

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



TOPIC:-Unit III, Other forms of Haemoglobin

Department of Chemistry
L.S COLLEGE MUZAFFARPUR
B. R. A. BIHAR UNIVERSITY
Dr. Priyanka

Other forms of Haemoglobin

➤ Hb-A1:

➤ Normal adult Hb, commonly called Hb-A, consists of 2α - & 2β chains ($\alpha_2\beta_2$)

➤ It is approximately 90% of total haemoglobin

➤ Hb-F:

➤ It is a human foetal haemoglobin

➤ Consisting of $\alpha_2\gamma_2$

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 O ₂ is less	Affinity to O ₂ is more
Delivery power of O ₂ more (unloading)	Delivery power of O ₂ 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	$\alpha_2\delta_2$	$\leq 5\%$
HbF	$\alpha_2\gamma_2$	$\leq 2\%$
HbA1c	$\alpha_2\beta_2$ -glucose	$\leq 5\%$

Hb-A1c (Glycosylated Hb):

- It is formed by covalent binding of glucose to haemoglobin
- Its normal range is 3 to 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 $-NH_2$ 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 3 months 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**