

**Information for Couples where one  
partner carries Haemoglobin S  
(sickle cell)  
and one carries Delta-beta  
Thalassaemia**

**Contacts for expert counselling centre**

## Couple at risk for Haemoglobin S/Delta-beta Thalassaemia

	Name	Date of Birth
<b>Ms</b>		
<b>Mr</b>		

- *One of you carries haemoglobin S and the other carries delta-beta thalassaemia. This means that, as a couple, you are at risk for having children with haemoglobin S/delta-beta thalassaemia. This booklet explains what this means.*
- *Your full blood test results are given below.*
- *Keep this booklet with your personal papers, so that you can refer to it again. Show it to your doctor and midwife in every pregnancy.*

### Blood test results

Name	Date of Test	Hb	MCH	MCV	Hb A2	Electro-phoresis	DNA data*

- *this is essential for all couples at risk for haemoglobin S/delta-beta thalassaemia*

### Centre where tests were done

Address		
<table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none;">Telephone</td> <td style="width: 50%; border: none;">Fax</td> </tr> </table>	Telephone	Fax
Telephone	Fax	
Other		

### Issued

Date
Signature of Doctor or Counsellor

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# Part 1.

## What is an at-risk couple?

One of you carries haemoglobin S (sickle cell) and the other carries delta-beta thalassaemia. You are both healthy, but you could have children with haemoglobin S/delta-beta thalassaemia. This is why doctors call you an *at risk couple*. Your blood test results are written in the front of this booklet.

Haemoglobin S and delta-beta thalassaemia are variations in the blood, of a kind that doctors call “*haemoglobin disorders*”.

### What are haemoglobin disorders?

Haemoglobin disorders cause changes in the haemoglobin in a person's red blood cells. They are *inherited* - they are handed on from parents to their children, they are present at birth, and they remain the same for life.

*Haemoglobin* is a component of the blood. It contains iron, which makes it bright red. This is why your blood is red. Your body needs oxygen to function: as your blood circulates haemoglobin picks up oxygen in your lungs and carries it round to all parts of your body. The usual type of haemoglobin is called haemoglobin A.

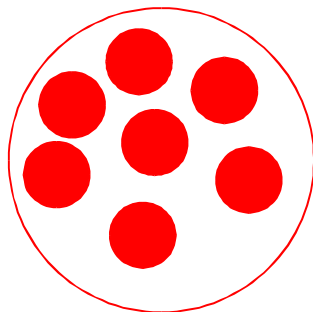
Haemoglobin is packed into *red blood cells*. Blood contains millions of red blood cells floating in a slightly yellow fluid called plasma.

### What is haemoglobin S (sickle cell)?

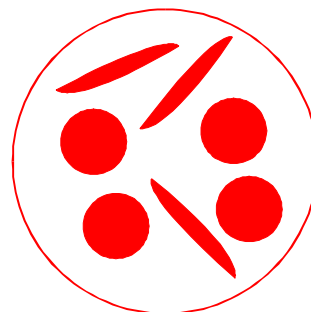
*Haemoglobin S* carriers have an unusual haemoglobin called haemoglobin S, as well as haemoglobin A. Their red blood cells contain approximately equal amounts of haemoglobin A and haemoglobin S. This is why they are sometimes said to “*be AS*”. Their blood functions normally and they are healthy people.

Haemoglobin S is called *sickle cell haemoglobin* because red cells that contain it can sometimes change from their normal disk-like shape, to sickle-shaped (longer, curved and pointed). This change can cause health problems.

Carriers are healthy because their red blood cells contain haemoglobin A as well as haemoglobin S. Such red cells hardly ever sickle.



Usual red blood cells



Usual red blood cells with sickled red blood cells

## How do people find out they carry haemoglobin S?

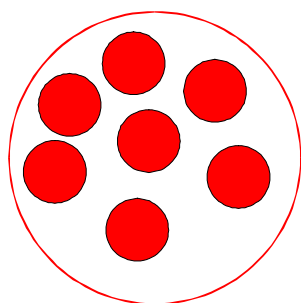
People find out they carry haemoglobin S through a special blood test called a *haemoglobinopathy screen*. This shows that:

- they have an unusual haemoglobin in their blood, and that it is haemoglobin S.
- their red blood cells contain slightly more haemoglobin A than haemoglobin S.

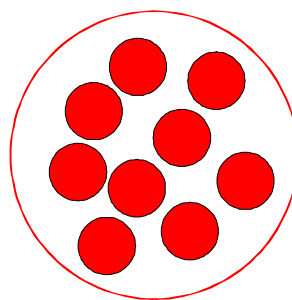
## What is delta-beta thalassaemia?

Delta-beta thalassaemia is an unusual type of *beta thalassaemia*. A carrier's red blood cells are slightly smaller than usual. Carriers make up for having small red blood cell by making more of them. Delta-beta thalassaemia carriers also have some *haemoglobin F*, which is the usual haemoglobin of unborn babies. This makes their thalassaemia milder than typical beta thalassaemia. Their blood functions normally, and they are healthy people.

The picture shows the usual kind of red blood cells, and a delta-beta thalassaemia carrier's red blood cells, seen down a microscope.



Usual red blood cells



A delta-beta thalassaemia carrier's red blood cells

## How do you find out you carry delta-beta thalassaemia?

People find out they carry delta-beta thalassaemia by a special blood test called a "haemoglobinopathy screen". This shows that:

- they have small red blood cells
- they have between 15 and 30% of *haemoglobin F* in their blood. Haemoglobin F is the usual haemoglobin of unborn babies. Most adults have less than 1% of haemoglobin F in their blood.
- the haemoglobin F is distributed unevenly among their red blood cells.

***They also need a special "DNA" test to confirm that they carry delta-beta thalassaemia.***

*The DNA test is essential to be sure that they do not carry a similar but harmless condition called "hereditary persistence of fetal haemoglobin" (HPFH for short).*

## How are haemoglobin S and delta-beta thalassaemia inherited?

They are inherited through *genes*. Every human characteristic, such as eye colour, or height, or type of haemoglobin is controlled by genes that we inherit from our parents. A child inherits *two* genes for every characteristic, one from each parent. Most people have inherited two genes for haemoglobin A.

A *haemoglobin S carrier* has inherited a gene for haemoglobin A from one parent and a gene for haemoglobin S from the other. This is why they are sometimes said to “*be AS*”.

A *delta-beta thalassaemia carrier* has inherited a gene for haemoglobin A from one parent and a gene for delta-beta thalassaemia from the other. Their delta-beta thalassaemia gene cannot make any haemoglobin A, but they make some haemoglobin F instead. Their normal haemoglobin A gene makes enough haemoglobin for their red blood cells to function normally.

*When one partner carries haemoglobin S and the other carries delta-beta thalassaemia* a child could inherit both a haemoglobin S gene and a delta-beta thalassaemia gene. This child would have *haemoglobin S/delta-beta thalassaemia*. When a person has haemoglobin S/delta-beta thalassaemia their red blood cells contain no haemoglobin A. They contain only haemoglobin S and haemoglobin F. Their red blood cells can sometimes sickle, and this can cause health problems.

## What are your chances of having children with haemoglobin S/delta-beta thalassaemia?

A couple where one partner carries haemoglobin S and the other carries delta-beta thalassaemia have the following chances *in each pregnancy*

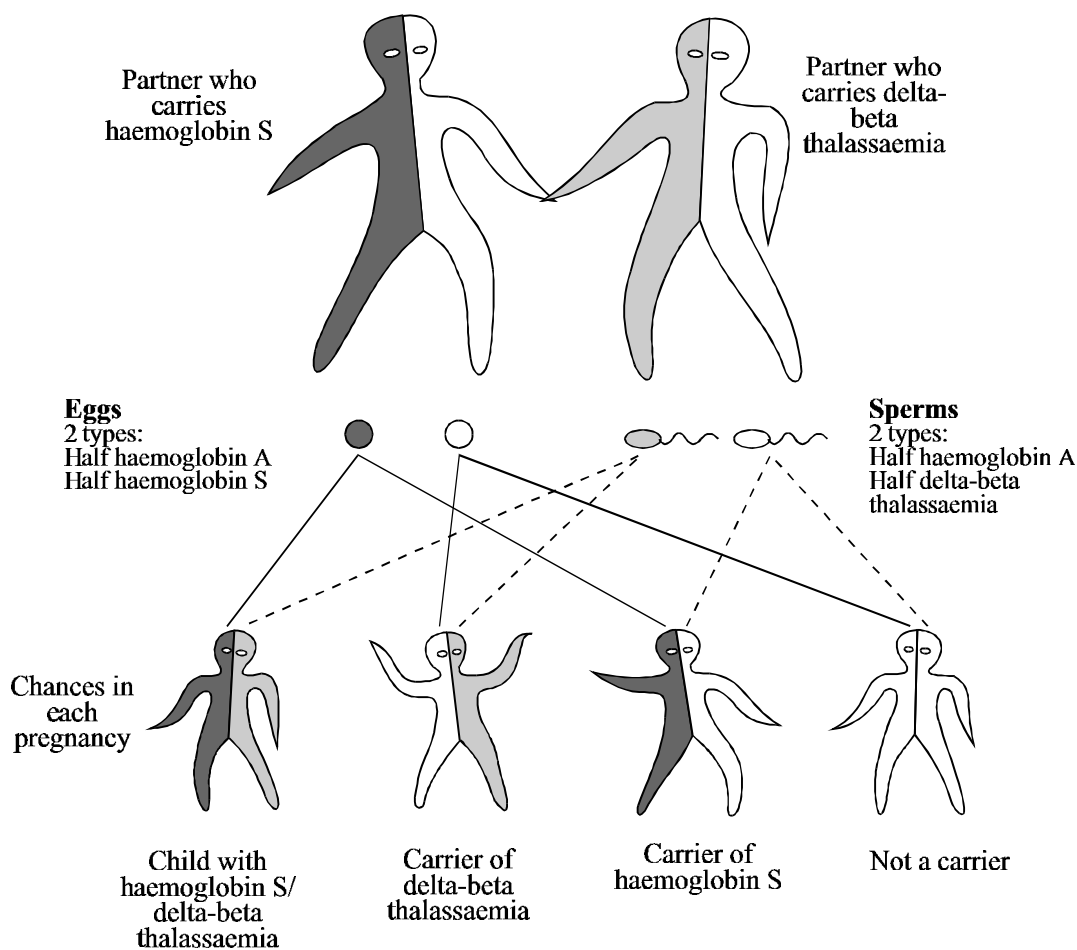
- a 1-in-4 chance of a child that is not a carrier.
- a 1-in-2 chance of a baby that is a healthy carrier of haemoglobin S or delta-beta thalassaemia.
- a 1 in 4 risk of a baby with haemoglobin S/delta-beta thalassaemia.

*In every pregnancy your chance of having a healthy child is much higher than your risk of having a child with haemoglobin S/delta-beta thalassaemia.*

## How could a child inherit Haemoglobin S/Delta-Beta Thalassaemia from you?

When a child is conceived, it inherits one gene for haemoglobin from each parent. The picture shows that when one parent carries haemoglobin S and one carries delta-beta thalassaemia there are four possibilities.

*Here we describe the possibilities when the woman carries haemoglobin S and the man carries delta-beta thalassaemia. Of course, it may also be the other way around.*



Women usually produce one egg each month. When the woman carries haemoglobin S, each egg contains either her normal haemoglobin gene or her haemoglobin S gene, but not both.

Men make sperm all the time. When a man carries delta-beta thalassaemia, each sperm carries either his normal gene or his delta-beta thalassaemia gene, but not both.

- If a normal egg is fertilised by a normal sperm, the child will not carry any haemoglobin disorder.
- If a normal egg is fertilised by a delta-beta thalassaemia sperm the child will carry delta-beta thalassaemia.
- If a haemoglobin S egg is fertilised by a normal sperm the child will carry haemoglobin S.
- If a haemoglobin S egg is fertilised by a delta-beta thalassaemia sperm, the child will have haemoglobin S/delta-beta thalassaemia.

## What is Haemoglobin S/Delta-Beta Thalassaemia?

Haemoglobin S/delta-beta thalassaemia is a type of *sickle cell disorder*.

Children with sickle cell disorders are healthy at birth, but usually become *anaemic* in the first year of life. This means they have less haemoglobin in their blood than other people.

People with sickle cell disorders may get *infections* more easily than others (for example, chest infections or bladder infections). In young children an infection can sometimes become life-threatening. Children with sickle cell disorders should take antibiotics regularly to protect them against infections. If a child develops a fever or other signs of infection, parents can usually prevent serious problems by taking the child to the treatment centre at once.

A young child with a sickle cell disorder can sometimes become ill suddenly, because a lot of their blood gets trapped in the spleen. The child becomes pale and weak, and their tummy swells up. This is called a "*splenic sequestration crisis*". Parents are taught to recognise this problem, and can usually prevent serious problems by bringing the child to the treatment centre for a blood transfusion.

Many children and adults with sickle cell disorders have a *painful crisis* from time to time. A painful crisis is an attack of very severe pain, anywhere in the body. In young children the commonest places are the hands and feet: this is called *hand-foot syndrome*. In older people the commonest places are the limbs and back. Painful crises usually last several days. It may be necessary to go into hospital to control the pain and bring the crisis to an end.

A few people with a sickle cell disorder have serious problems such as a stroke (this is mainly a risk for children), or kidney failure, or severe damage to joints, or long attacks of severe pain. Such people may need monthly blood transfusions for several years to avoid severe handicap or death.

The unpredictability of sickle cell disorders can make parents anxious. People with sickle disorders can get very frustrated if the condition keeps interrupting their life. It can be difficult for some people with sickle cell disorders to complete a course of study, or to work reliably.

### How often do these problems occur in haemoglobin S/delta-beta thalassaemia?

Haemoglobin S/delta-beta thalassaemia is rare, and there is limited experience with it. ***The best available evidence shows that it is a very mild form of sickle cell disorder.*** We expect most people with haemoglobin S/delta beta thalassaemia to lead a normal life. There should be little or no anaemia, and few if any painful crises or other serious problems.

### What is the life-expectancy in haemoglobin S/delta-beta thalassaemia?

There is good information on mild sickle cell disorders from the United States. There, 6 out of 7 people with milder sickle cell disorders (85%) live past the age of 45. The outlook for a child with haemoglobin S/delta-beta thalassaemia born in the UK today is probably even better than this.

In Africa risks may be higher because infections are more common, the climate is more extreme, and it is less easy to get rapid access to emergency medical care.

### What can parents do, to cope with haemoglobin S/delta-beta thalassaemia?

Early diagnosis and good information are important. When a couple carry haemoglobin S and haemoglobin C, it is usual to test each baby at birth to see if it has haemoglobin S/delta-beta thalassaemia or not. If a baby has haemoglobin S/delta-beta thalassaemia, the parents and child go regularly to a sickle cell clinic. The baby is given antibiotics to prevent infections. The parents are given advice on steps they can take to avoid painful crises. If the child becomes suddenly ill they can go directly to the clinic for treatment.



## What is the hope for people with sickle cell disorders in the future?

There is a great deal of hope for finding effective treatments for sickle cell disorders in the future.

- A drug called *hydroxyurea* may reduce the frequency and severity of painful crises, and may also help with other problems. It needs to be taken every day, by mouth. It should be taken only by people with severe problems from their sickle cell disorder, because experts are concerned that it might have undesirable side-effects in the long term. It is being studied carefully in clinical trials, over a long period of time.
- **Bone marrow transplantation** is becoming safer. Some children with a severe sickle cell disorder have been "cured" by bone marrow transplantation. However, it is not easy. Firstly, the patient must have bone marrow taken from a brother or sister (or occasionally a parent) who *exactly* matches their own tissue type. There is a 1-in-4 chance for a perfect match with each brother or sister. Secondly, there are serious risks to the patient's life and health, and they may be unable to have a family of their own in the future. Therefore bone marrow transplantation should be considered only if a child turns out to have a severe sickle cell disorder.
- "**Intra-uterine bone marrow transplantation**" may become possible in the next few years. This means that it may be possible to treat a fetus with a sickle cell disorder during early pregnancy, so that after birth it would have a milder disorder, or even none at all. Research is going on in several centres world-wide.
- "**Gene therapy**" may become possible for haemoglobin S/delta-beta thalassaemia within the next 20 years. However, it will probably be more complicated and expensive than it sounds.

## Other types of Sickle Cell Disorder

There are several other types of sickle cell disorder. They include:

Sickle cell anaemia (haemoglobin SS)

Haemoglobin S/beta thalassaemia

Haemoglobin S/C disorder

Haemoglobin S/D disorder

Sickle cell anaemia and haemoglobin S/D disorder are the severest sickle cell disorders. Some forms of haemoglobin S/beta thalassaemia are milder, and Haemoglobin S/C disorder can be very mild.

## **Finding out if Your Baby is Healthy or has a Sickle Cell Disorder**

Most at risk couples wish to know the answer to this question as early as possible.

### **Finding out when the baby is born**

You can find out soon after the baby is born, through *neonatal diagnosis* (new-born diagnosis).

All at-risk couples who have a baby ask for neonatal diagnosis.

Neonatal diagnosis is done on blood taken from the baby's cord at birth, or taken from the baby's heel a few days after birth. Your counsellor will arrange this for you, and will inform you (and your GP) as soon as the result is available.

### **Finding out during pregnancy**

You can also find out during pregnancy, through *prenatal diagnosis*. This test can be done at any time after 11 weeks of pregnancy. If the baby does not have haemoglobin S/delta-beta thalassaemia this is reassuring. If the baby has haemoglobin S/delta-beta thalassaemia you can choose whether to terminate the pregnancy and try again, or to continue the pregnancy and plan the best care for the baby.

Most couples at risk for mild sickle cell disorders decide not to have prenatal diagnosis because the condition is rarely severe and there is a small risk to the pregnancy.

However, if a couple wishes to have prenatal diagnosis to find out if their child has haemoglobin S/delta-beta thalassaemia, this is perfectly acceptable.

### **Do you want to know more?**

If you want to know more, or you are unsure what to do, you may find it useful to visit an expert centre that does prenatal diagnosis for haemoglobin disorders. You can meet an expert who will answer your questions and help you make the right decisions for yourselves and your family. To make an appointment, phone the number on the front of this booklet directly, or ask your counsellor or family doctor to make an appointment for you.