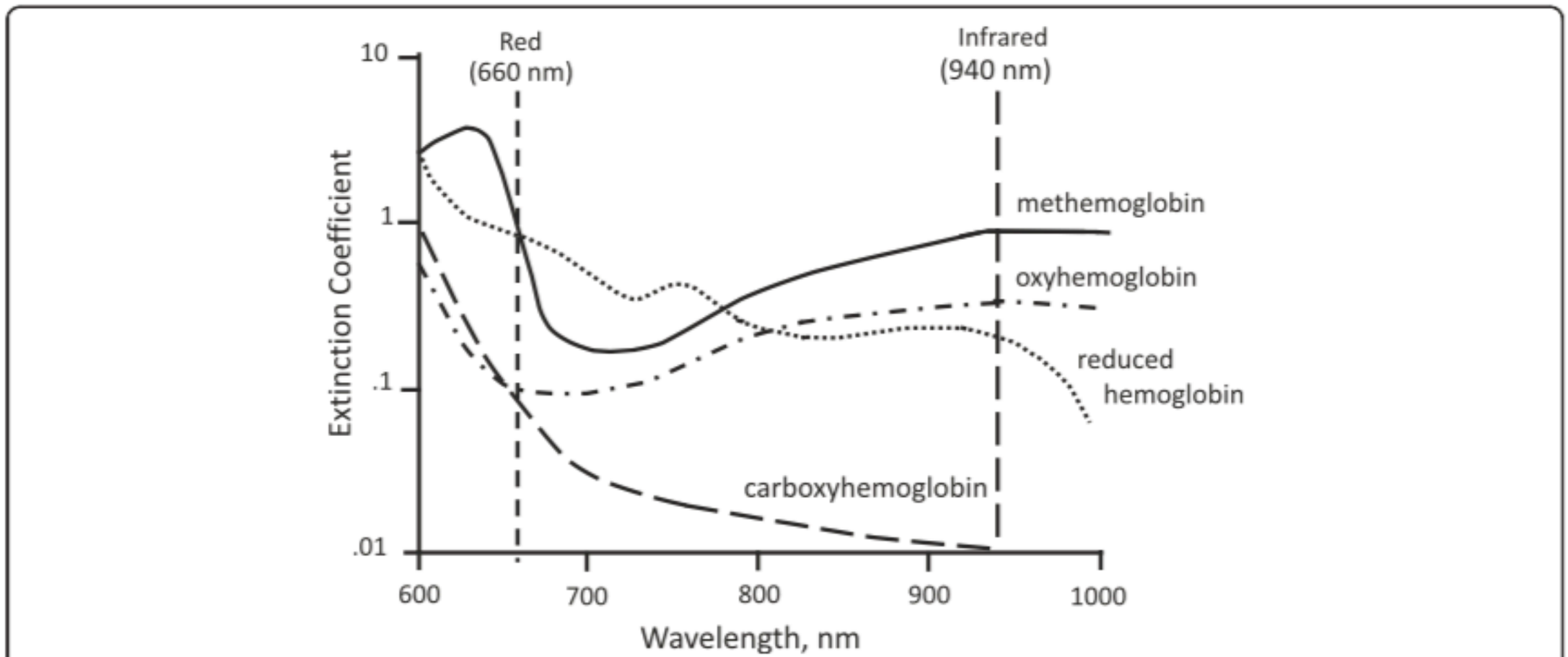



**Fig. 1** Transmitted light absorbance spectra of four hemoglobin species: oxyhemoglobin, reduced hemoglobin, carboxyhemoglobin, and methemoglobin

# How does a sats probe work?

# Pseudocyanosis

# Summary

- Cyanosis occurs when there is 60g/L deoxyhaemoglobin
- Hb 8 cyanosis at SpO2 60%; Hb18 SpO2 87%
- Causes include resp and cardiac causes of hyoxaemia
- TREAT THE CAUSE
- Don’t forget blue dye, abnormal haemoglobins and pseudo cyanosis
- Methaemoglobinaemia causes “cyanosis”
    - Treat with Methylene blue

# What Questions do you have?