# PAX8 Gene

Subjects: Genetics & Heredity
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paired box 8

genes

## 1. Introduction

The *PAX8* gene belongs to a family of genes that play critical roles in the formation of tissues and organs during embryonic development. The PAX gene family is also important for maintaining the normal function of certain cells after birth. To carry out these roles, the PAX genes provide instructions for making proteins that attach to specific areas of DNA. By attaching to critical DNA regions, these proteins help control the activity of particular genes (gene expression). On the basis of this action, PAX proteins are called transcription factors.

During embryonic development, the PAX8 protein is thought to activate genes involved in the formation of the kidney and the thyroid gland. The thyroid gland is a butterfly-shaped tissue in the lower neck. It releases hormones that play an important role in regulating growth, brain development, and the rate of chemical reactions in the body (metabolism). Following birth, the PAX8 protein regulates several genes involved in the production of thyroid hormones.

## 2. Health Conditions Related to Genetic Changes

### 2.1. Congenital hypothyroidism

At least 15 mutations in this gene cause congenital hypothyroidism, a condition characterized by abnormally low levels of thyroid hormones starting from birth. Other *PAX8* gene mutations only mildly reduce thyroid hormone levels or have no detectable effect. Sometimes, identical mutations in members of the same family have different effects.

Most mutations change one of the building blocks (amino acids) used to make the PAX8 protein. Other mutations disrupt protein production, resulting in an abnormally small version of the PAX8 protein. Nearly all *PAX8* gene mutations prevent the PAX8 protein from effectively binding to DNA. One mutation alters interactions between the PAX8 protein and other transcription factors. As a result, the PAX8 protein cannot perform its role in regulating the activity of certain genes.

The thyroid gland is unusually small in people with *PAX8* gene mutations. This finding suggests that *PAX8* gene mutations disrupt the normal growth or survival of thyroid cells during embryonic development. As a result, the thyroid gland is reduced in size and may be unable to produce the normal amount of thyroid hormones. Because cases caused by *PAX8* gene mutations are due to a problem with development of the thyroid gland, they are classified as thyroid dysgenesis.

### 2.2. Tumors

The *PAX8* gene is sometimes involved in the formation of thyroid tumors (neoplasms). In these cases, abnormal growth affects particular cells called follicular thyroid cells. Some of these growths, called follicular adenomas, are noncancerous (benign). Other tumors, known as follicular carcinomas, are cancerous (malignant). In some of these neoplasms, the *PAX8* gene on chromosome 2 is fused with the *PPARG* gene on chromosome 3. The fusion results when segments of the two chromosomes are rearranged (translocated). It remains unclear how the fused *PAX8-PPARG* gene affects the growth of follicular thyroid cells, or why some neoplasms become cancerous while others are benign. It is likely that the fused gene disrupts the normal control of cell division or triggers new cell activities that promote tumor formation.

## 3. Other Names for This Gene

- paired box gene 8
- PAX8_HUMAN

## References

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