Reading: The Function of the Myostatin Protein

Functional Myostatin

Figure A

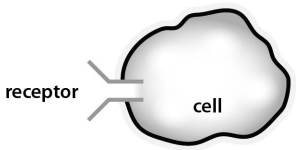
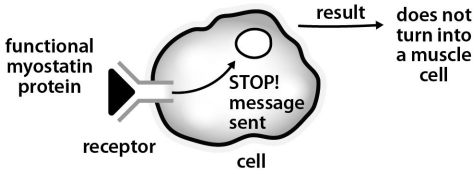


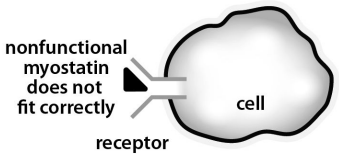
Figure B



Myostatin is a protein found in the skeletal muscles of many animals. The normal job of this protein is to stop cells from turning into muscle cells. So, the myostatin protein limits how many cells are made in muscle tissue so they don't get too big.[1]
The myostatin protein stops cells from turning into muscle cells like this: Cells have receptors on them. A receptor is a structure that sticks out of the outside of a cell membrane (see Figure A) and relays messages from outside the cell to inside the cell. The myostatin protein is shaped so that it fits into one specific kind of receptor like a key fits into a lock. When it does, it causes a message to be sent to the inside of the cell. The message tells the cell to stay the way it is. As a result, that cell does not turn into a muscle cell (see Figure B).[2] So the myostatin protein is specifically shaped to do this job of fitting into the receptor and sending a message, unlike the muscle proteins myosin and actin, which have structures that help them build and move muscles.

Nonfunctional Myostatin

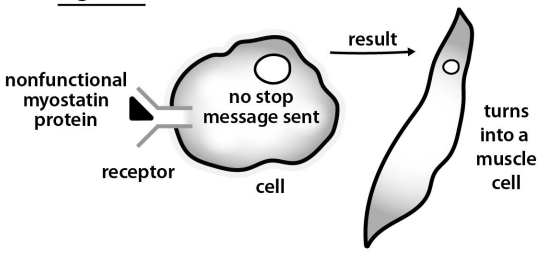
Figure C



Sometimes a myostatin protein is not the right shape. When this is the case, it cannot fit correctly into a cell's receptor. It might fit partially in, like how a wrong key might fit into a lock, but it cannot unlock the door (see Figure C). Since it doesn't fit correctly, the "stop" message does not get sent to the nucleus of that cell. When this happens, that cell ***does*** become a muscle cell (see Figure D). If the myostatin protein isn't working to stop them from doing this, more and more cells turn into muscle cells, and the muscle tissue continues to grow.[3]

History of Myostatin

Figure D



Heavily muscled cattle were first discovered in Belgium in the late 1800s.[4] Farmers had not seen this phenotype in cattle before then. By the 1970s, farmers in other countries, including the United States, were very interested in these heavily muscled cattle because of how much beef they produce.[5] In 1997, scientists were able to change the genetic information of mice to produce the same heavily muscled phenotype, and they discovered that myostatin is the protein responsible for these muscle differences.[6] At the time, they called the protein GDF-8, but it was renamed myostatin after its function was determined. The gene related to it is known as the MSTN gene. In addition to cattle, this change in the MSTN gene and the heavily muscled phenotype have also been found naturally occurring in dogs, sheep, and even humans.[7] In addition to mice, scientists have been able to change the genetic information of pigs[8], rabbits[9], fish[10], and goats[11] so they produce nonfunctional myostatin and have extra-big muscles too.

References:

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