M.SC Semester III
Core Course XI
Bio-Inorganic Chemistry

TOPIC:-Unit III, Other forms of Haemoglobin

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Other forms of Haemoglobin

- **Hb-A1:**
- **Normal adult Hb, commonly called Hb-A, consists of 2α - & 2β chains (α2β2)**
- **It is approximately 90% of total haemoglobin**
- **Hb-F:**
- **It is a human foetal haemoglobin**
- **Consisting of α2γ2**

Differentiation of Hb-A from Hb-F

Hb-A	Hb-F
Two α & two β chains	Two α & two γ chains
Denatured by alkali	Resistant to alkali denaturation
At pH 8.9 Hb-A moves ahead of Hb-F	Hb-F moves behind Hb-A
2,3-BPG content is high	2,3-BPG content is low
Affinity of O2 is less	Affinity to O2 is more
Delivery power of O2 more (unloading)	Delivery power of O2 is decreased
Concentration at birth-Hb-A=85%	15%
	Hb-F disappears by end of first year, persistence of Hb-F after one year is pathological

Hb-A2:

- It is a minor component of normal adult Hb.
- It contains two α & two δ-chains $\alpha_2\delta_2$
- It is approximately-2.5%
- Electrophoretically, it is a slowly migrating fraction

Hb-A3:

- It amounts for 3to 10%of total haemoglobin
- It is a fast moving fraction

Normal major types of haemoglobin

Type	Composition	%of total haemoglobin
HbA1	$\alpha_2\beta_2$	90%
HbA2	$\alpha_2\delta_2$	<5%
HbF	$\alpha_2\gamma_2$	<2%
HbA1c	$\alpha_2\beta_2$-glucose	<5%

Hb-A1c (Glycosylated Hb):

- It is formed by covalent binding of glucose to haemoglobin
- Its normal range is 3to 6%
- Its levels are increased in diabetes mellitus
- **Chemistry:**
- The amino acid sequence of HbA1c is exactly same as that of HbA1
- The attachment of 1-amino 1-deoxy fructose to the –NH2 terminal of valine of β-chain of HbA1

- Addition of sugar moiety to valine occurs non-enzymatically, either by addition of glucose directly to the protein.
- Diagnostic importance of HbA1c:
- The rate of synthesis of HbA1c is directly related to the exposure of RBC to glucose
- The concentration of HbA1c serves as an indication of blood glucose concentration over a period

- HbA1c reflects the mean blood glucose level over 3months period prior to its measurement
- In diabetes, HbA1c is elevated to as high as 15%
- Determination of HbA1c is used for monitoring of diabetes
- If the HbA1c concentration is <7%, the diabetic patient is considered to be in good control