

## **ATP and Cellular Ageing**

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Every winter around Christmas time, the city of Seattle sets up a quaint little ice skating rink in our city center, and each year my wife and I venture through the crowds with the kids in tow, for a festive night on the ice. As we weave in and out of mass chaos with skaters littering the chilly floor, I am always amazed that there are not more serious accidents, especially with all of the sharp blades of the ice skates.

This year as I was finishing up this intriguing thought of amazement, out of the corner of my eye I happened to capture a grandfather frantically flailing every limb in a different direction, desperately attempting to keep his balance. It was apparent he was going down like a wounded helicopter, and most of the by standers scattered appropriately except for a little one who was oblivious to the entire situation. As the entire rink watched in terror, the child's mother seemed to appear out of thin air and scooped her baby up like Elastogirl! It was the most amazing event that I had ever seen and truly a possible near death experience avoided for the little one.

### ***Adenosine Tri Phosphate***

Although there are many factors of survival instincts and motherhood that come in to play in a situation like this, regardless of whether an action or movement is voluntary or involuntary, it requires muscle strength and energy to power the muscles in a split second. This energy is known as Adenosine Tri Phosphate (ATP).

### ***Current of Life***

ATP is referred to as the “current of life” or “molecular currency” as it is literally the energy transfer or power source that makes life itself possible in every living organism. This includes all cellular activity, DNA replication, regeneration and healing, collagen and elastin synthesis, neuro transmission, and of course, muscle contraction. As the skin is the largest organ of the body, and is living, it to requires massive amounts of ATP to thrive, regenerate and renew itself.

ATP is a multifunctional nucleotide that is essentially a storage facility or liaison for energy derived from intake sources including carbohydrates,

protein and fat, to be used for cellular functions of life. In other words, carbohydrates, proteins and fat, are not directly usable by cells; where as ATP is. With out ATP, the cells of the body and therefore the body itself, would simply not function. Although we think of sustenance as food and liquids, these energy sources are useless without the appropriate liaison to allow the energy to be utilized, and utilized effectively. The term molecular currency is used to describe ATP as it is the only energy molecule that the body will accept and utilize as energy.

### ***ATP and Aging***

Although many factors are associated with the aging process, ATP or the lack thereof, is at the top of the pyramid as defined when discovered by Karl Lohman in 1929 and supported by Fritz Lipman in 1941 citing ATP as the primary energy transfer molecule of the human body. This supports the fact that without power and an ample supply thereof, the system of the human body will not function effectively and eventually deteriorate. Having said this, preventative aging and improved health begins with creating environments that support and maximize the synthesis of ATP. This includes the foods and supplements that we eat, the technology that we apply to our skin and body, and the topical products that we apply to our skin.

Since the body cannot survive without ATP, you would think that it would build up and store an ample supply so that the body could function at optimum levels, all the time. However the body does not “store” ATP, rather it manufactures it on an “as needed” bases via ATP Synthesis (ATP Synthase). To a certain degree, you can think of this a bit like our process of obtaining and storing food and liquids. Although we need to food and liquids to survive, we are not packing around 100 pound bags of food and liquids in preparation for our long term needs, as our body can only utilize so much at a time.

### ***ATP Synthesis***

Studies indicate that a healthy human body will use what is equivalent to their body weight in ATP every day. And by the time that they have reached the age of 60, this production will have deteriorated by nearly half. This fact certainly drives home the saying that when we age we simply run out of energy; it is a fact!

### ***Adrenaline or Phosphocreatine?***

There are three distinct chemical reactions or methods that facilitate the manufacture or synthesis of ATP. The first and most rapid way to synthesize ATP is via phosphocreatine also known as creatine phosphate.

Phosphocreatine is found in ample supply in the skeletal muscle cells and can be rapidly converted to ATP to energize the muscles for very short bursts of activity, generally lasting no more than 10 seconds. Although the mother described as Elastogirl may have been operating on a complete adrenaline rush, it was phosphocreatine converted to ATP that energized her muscles allowing her to make those amazing rapid movements. Unlike ATP that cannot be stored in large quantities, phosphocreatine can, which is why creatine supplementation is very popular and common with weight lifters and other athletes who require quick, short bursts of energy often; which includes every mother!

### ***Glycolysis***

The second way that the body synthesizes ATP is via glycolysis which is also referred to as your anaerobic form of ATP synthesis, as no oxygen is required to realize this process. The glycolysis method of synthesizing ATP works by utilizing the energy stored in the glucose molecule in the muscles. Unlike the phosphocreatine method of synthesizing ATP, the glycolysis method takes a bit longer to kick into gear and therefore could be thought of as taking over where the phosphocreatine method of energy production leaves off. If we refer to the scenario with our ice skater, after this super mom was able to move her child from harms way, she then quickly assisted the grandfather up after taking a hard fall. During this part of the process she was now using her glycolysis originated form of ATP energy. Glycolysis is the dominant form of energy used for strenuous activities that last more than ten seconds and less than two minutes.

### ***ATP and the Mitochondria***

The long term and most consistent form of energy or ATP synthesis is generated in the mitochondria of the cell and is sometimes referred to as the aerobic pathway, as it requires oxygen for the synthesis process to be complete. The more aerobic exercise that one performs has an impact and effect on how rapidly the body and especially the muscles can use oxygen, and therefore synthesize ATP. We often hear the comment that frequent

exercise gives a person more energy; this is completely true! Individuals in excellent aerobic shape maintain the best environment for ATP synthesis and as a result generally look and feel fantastic, as well as maintain a near bullet proof immune system.

So now that we know a little bit about ATP and the current of life, how does this affect our skin, and what can we do to enhance our ATP production to assist our health, well being, and our appearance?

### ***Device Energy and ATP***

From a technology standpoint, there are a few types of devices applicable to the skin therapist that can help enhance the synthesis of ATP. LED technology has been proven to enhance ATP synthesis as well as other cellular activity. As ATP is responsible to power all functions of life, it would be fair to assume that the increases in collagen, elastin, as well as many of the healing benefits that LED is best known for, are made possible due to the enhancement of ATP energy that facilitate these functions.

### ***Microcurrent and ATP***

Microcurrent, when used at levels less than 400 Ua (microamperes) has been proven to stimulate ATP production by as much as 500%. This stimulation in ATP synthesis is more significant than anything else known to date, making low levels of specific sequencing microcurrent the single most powerful tool to maximize ATP energy potential.

Studies indicate that microcurrent applications, as with LED, have significant side benefits of ATP synthesis that include increases in collagen (more than 12% in 30 days) elastin (more than 40% in 30 days) and blood circulation (more than 30% in 30 days). And the healing benefits of microcurrent are simply unmatched; ranging from soft tissue injuries, bone regeneration, to skin rejuvenation.

### ***Microcurrent and Facial Sculpting***

Microcurrent is also known for its ability to sculpt and or re-educate muscles of the face and body. From what we know about its ability to massively increase ATP synthesis, this makes complete sense as the muscles

themselves are completely dependent on ATP to shorten the actin and myosin filament cross bridges, required for muscle contraction.

### ***Usable External Energy Sources***

External energy sources, specifically lower levels of sequencing microcurrent can be used by the mitochondria in lieu of other natural energy sources to maximize ATP synthesis, giving the entire process a kind of turbo boost or turbo lift capability. A series of microcurrent applications help create an ATP heavy environment enhancing all cellular activities of life, in this case specifically benefiting the contour, texture, health, and visual appearance of the skin and muscles of the face and body.

### ***ATP and Oxygen***

The relationship between ATP and oxygen lends efficacy to combining oxygen infusion services with LED and specifically microcurrent, as oxygen is a necessary component for the primary synthesis of ATP. It would also answer many of the questions regarding the benefits of oxygen, even as a stand alone service, as oxygen simply creates a prime environment for maximum ATP synthesis, and therefore, beneficial cellular activity.

### ***What about topical ways to create the ultimate ATP Environment?***

Some of the most forward thinking ingredients on the market to day for the skin therapists have ATP and mitochondrion activity at the forefront of their formulations.

One of the hottest new ingredients is Unichondrin ATP, which is adenosine triphosphate itself! When formulated in a cosmetic, it acts as a biocatalyst that stimulates metabolism, fibroblasts in the extra cellular matrix of the connective tissue, and greatly assists with moisture retention comparable to that of hyaluonic acid. Efficacy studies performed with this ingredient confirmed a 42% increase in moisture of the skin after four weeks of use, and more than a 44% reduction of wrinkles and wrinkle intensity.

Ergothioneine - an amino acid found in mushrooms and wheat germ - is another hot ingredient for cosmetic products today because it plays four major roles in the skin.

1) **Ergothioneine ensures higher levels of cellular energy.** Energy is produced within cells by mitochondria - microscopic bodies responsible for producing over 90 percent of the body's energy production. Fatty acids and oxygen are paired within mitochondria to produce the fuel molecule ATP (adenosine triphosphate). By speeding the delivery of fatty acids into mitochondria, ergothioneine ramps up ATP production, making the fuel molecule more available to all parts of the cell. When energy levels go up, cells increase their production of lipids in the epidermis, resulting in softer skin that's more resistant to irritation. At the same time, youthful collagen, elastin and other dermal tissue also become more plentiful, visibly reducing lines, wrinkles and pore size while adding to skin's underlying firmness. These results can begin to be seen in as little as 24 hours of applying ergothioneine to the skin's surface.

2) **Ergothioneine is a unique antioxidant that protects mitochondria from free radicals.** Researchers studying the biochemistry of aging now believe the process begins within mitochondria when these cellular bodies process oxygen into ATP. Ergothioneine protects the structures within mitochondria from attack by oxygen radicals that are created when ATP is produced. So important is the interaction of mitochondria and ergothioneine to sustaining life, mitochondria have developed special ducts in their protective walls dedicated to receiving only ergothioneine. In various laboratory tests comparing ergothioneine to popular antioxidants, ergothioneine consistently performs better than members of the vitamin C family, CoEnzyme Q10, ubiquinol and green and white teas - not just within mitochondria, but throughout the skin.

3) **Ergothioneine inhibits the aging effects of glycation.** A natural process whereby sugars bind with collagen and other proteins, glycation causes collagen fibers to stiffen, leading to a loss of skin firmness and increased wrinkling. Ergothioneine is an effective glycation inhibitor, partially due to its extensive antioxidant activity.

4) Ergothioneine brightens and clarifies skin's color. As a powerful copper chelator and scavenger of hydroxyl radicals - free radicals that have been linked to inflammation and post inflammatory hyperpigmentation - ergothioneine noticeably inhibits the formation of melanin.

Another mitochondria-specific ingredient, trade named Mitostime (*Laminaria digitata*), is referred to as the fountain of youth as it increases mitochondrial activity by increasing the capacity for oxygen uptake by as much as 17 percent, providing the perfect environment for ATP synthesis. It also helps to rejuvenate aging cells by restoring protein synthesis activity by as much as 37%. The results of this ingredient were performed over a four week span of time.

An ingredient trade named Vitacell has been touted as the cell revitalizing factor as it regenerates epidermal energy; ATP. As the skin is a living tissue made of highly developed eukaryotic type cells containing many mitochondria, it requires maximum ATP production to remain vibrant, healthy and youthful. Studies performed with Vitacell established a 57.7% increase in respiration/oxygen consumption allowing for healthier more resilient skin and a clear stimulation of ATP synthesis. Additionally, Vitacell was proven to enhance cellular metabolism and cellular function.

### ***ATP: Current of Life***

ATP is a subject that you will never stop hearing about; it is healthy, it is youth, it is life. Whether you are 17 or 70, we all need it to survive, maintain optimum health, maintain the youngest looking skin and body possible, and of course performing super mom duties on ice! Although there are many other supplements, technology, topicals and foods, focused on health, wellness, and youth, keep your eye on the epicenter of life, ATP. Without the current of life, all else is a moot point!