CA12 Gene

Subjects: Genetics & Heredity
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carbonic anhydrase 12

Keywords: genes

1. Normal Function

The *CA12* gene provides instructions for making a protein called carbonic anhydrase 12 (CA 12), which belongs to a family of proteins known as carbonic anhydrases. These proteins carry out a chemical reaction that involves the molecules carbon dioxide and water and produces a negatively charged bicarbonate molecule (bicarbonate ion) and a positively charged hydrogen atom (known as a proton). Carbonic anhydrases can also carry out the reverse reaction, forming carbon dioxide and water from bicarbonate. Carbon dioxide, bicarbonate, and protons are involved in many functions in the body; by regulating the levels of these substances, carbonic anhydrases play roles in several important processes. The presence of protons and bicarbonate affect the relative acidity (pH) of cells; one function of some carbonic anhydrases is to help maintain the correct cellular pH.

CA 12 is found in several tissues, including the sweat glands, kidneys, and large intestine. The protein likely helps regulate the transport of salt (sodium chloride or NaCl) in these tissues. Researchers suggest that channels that move salt in and out of cells are controlled in part by the pH of the cells. By regulating cellular pH, CA 12 may be able to control salt transport. In sweat glands, CA 12 is thought to play a role in determining how much salt is released from the body in sweat.

2. Health Conditions Related to Genetic Changes

Isolated Hyperchlorhidrosis

At least one mutation in the *CA12* gene causes isolated hyperchlorhidrosis, a condition characterized by abnormally high levels of salt in sweat that can lead to dehydration associated with low levels of sodium in the blood (hyponatremic dehydration). The gene mutation that causes this condition changes a single protein building block (amino acid) in the CA 12 protein, replacing the amino acid glutamate at position 143 with the amino acid lysine (written as Glu143Lys or E143K). The function of the altered protein is reduced to about 70 percent of normal. In addition, the altered protein is more easily turned off (inhibited) than normal, which further reduces protein function. It is thought that the altered CA 12 is less able to regulate pH, and it loses its ability to control how much salt is released in sweat, leading to hyperchlorhidrosis.

Researchers suggest that other tissues are seemingly unaffected by *CA12* gene mutations because these tissues contain other carbonic anhydrases that compensate for the loss of CA 12 function.

3. Other Names for This Gene

- CA XII
- CA-XII
- carbonate dehydratase XII
- carbonic anhydrase XII
- carbonic dehydratase
- CAXII
- tumor antigen HOM-RCC-3.1.3

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