

Locomotive Tries Milk Fuel

DEMONSTRATING its energy value, two tons of dried milk in the form of briquets was used in place of coal to fuel the locomotive of the Dixie Limited at the start of its run from Chicago Depot to Florida. The substitute fuel is said to have burned readily, providing as much heat as coal.



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Dried milk briquettes may be used as fuel in lieu of coal or wood in the firebox of a steam locomotive.



The 'physical rules' for making fire require fuel and oxygen.

The basic formula of combustion is:



Food Combusts in a Firebox the 'same way' Gaseous Fuels Do

COW BURPS (Methane)	$CH_4 + O_2 \rightarrow CO_2 + H_2O + HEAT$
GAS GRILL FUEL (Propane)	$C_3H_8 + O_2 \rightarrow CO_2 + H_2O + HEAT$
LIGHTER FLUID (Butane)	$C_4H_{10} + O_2 \rightarrow CO_2 + H_2O + HEAT$
GLUCOSE	$C_6H_{12}O_6 + O_2 \rightarrow CO_2 + H_2O + HEAT$
FAT	$C_{16}H_{32}O_2 + O_2 \rightarrow CO_2 + H_2O + HEAT$
PROTEIN	$CH_3CH(NH_2)COOH + O_2 \rightarrow CO_2 + H_2O + HEAT$

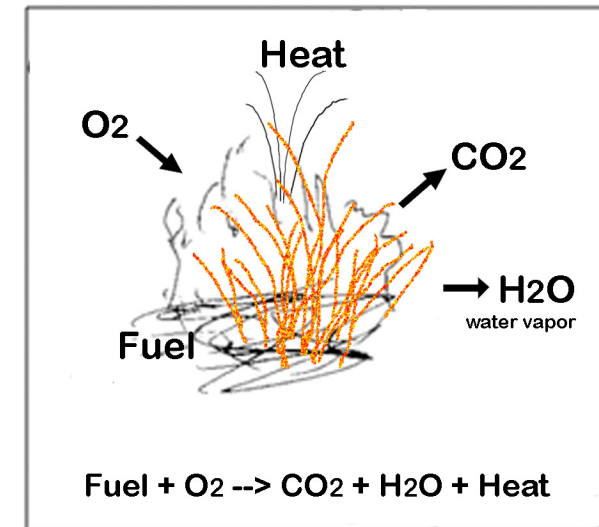
The 'same way' means in all cases above, food and gaseous fuels combine with oxygen and produce the same three products: **CO₂, H₂O, and Heat.**

Hydrocarbons (gaseous or fossil fuels) consist of combinations of Hydrogen and Carbon, hence the name combination, hydro + carbon.

Any type of food, such as milk briquettes burn in lieu of coal or wood in a steam locomotive because it too is essentially a hydrocarbon fuel; it burns in a 'firebox' the same way gaseous fuels do, i.e. according to the 'chemistry of combustion'.



Note: The equations are unbalanced.



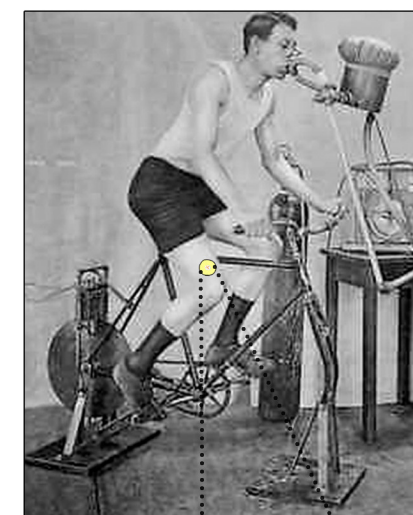
A bonfire exemplifies external combustion or an 'open system' because the fire is open to air.

Oxygen and the fuel are called **reactants** of combustion because they combine or 'react' together .

When food reacts with O₂ in your body (either fat or carbohydrate) we refer to food as **fuel substrate**.

Metabolism is the process of food or fuel transforming into Carbon Dioxide (CO₂), Water (H₂O), and Heat.

Similarly, we breathe in oxygen and our blood stream delivers oxygen to **muscle cells** where combustion of 'food stuffs' takes place.



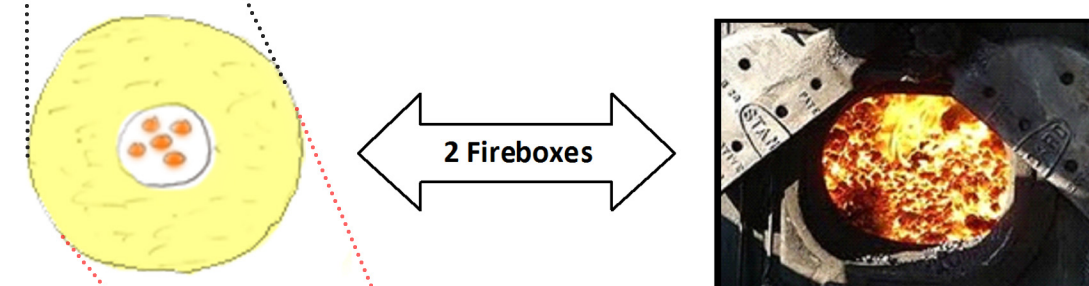
In terms of the chemistry of combustion, there is no conceptual difference between burning fuel in a firebox or burning food in the cells of your body.

Metabolizing food is essentially identical to combustion of any fossil fuel. The basic reaction is: Fuel + O₂ --> CO₂ + H₂O + Heat

A human cell is where combustion or this transformation of matter takes place. We exhale CO₂ because our cells produce it.

The 'exhaust gas' of metabolism - CO₂ - collected from the mouth of the man pictured left, is a metabolic waste product made from 'combustion' of food stuffs, aka fuel substrate...primarily fat and carbohydrate.

A cell is a glorified firebox... 'closed' or sealed off from air.



Internal combustion occurs inside of a sealed vessel such as a human cell or chamber such as the cylinder of an internal combustion engine, pictured below. Your body 'combusts' food internally; your cells are not exposed directly to air, so it too is a **closed system**.

