The importance of laser light as an efficient, natural weapon against Covid-19

Introduction

The therapy results of Low Level Laser Therapy (LLLT) / Photo Bio Modulation Therapy (PBMT), related to Covid-19, are so convincing, that all of the social and medical forces should deal with this new medical technology as soon as possible. All of the existing scientific work on LLLT shows that the broad use of high-dose LLLT/PBMT can definitely improve the existing Covid-19 situation. However, it seems that the opposite is the case.

LLLT's excellent therapy results, even in seriously ill Covid-19 patients, apparently has been intentionally or unintentionally withheld from the public.

There are numerous experts and recovered patients that are trying to inform the necessary authorities and mass media concerning the well documented positive effects of the LLLT/PBMT results on Covid-19.

So far, all of these efforts have failed due to a completely incomprehensible lack of interest or credibility of those responsible**.**

In the case of Covid-19, this behavior of our medical experts means that a number of patients who are seriously ill with Covid-19 have to die or have to endure serious secondary diseases. This is due to the fact that our medical crisis managers refuse to use high-quality laser therapy in intensive care units.

Please view the video by Dr. Scott Sigman at www.luxspaibiza.com concerning the information on LLLT and Covid-19.

These patients were seriously ill with Covid-19 and were about to be intubated. After intensive laser light therapy and after only 4 days of therapy they were able to leave the hospital, fully recovered.

This is not a surprise for the doctors who take the time to seriously deal with LLLT / PBMT.

The outstanding factor about this therapy is the therapeutic use of light energy.

So far, we all live with the idea that only plants can use light directly as energy source. Popular belief apparently excludes that humans and all animals also benefit from the direct biological use of electromagnetic light energy.

This is a central dogma within the entire human sciences that has influenced our misperception (for generations) that our body is not connected with electromagnetic light energy.

We need a complete change in our perception of energy in the biological and medical fields.

In physics, every theory must be confirmed experimentally. With LLLT or PBTM, it seems to be the opposite.

All of the experimental and clinical tests have clearly shown the positive biostimulative effectiveness of laser light on all body cells. This has been confirmed a thousand times.

What is missing in public awareness, so far, is a general, transparent and interdisciplinary discussion on the biological interactions of electromagnetic light energy and our body.

Light is, whether we believe it or not, a physically defined electromagnetic energy. Its effective parameters are its respective wavelengths and/or frequencies. As well as the respective absorption behavior of the corresponding molecular/electromagnetic structures.

The problem of understanding the biological effectiveness of light is due to an outdated concept of energy in the minds of the ruling biological and medicinal authorities..

Uninformed authorities believe that our cells cannot utilize electromagnetic energy directly. They imagine that the energy within our cells and in our body is liquid or particles. According to current biological doctrine, electromagnetic realities and interactions within our body do not exist!

This explains the completely incomprehensible resistance of our intellectual elites, and thus the general public, to therapy with electromagnetic light energy. Despite the published scientific and clinical facts concerning LLLT / PBMT.

It is therefore very important that many people, not just the medical experts, seek their own knowledge and an open and free discussion regarding our actual biological realities.

This text tries to present scientific facts in a simple and understandable way, so that you can evaluate with your own logic and your own common sense.

You should be open to new perspectives on yourself and of your body. Expanding your perception of a purely molecular body to that of an electromagnetic body.

If this change in perception succeeds, slowly but steadily, completely new and previously unimaginable medical possibilities will open up for mankind.

Perhaps it is also an imposition on my part to confront you with the fact that behind the previously familiar molecular perception of our own body processes, there should suddenly now be an electromagnetic perception of our own body.

But major crises can often only be resolved when valid dogmas, which have narrowed our thinking and imagination up to now, are replaced by new knowledge and insights.

What is a biostimulative laser?

For more than 60 years people have been observing that our body reacts extremely positively to exposure of light. This becomes particularly clear when using a therapeutic laser. A therapeutic laser produces coherent ,compressed light. This light makes it possible to supply traumatized, exhausted and overworked body cells immediately with high amounts of light energy.

The electromagnetic waves of light immediately and directly stimulate the cellular, mitochondrial energy (ATP) production and It is measurable, observable and clearly perceptible, thus an easy to document healing process.

If a search is made in internet for LLLT and lung diseases, Covid-19, wound healing, orthopedic problems, tinnitus, other ear problems, veterinary medicine and dentistry, you will be amazed at the wealth of information available. Abundant information on these subjects are available on my website www.dr-wilden.de and www.luxspaibiza.com . A search for Photo Bio Modulation Therapy (PBMT) will also yield very much interesting information.

What are the benefits of laser light in our body concerning Covid-19?

A good description of the biological effectiveness of light is the improvement related to the biological quality of irradiated organs and body areas. Light improves and heals biological crises.

With Covid-19, the use of high doses of light cause dramatic improvements, both for severely affected people who have to be mechanically ventilated and for all other degrees of severity of a Covid-19 infection as well as the prevention of infections (prophylactic treatment).

The therapy should include the irradiation of the lungs as well as of our immune system, i.e., our axel and inguinal lymph nodes.

Our Immune System

The LLLT/PBMT strengthens and mobilizes the immune system. This is clearly measurable and documentable, like no other therapy worldwide!

Our immune system has developed over millions of years and protects our body in a variety of ways, in particular against bacterial and viral infections.

Covid-19 is not the first virus that mankind has been confronted with.

Therefore, our immune system has a biological intelligence that extends deep into our biological past and at the same time is currently highly relevant.

However, an immune defense is always associated with high energy consumption. Therefore, i.e., the flu, as well as Covid-19, forces us to stay in bed instead of going to work as usual. Our body reduces our mobility in order to use the saved energy to strengthen the immune system. We then generally say: “I have no more energy to get up”.

It is precisely at this point that the effect of concentrated electromagnetic light energy can be clearly measured and experienced biologically.

Because the laser light energy immediately stimulates the cellular power plants (mitochondria) to improve their energy (ATP) production, which in turn enables the regenerative intelligence located in the cell nucleus to use its entire, highly complex, genetically fixed, regenerative knowledge much faster.

For the patients suffering from Covid-19, this means that even after the first professional, high-dose LLLT/PBMT treatment an immediate improvement is noticed concerning shortness of breath, lack of energy, general exhaustion, fever as well as all other symptoms present. Each case becomes noticeably and measurably better and continuously improves until it subsides completely. At the same time, the corresponding measurable laboratory values improve.

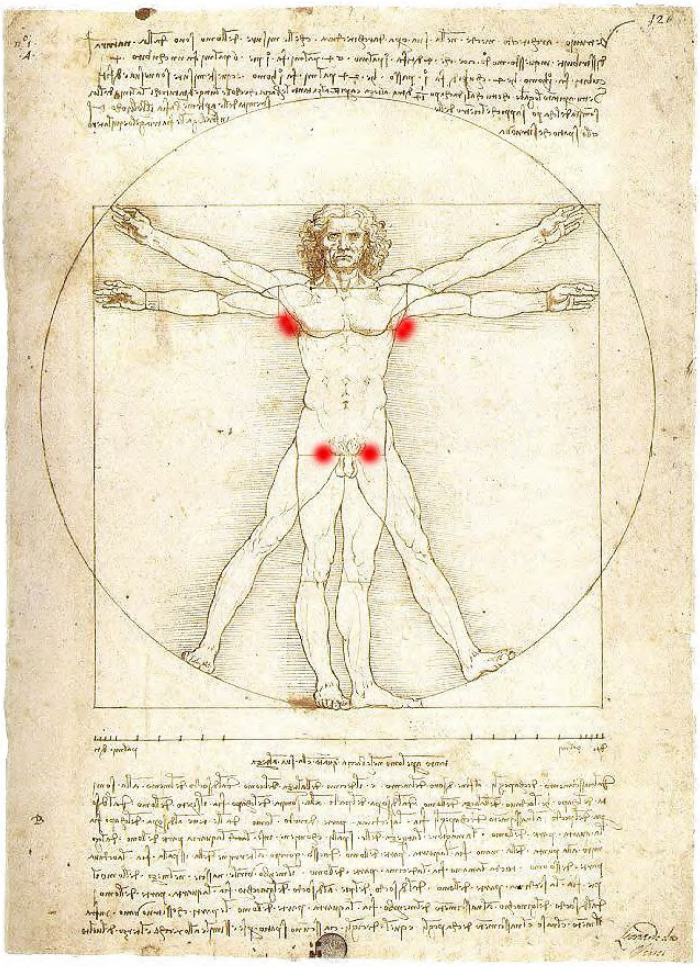

Fig. 1 The localization of our immune system in our body

Our immune system is an organ like the heart or the kidney organs. In adults it consists mainly of the axel lymph nodes and the inguinal lymph nodes. In children it also consists of the thymus, a large, immunocompetent gland which is located directly behind the breastbone and which slowly but steadily regresses from childhood to adulthood.

The direct irradiation of our immune organ via the axel and inguinal lymph nodes and thymus gland (in children) with electromagnetic laser light energy, helps the immune-competent cells of the immune systems to realize their cellular defense processes much better.

At the same time, direct organ irradiation, such as that of the lungs, develops rapid improvements in the respective organ cells attacked and damaged by Covid-19 and immediately improves their biological condition.

Due to thousands of experimental and clinical studies, the LLLT/PBMT is internationally recognized as free of any undesirable side effects!

Patients who have experienced and are currently experiencing high-quality LLLT/PBMT on themselves, i.e., find the therapy to be very pleasant and relaxing.

This is not the case with any of the officially recognized Covid-19 therapy strategies.

Fig.2 LLLT/PBMT of the lungs

Fig.3 LLLT/PBMT of the back of the lungs

Fig.4 LLLT/PBMT of the axial lymph nodes

Fig.5 LLLT/PBMT of the inguinal lymph nodes

Fig.6 LLLT/PBMT of the inner ear organ

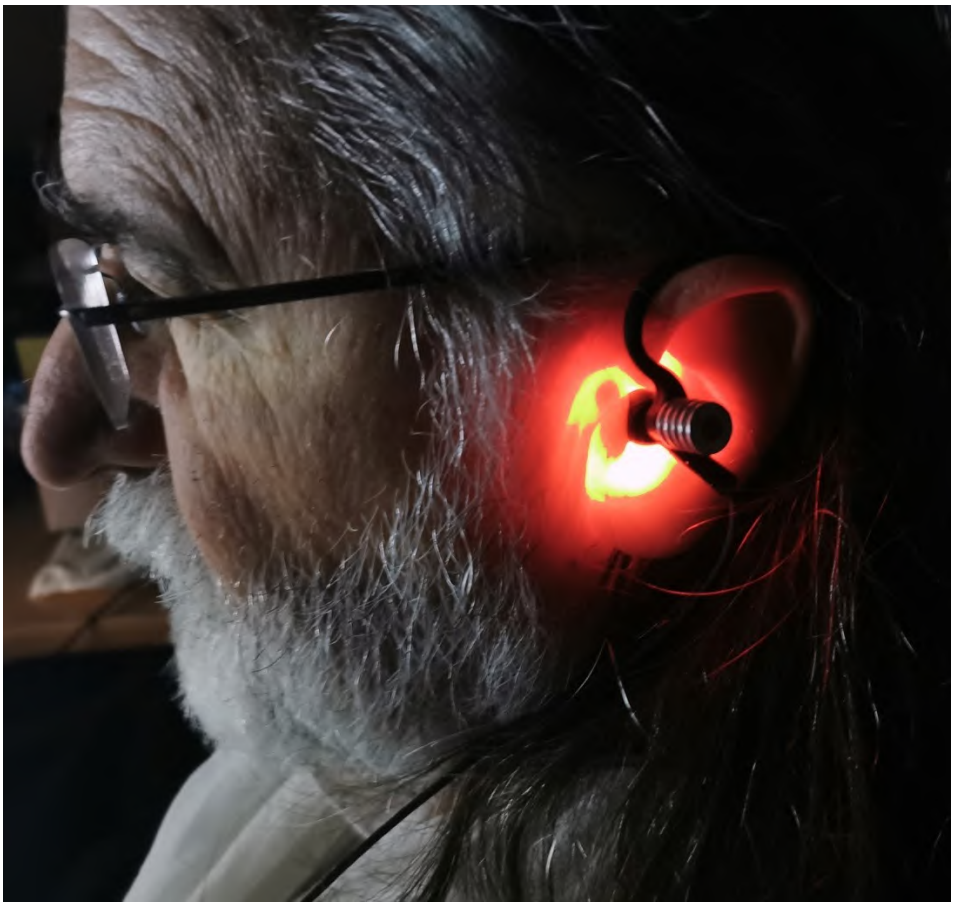

Fig.7 LLLT/PBMT of the inner ear organ with the Lux Spa Home Laser by Dr. Wilden

What is light?

Light is the part of cosmic and solar electromagnetic radiation which constantly surrounds us and which we can see with our visual cells. It radiates into our body through the skin and through our eyes.

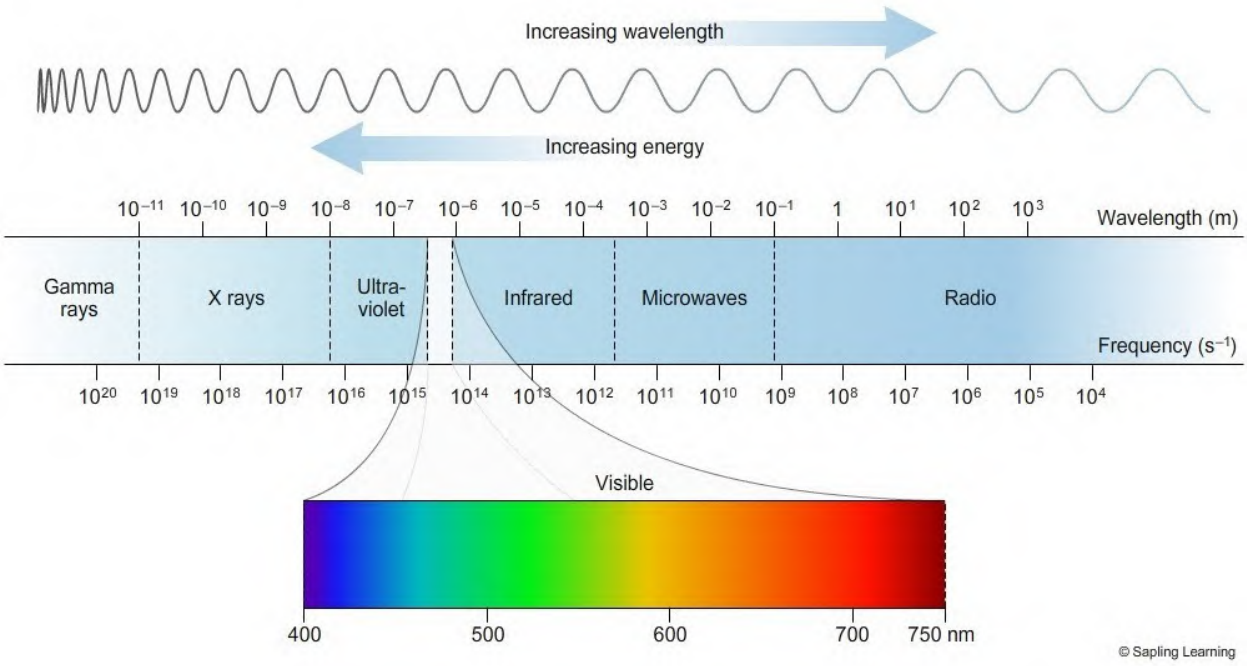

Fig.8 electromagnetic spectrum

Its effective parameters are always the same.

The fundamental factors involved are: the wavelength of light and the absorption behavior within the corresponding biological, molecular, electromagnetic structures.

The electromagnetic light energy shines through our body cells and interacts directly with our body and its organs. When looking at the graphical representation (Fig.8) of the electromagnetic energies and their interactions with our body, it is normal that all of the electromagnetic wavelengths radiate into our body including those that are harmful. Which include all of the dangerous UV radiation, X-rays and the deadly gamma, beta and alpha radiation waves.

In order to be harmful, these dangerous or deadly radiations have to radiate into our body in order to be able to have a negative effect inside our body. We usually have no problem accepting this.

We easily understand that infrared waves radiating into our body produces a warm and absolutely beneficial effect in our body.

According to official biology theories, the narrow band of electromagnetic energies in light do not enter our body. Even if recognized that the light radiates into our body, which is visible

and therefore cannot be denied, the electromagnetic energy of the light, according to the officially recognized biology science, does not develop any biological effectiveness in our body.

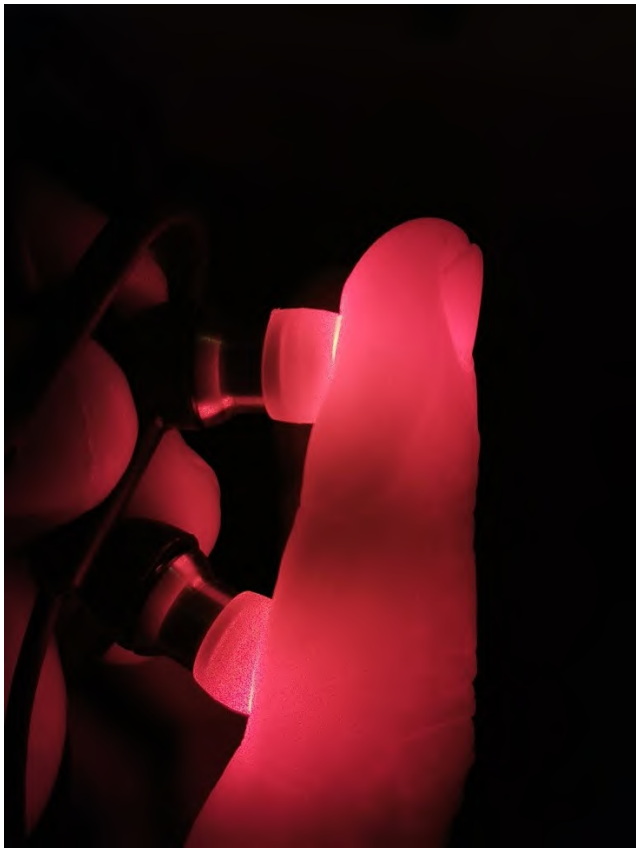

Fig.9 Image of an irradiated finger by the laser light from our Lux Spa Home Laser.

Light and evolution

Light is older than our biological evolution. The electromagnetic light energy existed on our planet long before the formation of the first organic molecules. Biological evolution had to adapt to the electromagnetic nature of light in order to be able to use its electromagnetic energy.

All living beings are therefore in a direct connection with the electromagnetic energy of light. Only a few days of a total solar eclipse is enough to collapse the entire biosphere, including ourselves!

Fig.10. Fill up with light!

“Light filling” is the best description of what we all feel when we let the natural, electromagnetic, solar radiation into us.

What is popularly believed is that light radiation on the body only affects the pigmentation of the skin and the formation of vitamin D. Also that UV of natural solar radiation is harmful.

According to the current biological doctrine, light has no biological meaning for humans and animals. Since vitamin D is a molecule and can also be produced pharmaceutically, this specific effectiveness of electromagnetic light energy is generally accepted. What remains taboo is the question: If light can produce vitamin D, what else can it do?

Why does the recognized, biological/medical, academic world cannot or does not want to recognize the importance of light for our cells to this day and how this shapes our body image (the ideas we have about our own body)?

Biology claims and believes, that there is no electromagnetic energy (light) in animal or human cells. Inside our body, all cellular processes take place in the dark and exclusively on a molecular level of action.

The energy that acts between the molecules is imagined by modern biology as a liquid or energy particles.

In this world of ideas, energy flows out of one molecule and into another, or the energy is broken down into small energy packets (electrons) and passed on from one molecule to the

other (search for respiratory chain in https://images.google.com).

How the electromagnetic background of any molecular structure functions has not yet been seen or taken into consideration by theoretical biology.

However, this is very easy to imagine.

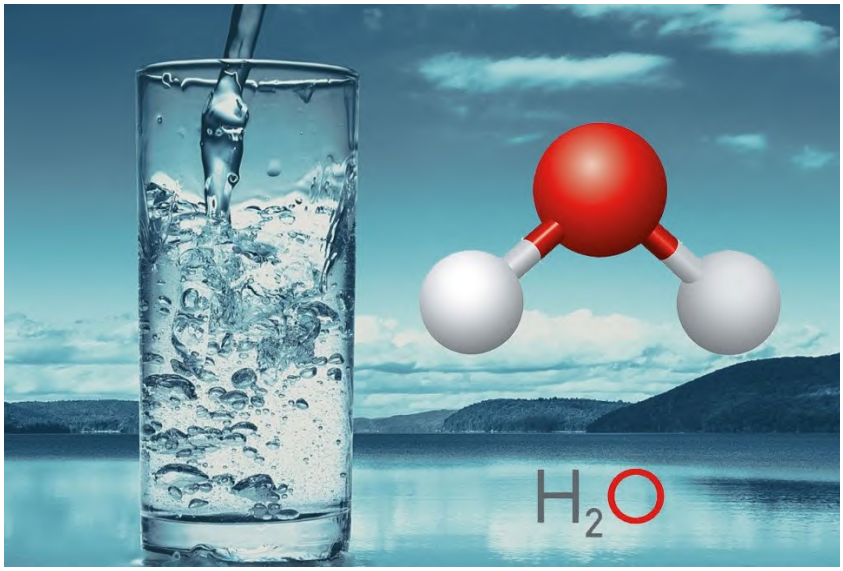

Fig.11. Water molecule

Consider a transparent glass filled with water. In this glass there are billions of H_2O molecules. In this form, water (the mass of H_2O molecules) is liquid. We can drink the water (the H_2O molecules) and bring it into our body.

But if, looking at the water glasse, we imagine that we are getting smaller and smaller, until we are as small as an H_2O molecule, how does this one H2O molecule look like?

Do we find a last small drop of water there? Or something else that is liquid?

No, we then no longer see any liquid but we do see a molecular, electromagnetic structure that shines in all colors.

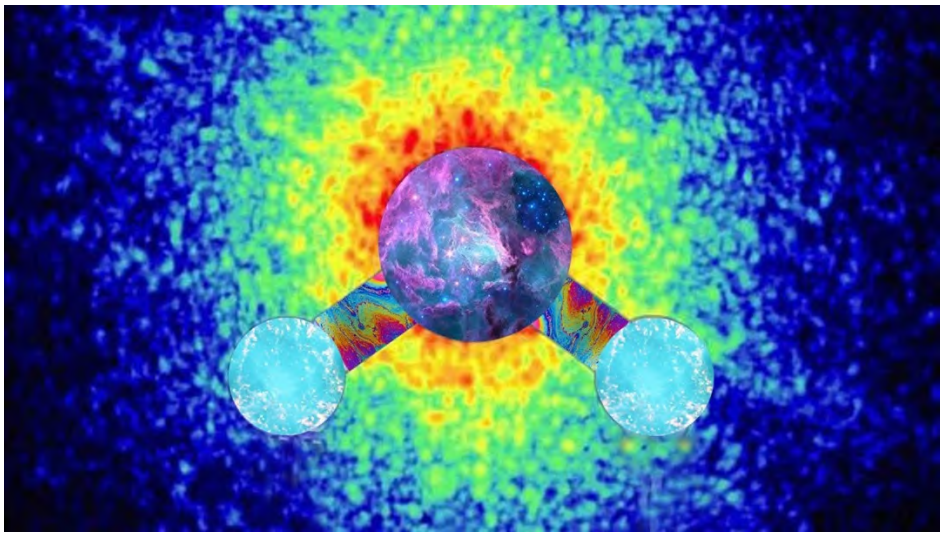

Fig. 12 Electromagnetic structure of the H_2O molecule

Since our body consists of approximately 60% water (H_2O molecules), we therefore have 60% electromagnetic energy in us.

The internal electromagnetic and intra-molecular communication takes place via the so-called molecular, electromagnetic binding energies.

This is a scientific fact (Nobel Prize Wolfgang Pauli 1945) and has therefore been an integral part of our previous physical worldview for decades.

However, chemistry and biochemistry have succeeded to establish the concept of the so-called "chemical binding energy" in the general public energy concept. This "chemical binding energy" is, in contrast to electromagnetic molecular binding energy, a physically undefined term.

Future generations will desperately wonder how it was possible for a global elite to imagine, on one hand, vaccinating the entire world population with always new vaccination products. However, at the same time was not able to accept the effectiveness of LLLT treatment and implementation of high-dose low level lasers on a large scale.

At the moment, the majority of all leading and all-determining biological, medical and industrial experts try obsessively and with increasing aggressiveness, to prevent the electromagnetic laser light energy and its targeted medical applications.

This is no longer rationally understandable. However, it has a highly rational background.

The importance of the wave aspect of the electrons

Biology is using the term electron for decades to describe the energy that is released at the end of our degrading cellular metabolism and which is going into our cell power plants, the mitochondria.

This energy is used to generate the cellular, molecular energy carrier, the so-called adenosine tri-phosphate (ATP).

The term electron comes from physics. There it has a double definition, as a particle and as a wave.

J.J.Thomson found a correlation between the mass and charge of the electron and introduced it into physics as an elementary particle (Nobel Prize 1906).

Thirty years later, his son G.P. Thomson discovered the correlation of electron radiation and interference patterns and thus the wave aspect of the electron (Nobel Prize 1937).

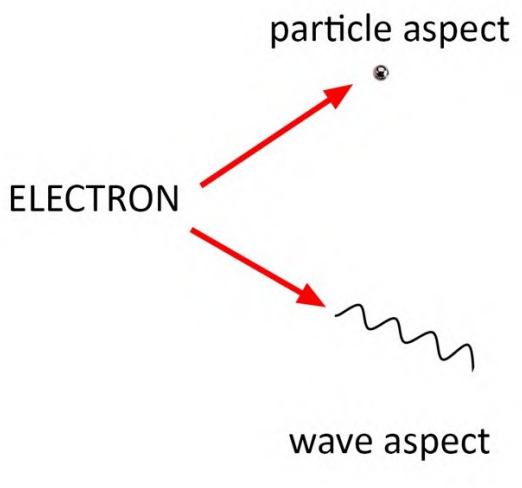

Fig. 13 The particle and wave aspect of an electron

By using the term electron, biology is a secondary science.

As such, biology is obliged to use the full definition of primary science (physics).

A new perspective that includes the wave aspect of the electron, however, enables a physically correct description of cellular energy (ATP) production.

If one specifies the wavelengths of the electromagnetic bonds released during the energy transfer from the last component of our nutrients, the pyruvate, it becomes visible that these are in the range of the wavelengths of natural solar radiation.

In other words, the last step in our digestion of food is the release of light from the pyruvate and its passage into the mitochondrion. This is a radiation process and not, as previously claimed in all textbooks, a flow process of some type of fluid energy.

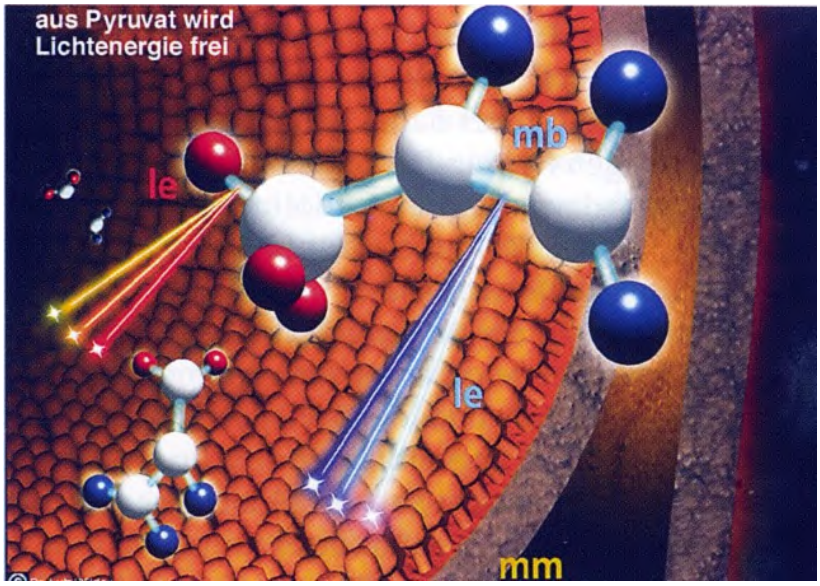

Fig.14. The energy transfer from pyruvate into the mitochondrion is a radiation process.

However, how does the absorption of the electromagnetic bond energies of our last nutrient molecule (pyruvate) work?

Fig.15. Cross-section of a mitochondrion © Chr. De Duve

The architecture of our cell power plants is clear. It is a large, folded surface that is littered with light-absorbing molecules and thus corresponds to a solar power plant whose surface is littered with light-absorbing materials.

Fig. 16 Solar panels © Zhao jiankang.

The mitochondrion consists mainly of a folded surface which is always covered with the same molecular structure, the so-called respiratory chain.

This respiratory chain consists of 24 molecular structures.

Their respective absorption behavior of the respiratory chain towards electromagnetic energy has long been known. It is exactly in the same wavelength range as natural solar radiation and thus in the same wavelength range as the electromagnetic, molecular binding energies released from the pyruvate.

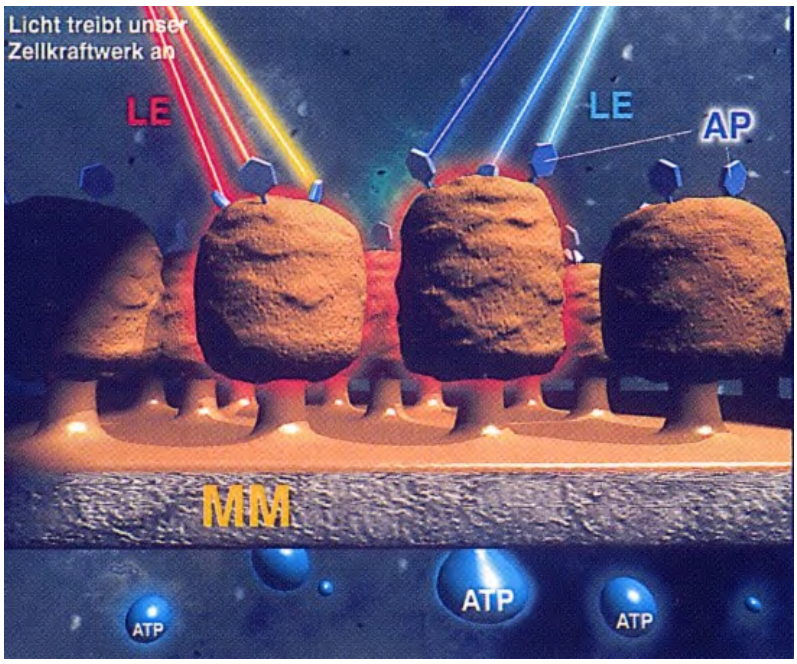

Fig. 17 Computer graphics of light absorption (light absorption) via the so-called inner mitochondria Membrane (MM)

The absorption of the molecular electromagnetic binding energies released from the pyruvate by the mitochondrion is a light absorption process.

A single, unfolded, inner mitochondrial membrane has an area of 5000 nano square millimeters. If you multiply this area by the average number of 2000 mitochondria per cell and multiply this area by the estimated total number of 100 trillion body cells, you get a total area of 10^6 square meters. This corresponds to a total area of about 200 soccer fields !!

We have a huge area in our body which is littered with molecular structures that have no other function than to absorb the light from within the electromagnetic energy, released from the pyruvate binding energies, as well as from external light (natural solar radiation and laser light).

The light energy absorption takes place according to precisely defined parameters: the respective wavelengths of light and the absorption behavior of the corresponding molecular/electromagnetic structures in our body, particularly in our mitochondria.

Therefore, a therapeutic, biostimulative, high-quality laser suddenly improves the cellular energy production of the irradiated organs.

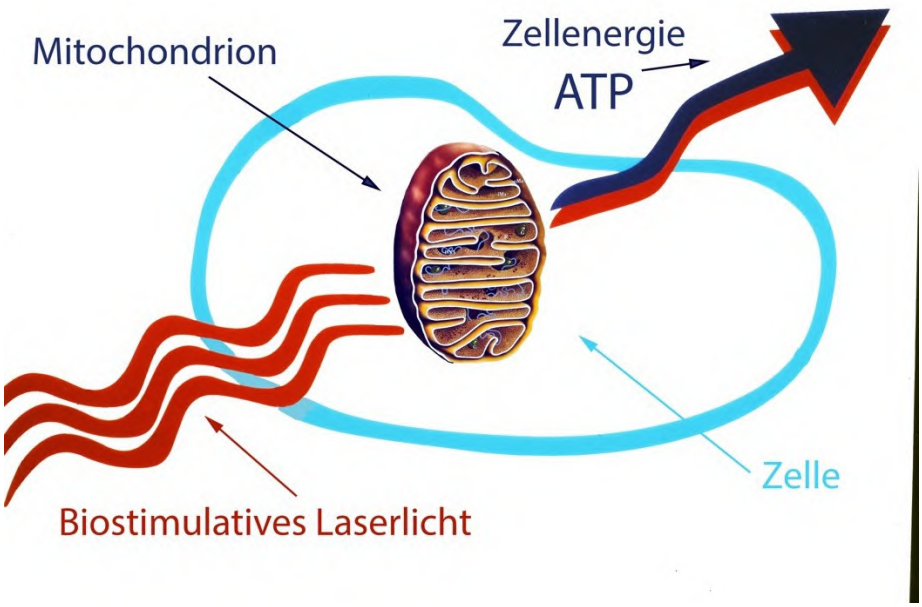

Fig. 18 Light is stimulating the mitochondrial production of ATP

In contrast to this, our current theoretical biology has so far perceived our body and its cells as being isolated from all electromagnetic energy, especially from light energy.

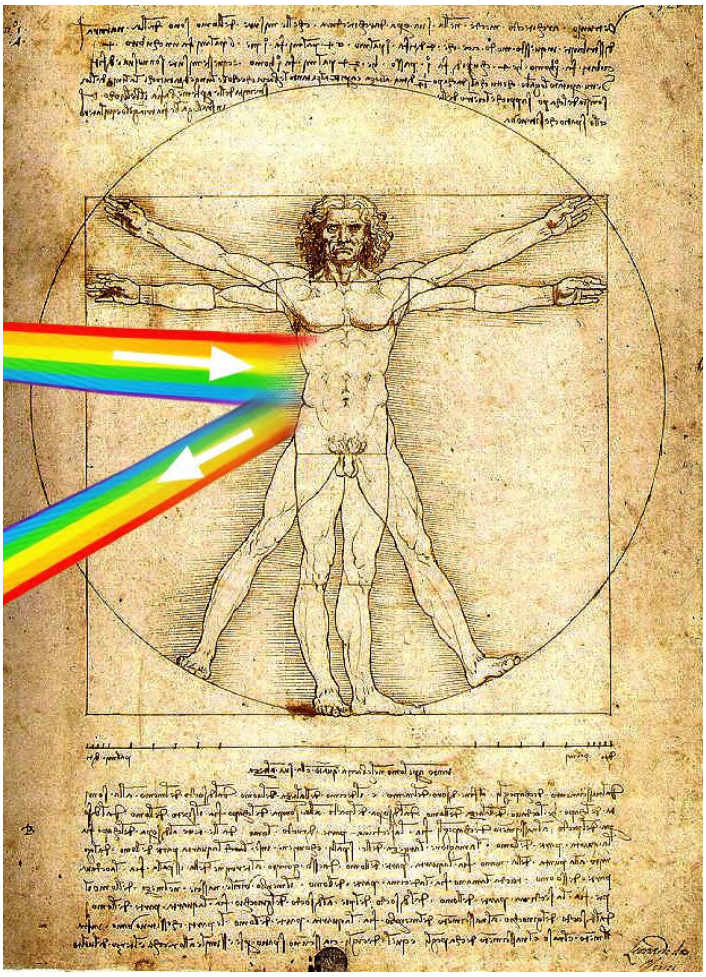

Fig.19 antiquated body image, sealed off from any electromagnetic light energy

This antiquated perspective has deeply influenced our unconscious and self-perception. This applies to the majority of the medical laypeople as well as to almost all doctors and experts. That are currently desperate, and so far, unsuccessful in their fight against Covid 19 based primarily on solutions at the molecular level with molecular pharmaceutical drugs.

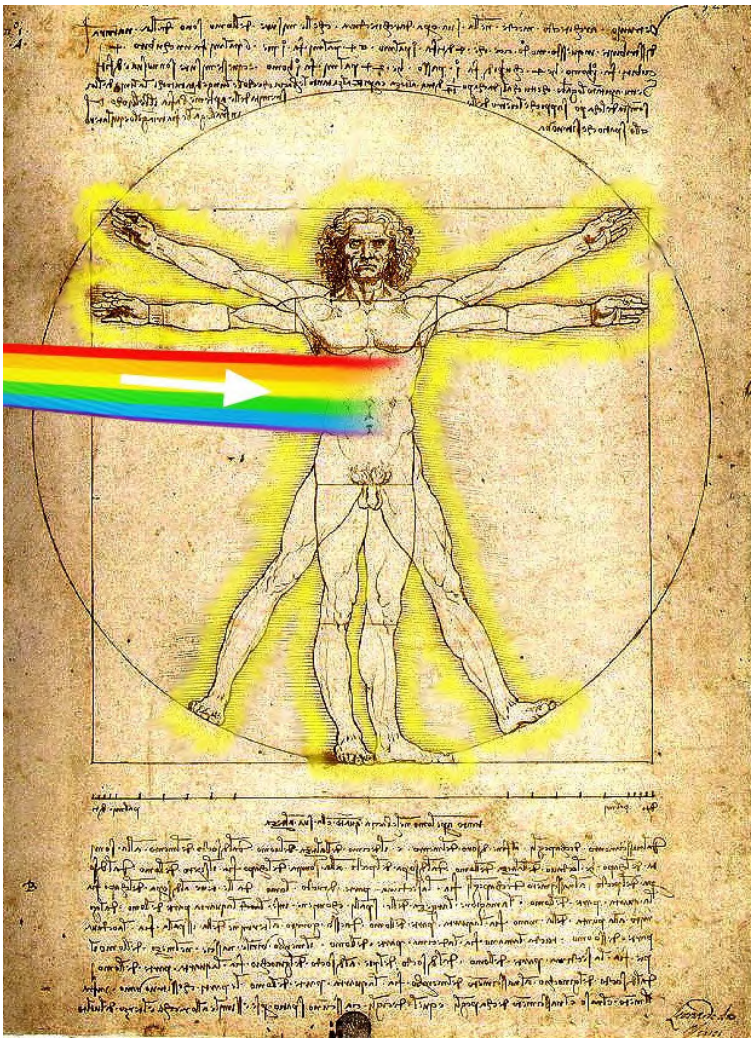

Fig.20 A graphical representation of a modern body image that includes an electromagnetic reality.

Please send this text to all the interested people and also the information on my website www.lux-spa-ibiza.com Please include my information in the following original article from the Journal of Clinical Laser Medicine & Surgery:

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Pp. 159–165

Import of Radiation Phenomena of Electrons and Therapeutic Low-Level Laser in Regard to the Mitochondrial Energy Transfer

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ABSTRACT

***Objective*: The authors describe a consistent theoretical model of the cellular energy transfer (respiratory chain) by taking into consideration the radiation phenomena of electrons and therapeutic low level laser. *Summary Background Data*: Biochemical models of the cellular energy transfer regard the classical corpuscular aspect of electrons as the responsible energy carriers, thereby ignoring the wave-particle dualism of the electrons and the import of radiation energy in this process. *Methods*: The authors show the influence of radiation phenomena on the cellular energy transfer, explaining consistently some of the intermediate steps of this complex process. *Results*: Because of the inherent wave-particle dualism of the electrons, it is appropriate to regard radiation phenomena to explain the cellular energy transfer. The classical biochemical models use only the particle part of the electrons as energy carriers. The connection between energy transport by radiation and the order in structures may be understood if, for instance, structurally bound energy is released during the dissolution of structures (oxidation of foodstuffs) or is again manifested (final reduction of oxygen to water). With a attention to the energy values relevant for the respiratory chain, the import of electromagnetic radiation of characteristic ranges of wavelengths on the cellular energy transfer becomes evident. Depending on its wavelength, electromagnetic radiation in the form of light can stimulate macromolecules and can initiate conformation changes in proteins or can transfer energy to electrons. Low level laser from the red and the near infrared region corresponds well with the characteristic energy and absorption levels of the relevant components of the respiratory chain. This laser stimulation vitalizes the cell by increasing the mitochondrial ATP(adenosine-tri-phosphate)-production. *Conclusions*: With regard to radiation phenomena and its inhanced electron flow in the cellular energy transfer (respiratory chain), it is possible to explain the experimentally found increase of ATP-production by means of low-level laser light on a cellular level. Intense research for this biostimulative effect is still necessary.**

INTRODUCTION

Every living cell needs energy. The energy necessary for the complex functions of the cell comes from nutrients absorbed by the organism. In its primary form, however, the chemical energy of the nutritive compounds is not directly useable for the cell, but has to be first converted biochemically into a cellularily usable form. The most important form of use in cells is the highly energetic ATP system. The cellular energy transfer takes place in the mitochondria and, therefore, these organelles have a key function for the eucaryotic cell. Biochemical models of the energy transfer describe the energy transporting electrons as responsible for the intermediate steps of this conversion. It begins, via the citric acid cycle, with the generation of high-energy electrons, which subsequently lose their initial energy in the electron transport chain of the inner mitochondrial membrane (respiratory chain) and disappear again as soon as oxygen (O_2) is reduced to water (H_2O). According to the classical corpuscular idea of electrons, the transfer of energy originating from foodstuffs to cellular energy in the mitochon-

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drial structures of the inner membrane is a flow process of high-energy electrons (electron flow). Several processes in this assumed flow of electrons can be explained only insufficiently with regard to the particle idea of electrons. Furthermore, the energy transport has been consistently explained only recently.

WHAT CHARACTERIZES AN ELECTRON?

Electrons belong to the elementary particles (leptons) and are therefore a constituent part of the fundamentals of which all matter is made. The corpuscular model qualities (mass, charge) of electrons discovered by J. J. Thomson still hold today. This furnished a basic explanation of the structure of matter. Thirty years later, his son, G. P. Thomson, demonstrated the wave-particle dualism of electrons by means of electron interferences that occurred during the translumination of polycrystalline metal foils. The wave-particle dualism is described by the Einstein—de Broglie relations for the wavelength and frequence of corpuscular radiation.[1] These relations represent the connection between the particle and wave qualities of both electrons and other objects such as photons (the quantum units of electromagnetic energy) without hurting the classical corpuscular mechanics. The striking proof of the wave-particle dualism of photons arises from the fact that electrons are energetically stimulated by electromagnetic rays. Furthermore, electromagnetic radiation can transfer its energy to electrons. It is possible to apply the wave as well as the particle concept to describe atomic processes involving electrons and electromagnetic radiation. The wave and particle qualities of electrons are complementary. Their diffusion is characterized primarily by their wave qualities, their interaction with atomic systems by their particle qualities. These physical facts were taken into consideration in the following examination of the mitochondrial energy transfer.

THE CLASSIC MODEL OF THE MITOCHONDRIAL ENERGY TRANSFER

In biochemistry the electron transport linked with mitochondrial energy transfer is defined by the particle idea of the electron. The function of electrons in the mitochondrial energy transfer system is to operate the real power plant of the mitochondria as energy carriers. That is oxidative phosphorylation, which produces ATP. The oxidative phosphorylation can work only in connection with an electron donator and an electron acceptor. The most important electron donators in this regard are the nicotinamide adenine dinucleotide ($NADH/NAD^+$) and the flavin adenine dinucleotide ($FADH_2/FAD$) systems. The catabolism of foodstuffs in the citric acid cycle generates high-energy electrons that pass via NADH and $FADH_2$ to the respiratory chain. These electrons flow in the system of ATP-producing oxidative phosphorylation and lose their energy in doing so. Finally, they reduce molecular oxygen (O_2) to water (H_2O). This mitochondrial electron flow is described biochemically as a hydrodynamic, electrochemical, and biomechanical model.

The hydrodynamic model

The hydrodynamic model illustrates the aspect of the mitochondrial electron flow by means of defined potential levels, where electrons are either picked up or delivered. In this connection, the cellular electron flow can be compared to a watercourse with several waterfalls, like an artificial garden. The waterfalls owe their existence to several water reservoirs, which are linked to each other and situated at different heights. The height of these water reservoirs corresponds with the oxidation-reduction potential (redox-potential) of the involved redox-pairs (donator/acceptor). However, not every waterfall (electron flow) must be connected to a power station and an energy conversion system (oxidative phosphorylation). If, however, there are such transfer systems in the electron flow, nature tries to establish as many intermediate steps as possible in the whole system. These intermediate steps are comparable to cascades in the watercourse.

The electrochemical model

The electrochemical model explains the mitochondrial energy transfer and electron flow as follows. The energy, which is released during the transfer of electrons from a high-energy to a low-energy state, is used to operate proton pumps as part of an elaborate electron-transport process in the mitochondrial membrane. The mechanism is basically analogic to an electric cell driving a current through a set of electric motors. However, in biologic systems, electrons are carried between one site and another not by conducting wires, but by diffusible molecules (electron carriers) that can pick up electrons at one location (donator) and deliver them to another (acceptor).[3]

The biomechanical model

The corpuscular-based concept of cellular flow demands the realization of a complex electron-transporting biomechanism that, at the present time, cannot be explained consistently. Mitochondrial electron-transport starts with the generation of high-energy electrons in the citrate cycle. In the course of four oxidation-reduction reactions, three electron-pairs are transferred to the oxidized form of NAD^+, while one pair becomes the oxidized form of FAD. These electron acceptors, which, in their reduced forms ($NADH/FADH_2$), are highly energetic, are regenerated again when they deliver their electrons to the respiratory chain in the inner mitochondrial membrane. Reduced NADH gives its electrons to membrane-bound proteins of the respiratory chain due to random collisions. Reduced FADH, because of sitting on the inner membrane, hands its electrons directly to the respiratory chain. In the course of this transfer, the electrons lose their energy due to the high redox potential with regard to molecular oxygen (O_2). This energy is used cellularily to install a proton gradient so that this energy will be transferred by means of the oxidative phosphorylation to produce ATP. In aerobic organisms, this process is the main source of ATP. The features of this process are characterized by:

1) Oxidative phosphorylation takes place in the respiratory chain that is located on the inner mitochondrial membrane and is one of its integral parts. The NADH reduced by means of the extramitochondrial glycolysis cannot penetrate the mitochondrial membrane and the same applies to energy suppliers such as pyruvate and fatty acids. The mitochondrial membrane is a structural obstacle to transportation. This is why NADH, the main source of electrons, depends on the help of membrane-transport systems (shuttles) to get into the mitochondria. As far

as quantity is concerned, the malate-aspartate shuttle (malate cycle) is the most important transport system of the cytoplasmic NADH.[4]

2) The arrangement of the respiratory chain contains numerous electron carriers such as cytochromes and flavins. The transfer of electrons from NADH or $FADH_2$ to O_2 by means of these electron carriers consists of several intermediate steps. In addition to this, proton pumps generate a membrane potential (proton-motor force) in the mitochondrial matrix. According to the particle concept of electron flow, the high-energy electrons flow through the respiratory chain via a set of electron carriers (flavins, iron-sulphur complexes, chinones, and cytochromes) until they finally reduce O_2 to water. With the exception of the chinones, these electron carriers are prosthetic groups of proteins. The reaction centers of these proteins are almost exclusively equipped with reactive transition metals such as iron and copper. The model of electron transport shows that the electrons flow mainly from one metal to another by means of rotation and translation of the electron carrier.[2] The electrons are thus brought down to the lowest energy level, oxygen, and emit their energy. But, although each NADH donates two electrons, each O_2 molecule must receive four electrons to produce water. This is why a corpuscular conception of electron flow quantitatively demands the existence of different electron-collecting and dispersing points along the electron-transport chain, where these differences in the number of electrons are compensated for.[3]

3) The driving force of oxidative phosphorylation in the model is the membrane potential of the inner mitochondrial membrane and the electron transfer potential of 1, 14 V, which is created between the NADH/$FADH_2$ and O_2. The free energy of the oxidation of NADH via O_2 amounts to 220 kJ/mol. The electron-transfer feeds three oxidative phosphorylation units until the electrons are finally delivered to O_2. Therefore, most of the energy released can be converted into a storage form instead of being lost to the environment as heat. The model explains this with an indirect method of reaction, where hydrogen atoms are separated first into protons and electrons (creation of hybrid ions, hydrogen atoms with additional electrons and H^+). At several steps along the way, protons and electrons are recombined transiently, but only when the electrons reach the end of this electron-transport chain are the protons permanently returned to neutralize the negative charges created by the final addition of electrons to the oxygen molecule.[3]

THE MODEL OF THE MITOCHONDRIAL ELECTRON FLOW WITH REGARD TO RADIATION PHENOMENA

In the prevailing classical particle idea of electrons, the energy-transfer from nutritive molecules such as pyruvate to the molecular mitochondrial structures of the respiratory chain is described as a flow of high-energy electrons. But, as has already been noted, there are no consistent explanations for some intermediate steps involved in this electron flow. These include the transport and diffusion of electrons and the interaction between electrons and other components of the mitochondrial energy transfer. Furthermore, the question of the coordination in this process taking part on all levels is answered insufficiently with the random principle. According to the molecular particle concept of biochemistry, the intermediate steps of energy-transfer are regarded as chaotic occurrences without any synergetic precision.[5] For example, NADH emits its electrons to the respiratory chain in the course of random collisions. The particle concept describes this as a well-aimed vibratory and rotary motion of the components up to quantum mechanical tunneling of electrons through molecular barriers.[6] One reason for this could be the correspondence between the observed rapidity of electron transfer and the frequency of random collisions between diffusible electron carriers and the enzyme complexes (rate: each complex donates and receives an electron approximately once every 5–20 milliseconds). This assumed randomness of collisions is linked with the observation, however, that there is no need to postulate a structurally ordered chain of electron-transfer proteins in the lipid bilayer, and that the ordered transfer of electrons is due entirely to the specificity of functional interactions among the components of the respiratory chain.[3]

FROM THE PARTICLE ASPECT TO RADIATION PHENOMENA

Because radiation phenomena, in consequence of wave-particle dualism, belong to the fundamental nature of electrons, the electron flow linked with the mitochondrial energy transfer can also be described as a radiation process. Contrary to the above-mentioned chaotic randomness in the classical particle concept, functional movements and changes in the cell take place in a highly ordered way.[7] The cellular order and the whole human organism could not exist otherwise. Order principles only work if high-structured processes are dependent on long-range interactions between the components involved. These interactions have a greater radius of action than that of chemical forces, for example of chemical bonds. This makes it necessary to leave the exclusively molecular point of view and turn to the radiation aspect of matter.[5] Therefore, the classical particle concept of the mitochondrial electron flow can be regarded, theoretically, as a wave. The connection between energy transport in the space (radiation) and order (molecular structure) reveals itself when, in structural form, bound energy is released during the breakdown of structures and, if circumstances are reversed, is structurally bound again. This explains some of the above-mentioned aspects of mitochondrial energy transfer that so far, cannot be explained consistently.

THE IMPORT OF ELECTROMAGNETIC RADIATION

Chemical reactions are made basically of splittings or combinations of the reaction partners. Cellular examples of this are the oxidation of foodstuffs in the citric acid cycle and the ATP-production in the respiratory chain. To cause a chemical reaction in a cell, the involved partners need to receive enough energy of motion to meet. Usually, at least one of the reactant partners must be stimulated—at least for a short time—to change its electric charge distribution before new units can be formed.[5] These essential regulations in the team-work of the components are triggered off by electromagnetic radiation phe-

TABLE 1. COMPARISON BETWEEN THE CHARACTERISTIC ENERGY RANGES OF CHEMICAL BONDS AND THE ENERGY OF ELECTROMAGNETIC RADIATION (PHOTONS) EXPRESSED IN WAVELENGTH[8–10]

Chemical Bond	*Energy of Bond (Joule) (characteristic ranges)*	*Energy of Electromagnetic Radiation in wavelength (nm)*
Van-der-Waals-bond	ca. $6{,}4 \cdot 10^{-21}$ — $1{,}3 \cdot 10^{-20}$	31100 — 15300 (Infrared)
Hydrogen bond	ca. $2{,}1 \cdot 10^{-19}$ — $4{,}8 \cdot 10^{-19}$	950 — 410 (Infrared, Visible light)
Ionic bond	ca. $3{,}2 \cdot 10^{-19}$ — $6{,}4 \cdot 10^{-19}$	620 — 310 (Visible light, UV-A)
Covalent bond	ca. $3{,}5 \cdot 10^{-19}$ — $1{,}2 \cdot 10^{-18}$	560 — 160 (Visible light, UV-A, -B, -C)

nomena.[7] In other words, the presence or absence of radiation of a special frequency, wavelength, intensity, diffusion, or polarization in the cell is the deciding factor for whether or not reactions take place. We discuss below the import of electromagnetic radiation on the systems and components involved in mitochondrial energy transfer. The basis for this view is the energy range that plays a role for energy carriers of mitochondrial energy transfer. This cellular energy range can, for example, be shown by means of the following components, which are primarily involved in energy transfer.

1) The starting point of the examination is the bond energies of different kinds of chemical bonds in the cellular catabolism of nutrients in the citric acid cycle. Table 1 shows typical energy ranges for the bond energies of chemical bonds (van der Waals, hydrogen, covalent, and ionic bonds). These energies can also be expressed in units of wavelengths of electromagnetic radiation. To present chemical bond energies as energies of electromagnetic radiation, the following fundamental formula by Einstein is used. Electromagnetic radiation of the wavelength λ is inversely proportional to the energy E of the electromagnetic radiation:

$$E = h \cdot c\lambda \text{ (J)}$$

with E = energy of electromagnetic radiation in Joule (J), h = Planck constant (= $6{,}6256 \cdot 10^{-34}$ J · s), c = velocity of light (= $2{,}9979 \cdot 10^{8}$ (m/s) and λ = wavelength of electromagnetic radiation in meters (m).

To illuminate the energy values shown in Table 1, the wavelength of the range of electromagntic radiation that is visible to the human eye measures ca. 400–800 nm. The energies of the chemical bonds mentioned above correspond, more or less, to the energy range of visible light. Some partly reach into the near infrared and ultraviolet (UV-A, UV-B, and UV-C) range of electromagnetic radiation. For example, the energies of hydrogen bonds are nearly the same as the wavelengths of the low energetic range of visible light and reach from yellow over red to the near-infrared.

2) As shown above, the chemical energy of the different kinds of bonds is first released during the breakdown of bonds in the cellular metabolism and then converted into cellularly usable energy by corresponding molecular structures of the mitochondria. These molecular structures consist of the electron-donator and acceptor systems and, in addition to this, of the components of the respiratory chain. The characteristic energy ranges that apply to these systems can also be specified. One corresponding functional structure on the molecular side of the energy transfer is the nicotinamide adenine dinucleotide system (NADH/NAD+). Its photoabsorption (UV-visible) spectrum is shown in Fig. 1. The $FADH_2$/FAD system, which in the corpuscular model of the electron transfer also yields as a donator of high-energy electrons, shows an photoabsorption behaviour similar to that of NADH/NAD+ (Fig. 1, inset).

Due to its physical origin (electronic configuration, specific molecule orbital structure), the photo(UV-visible)absorption spectrum is a characteristic fingerprint of the systems in question. Absorption maxima (absorption bands) of the spectrum mark the range where the observed system resonates and absorbs the most energy in the form of electromagnetic radiation (visible light). What happens with the absorbed energy depends on the physical nature of the specific systems and their own original electronic structure. Whether energy is released or not is dependent on factors such as relaxation, fluorescence, heat conversion, or dynamic changes in the system. In comparison

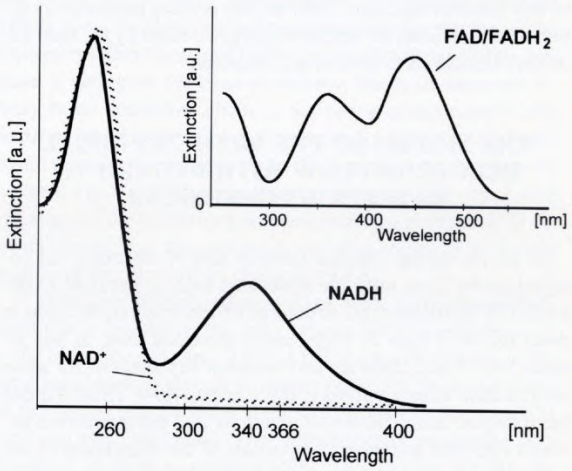

FIG. 1. Photo (UV-visible) absorption spectra of the NAD^+/NADH-system (inlet:$FADH_2$-system).[11]

TABLE 2. CHARACTERISTIC RANGES OF ABSORPTION BANDS OF COMPONENTS INVOLVED IN THE MITOCHONDRIAL RESPIRATORY CHAIN (WAVELENGTH IN NM)[12]

Component		*Soret-band*	*Absorption Band (nm)* *β-band*	*α-band*	
NADH/NAD	UV-band of the protein in the range of 220–290 nm	300–340			
Flavoproteins		350–490		470–490	580–630
Ubichinon Q		270–410			
Cytochrom b			450–465	520–530	558–562
Cytochrome C_1			370–380	530	555
Cyrochom c			410–415	521–528	551–557
Cytochrome a			420–450	520–540	603–605
Cu A					830
Cu B					760
Cytochrom a_3				520–540	806

to the energies of chemical bonds (see Table 1), there is a remarkably good correspondence between the energy-value ranges of the components of the mitochondrial energy transfer. The chemical bond energies (expressed in wavelengths of electromagnetic radiation) that are released in the citric acid cycle from covalent carbon bonds and hydrogen bonds correspond well to the absorption bands of the NADH/NAD^+ and $FADH_2$/FAD systems (compare Fig. 1 and Table 1).

3) Another energy range to be examined more closely aises from the key structures in the respiratory chain, the electron carriers. These electron carriers are primarily metal proteins with iron-sulphur centers, heme groups, and copper atoms as prostetic groups. The best known are the flavins and heme components. The three main enzyme complexes of the respiratory chain with such metal proteins are the NADH dehydrogenase complex, the cytochrome bc_1 complex and the cytochrome oxidase complex (cytochrome aa_3). In general, each electron carrier has an absorption spectrum and reactivity that is distinct enough to allow its behavior to be traced even in crude mixtures.[3] They absorb electromagnetic radiation in the range of visible light and change

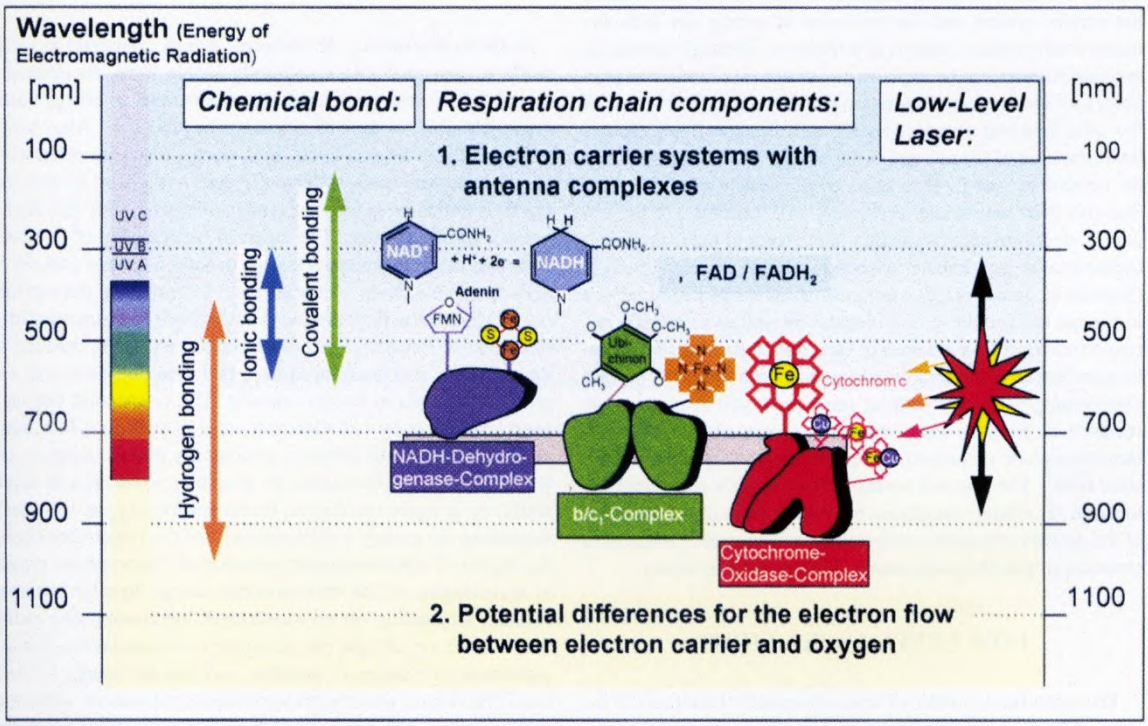

FIG. 2. Comparison of the energy ranges between the chemical bonds, the components involved in the mitochondrial respiratory chain, and the electromagnetic radiation of low level laser shown as energy (wavelength) of electromagnetic radiation.

their absorption bands (color) when they are oxidized or reduced. Table 2 shows some of the essential electron carriers and the range of their absorption bands. For example, flavins constitute an astonishing class of green and yellow pigments that derive from riboflavin or vitamin B_2, while hemes (iron-porphyrines) combine with proteins to form a whole range of colored molecules with hues from blood red to pea green. The position of the absorption bands can vary depending on the coordination of the prostetic groups in the holoprotein.

As mentioned above, these components of the respiratory chain are clearly distinguishable by means of their absorption spectra. The shortwave absorption bands in the region of 280 nm (UV range of the electromagnetic radiation) are derived from amino acids of the proteins trytophan and tyrosine. The longer wave absorption region originates primarily form the prostetic (metal) group of the particular electron carrier (for example, Soret, α-, β-bands of heme). These energy ranges correspond well with both the energies of released chemical bonds (see Table 1) and the photoabsorption spectra of the electron-donator and acceptor systems (see Fig. 1). Therefore, electromagnetic radiation entering in the mitochondrial respiratory chain can be absorbed directly by the electron carriers through their so-called antenna pigments. The effective radiation scale (expressed in frequency or wavelength) extends from UV over the visible region to Infrared (IR).

Furthermore, the oxidative phosphorylation is enabled by the close link between electron carriers and protein molecules. These proteins control the electrons through the respiratory chain, so that they can pass from one enzyme complex to another in the right order and effectively. This electron control occurs by allosteric rearrangements in the proteins involved. Both the control system and the provision of energy for such dynamic conformation changes in proteins or vibratory motions in macromolecules can be explained with the aid of radiation phenomena.[5] The import of radiation phenomena in the context of the mitochondrial energy transfer and electron flow, enables understanding of the process of the energy finally released from the catabolism and its absorption by the structures of the inner mitochondrial membrane. Following an explanation of the import of electromagnetic radiation in the form of light on the mitochondrial energy transfer. Depending on its wavelength, light (photons as quant) can, for instance, stimulate macromolecules to change the geometry of molecules as well as to transfer energy to electrons. As a matter of fact, light has a directly stimulating effect on cellular structures, as has been shown by several experiments.[13] On this cellular level there still remains much research to be done concerning the biostimulative effect of electromagnetic radiation (e.g., in the region of visible, natural solar light). The relevant issues in this research arise from the location of cellular stimulation points and from the explanation of the directly stimulating effect of electromagnetic radiation in connection with the components of the respiratory chain.

LOW LEVEL LASER LIGHT

The stimulative effect of electromagnetic radiation in the form of low level laser light in medicine is already used today.[14–16] It is known that the effect of low level laser light does not derive from heat.[17] Variations of the energy of electromagnetic radiation show that the effect of laser light is limited to certain spectral regions. The wavelength (energy range) between 600–700 nm (red region) seems to be especially effective.[18] Low level laser light from the red region and the near-infrared region corresponds definitely with the characteristic energy and absorption levels relevant for the respiratory chain. This indicates the reaction center of low level laser light in this way that the electromagnetic energy stimulates the components of the so-called antenna pigments of the respiratory chain and therefore vitalizes the cell by increasing mitochondrial ATP production. This kind of stimulation can be interpreted as a biological resonance effect.[12] Therefore, the components of these antenna pigments are resonators of different sizes and forms, which resonate with a specific stimulation that means energy of radiation. They are capable of transfering the stimulation functionally for various regulation processes in the cell. The energy range of the different processes and components of the cell involved in the mitochondrial respiratory chain, is shown in Figure 2.

One characteristic energy range is represented by the chemical bonds that are released by the cellular catabolism. On the other hand, the absorption bands of the components of the mitochondrial respiratory chain (particularly the electron carriers with their antenna pigments) are in a comparable energy range (see Fig. 1 and Table 2). Both of these relevant energy ranges correspond remarkably well to the energy range of the electromagnetic radiation of low level laser light used therapeutically.

CONCLUSION

In the mitochondria, the chemical energy contained in foodstuffs is converted into a cellularly usable form. Biochemical models of this energy transfer regard electrons as energy carriers responsible for the different transfer processes. After being gained in the citric acid cycle, high energy electrons effectively pass the electron transport chain (respiratory chain) by delivering their initial energy to the cellular energy transfer and finally reduce oxygen to water. The classical particle idea of electrons describes the mitochondrial energy transfer as a flow process of high energy electrons (electron flow). Intermediate steps in this model of electron flow are inconsistent with the particular idea of electrons. Because of the inherent wave-particle dualism of the electrons, it is necessary to use radiation phenomena to explain mitochondrial energy transfer. The connection between energy transport by radiation and order in structural form may be understood if, for instance, structurally bound energy is released during the dissolution of structures (oxidation of foodstuffs) or is again manifested (reduction of oxygen to water). Regarding the energy values relevant for the respiratory chain, the import of electromagnetic radiation of characteristic ranges of wavelengths on the mitochondrial energy transfer becomes evident. Depending on its wavelength, electromagnetic radiation in the form of light can stimulate macromolecules, initiate conformation changes in proteins, and transfer energy to electrons. Therefore, with regard to radiation phenomena in the mitochondrial energy transfer and its inhanced electron flow in the respiratory chain, it is possible to explain the experimentally found increase of ATP-production by means of low-level laser

light on a cellular level. Furthermore, it must be emphasized that the theoretical model mentioned above and the biostimulative effect of radiation phenomena require continued research.

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