THE SCIENCE BEHIND
RED LIGHT THERAPY
AND HOW IT WORKS
EMPOWER YOUR BODY TO HEAL ITSELF
Your body is made of matter and energy

In physics, energy can be seen on the electromagnetic spectrum. Light at certain wavelengths is proven to interact with the body in beneficial ways. This is the energy principle behind red light therapy.
WHAT IS RED LIGHT THERAPY?

There is a revolution under way in Western medical science, changing the view of how our bodies work. We are not just a bag of random biochemicals - we are charged energy beings, constantly interacting with and reacting to our environment.

New research has unearthed a whole new understanding about how our cells function optimally. Food is not the only way we obtain energy. The human cellular battery crucially depends on light and its interaction with the body.

In fact, the body operates in a similar way to a battery - and our health is determined by our ability to receive and maintain a charge. Red light, comprising both red and near-infrared wavelengths, is a uniquely healing part of the electromagnetic spectrum and it is one of the most natural ways to charge the body.

The healing power of red light is now being used as a new form of therapy which falls under the umbrella of Photobiomodulation (PBM). PBM is a general term that refers to therapeutic approaches based on the interactions of light.

After more than 50 years of extensive research on PBM and has been proven as a non-invasive, non-toxic and non-traumatic therapy. There are no known side effects.

**Red Light**: Wavelengths ranging from 600-650nm. Red light boosts the formation of collagen and elastin, and assists cell communication. It penetrates superficially (up to 5mm) and is mainly used for skin conditions.

**Near Infra-red (NIR) light**: Wavelengths ranging from 750-850nm. NIR stimulates healing, increases mitochondrial function and improves blood flow and tissue oxygenation. It penetrates deeper into the body (up to 10cm).
THE HEALING POWER OF SUNRISE

Sunlight is essential for good health. We have evolved in an outdoor environment and sunlight contains a broad range of wavelengths that vary at different times of the day. This circadian biology has a huge effect on our bodies.

At sunrise and sunset, we are exposed to light that is mainly in the red and near infrared range, and this light has been proven to have a very beneficial healing effect. In fact, the ‘sun salutation’ in yogic tradition was originally intended to be undertaken precisely at sunrise due to its healing effect on the body.

Within a very short time of human evolution we have moved from living according to the rising and setting of the sun to an indoor life with electricity and artificial light. This shift turns out to have a major impact on our wellbeing.

Science is only now beginning to understand the effect of red light on the body and how vital it is for health and optimal functioning.

Recharge draws inspiration from the natural healing power of the sun. Our devices have been designed to provide radiant energy in a way that the body can naturally recognize.

Far from a simple on-off function, FlexBEAM™ is programmed to mimic sun exposure and provide the body with the heightened experience of a healing sunrise or sunset.

Red light therapy technology allows people to harness the benefits of the sun, without being exposed to harmful ultraviolet rays.
HOW TO RECHARGE?

Electric charge is a fundamental property of the body. The surfaces in our bodies - such as membranes, proteins and DNA - are all charged, negatively or positively, depending on whether they lose or gain electrons.

By improving the flow of charged electrons, we can re-energize the body.

At the core of your body’s power to heal itself are sub-cellular organelles called mitochondria. The number of mitochondria in a cell varies widely by organism, tissue, and cell type, and are concentrated in organs with high energy demands such as the brain, heart, liver, skin, ovaries and muscles.

This is because mitochondria generate most of the chemical energy supply in the body via the molecule ATP (adenosine triphosphate).

They also regulate a wide variety of other tasks, such as signalling, cellular differentiation, and maintaining control of the cell cycle and cell growth. This is why they are often referred to as the ‘powerhouse’ of the cell.

Crucially, within the mitochondrial membrane are chemicals that act as ‘light receptors’. Red light energy is taken up by these receptors, increasing the electron transfer across the mitochondrial membrane via a cascade of reactions, resulting in increased charge, which leads to more available energy all through the body.
MITOCHONDRIA: YOUR CELLULAR ENERGY GENERATORS

1. LED light at a wavelength of 625-635nm (red) and between 810-850nm (infrared) is delivered to the tissue via the red light therapy device.

2. The light enters the cell's mitochondria and is absorbed by the chromophores, including the protein cytochrome c oxidase (CCO), and EZ water, which then increases its activity.

3. As a result of this highlighted activity, three molecules are affected: Adenosine Triphosphate (ATP), Reactive Oxygen Species (ROS) and Nitric Oxide (NO).

ATP
An increase in ATP, the main energy source of the majority of the cellular functions, increases the cell’s ability to fight infection and accelerates the healing process.

ROS
The modulation of ROS activates transcription factors positively impacting cellular repair and healing.

NO
The release of NO, a potent vasodilator, increases circulation, decreases inflammation and enhances the transport of oxygen and immune cells through tissue.
WATER: YOUR BODY’S BATTERY

About 55-70% of your body weight and 99% of your body's molecules are made of water, and this water is in a charged state.

Recent research by Prof Gerald Pollock of the University of Washington has shown that water adjacent to a cell or mitochondrial membrane is so-called structured water. This is also called EZ (Exclusion Zone) water because it creates a separation of charge.

Positive protons are excluded and pushed to the bulk water, and a lattice-like, negatively charged water forms near the membrane. This increases the voltage across the membrane.

This charge separation of water in the body functions like the positive and negative poles of a battery.

Red light has been repeatedly shown to increase this EZ zone in water, making cell water in and around the mitochondria able to store and maintain charge - like a liquid crystal.

Infrared light has also been found to increase the electrical capacitance of the membrane, which greatly affects the body's energy conservation.

WHERE THERE IS LIFE, THERE IS CHARGE

Electric charge is the force behind our physical energy as humans.

Experiments have clearly shown that red light therapy stimulates mitochondrial energy generation in the cells, enhances the voltage across the membrane, and increases the body's capacity for energy storage.

Light enhances the charge of your body and activates its natural healing power.

Recharge with red light therapy.
RED LIGHT THERAPY WORKS ON MANY LEVELS

**MOLECULAR**
- Chromophores, cytochrome c oxidase, water, opsins
- Retrograde mitochondrial signalling
- Light-sensitive ion channels
- Adenosine triphosphate ATP
- Reactive Oxygen Species ROS
- Calcium
- Heat-shock proteins
- Melatonin
- Brain-derived neurotrophic factor
- Gene transcription factors
- Akt/mTOR/CyclinD1 pathway

**CELLULAR**
- Inflammation
- Cytoprotection
- Proliferation
- Migration
- Protein synthesis
- Stem Cell production and migration
- Immune cell viability
- Retrograde mitochondrial signalling
- Transforming growth factor
- Pro- and anti-inflammatory cytokines
- Vascular endothelial
- Mitochondrial membrane potential

**TISSUE**
- Muscles: Increases endurance, tone, density
- Brain: Improves cognition and immune response, lowers dementia risk
- Nerves: Repair and pain relief
- Healing: Bones, tendons and wounds
- Hair: Increases growth
- Skin: Improvement of collagen network, anti-aging, skin disorders
- Fat: Fat reabsorption improved by enhanced micro-circulation
- Lymph: Improved immunity
- Fascia: Communication, improved tensegrity
THE INTERCONNECTED BODY

Red light therapy applied to one site of the body can produce an improvement of a condition in an unexposed body part. Local effects of light can be transferred through circulating blood, the lymphatic system, or the nervous system, for a global effect.

As Red light therapy charges the body, the effects of healing in one area often leads to positive changes in another area, in a cumulative and ongoing process. When given the right energy to heal, the body will use it to facilitate self repair.
SYSTEMIC EFFECTS OF RED LIGHT THERAPY

Red light therapy affects multiple bodily systems:

1. **FASCIA**
   The interconnected collagen matrix in and around organs and tissues.

2. **GUT–BRAIN AXIS**
   The bidirectional communication between the central and the enteric nervous system.

3. **IMMUNE SYSTEM**
   The defence against infections, including the thymus and lymphatics.

4. **CIRCULATORY SYSTEM**
   The blood transport system for nutrients and waste removal.

5. **NERVOUS SYSTEM**
   Complex network of nerves and cells that carry messages to and from the brain and spinal cord to various parts of the body.

6. **STEM CELLS**
   Produced in the bone marrow mainly of the long bones and adipose (fat) tissue and circulate throughout the body to where they are needed.
The fascia is a layer of sensitive and highly interconnected connective tissue beneath the skin that attaches, stabilizes, encloses, and separates muscles and other internal organs.

Fascia is primarily made from hydrated collagen - protein chains in a triple helix formation surrounded by water, with a capacity to generate an electric charge in response to applied mechanical stress (piezoelectric).

The bioelectrical nature of this collagen-rich matrix is the key to understanding how pathological changes in one part of the body may cause a cascade of ‘remote’ effects in seemingly unrelated areas and organ systems. The fascia is the long overlooked but absolutely crucial interconnecting organ of the human body.

The therapeutic effect of red light energy can be carried through the fascia network to other parts of the body where it is needed. This in turn elevates the body’s capacity to communicate via this charged matrix, in a positive feedback loop.

The well known energy meridians of traditional Chinese medicine may actually be low resistance pathways operating through the fascia conveying energy to the rest of the body.
GUT-BRAIN AXIS

The gut-brain axis links the emotional and cognitive centres of the brain with peripheral intestinal functions. Red light energy applied to the abdomen area can therefore influence mood and neuropsychological issues via several mechanisms:

- Reduction in bowel inflammation and gut spasms.
- Stimulation of neurotransmitters and hormones in the gut including serotonin, leptin and ghrelin.
- Modulation of the microbiome. The microbes in the gut are sensitive to light energy and respond to light energy with differences in growth, migration and proliferation of the different species.
- Increasing availability of neurotransmitters, activating the brain’s immune system, increased blood flow and removal of toxins.
- Increased blood circulation and reduced blood pressure leading to a reduction of anxiety and brain fog.
- Modulation of the vagus nerve, one of the biggest nerves connecting the gut and brain. This plays an important role in stress and social communication, communicating motor and sensory impulses to every organ in the body.
Beaming red light and near-infrared light onto cells creates a short, low-dose metabolic stress that builds up the anti-inflammatory, anti-oxidant and natural defence systems of the cells, making the body stronger and more resilient to infections.

This is the concept of hormesis; safe, low level exposure to a stressor results in increased resistance to illness. Red light has been shown to influence the immune response in several ways:

- **Activation of mast cells leading to movement of leukocytes and reduced inflammation.**
- **Mast cell de-granulation and the release of pro-inflammatory cytokines.**
- **Increased infiltration of the tissues by leukocytes.**

- **Enhanced proliferation, maturation, and motility of fibroblasts.**
- **Increased production of fibroblast growth factor.**
- **Lymphocyte activation and proliferation.**
- **Macrophages activated to act like phagocytes.**
CIRCULATORY SYSTEM

Red Light therapy has been shown to aid the functioning of the circulatory system and increase micro-circulation of blood, one of the most recognized and well documented effects of this therapy.

Red light stimulates the formation of new capillaries carrying more oxygen to the body generally - and if applied locally - to the site of application. A good oxygen supply is intricately involved in numerous biological processes, including cell proliferation, angiogenesis, and protein synthesis, which are required for restoration of tissue function and integrity.

Increased circulation allows waste products to be carried away more effectively. It triggers and heightens the body’s own process of scavenging for, and ingesting degenerated cells for the purpose of clean-up. In fact, increased micro-circulation of blood is thought to be the most vital function for healing the body for almost every illness, and for general well-being. Nutrient-rich blood and efficient waste removal is strongly linked to good health.
The nervous system is a complex electrical system, including the brain and spinal cord. It collects, processes and responds to input of energy - be it light, sound, heat or pressure - and it relays these messages to the brain and around the body.

Red light energy affects the nervous system in several crucial ways:

- Myelination of fibres and a better lamellar organization of the myelin sheath.
- Improvement of electro-physiological function.
- Facilitation of neural regeneration.
- Release of growth factors.
- Increase of vascular network and collagen.
- Faster regeneration of nerve lesions and functional improvement of damaged nerves.

The peripheral nerves can be damaged by infection or high sugar levels in the case of diabetic neuropathy.

Red light therapy is being explored as a promising drug free therapy for all kinds of nerve damage.
STEM CELLS

At the frontier of science, red light therapy is showing huge promise in current research to both stimulate growth of stem cells in the body, and to maximize the effect of stem cell implantation for a wide variety of medical purposes.

Red light may therefore be useful after surgery to stimulate stem cells to aid the repair of tissues and possibly organs.

Light at certain wavelengths has also been shown to coax stem cells to repair teeth, so red light therapy could soon revolutionize dental treatments. Indeed, some progressive dental clinics now offer red light therapy as an alternative to conventional drug and drill treatments.

Red light therapy has even been shown to stimulate so-called mesenchymal stem cells in bone marrow to enhance their capacity to infiltrate the brain.

This has implications for healing degenerative conditions such as dementia, Alzheimer’s and Parkinson’s disease - conditions currently lacking any orthodox treatment solution.
APPLICATIONS OF RED LIGHT THERAPY

REVIVE CIRCULATION
REDUCE INFLAMMATION
RELIEVE PAIN
REPAIR TISSUE
REGAIN PERFORMANCE
Red light is absorbed by the surface of the skin, to a depth of 5mm, so the effect of red light is concentrated on the skin and the fine blood vessels close to the surface. The effect is to improve the condition of the capillaries and the elastin and collagen that make up the circulatory system.

NIR light penetrates deeper into the body - up to 10cm, hence, it reaches the blood supply around the muscles, nerves and the major organs. Here it acts on the structured EZ water within the cell membranes to increase the charge and generate cellular energy. This results in enhanced blood flow, since charged blood cells repel each other and stay clear from the walls of the blood vessels.

The skin naturally radiates infrared energy every day as heat, so this is an energy that the body readily recognises and uses as an energy source.

The effect of using a mixture of Red and NIR is synergistic and cumulative. Studies have shown a variety of benefits to the circulatory system:

- Dilates existing blood vessels.
- Increases formation of new capillaries.
- Increases nutrient transport to all tissues.
- Increases lymphatic system activity.
- Increases oxygen-carrying capacity of red blood cells.
- Decreases blood pressure.
- Removes cellular waste products.
- Stimulates the production of collagen, essential for repairing damaged blood vessels.
Inflammation can be acute and topical (short-lived, caused by accidents, sprains and infections), or chronic and general (long-term, caused by persistent conditions).

While acute inflammation is a healthy physical healing response, chronic and general inflammation can be detrimental to health and often goes undetected.

Currently the main treatment for inflammation in the body is NSAID or steroid drugs, both of which have side effects and disrupt the healing process of the body. Red light therapy stimulates the body to activate its own healing mechanism, dramatically reducing the health risks associated with long-term drug use.

Red light therapy works by decreasing the number of inflammatory cells, increasing fibroblast proliferation (the cell that synthesizes the extracellular matrix and collagen), stimulating angiogenesis (the formation of new blood vessels), and activating the body’s innate anti-inflammatory, antioxidant defences.

The following conditions, associated with both chronic and acute inflammation, are currently being investigated as highly promising targets for red light therapy:

- Arthritis
- Asthma
- Sinusitis
- Muscular sprains
- Fibromyalgia
- Neuroinflammatory disorders such as Alzheimer’s
- Irritable bowel syndrome and colitis
- Rheumatic conditions
In humans, photobiomodulation is reportedly effective against a variety of pain conditions, including mucositis, carpal tunnel syndrome, orthodontic pain, temporo-mandibular joint pain, neck pain, menstrual cramps and neuropathic pain from amputation.

Red light therapy significantly reduces the severity of pain hypersensitivity while improving sensorimotor function. These improvements are preceded by an anti-inflammatory microglia/macrophage cell population in the injury zone, thereby providing a lasting pain relief effect.

Red light therapy has been shown to yield effective pain relief via the modulation of multiple mechanisms:

• Modulating nerve transmission
• Increasing endorphins and serotonin release
• Stimulating metabolism
• Activating peripheral opioid receptors
• Inhibitory cyclooxygenase and prostaglandins
Red light therapy is used for the rapid and safe healing of wounds from burns, surgery incisions, scars, diabetic neuropathy, ulcers and bed sores.

Faster and better wound healing was one of the original findings of NASA’s research, and one of the key recognized uses for this technology.

Red and near-infrared light promotes beneficial effects during all four phases of the wound-healing process:

- Coagulation
- Inflammation
- Migration
- Remodeling

These processes are regulated by many growth factors and are connected with nitric oxide (NO) signalling release, which is modulated by light energy.

A major typical inhibiting factor for the body’s ability to recover from a wound is low oxygen flow. Therefore, the unique ability of red light to increase flow of oxygen to the affected area has a massive effect on the healing process.

Through reduction of inflammation, oxygenation of the area, and formation of new blood vessels, a rapid healing process unfolds with less pain and scarring.

Red light energy may also reduce or prevent the need for pharmaceutical painkiller medication during the healing process.
Regain Performance

Red Light therapy has become a hot topic in sports and performance. Not only is it safe and non-toxic - it yields rapid and lasting results in many areas of application.

Besides the overwhelmingly beneficial effects on health overall, red light therapy supports muscle growth and repair by increasing the amount of ATP available, which allows for better performance and faster recovery.

Red Light therapy used before training is known to prepare and strengthen the body, and after physical exertion to help with recovery.

Documented effects from red light therapy include:

- Reducing DOMS (Delayed Onset Muscle Soreness)
- Greater endurance and performance
- Improving sleep quality
- Increasing sexual function and libido (including testosterone)
- Aiding weight loss
- Boosting cognitive function
- Reversing skin ageing
- Reducing cellulite
FLEXBEAM™

Our portable multi-purpose device for home use.

- 6 near-infrared (NIR) LEDs at a unique sweeping profile of 810-840nm and 3 red LEDs at 625-635nm.
- The device is designed as a multi-angular treatment shaped for the body, to be placed directly on the skin where it hurts.
- FlexBEAM™ is powered by a rechargeable Li-ion battery, with one charge lasting up to 2.5 hours.
- The device contains an active fan cooling system to regulate temperature and automatic shutdown at the end of each treatment.
POWERBEAM™

Our professional clinical device.

• With 16W of optical output power per module, delivering a sweeping profile of 810-880NM NIR light, covering the body’s entire therapeutic window.
• It has full frequency pulse control, wavelength sweep function, and manually adjustable settings for maximum versatility and power.
• Delivered with a Color Touch display control unit and optionally mounted on a mobile trolley.
• PowerBEAM™ is the ultimate red light therapy device for professional users.
• Optional choice; 12W of optical output power with NIR 810-845NM and Red 635NM.
MULTI-ANGULAR APPROACH

FlexBEAM™ has been designed to fit the human body. Its shape and flexibility enables more effective and targeted dosing, because less power is needed to deliver energy directly to the affected site.

This allows light to penetrate deep into difficult-to-reach areas of the body – such as the knee and shoulder joint – which is impossible with flat light panels.

Ours is also a safer approach because it reduces unnecessary exposure of skin and surface tissue. Because FlexBEAM™ is designed to be worn on the skin, each session yields a consistent dose and is not dependent on distance from the light source.

In turn, this reduces treatment time, making it possible to deliver a targeted therapeutic dose in 10 minutes for a single placement.
OPTIMIZED POWER OUTPUT

Determining the right dose - not too little, not too much - is crucial for the treatment to be effective.

A biphasic curve can be used to illustrate the expected dose response to light at a sub-cellular, cellular, tissue or clinical level. If insufficient energy is applied there will be no response (because the minimum threshold has not been met). If more energy is applied and a threshold is crossed, real stimulation is achieved. But if too much energy is applied, the stimulation effect disappears and gives way to inhibition.

Nitric Oxide release from red blood cells at optimal dose is beneficial, while very high levels of light will reduce the benefits back to zero.

Moreover, proper dosing depends on how the energy is delivered. Just like it makes a difference whether you drink a gallon of water in two minutes or two hours, delivering the appropriate amount of red light energy is about more than power output.

Our BEAM™ technology has been designed with these crucial factors in mind. Both FlexBEAM™ and PowerBEAM™ deliver light within the optimal range for maximum therapeutic benefit at the targeted depth.
SAFE AND EASY TO USE PROGRAMS

The 3 preset programmes in FlexBEAM™ cover a variety of medical and wellness applications in one device. Each program lasts for 10 minutes, allowing for multiple target sites in one session.

1. **SURFACE**
   - PENETRATION DEPTH 0-2.5cm
   - Red 635nm pulse  NIR 810-850nm pulse
   - For conditions that are skin deep. A greater proportion of red light to near infra-red.

2. **MEDIUM**
   - PENETRATION DEPTH 2.5-4cm
   - Red 635nm pulse  NIR 810-850 pulse
   - For smaller joints like the elbow, tissue, muscles and more. A mix of red and near-infrared.

3. **DEEP**
   - PENETRATION DEPTH 4-10cm
   - Red 635nm pulse  NIR 810nm: CW (continuous wave)
   - For joints like knees and shoulders, and large organs like the liver. This preset has a predominance of near-infrared light.
BIOCOMPATIBLE DOSING

Gradual build up of dose for a natural stimulation of light energy.

WAVES
In nature, most signalling is rhythmical and cyclical. The wave pattern is everywhere, from sunset to sunrise to brain patterns to how we experience pain - it comes and goes like waves in the sea. In FlexBEAM™, both frequency and power output increase in a steady wave-like fashion and ramp down at the end of the cycle.

PULSING
The body pulses naturally. Heart rate variability (HRV) is a pulsating indication of our health condition, muscles are controlled with electrical impulses. The Earth itself pulses at around 7.8Hz. FlexBEAM™ and PowerBEAM™ use specific pulsed frequencies within the range of 1-1000Hz.

COMBINED
FlexBEAM™ uses both red light at 635nm and near-infrared between 810-845nm in a combined composition that sweeps through frequencies for optimal effect.

The unique combination of Red and NIR wavelengths, along with a gradual pulsed frequency harmonizing with nature, is what truly makes BEAM™ devices different.

Ingeniously designed for an optimal physiological response, the result is a powerful healing experience that feels as good for your body as a glorious sunrise and a glowing sunset.
A BRIEF HISTORY OF RED LIGHT THERAPY

Physician Niels Ryberg Finsen wins the Nobel Prize in Medicine for his successful treatment of smallpox and lupus with red light.

1903

By the early 1970s, laser therapy is recognized as a physical therapy modality in Eastern Europe, the Soviet Union, and China. In 1977, it appeared in the United States.

1970

Researcher Endre Mester discovers the healing power of red light on a group of animals, testing to see if laser could cause cancer. Not only do they not get cancer but the hair on the laser treated group grows back faster than the untreated group.

1967

NASA uses red light therapy to help astronauts maintain muscle and bone mass, and to treat chronic wounds.

2000
FDA light therapy has widespread scientific and evidence-based acceptance.

Development of double stack emitter LED – making PBM with LED effective, safe and affordable.

Recharge develops the PowerBEAM™ and FlexBEAM™ using advanced LED technology with intelligent biocompatible dosing for increased efficacy and ease of use.

Recharge global launch of FlexBEAM™ and PowerBEAM™.