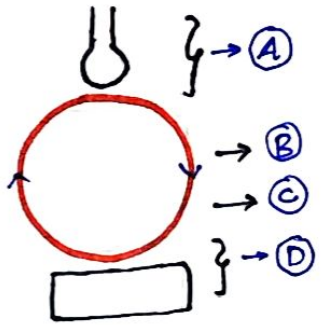
HYPOXIA

Def :- Decreased availability of oxygen to tissues in body

Classification :-

A) Hypoxic Hypoxia
B) Anaemic Hypoxia
C) Stagnant (Ischaemic) Hypoxia
D) Histotoxic Hypoxia.



HYPOXIC HYPOXIA :-

- **Characteristic features :-**
  - i) ↓ arterial pO_2
  - ii) ↓ arterial O_2 content
  - iii) ↓ arterial % O_2-saturation of Hb
  - iv) ↓ A-V pO_2 difference

pO_2	$100_{(a)}$	$40_{(v)}$	$55_{(a)}$	$25_{(v)}$
% sat. of O_2	$97\%_{(a)}$	$75\%_{(v)}$	$85\%_{(a)}$	$45\%_{(v)}$
O_2 content	$19_{(a)}$	$14_{(v)}$	$14_{(a)}$	$9_{(v)}$
A-V pO_2 diff.	$100-40=60$		$55-25=30$	
	NORMAL		HYPOXIC HYPOXIA	

- **Causes:-**

I.) Low pO_2 in inspired air
- High altitude
- Breathing in closed space.

II.) Decreased pulmonary ventilation
- Airway obstruction
- Weakness/paralysis of respiratory muscles
- Depression of respiratory muscles

III.) Defect in gaseous exchange

IV.) Venous - arterial shunts.
- Cyanotic congenital heart disease (Fallot's tetrology)

- **Pathophysiology:-**

Hypoxic hypoxia
↓⊕
Respiratory centre
↓⊕
Pulmonary ventilation↑
↓
washout from body↑
↓
terial pCO_2 ↓ ⟶ OHDC shift to left
↑
↓ Release of O_2 from Hb
↑
Tissue Hypoxia

- **Causes:-**

I.) Low pO_2 in inspired air
- High altitude
- Breathing in closed space.

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IV.) Venous-arterial shunts.
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- **Pathophysiology:-**

Hypoxic hypoxia
↓⊕
Respiratory centre
↓⊕
Pulmonary ventilation↑
↓
CO_2 washout from body↑
↓
Arterial pCO_2 ↓ ⟶ OHDC shift to left
↑
↓ Release of O_2 from Hb
↑
Tissue Hypoxia

ANAEMIC HYPOXIA :-

↳ Arterial pO_2 is NORMAL

⇒ Amount of Hb available to carry O_2 is reduced.

- **Characteristic features :-**

	Art.	Ven.
i) Arterial pO_2 Normal →	100	40
ii) Arterial O_2 content Normal/↓ →	10	5
iii) Arterial % O_2 saturation of Hb ↓ →	60 %	20 %
iv) A-V pO_2 difference - Normal →	60	
v) A-V % O_2 sat. of Hb difference → ↑ →	40 %	

- **Causes :-**

I) Anaemia

II) Hge

III) conversion of Hb to abnormal Hb
- Met-Hb
- Carboxy-Hb

- **Pathophysiology :-**

At Rest -

Anemia ⇒ ↑ 2,3 BPG in RBC's

$HbO_2 + 2,3BPG \longrightarrow Hb2,3BPG + O_2$

↑ Liberation of O_2 ⇒ Hypoxia is not severe

Exercise -

O_2 demand >> Liberation of O_2

⇓

Severe Hypoxia develops.

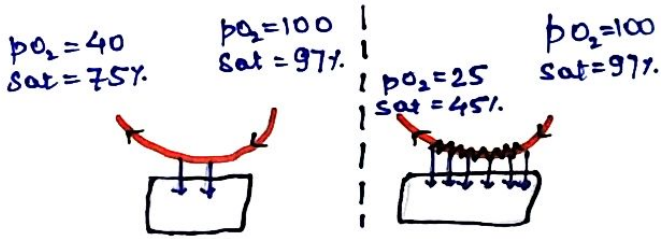
STAGNANT (ISCHAEMIC) HYPOXIA :-

↳ ↓ Blood flow to tissues

↓

Adequate O_2 not delivered @ tissues.

- Characteristic feature :-
  - i.) Arterial pO_2 - Normal
  - ii.) Arterial O_2 content - Normal
  - iii.) % O_2 sat. of Hb - Normal
  - iv.) A-V pO_2 difference - ↑
  - v.) A-V % O_2 sat. of Hb difference - ↑



- Causes :-
  - I.) Circulatory failure
  - II.) Hge
  - III.) Congenital Heart failure.

HISTOTOXIC HYPOXIA :-

↳ Inadequate utilisation of O_2 by tissues supplied to them.

- **Characterstic features :-**

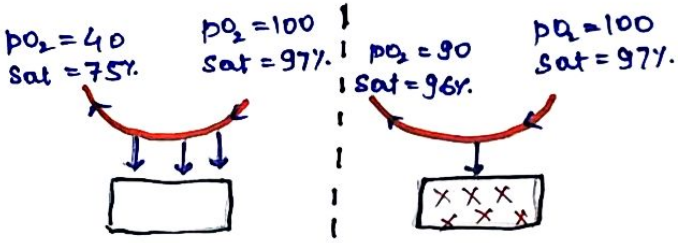
  i.) Arterial pO_2 - Normal

  ii.) Arterial O_2 content - Normal

  iii.) % O_2 sat. of Hb - Normal

  iv.) A-V(pO_2) difference - ↕

  v.) A-V(% O_2 sat. of Hb) difference - ↓



- **Causes :-**

  I.) Cyanide poisoning (damage to cyt. oxidase)

  II.) Beri Beri

* m.c. type of Hypoxia = Hypoxic Hypoxia
* most potent stimulus for peripheral chemoreceptor = Cyanide
* Most sensitive brain area to Hypoxia = • Hippocampus
  • Purkinje cells of cerebellum.
* Most resistant to Hypoxia = Spinal cord.

EFFECTS OF HYPOXIA :-

① On RESPIRATION

- All hypoxia (except anemic hypoxia) stimulates peripheral chemoreceptor.
  ↓
  ↑ Respiration.

② On CNS

- Brain is affected first
- Overdose of Alcohol like symptoms
  - Drowsiness
  - Depression / Excitement
  - headache
  - Disorientation
  - Emotional outburst of laughing, shouting.

③ On CVS

Hypoxia (except anaemic)
↓ ⊕
Peripheral chemo. ⊕→ VMC ⇒ ↑HR, ↑BP
⊕→ Resp. centre ⇒ ↑ rate & depth of respiration.

④ Others

- Nausea, vomiting
- Anorexia.

TREATMENT OF HYPOXIA

Tx of underlying cause

O_2 therapy

- 100% pure O_2 at atm. pressure → - Hypoxic hypoxia
- 100% O_2 at high pressure "HYPERBARIC OXYGEN THERAPY" → -Anaemic hypoxia, -Stagnant hypoxia, -Histotoxic hypoxia.

OXYGEN TOXICITY

100% O_2 ⇒ w/o monitoring ⇓ ↓ in Respiration

- 8 hrs → Irritation in respiratory passage
- >24 hrs → Bronchopneumonia

- O_2 ↑↑ → superoxide ions → H_2O_2 → ⊖ Macrophages ↓ Bact. dont get killed
- O_2 ↑↑ → ↓↓ surfactant

Newborns are more sensitive (even >40% O_2) ⇓

"RETROLENTAL FIBROPLASIA"

- Proliferation of retinal vessels & formation of fibrous tissue ↓ PERMANENT BLINDNESS.

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PERMANENT BLINDNESS.