Hematology

Medical Committee
The University of Jorda

- Histology
- Biochemistry
- Pathology
- Pharmacology
- Physiology
- Microbiology

Dr. name : Dr. Nayef

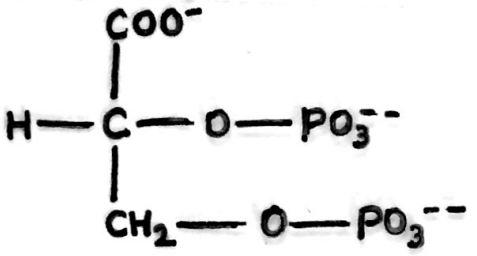
lecture number :

Done BY :

- Handout
- Sheet
- Slide 3

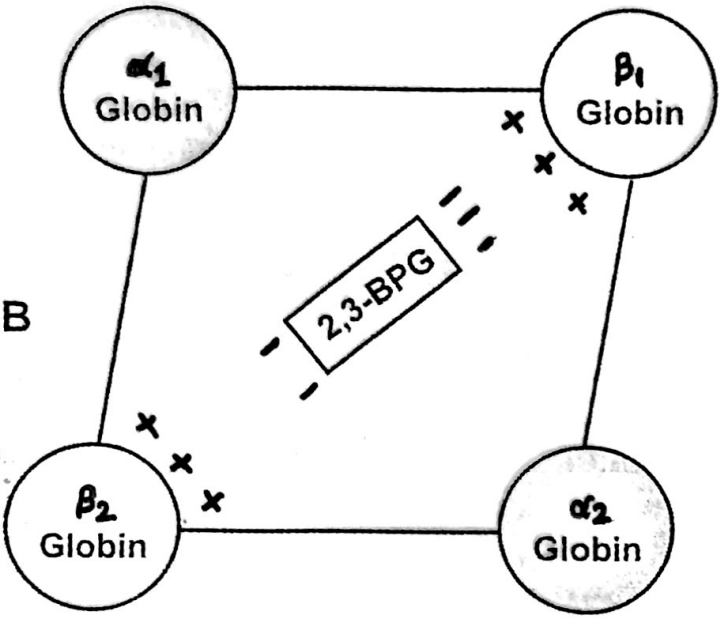
By: Amer ABU Shanab

A

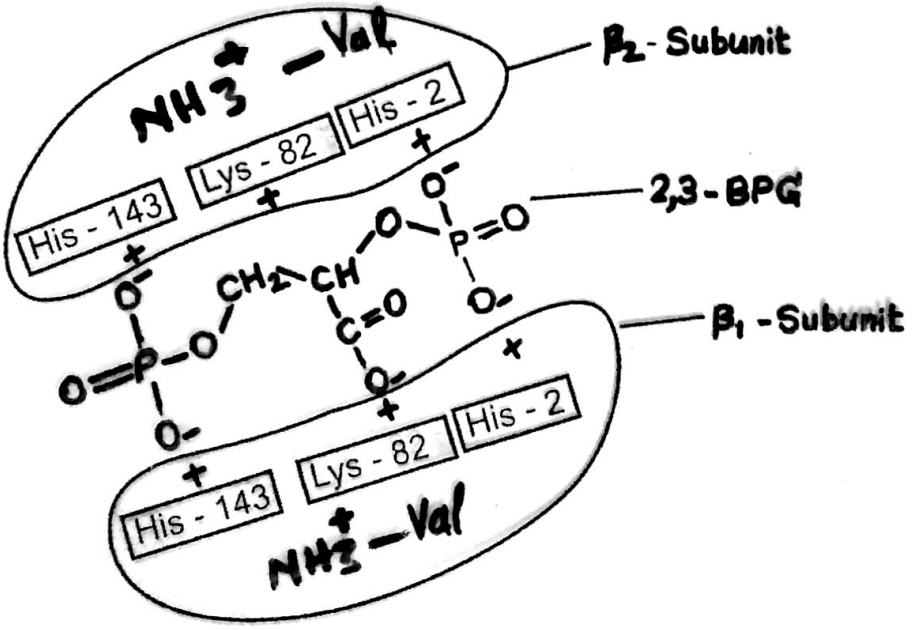


2, 3-Bisphosphoglycerate
(2,3-BPG)

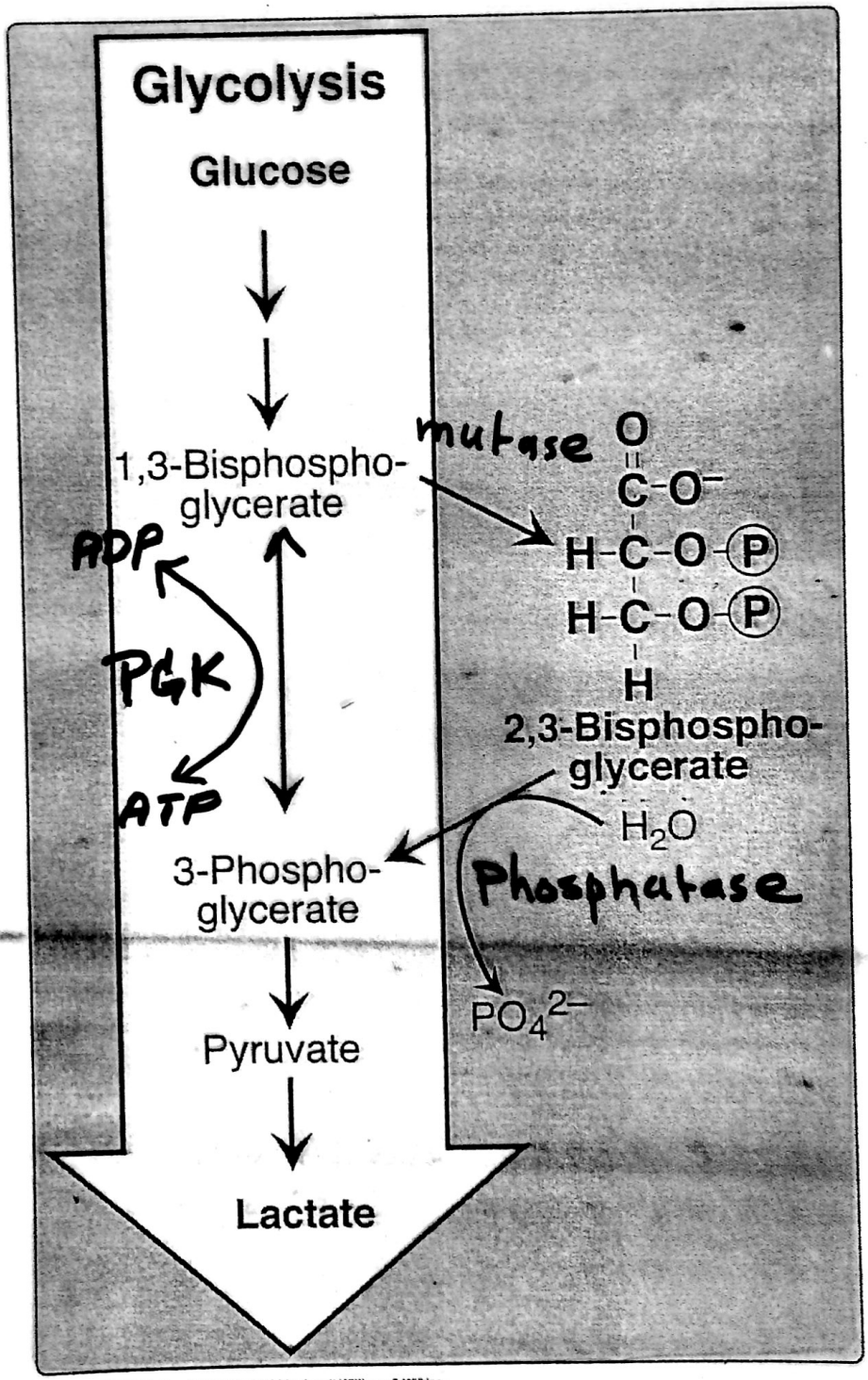
B



Figures 8.9A and B: (A) Structure of 2,3-BPG, (B) Schematic representation of binding of 2,3-BPG to the haemoglobin



Synthesis of 2,3-BPG



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BPG decreases O_2 affinity by cross-linking deoxyHb

2,3-bisphosphoglycerate (BPG) interacts with 3 positively charged groups on each β-subunit

$HbA = \alpha_2^A \beta_2^A$

$HbF = \alpha_2 \gamma_2$

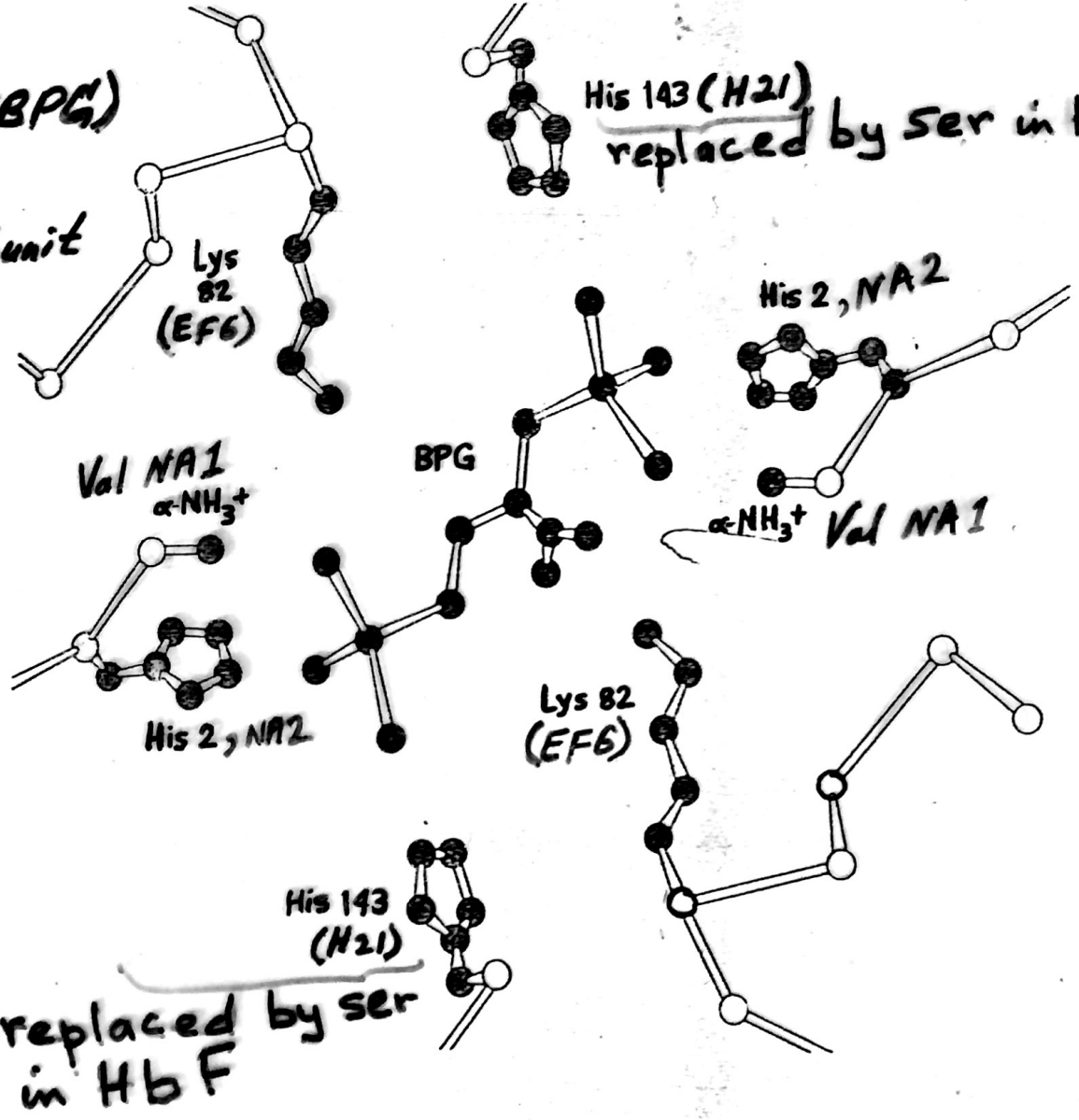
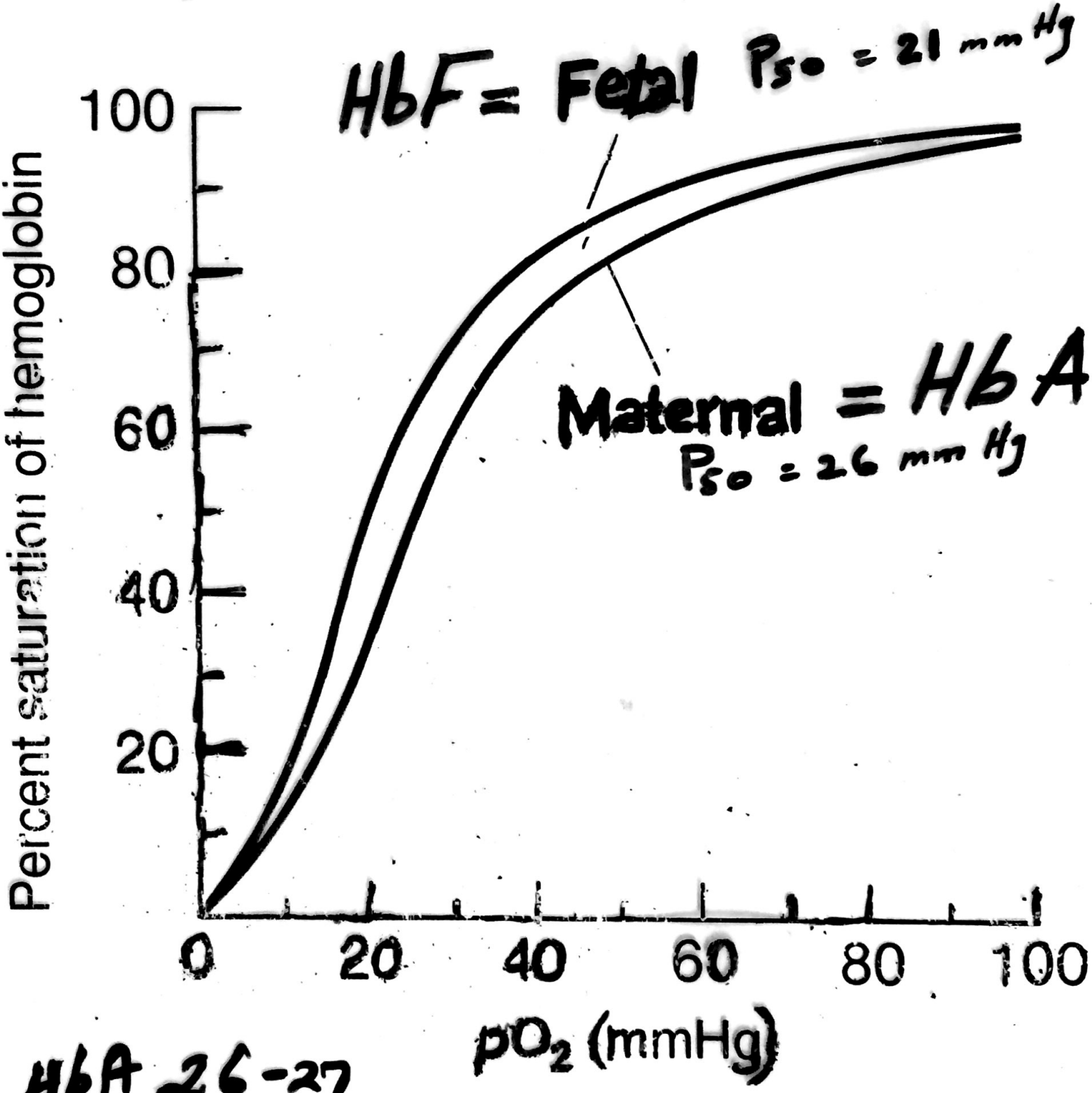


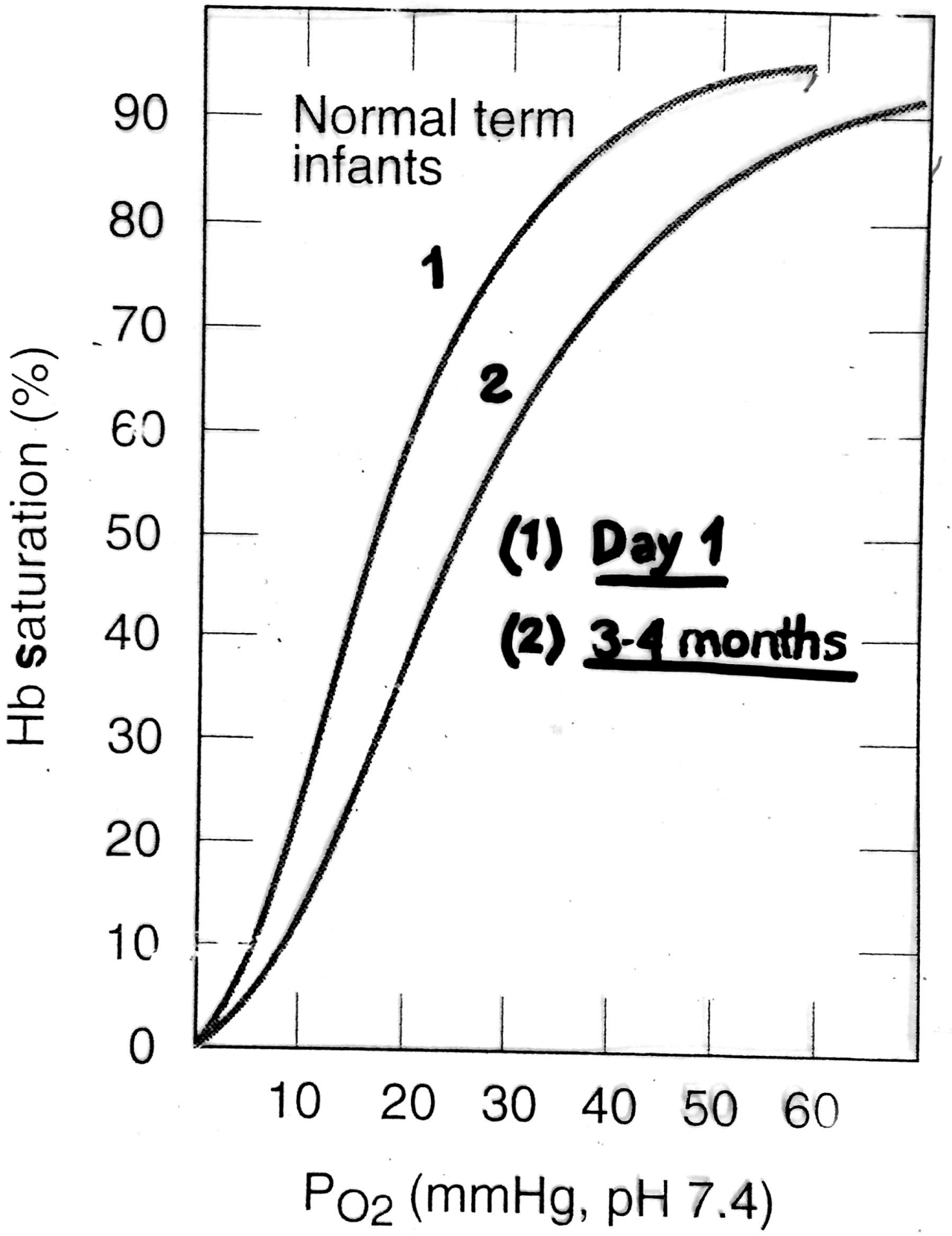
Figure 7-34
Mode of binding of BPG to human deoxyhemoglobin. BPG interacts with three positively charged groups on each β chain. [After A. Arnone. *Nature* 237(1972):148.]

Fetal Hemoglobin has a Higher Affinity for Oxygen than Adult Hemoglobin



HbA 26-27
HbF 20 mm Hg

Oxygen-hemoglobin Dissociation Curve; Comparison of Fetal and Maternal Hemoglobin
© 1993 by HarperCollins College Publishers


Normal term infants
1
2
(1) Day 1
(2) 3-4 months
Hb saturation (%)
90
80
70
60
50
40
30
20
10
0
10
20
30
40
50
60
P_{O_2} (mmHg, pH 7.4)

Effect of 2,3-BPG

- It is an important regulator of O_2-binding
- It is the most abundant organic phosphate in the RBC

$$[2,3\text{-BPG}] = 4-5\ mM = [Hb]$$

- It is synthesized from an intermediate of the Glycolytic pathway
- High affinity for O_2 in its absence

$$P_{50} \text{ is } 7 \text{ to } 10\ mmHg$$

- BPG stabilize the T state
- BPG binds the β subunits in (1:1) in a pocket lined with positively charged amino acids
- BPG conc. is increased in response to chronic hypoxia. e.g
  - chronic obstructive pulmonary disease [COPD] like emphysema
  - High altitude
  - Chronic anemia. e.g. PK deficiency

- Stored blood in Blood Bank.

storage → ↓ 2,3-BPG → O_2-trap

- transfused blood restore BPG in 6–24 hrs.
- supplement of Adenine and changes of H^+, phosphate and hexoses restores ATP and improves [BPG] → ↑ storage time from 21 d to 42 days