

# Haematology

## Team <sup>431</sup>

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## Normal Types of Haemoglobin

Team Leaders

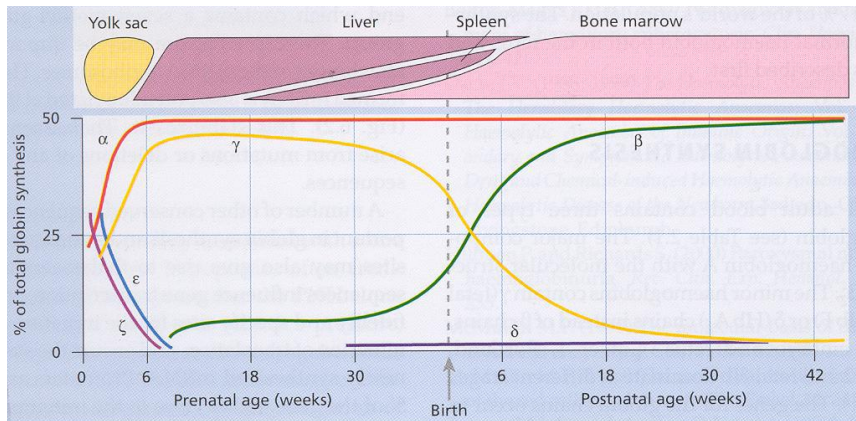
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- ◆ very important
- ◆ mentioned by doctor
- ◆ team notes
- ◆ not important



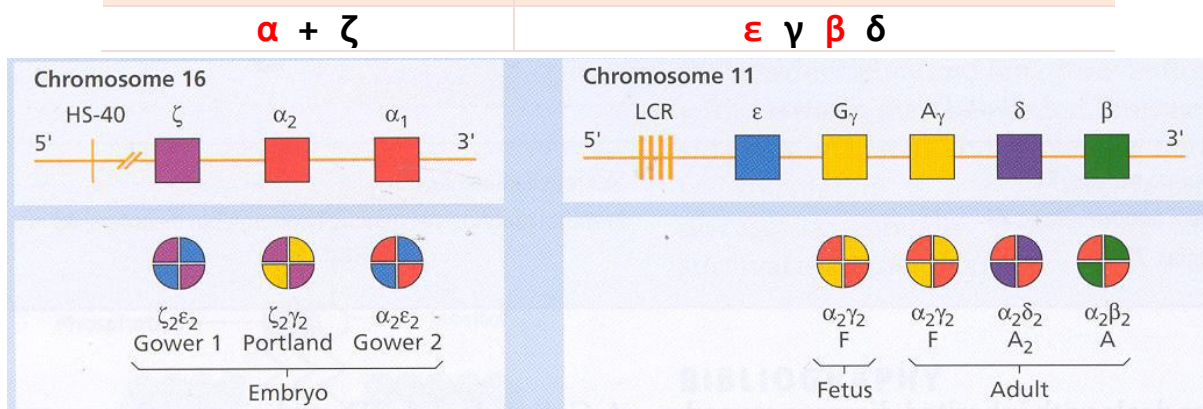
### Hemoglobin Formation

Stage	Site of formation	globin Chains present
<b>Embryonic Stage</b> (lasts until about 8 weeks after fertilization)	Yolk sac	$\alpha$ $\zeta$ $\epsilon$ $\gamma$
<b>Fetal Stage</b> (starts after the embryonic stage until birth)	Liver, spleen	$\alpha$ $\gamma$ " $\beta$ & $\delta$ in small amount"
<b>Before Birth</b> (about week 30 "8 <sup>th</sup> month" until birth)	Bone marrow	
<b>After Birth + adulthood</b>	Bone marrow	$\alpha$ $\beta$ "mainly, $\gamma$ & $\delta$ in small amount"

\* $\zeta$  = zeta,  $\epsilon$  = epsilon,  $\gamma$  = gamma,  $\delta$  = delta.

- Bone marrow production: -long bones stop at the age of 5.  
-Flat bones continue the whole life e.g. vertebrae, sternum.
- The adulthood for hemoglobin is one year of age.

The genes that control synthesis of globin chain carried on 2 chromosomes



**A Hemoglobin molecule has 4 globin chains; each one is attached to heme.**

- \*Alpha ( $\alpha$ ) chains are made of **141** amino acids.
- \*Beta ( $\beta$ ) chains are made of **146** amino acids.



Hemoglobin							
	Name	Chains		Percentage			
				fetal	At birth	Adult(one year)	
						Saudis	Caucasian
Adult hemoglobin	HaemoglobinA	$\alpha 2$	$\beta 2$	15-40%	15-40%	95%	97%
	HaemoglobinA2	$\alpha 2$	$\delta 2$	-	<0.3%	3.5%	2.5%
	HaemoglobinF*	$\alpha 2$	$\gamma 2$	60-85%	60-85%	1.5%	0.5%
EMBRYONIC hemoglobin	HaemoglobinGower I	$\zeta 2$	$\epsilon 2$				
	HaemoglobinGower II	$\alpha 2$	$\epsilon 2$				
	Haemoglobinportland	$\zeta 2$	$\gamma 2$				
Abnormal hemoglobin	HaemoglobinH	-	$\beta 4$				
	Haemoglobin Bart's	-	$\gamma 4$		<0.5%**		
	Haemoglobin Lepore	$\alpha 2$	$(\delta\beta)2$				

\*hemoglobin F is a fetal and adult hemoglobin.

\*\* it is normal to present at birth in minimal amount (less than 0.5%) ,but it has to disappear after that or it will be abnormal ( $\alpha$  thalassaemia).

HaemoglobinH : Seen after one year and result in  $\alpha$  thalassaemia.

HaemoglobinA2 : If there is an  $\uparrow$  by 1% only , will result in  $\beta$  thalassaemia ,but if there is a  $\downarrow$  by 1% only ,will result in  $\alpha$  thalassaemia.



## Questions

**1. Which one of the following is an abnormal hemoglobin in humans?**

- A. Hemoglobin A2
- B. Hemoglobin F
- C. Hemoglobin A
- D. Hemoglobin C

**2. The structure of Hemoglobin A is composed of ?**

- A. 2 alpha globin chains and 2 delta globin chains
- B. 2 alpha globin chains and 2 beta globin chains
- C. 2 alpha globin chains and one beta globin chains
- D. 2 alpha globin chains and 2 gamma globin chains

**3. The alpha genes ( 4 genes) are located on which one of the following chromosome ?**

- A. Chromosome 11
- B. Chromosome 12
- C. Chromosome 16
- D. Chromosome 20

**4. The following haemoglobins are composed of structural globin chains (Mark one false).**

- A. Haemoglobin A is composed of 2 alpha and 2 beta chains.
- B. Haemoglobin A2 is composed of 2 alpha and 2 delta chains.
- C. Haemoglobin F is composed of 2 alpha and 2 gama chains.
- D. Haemoglobin Barts is composed of 4 alpha chains.
- E. Haemoglobin H is composed of 4 beta chains.

**5. Quantitative measurements of the normal human haemoglobins at 1 year of age are as follows: (Mark one false)**

- A. Haemoglobin A (95-97%).
- B. Haemoglobin A2=(2.5-3.5%).
- C. Haemoglobin F = (less than 1.5%),
- D. Haemoglobin Barts = (4-5%).
- E. Haemoglobin H = Not measurable.

Answers: 1: D    2: B    3: C    4:D    5: D