

# **Light of Life**

By David Suzuki

Light itself represents life, as most everything in our living world requires some form of light energy, directly or indirectly, to sustain life. It is what wakes us up in the morning, allows our food to grow, and energizes our day. When the light is gone, our body instantly reacts, decompresses, and prepares itself for rest. This internal 24 hour cycle of biochemical, physiological, and behavioral process is referred to as the circadian rhythm, which exists in all living forms of life from bacteria, animals, to humans.

## **Light and Humans**

Besides the dominant lead that natural sunlight takes on our circadian rhythm, it also has a significant effect on our well being via its ability to massively synthesize our own supply of vitamin D. Where most other vitamins must be obtained from food, vitamin D can be synthesized in the skin through a form of photosynthesis. For most individuals with light to white skin, 30 minutes in the summer sun can synthesize as much as 50,000 IU (1.25 mg) of vitamin D within 24 hours of exposure. Amongst other benefits, adequate levels of vitamin D are necessary to form strong bones in growing children and to maintain good bone health for adults. This may be another reason that retiree's have a tendency to gravitate toward warmer environments.

## **Light Effects**

Light also allows us to see. The "visible spectrum of light" ranges from 380nm to 770nm, and essentially defines what we interpret as sight. Each color is actually a different wave length. Red, for example, is in the 640nm to 700nm range, while blue is on the other end of spectrum in the 400nm to 470nm range. Our psychological reaction to color, whether it be from a light source or a color of paint, is a proven science. Exposure to blue light suggests to our circadian rhythm that we are at the peak of our day and should have maximum energy. Waking up to natural sunlight, is evidence of the body's reaction to blue light. Conversely, the absence of blue light suggests to our body that it is time to slow down and rest, and therefore increases the secretion of melatonin – our natural sleeping hormone. Interestingly, it has been proven that the circadian rhythm or the human reaction to light is consistent regardless of whether it is natural light, or man made. With this in mind, it is no wonder that blue light "feel good" lamps are a big hit in geographical areas that are sun deprived, and why lighting generally has significant effect on the comfort or lack thereof, of an environment.

## **LED Light**

In the late 80's the NASA Marshall Space Flight Center embarked on a series of light studies that continued through the last decade. The focus was the use of LED (light emitting diodes) to create a photosynthesis reaction in plants in space, with this quickly evolving to studies involving human reaction to different variations of nanometers (colors of light).

LED lights were first discovered in 1927 by a Russian man named Oleg Vladimirovich Losev, however, did not really come into common, feasible commercial use until the early 70's. By this time, they were extremely cheap to manufacture, required a minimal power source, could be made to be extremely bright, and had an incredible life span. As a result of these qualities, LED lights are used today in just about every industry that requires light, from a simple indicator light to brightest headlights on the most sophisticated vehicles on the road.

Over the years LED lights have evolved to a science in itself with the use of many different combinations of inorganic semiconductor materials that allow for an ever growing range of precise nanometers (colors). LED are unique in this way in that they can reproduce the natural nanometer precisely, and individually. This proved to be very useful in many industries, including the medical and esthetic industry. For the first time, specific, controlled, clean, exact nanometers could be tested in different ways to observe specific reactions, which has lead to the evolution of LED light therapy.

## **LED and Cellular Energy**

There is no shortage of studies regarding the effectiveness of LED for a wide variety of applications ranging from wound healing, deep muscle regeneration, acne, fine lines and wrinkles, etc. Although there are many different variations of mechanisms of action cited, most agree that in short certain nanometers of LED delivered in specific pulse structures and power density levels have the ability to increase the body's natural form of cellular energy known as ATP (adenosine tri phosphate). Very similar to microcurrent, the right combination of LED can be used as an outside source of energy, creating a proton gradient across the mitochondria, allowing for a significant upregulation of ATP. With more cellular energy, the body has the ability to function better, faster, and more effectively which in turn results in faster healing time, faster recovery from surgical procedures, and healthier, younger looking skin.

What is specific about LED technology and results are the parameters in which it is used in each study. Generally, there are four components of LED.

1. Wavelength or nanometer = color
2. Pulse structure or Hz = flickering
3. Power density or energy = brightness of LED and the number of LED's
4. Time exposure

## Wave Length

Wavelength, nanometer, and color are essentially one in the same. We measure a wavelength in nanometers, and each color within the visible spectrum of light is in reality a unique wavelength. Although there is a broad spectrum of colors within the visible spectrum of light, Red, Yellow, and Blue have been studied the most extensively. This is not to say that the other colors are not effective, only that we have a limited amount of knowledge about them.

Red light, at 640nm – 700nm, most consistently shows efficacy with wound healing, deep tissue healing, reduction of fine lines and wrinkles, and the improvement of skin texture. For us as the skin therapist, red light is likely the number one candidate for our objective of improving the appearance of the skin and is also thought to have the most profound impact on ATP production.

Yellow light at 590nm, has less studies than those performed with RED light, however, the few studies that exist are impressive and give great credibility to the yellow or amber light. With this being said, should you have a device with the capabilities, it would be strategic to expose the skin to both yellow and red light within one service.

Green light at 570nm is absent of studies at this time, however, anecdotally green light has been known to help stimulate circulatory benefits, specifically lymphatic. Green light has also been said to decrease the level of melanocyte excitement lending it to a possible tool to use with hyper pigmented skin.

Blue light at 425nm to 470nm most consistently shows efficacy with regards to acneic skin, however, its efficacy has nothing to do with ATP. Blue light has an effect on the bacteria that is root cause of acne; *P. acnes*. *P. acnes* produce tiny molecules known as porphyrins. When porphyrins are exposed to blue light, they produce free radicals that in turn kill the bacteria *P. acnes*, thus stopping the cycle at its base. Many studies have included Red light with blue light. Although red light has no proven efficacy to affect the *P. acnes* bacteria, it has certainly been proven to speed up the healing process, improve the texture of the skin and decrease redness and inflammation. With that in mind, Blue and Red light make a great combination for an acne service.

Very similar to how different levels of microcurrent electricity can travel to different depths of human tissue, LED also maintains this property. The higher the nanometer, the deeper the wavelength travels. Red travels the deepest, while blue is the most topical, which completely coincides with their efficacy and effectiveness.

## **Pulse Structure**

Pulse structure, frequency, or hz are one in the same. They represent the “flickering” of the light. What may appear to be a solid light, is actually not solid at all. Rather it is a light functioning at a very high (quick) frequency that gives the human eye the perception that the light is solid. With an LED device, 80hz to 100hz, will give you this effect. What may appear almost like a “strobe” light, flickering at an almost unbearable rate is likely set at 10hz-15hz.

Pulse structure has been proven to be a significantly important factor in regards to gaining results with LED, or the lack thereof. Pulse structure is the most proprietary factor with most manufacturers, and therefore you will notice that pulse structure is usually not well documented in clinical studies. The studies that have documented pulse structures suggest that between 5hz and 20hz are the most effective. The key is to invest in a device that has frequency options available so that you can utilize different methods of application depending on the objectives at hand, and the most recent clinical evidence.

## **Power Density, Energy and Exposure Time**

Power density and energy can be thought of like the different wattages of a light bulb. A 100-watt light bulb is very bright, where as a 40 watt light bulb is much softer. Inherently the 100-watt light bulb emits significantly more energy and as a result creates a much brighter and broader illumination. Both lights will cause a reaction to the human eye. The 100 watt light bulb will likely cause you to immediately look away from the light, where as the 40 watt light bulb is quite a bit more tolerable and would require you to be closer to the light, and look at the light significantly longer before you found the need to look away.

With regards to LED light, it has been proven that there is an optimal dose of light, or tipping point, that allows for specific cellular reactions to take place. The confusing part of LED clinical studies is that the time exposure of applications seems to vary significantly. Although there are many reasons for the different time variations, the most prominent reason is relative to the level of power or energy that the LED device used in the study is capable of. Power density, or energy, is calculated in milliwatts per square centimeter (mW/cm<sup>2</sup>). This calculation considers the brightness or max output of each individual LED light and the number of lights per square centimeter.

Keeping the light bulb analogy above in mind, even a weak LED light would appear to be LED, however, is it really effective? To put this in perspective, lets think about natural sun light and vitamin D synthesis again for a moment. One minute of summer sun exposure is not enough to gain a significant impact on your vitamin D synthesis, where as 30 minutes of exposure in this same environment can synthesize as much as 50,000 IU's of vitamin D.

There are a plethora of studies regarding LED. Some document the energy levels used, while other simply document the nanometer and time. If you look at the global consensus, it would suggest that most results can be achieved with 300mW/cm<sup>2</sup> for 7-10 minutes using a “panel” type LED device placed no further than 2 inches away from the skins surface. Remember that as the panel is moved further away from the skins surface, the energy level of the LED lights become more diluted. Most studies indicate that two services per week will maximize the results of LED and that more than three will not have a greater effect.

### **Panel or Hand Held**

Panel style LED devices are the most consistent and efficient way to apply LED to the skin. Once the device is set and the technology is in motion, you are now free to perform additional services to your client such as a shoulder and arm massage, hand services, etc.

Handheld probes emitting LED may be effective for “spot” applications if you have the time, however, attempting to work them around the entire face and neck would be cumbersome and time consuming to say the least. You must also question whether you can ensure consistent exposure to every area using the hand held method. The idea of LED technology being effective as a “guiding” light on the end of another technology hand piece such as microdermabrasion, is not realistic at all. One single light or a small group of lights, glancing over the skin momentarily will not create a cellular reaction significant enough to gain any type of result.

Although the natural elements of life seem quite simple, it is their intense organic smooth orchestration that allows this perception. In reality, they are the most complex. Because light itself is a necessary requirement for life, it is not surprising that we have come to realize the potential of specific wavelengths and frequencies that we can reproduce to “turn on” specific reactions in the human body. More exciting is that we have only scratched the surface of the potential of light energy at this point. It is imperative for us as skin therapists to work with LED panel style devices that allow for the broadest array of diversity with regards to nanometers, frequency range, and power density so that we can evolve our LED parameters as new science becomes available.

Light defines day, literally, and our world is based around this window of opportunity. LED is a fantastic non invasive, natural technology available to skin therapists to battle the effects of aging and acneic skin. If you do not have LED in your business, seize the moment!