product information

The Role of Glutathione in Energy Production

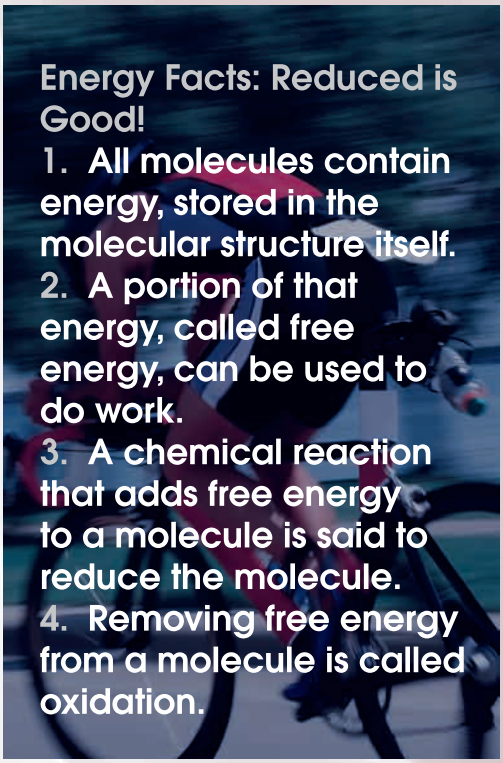
You've been told that glutathione increases energy on a cellular level. How does it do this? Since glutathione is not the actual fuel for the "engines" or "energy factories" of our cells, what part does it play in the creation of cellular energy?

These are questions we would all like answers to, but not if they make us feel like we're back in Chemistry 101! Hopefully, what you read below will provide a non-technical explanation for these questions.

The Tiger in Your Tank Is Called ATP

It's obvious that all cells must produce energy to survive. We know that the "gasoline" or "electricity" that powers our cells is called ATP (adenosine triphosphate). If your car runs out of gas, it can sit for a while until you replenish the supply. Not so with our cellular fuel. Our cells simply cannot survive unless they have a continual, sufficient supply of "cellular gasoline" or ATP. So the process of creating fuel in each and every cell must go on constantly.

A single cell may have a couple of hundred energy factories or cellular power plants called mitochondria or it may contain thousands of them. Your hard-working heart cells have been estimated to have 5,000 mitochondria each[1]!



Energy Facts: Reduced is Good!

1. All molecules contain energy, stored in the molecular structure itself.
2. A portion of that energy, called free energy, can be used to do work.
3. A chemical reaction that adds free energy to a molecule is said to reduce the molecule.
4. Removing free energy from a molecule is called oxidation.

The complex process of turning nutrients into ATP in the mitochondria depends on many oxidation and reduction reactions.

Redox is the shorthand term for the chemical reaction where atoms are changed by either losing elections (oxidation) or gaining electrons (reduction).

The Process

Understanding the exact process of ATP creation didn't happen until 1937. Hans A. Krebs finally figured out a metabolic pathway in the cells that explained how energy is created. There were many scientists who played a key role in understanding how this pathway worked, but because Krebs had the insight that the pathway was a cycle, the process was named for him and is usually called the Krebs cycle.

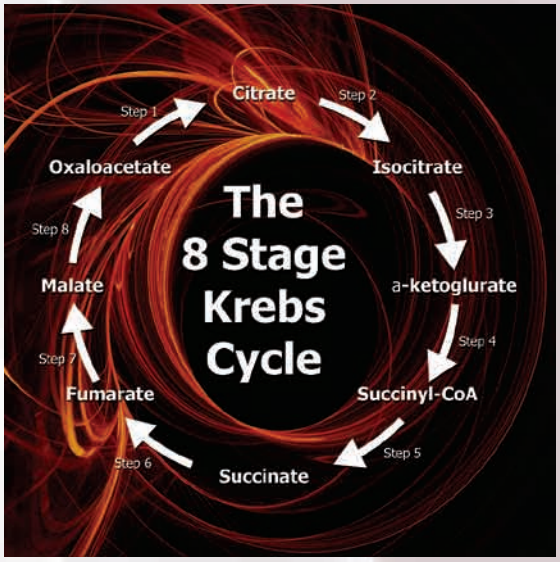
You will also read of it as the "citric acid cycle" or the tricarboxylic acid cycle (TCA) or occasionally, the Szent-Györgyi-Krebs cycle (adding the name of the scientist who mapped out many of the molecules and the sequence of reactions of the Krebs cycle).

We are including a diagram of the eight major steps in the energy cycle. Since we are not doing Chemistry 101, describing this process

could be as simple as saying it's a metabolic dance of electrons being transported and transferred, through complex processes of reduction and oxidation. Remember that transferring (or grabbing!) electrons is also what starts the cycle of free radical damage.

The Role of Glutathione

Oxidation is like a flame, wonderful when harnessed, dangerous when out of control. When we are young, the oxidation necessary for energy production is highly efficient with only a small amount of oxygen not utilized. Even this minor oxygen loss (1-3%) unfortunately results in the production of free radicals. And this is where glutathione comes in to neutralize those free radicals.



A one-to-three percent oxygen loss causing free-radical production doesn't sound too bad, does it? But say you are no longer 20 years of age and correspondingly, your cellular mitochondria are not as efficient as they once were. More and more free radicals are generated in the oxidative energy process and they are, in turn, damaging the mitochondria themselves.

The powerful antioxidant, glutathione, quenches a number of free radicals, including the highly dangerous hydroxyl radical by donating an electron. Glutathione itself does not become a free radical even though it has given up an electron.

No wonder it is called the Master Antioxidant! Now that it is quenched, the extremely harmful hydroxyl radical is halted from its real dirty work: generating other free radicals like peroxynitrite and the radicals of oxidized fats (lipids).

Glutathione has just halted a literal cascade of free radicals by quenching the hydroxyl free radical. But you need to know just what a favor glutathione has done for you in preventing peroxynitrite production.

Peroxynitrite is truly pernicious!

Martin L. Pall, PhD, professor of Biochemistry and Basic Medical Science at Washington State University stated: "Peroxynitrite reacts with and inactivates several of the enzymes in mitochondria so that mitochondrial and energy metabolism dysfunction is one of the most important consequences of elevated peroxynitrite."[2]

Translation: When the mitochondria have suffered enough free radical damage as to become dysfunctional, energy production is impaired. Your cells do not get the amount of energy they need to function properly. Your cells may function at a level below the optimum although you probably won't feel it.

There is yet one more free-radical mitochondrial consequence as a result of low glutathione levels that you "will" be aware of. Richard Van Konynenburg, PhD, wrote: "The resulting partial blockades in the Krebs cycles and the respiratory chains in the red, slow-twitch skeletal muscle cells decrease their rate of production of ATP. Since ATP is what powers muscle contractions, the lack of it produces

physical fatigue. It becomes chronic because GSH [glutathione] remains depleted."[3]

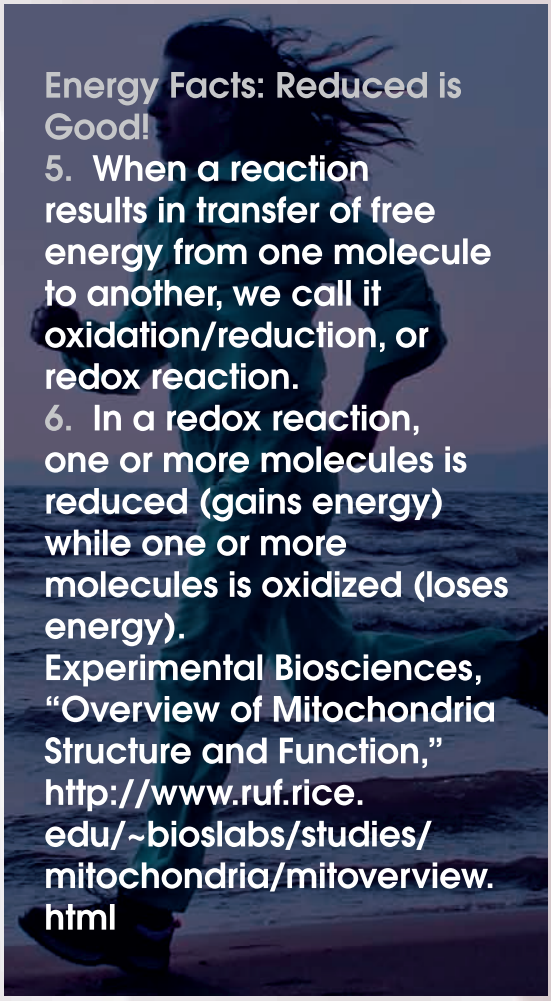
You might think of free radicals as a band of marauders circling an oil tanker, preparing to hijack the precious commodity that fuels cars and trains and pretty much the entire Western world. Glutathione molecules could be considered a group of highly efficient bodyguards—handing out electrons and turning vicious marauders into mild-mannered bystanders.

Glutathione Praise from Dr. Keller

As you understand this intricate energy creation process, perhaps you will appreciate more a statement by the creator of MaxGXL, Dr. Robert H. Keller. Dr. Keller said that glutathione is "critical to cell functions such as the TCA (Kreb) cycle and then the respiratory chain that uses 4 molecules of ATP to generate 32 molecules of ATP."

Is it vital for you to have those glutathione bodyguards on energy duty? Van Konynenburg certainly thinks so as he wrote, "GSH [glutathione] plays very important roles in maintaining mitochondrial function and integrity."[4]

Perhaps it's enough to remember that glutathione is there to assure that the creation of cellular energy is not hampered by free radical damage. While this is not by any means the only role glutathione plays in keeping your body running smoothly, it is a vitally important role. Now you have one more reason to appreciate Dr. Keller's marvelous, patented product!



Notes

1. Stephen T. Sinatra, MD, FACC, "L-Carnitine and the Heart," McGraw-Hill, 1999, p. 36

2. Pall M, "Elevated, sustained peroxynitrite levels as the cause of chronic fatigue syndrome," Medical Hypotheses (2000) 54(1):115-125.

3. Glutathione White Paper, Richard Van Konynenburg, PhD, http://phoenix-cfs.org/GluAACFS04.htm

4. Ibid.