

My Ground Beef is Brown... Is It Safe?



Ben Bohrer, Ph.D

Ph.D., Department of Animal Science, Ohio State University

Why does ground beef turn brown?

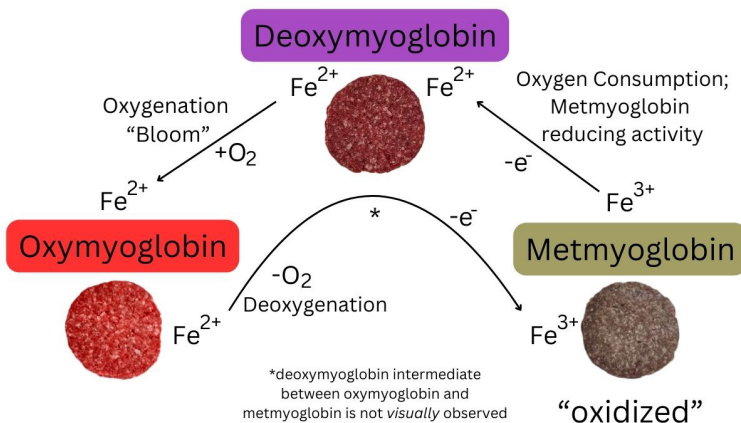
Myoglobin is a protein in meat that gives it its color. The reason ground beef turns brown has to do with how myoglobin reacts to oxygen. When meat is exposed to air, a chemical reaction called oxidation occurs. This happens as the oxygen interacts with the meat, gradually changing its color to brown.

Myoglobin chemistry

Ground beef is red on the surface because of exposure to oxygen, which reacts with the meat protein myoglobin to create oxymyoglobin (bright red pigmentation). In areas where oxygen is limited like in a vacuum-sealed bag or even within the surface of a whole-muscle product like a steak or roast, myoglobin is in the deoxymyoglobin form (purplish-red pigmentation). Over time and with exposure to oxygen, myoglobin becomes oxidized and the resulting form of myoglobin is called metmyoglobin (brown pigmentation).

Initially, muscle has the ability to transfer electrons back to myoglobin, so the oxymyoglobin form can be stable for a period of time (generally in the range of 5-10 days). In addition, oxymyoglobin and deoxymyoglobin can undergo interconversions with exposure to / removal from oxygen. However the ability to donate electrons eventually runs out, resulting in the inevitable fate of the oxidized form of myoglobin that is metmyoglobin.

Fresh Meat Color Chemistry Triangle



Interconversions of myoglobin in fresh meat.

Adapted from Drs. M. C. Hunt, Kansas State University, and D. P. Cornforth, Utah State University.



Oxymyoglobin, bright red

Deoxymyoglobin, purplish-red

Metmyoglobin, gray-brown

Is it safe to consume brown ground beef?

The most appropriate answer for this question is that it depends...

First and foremost, has the meat been stored properly and is it within an acceptable amount of time from the sell-by date (i.e., constantly under refrigeration if before the sell-by date, or frozen if beyond the sell-by date)?

Secondly, does the meat smell bad, have a slimy texture, or have visible mold? If any of these exist, then discard the meat and clean any utensils or surfaces that the meat touched.