the arms more than legs, prominent involvement of the speech and swallowing muscles, slowness of movement and poor balance. RDP usually occurs in adolescence or young adulthood with little progression after the sudden appearance. A small number of families have been identified with this rare form of dystonia, at least three of which share linkage to the same location on chromosome 19q13.

Late-onset dystonia has an average age of onset of 48 years but can range from the 3rd to the 8th decades. The dystonic symptoms tend to remain focal. Several common forms of focal dystonia include cervical dystonia, blepharospasm, spasmodic dysphonia and writer’s cramp. Probably at least 25% of focal dystonias are inherited and these seem to be dominant. A gene (DYT-7) has been linked to chromosome 18p in a family with cervical dystonia but many other focal dystonia families do not show linkage to this region, suggesting there are more genes, as yet unidentified, for focal dystonias.

Genetic research has the potential to help all. Dystonia is a complex disease. Its causes, treatment, progression, and variability of symptoms are difficult to explain, but all dystonias have similar symptoms which involve the same area of the brain and similar neurotransmitters. The discovery of the DYT1 gene is a major step to finding new treatments and leading us to answers that will be applicable to all dystonia patients. Until now, treatments for dystonia have addressed only the surface symptoms of the disorder. Current research is seeking to understand the causes of dystonia and is providing the information necessary to develop treatments that address dystonia at a biochemical level.

What the Society offers

- **The Dystonia Society** is dedicated to providing information and support to everyone affected by dystonia in the UK and to raising awareness of the condition and the needs of everyone affected. The Society is also committed to ensuring that everyone with dystonia has access to the treatments they need.

- **Our Helpline** 0845 458 6322 is open Mondays – Fridays between 10am – 4pm and offers an opportunity to discuss concerns in confidence, and to obtain information on dystonia and its various treatments, including ways of making living with dystonia easier.

- **Local support** is provided via the Society’s regional support groups run by the Society’s team of volunteers.

- **The organisation** encourages and supports research into potential treatments and practical ways of coping with the condition.

- **Join us** – become a member and receive our quarterly newsletter. Call: 0845 458 6211.
Dystonia and genetics

Genes are made up of DNA (deoxyribonucleic acid), a long threadlike molecule coiled inside our cells. Each cell in the body has a large central body called the nucleus. Within this cell nucleus, DNA is packaged into 23 pairs of chromosomes, which contain a complete set of genetic instructions known as the human genome.

Each chromosome, in turn, carries thousands of genes arrayed like beads on a string. There are about 30,000 genes which determine, at least in part, many of our traits such as eye colour, height, blood types, and bodily functions. Genes, which are simply short segments of DNA, are packets of instructions that tell cells how to behave. They do so by specifying the instructions for making particular proteins.

The hereditary instructions are written in a four-letter code, with each letter corresponding to one of the chemical constituents of DNA: A (Adenine), T (Thymine), C (Cytosine), G (Guanine). Genes are, in essence, the ‘recipe’ which is written in DNA language, with a certain sequence of A’s, T’s, C’s and G’s for a specific protein. Your DNA plan contains recipes for making thousands of different types of proteins, and every second your cells are using gene recipes to make the proteins they need to communicate and function.

How do genetic disorders occur?

If the DNA language becomes garbled, the cell may make the wrong protein, or too much or too little of the right one – mistakes that sometimes result in disease. In the case of dystonia, the proteins involved are crucial to the brain’s communication with the muscles. The muscle spasms of dystonia are what happens when your body isn’t making the correct proteins and your muscles aren’t getting the right message.

The genetics of dystonia

Researchers have identified several genes or sections of specific chromosomes associated with dystonia. Most identified genetic forms of dystonia are autosomal dominant disorders. Autosomal means that the chromosomes involved are not the X and Y sex chromosomes. Dominant indicates that only one parent needs to have the gene for a child to inherit the disorder. (If a disorder is recessive, both parents must have the gene for a child to inherit the disorder.) Penetrance refers to the fact that only a percentage of those who inherit a mutated gene will show symptoms.

Known inherited forms of dystonia

Early-onset dystonia (Childhood-onset dystonia, generalized dystonia or idiopathic torsion dystonia [ITD]) usually starts in childhood or adolescence. Symptoms typically start in one part of the body, usually in an arm or leg and may eventually spread to the rest of the body, causing it to twist into unnatural positions. It is the most common hereditary form of dystonia, resulting, in most cases, from the DYT1 gene.

Dopa-responsive dystonia (DRD) usually starts in childhood or adolescence with progressive difficulty in walking. It may be misdiagnosed since it mimics many of the symptoms of cerebral palsy or even parkinsonism. There are many subtypes of DRD, all of which share a dramatic and sustained response to low doses of the drug levodopa. Most cases are autosomal dominant, are caused by mutations in the GCH1 gene and vary in penetrance. More than 60 mutations have been described in the GCH1 gene. In a few cases, DRD can be inherited as an autosomal recessive disorder involving mutations in the TH gene or as an autosomal dominant disorder associated with the DYT-14 locus.

Paroxysmal dyskinesias are a group of episodic movement disorders that may include brief attacks of dystonic movements and postures and a return to normal postures between episodes. Specific genes have been identified – paroxysmal nonkinesigenic dyskinesias (DYT-8), paroxysmal choreoathetosis with spasticity (DYT-9), and paroxysmal kinesigenic dyskinesias (DYT-10).

Myoclonus dystonia is characterized by rapid lightening-like movements (jerks) alone or in combination with the sustained postures of dystonia. Myoclonus dystonia usually begins in the first or second decade of life and is inherited as an autosomal dominant trait with reduced penetrance. Multiple mutations in the e-sarcoglycan gene have been found in the majority of familial cases. However, at least one family does not have a mutation in this gene but rather shows linkage to chromosome 18p suggesting that another myoclonus dystonia gene resides in this region.

Rapid-onset dystonia-parkinsonism (RDP) is an autosomal dominant movement disorder with abrupt onset of slowness of movement (parkinsonism) and dystonic spasm. The classic features include involuntary dystonic spasms in