Neurofibromatosis 1
- or -
NF1
This guide is not meant to take the place of medical advice.

Please consult with your doctor about your genetic results and health care choices. The information in this guide was up to date at the time it was written in 2019. But new information may come to light with new research. You may find it helpful to share this guide with friends and family members or doctors and teachers of the person who has NF1.
What is NF1?

NF1 happens when there are changes to the NF1 gene or the SPRED1 gene. These changes can keep the genes from working as they should.

**Key role**
The NF1 and SPRED1 genes play a key role in cell growth and brain function.

**Symptoms**
Many people who have NF1 have:

- Tan spots on their skin, freckles around the armpits, and growths under the skin
- Different types of tumors, a mass of lump of cells
- Learning disabilities
- Attention deficits
- Social challenges similar to autism spectrum disorder
What causes NF1?

Our genes contain the instructions, or code, that tell our cells how to grow, develop, and work. Every child gets two copies of the NF1 and SPRED1 genes: one copy from their mother, from the egg, and one copy from their father, from the sperm. In most cases, parents pass on exact copies of the gene to their child. But the process of copying genes is not perfect. A change in the genetic code can lead to physical issues, developmental issues, or both.

Sometimes a random change happens in the sperm or egg. This change to the genetic code is called a ‘de novo’, or new, change. The child can be the first in the family to have the gene change.
De novo changes can take place in any gene. We all have some de novo changes, most of which don’t affect our health. But because NF1 and SPRED1 play a key role in development, de novo changes in these genes can have a meaningful effect.

Research shows that NF1 is often the result of a de novo change in NF1 or SPRED1. Many parents who have had their genes tested do not have the gene change found in their child who has the syndrome. In some cases, NF1 happens because the gene change was passed down from a parent.
Why does my child have a change in the NF1 or SPRED1 genes?

No parent causes their child's NF1. We know this because no parent has any control over the gene changes that they do or do not pass on to their children. Please keep in mind that nothing a parent does before or during the pregnancy causes this to happen. The gene change takes place on its own and cannot be predicted or stopped.

What are the chances that other family members or future children will have NF1?

Each family is different. A geneticist or genetic counselor can give you advice on the chance that this will happen again in your family.

The risk of having another child who has NF1 depends on the genes of both birth parents.

- If neither birth parent has the same gene change found in their child, the chance of having another child who has the syndrome is on average 1 percent. This 1 percent chance is higher than the chance of the general population. The increase in risk is due to the very unlikely chance that more of the mother's egg cells or the father's sperm cells carry the same change in the gene.
- If one birth parent has the same gene change found in their child, the chance of having another child who has the syndrome is 50 percent.

For a symptom-free sibling, a brother or sister, of someone who has NF1, the risk of having a child who has the syndrome depends on the symptom-free sibling's genes and their parents' genes.

- If neither parent has the same gene change found in their child who has the syndrome, the symptom-free sibling has a nearly 0 percent chance of having a child who has NF1.
- If one birth parent has the same gene change found in their child who has the syndrome, the symptom-free sibling has a small chance of also having the same gene change. If the symptom-free sibling has the same gene change as their sibling who has the syndrome, the symptom-free sibling's chance of having a child who has NF1 is 50 percent.

For a person who has NF1, the risk of having a child who has the syndrome is about 50 percent.
How many people have NF1?

NF1 is a common genetic disorder. It happens in about 1 in 3,000 people.

Do people who have NF1 look different?

People who have NF1 may look different. Appearance can vary and can include some but not all of these features:

- **Skin**: Many people have tan spots on their skin. These spots are flat and about 1 to 3 centimeters across. Spots can appear anywhere on the body. People may also have clusters of freckles on their trunk or where skin rubs against other skin.

- **Eyes**: Many people have harmless spots called Lisch nodules in the iris of their eyes.
How is NF1 treated?

Scientists and doctors have only just begun to study NF1. At this point, there are no medicines designed to treat the syndrome. A genetic diagnosis can help people decide on the best way to track the condition and manage therapies. Doctors can refer people to specialists for:

- Physical exams and brain studies
- Genetics consults
- Development and behavior studies
- Other issues, as needed

A developmental pediatrician, neurologist, or psychologist can follow progress over time and can help:

- Suggest the right therapies. This can include physical, occupational, speech, or behavioral therapy.
- Guide individualized education plans (IEPs).

Specialists advise that therapies for NF1 should begin as early as possible, ideally before a child begins school.

People who have NF1 may have a higher risk of developing tumors. These may be cancerous or non-cancerous. Your doctor can recommend whether you need additional screening or to consult a specialist.

If seizures happen, consult a neurologist. There are many types of seizures, and not all types are easy to spot. To learn more, you can refer to resources such as the Epilepsy Foundation’s website: epilepsy.com/learn/types-seizures.
This section includes a summary of information from a published article describing symptoms in these four people. To learn more about the articles, see the Sources and references section of this guide.

**Behavior and development concerns linked to NF1**

**Behavior**
Children who have NF1 often have attention deficit hyperactivity disorder, also called ADHD, or other attention issues. These attention issues can add to learning challenges. Around 30 percent of people who have NF1 have autism or features of autism. Other issues include visual-spatial issues, coordination issues, body movement issues, memory issues, and language.

**Mental health**
Some people have mood and anxiety disorders.

**Learning**
People who have NF1 often have some degree of learning disability. About 6 percent have intellectual disability.
Medical and physical concerns linked to NF1

**Skin**
Many people have harmless growths under the skin called neurofibromas. These growths are benign, meaning that they will not cause cancer and won't spread to other parts of the body. They grow slowly and usually appear in late childhood. More growths happen with age.

**Internal nerve tumors**
About one-half of people develop a different type of growth called plexiform neurofibromas. These growths develop deeper inside the body or under the skin. They don't generally produce symptoms on their own. But they can grow quite large and cause nerve damage and pain.

**Other tumors**
People who have NF1 have a higher risk for developing other kinds of tumors. The most common are tumors in the brain and the optic nerve, which connects to the eye. However, these are likely to be less severe than typical brain tumors. The optic nerve tumors grow very slowly. They can sometimes cause blindness. About 10 percent of people who have NF1 develop tumors around the nerves, known as malignant peripheral nerve sheath tumors.
Medical and physical concerns linked to NF1

**Growth**
People who have NF1 may be short and have a slightly large head size. Puberty is usually normal but sometimes comes early.

**Brain**
People who have NF1 may have nervous system issues including seizures, sleep problems, headaches, and migraines.

**Heart and blood vessels**
High blood pressure is common and can occur at any age. Some people also have abnormal heart valves or other heart defects from birth.

**Joints and spine**
Some children develop an abnormal curve of the spine, also called scoliosis. This condition may require surgery.

**Birth defects**
Some people who have NF1 are born with an abnormally shaped bone, usually the shinbones.
Where can I find support and resources?

Neurofibromatosis Network
www.nfnetwork.org
Sources and References

The content in this guide comes from a published article about NF1. Below you can find details about the article, as well as a link to the full article.

- Friedman JM. GeneReviews, (2018). Neurofibromatosis 1
  www.ncbi.nlm.nih.gov/books/NBK1109