

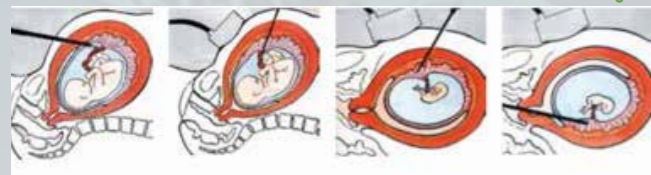
(1) Amniocentesis

This test withdraws amniotic fluid from the pregnant woman and is performed in the second trimester of pregnancy, after about 15 weeks' gestation.

(2) Chorionic Villus Sampling (CVS) (most commonly used)

This method uses and tests chorionic villus cells and has the advantage to be performed earlier than amniocentesis at about 10-11 weeks' gestation. Detailed information on pros and cons can be found in TIF's specific on prevention publications and other educational tools.

Fig. 7



(3) Pre-implantation genetic diagnosis (PGD)/testing is a refined, procedure whereby:

- (i) cells from a very early embryo (resulting from in-vitro fertilisation) are analysed in the laboratory to confirm the presence or absence of a haemoglobin disorder. Non-mutated embryos are then selected for implantation into the womb of the carrier woman;
- (ii) unfertilised ova (eggs) which do not carry a haemoglobin disorder or mutation, detected by polar body diagnosis, are selected from the carrier woman and then fertilised using her husband's sperm. The selected fertilised ova are then introduced into her womb.

PGD/testing is, however, a costly and technologically demanding procedure and several attempts are often necessary for a successful pregnancy.

In addition, this test is not widely available and, not to date, integrated into the national strategies for prevention and control of Hb disorders.

For further inquiries or information, contact the Ministry of Health of your country. Additionally, you may contact:

- Your national Thalassaemia Association(s).

Thalassaemia International Federation (TIF) can help you resolve many of your queries and questions through its International Medical and Scientific Advisory Board and educational programme.

- Please visit TIF's website (<http://thalassaemia.org.cy>)
- Request additional educational material on Prevention (see below) which will be sent to you free of charge.
- Contact TIF's helpline at +357 22 319 129 [operates between 8:00 am to 4:00 pm local time (GMT+2)]

Enroll in TIF's e-patient platform!

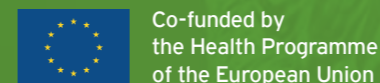
Suggestions for further reading (TIF's publications):
(<https://thalassaemia.org.cy/publications/tif-publications/>)

- About Thalassaemia
- Guidelines for the Management of Transfusion Dependent Thalassaemia, 3rd Edition
- Prevention of Thalassaemias and other Haemoglobin Disorders, Vol 1, 2nd Edition
- Prevention of Thalassaemias and Other Haemoglobin Disorders, Vol. 2: Laboratory Protocols

Watch our video on Prevention on Youtube!
TIF_Community Awareness on Thalassaemia Control



This Educational Brochure received funding under an operating grant from the European Union's Health Programme (2014-2020).



© Thalassaemia International Federation 2020
All rights reserved.

Your comments are very welcome



Thalassaemia International Federation
31 Ifigenias Street, 3rd Floor, 2007 Strovolos, Nicosia Cyprus
P.O. Box 28807, 2083 Strovolos, Nicosia Cyprus
Tel: +357 22 319 129 • Fax: +357 22 314 552
E-mail: thalassaemia@cytanet.com.cy
Website: <http://thalassaemia.org.cy>



PREVENTION

of inherited diseases

- β -Thalassaemia

**PREVENTION OF INHERITED DISEASES:
THE EXAMPLE OF β -(BETA) THALASSAEMIA**

Inherited diseases are medical conditions caused by changes or **mutations** (as called in biology) in the genetic make-up of people. Each human being has thousands of **genes** organized in **pairs** and whose role is to **produce proteins**, the building blocks of the human body. (Fig.1) In every pair of genes, one comes from the mother and the other from the father. Inherited diseases result from the mutations that occur on specific genes, rendering them significantly less or non- functioning at all i.e. the specific genes can no longer perform their role. **In the case of β -thalassaemia**, the mutation occurs on the **β -globin gene** of the human body that **controls** the **production of normal adult Haemoglobin**. (Fig. 1) This is a protein which is an essential part of the RBCs¹ of blood, charged with the role of **transferring oxygen**; an important nutrient for the growth and activity of the cells and tissues of the human body.

About inheritance

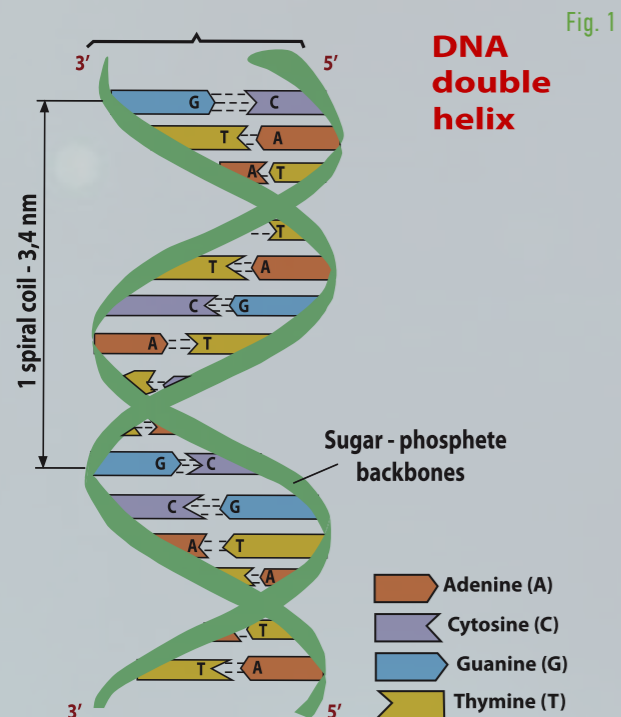


Fig. 1

The mode of transmission of **any genetic characteristic** is known as **inheritance** and there are several forms of it. One very common is known as **autosomal recessive**, which is the way β -thalassaemia is passed on. In this form of inheritance, it is required that **a child receives two 'mutated' β -globin genes** from its parents, **one from the father and one from the mother**, in order to develop the full blown disease. Each parent has one of the two β -globin genes (which are always in pairs) mutated and is commonly referred to as **"carrier"** of the disease.

About the carrier

A **carrier** is a person who has a non-mutated i.e. normal β -globin gene on one chromosome and a mutated β -globin gene, i.e. one with reduced function, on the other. Carriers of β -thalassaemia **do not have a disease and they do not develop a disease over time**. Simple laboratory tests performed in specialized laboratories can identify a carrier.

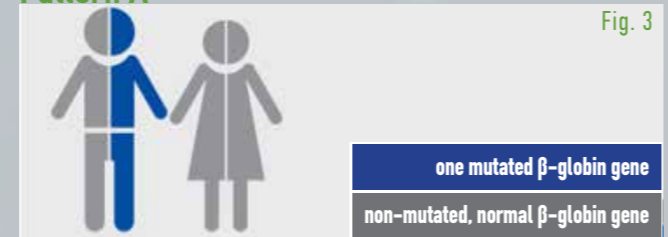
One may also come across other names describing a carrier of β -thalassaemia, such as:

- **Carrier of the β -thalassaemia trait**
- **Individual heterozygous for β -thalassaemia**
- **Individual with β -thalassaemia minor**
- **β -thalassaemia carrier**

INHERITANCE PATTERNS OF β -THALASSAEMIA

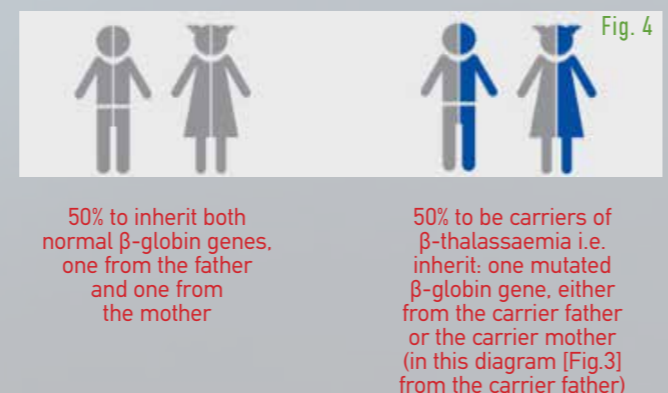
Below the various ways are described in which β -thalassaemia is inherited.

Pattern A



When **only one of the parents is a carrier** of β -thalassaemia as shown above (Fig3):

For every pregnancy the chances for the children are:

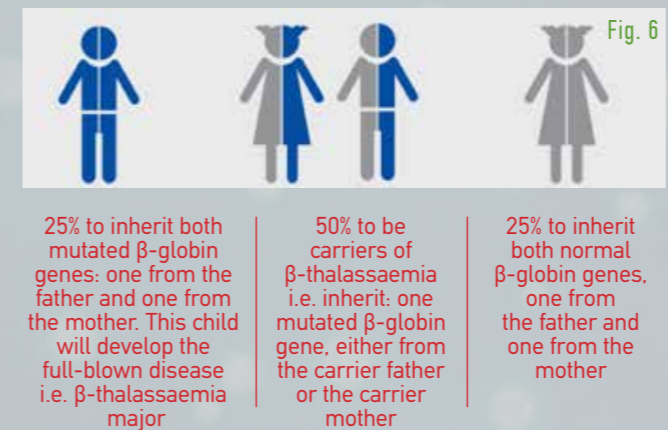


Pattern B

When **both parents are carriers** of β -thalassaemia as shown below (Fig5):



For every pregnancy the chances for the children are:



In more detail

Partners who **both** carry one mutated β -globin gene are referred to as an "at-risk" couple. Although being a carrier of β -thalassaemia has no adverse health effects, if the couple plans to make a family, then at each and every pregnancy, the risks involved are as described above.

THE CHOICES AVAILABLE FOR AN 'AT RISK COUPLE' TO HAVE A CHILD WITHOUT β -THALASSAEMIA MAJOR

Partners in a relationship who are aware that they are carriers of β -thalassaemia, have a number of choices with regards to having a family as briefly described in Table 1 below.

These should be discussed as early as possible with an expert health professional, preferably and if possible a genetic counsellor. The decision **HOW TO PROCEED** should be taken by the couple itself, subsequent **always** to receiving **promptly reliable, updated** and **non-directive information** from an **expert**.

Risk identified	Choices
Before marriage or pregnancy	a. To avoid marrying another carrier b. To separate from a relationship that puts their future children at risk c. To marry their chosen partner despite knowing the risk
After marriage or cohabitation	a. To proceed with a pregnancy accepting the risk of an affected child b. To avoid having children e.g. choosing adoption c. To proceed to prenatal diagnosis, and decide based on the results how to proceed with the pregnancy. (1, 2) d. To use pre-implantation genetic diagnosis/testing (see below) as an alternative to prenatal diagnosis. The test aims to the birth of a child without thalassaemia. (3)
When already pregnant	a. Choose to go through prenatal diagnosis (if in early pregnancy) and decide with expert support and guidance how to proceed.

Table 1

If an "at risk" couple decides to proceed with pregnancy and test the foetus:

There are two methods of prenatal diagnosis (1, 2) both of which involve the services of gynaecologists, who under ultrasound direction withdraw, special fluid from the pregnant woman, containing cells from the foetus. This enables them to check whether the foetus has:

- the full-blown disease i.e. β -thalassaemia major or
- is a carrier of β -thalassaemia major or
- has non-mutated, normal β -globin genes.

¹ RBCs: Red Blood Cells