

# Hadron Encyclopedia Article

## Hadron

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# Hadron

Hadrons are **subatomic particles** that are affected by the strong **force**, the force that binds the **nucleus** together. Two hadrons--the **proton** and the neutron--are found in the atomic nucleus. All others are created by high-energy collisions, from **cosmic rays** and particle **accelerators**. Hadrons are combinations of basic particles, **quarks** and gluons, held together by the strong force. Quarks contribute **mass** and determine the hadrons properties, including electronic charge and spin. Gluons carry the strong force and hold the quarks together. All known subatomic particles except bosons (such as photons) and leptons (such as electrons and neutrinos) are hadrons. They are divided into two categories: baryons, made of three quarks, and mesons, made of a quark and an anti-quark.

All mesons and all the baryons, except the proton, are unstable and decay into other particles. Most of them exist for less than a millionth of a second, and some can survive only for the amount of time that it takes for a **light** wave to pass from one side to the other. Their existence is known by observation of the products and process of particle decay. Although a free **neutron** will decay in an average of about 15 minutes, neutrons bound within an atomic nucleus are stable. Some theories indicate that the proton may have some instability, but its **half-life** is very much longer than the age of the **universe**.

Particle physicists have discovered a large number of hadrons. The *Review of Particle Physics*, published every other year, contains more than 300 pages, listing particle types and their observed decay processes.