

## B.Sc Second year Zoology (Honours)

### Paper-4

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#### **Types of Haemoglobin**

There are seven types of haemoglobin molecules throughout a human's life. Four when you are an embryo, one once you develop into a fetus and then as an adult you have two.

#### **Embryonic Haemoglobin:**

The form of haemoglobin most common and in highest proportion in an embryo is Haemoglobin Gower I ( $\zeta_2\epsilon_2$ ) The four polypeptide chains that compose this type of haemoglobin are two zeta and two epsilon chains.

The other three forms of haemoglobin are present at much lower levels and are:

- Haemoglobin Gower II ( $\alpha_2\epsilon_2$ ) – Composed of two alpha and two epsilon chains.
- Haemoglobin Portland I ( $\zeta_2\gamma_2$ ) – Comprised of two zeta and two gamma polypeptides.
- Haemoglobin Portland II ( $\zeta_2\beta_2$ ) – Made of two zeta and two beta polypeptide chains.

#### **Fetal Haemoglobin:**

Once an embryo develops into a fetus and the four types of embryonic haemoglobin molecules disappear they are replaced by Haemoglobin F ( $\alpha_2\gamma_2$ )

This type of haemoglobin is used due to it having a greater affinity for oxygen than adult haemoglobin. Therefore the growing fetus is able to take its mother's oxygen which is in her bloodstream.

#### **Adult haemoglobin:**

Haemoglobin F remains in the child's blood until it is around six months old and then almost all of it is replaced with adult haemoglobin.

The two types of adult Haemoglobin are:

- Haemoglobin A ( $\alpha_2\beta_2$ ) – Has two alpha chains and two beta chains
- Haemoglobin A<sub>2</sub> ( $\alpha_2\delta_2$ ) – Has two alpha polypeptides and two delta polypeptides.

There is also a small amount of Haemoglobin F remaining.

Haemoglobin A is the most prevalent as it makes up about 97% of adult haemoglobin

### **Variant Forms:**

As with all biological substances mutations can occur and these mutations cause a change in the genes coding for haemoglobin and so variant forms of haemoglobin are formed. There are several hundred variant forms of haemoglobin.

Thankfully, most variant forms of haemoglobin cause little to no problems. However, there are a select few that do; most notably Haemoglobin S.

Haemoglobin S has a slight change in the coding for the beta chain in adult haemoglobin and this causes sickle cell anaemia.